Precision, Quality, Innovation

Starrett®

# PRECISION TOOLS

- Precision Hand Tools
- Data Collection Systems
- Hardness & Surface Testers
- Roundness Measurement
- Special Gaging
- Gage Blocks
- Granite Surface Plates
- Vision Systems
- Optical Comparators
- Material Test & Force Measurement
- Precision Ground Flat Stock & Drill Rod




Catalog 33

# PRECISION, QUALITY, INNOVATION

Welcome to our new edition, Catalog 33. We remain as dedicated today to the making of great tools for our customers as we were when L.S. Starrett founded the company in 1880. He created a business and a brand that has become synonymous with precision, quality and innovation, backed by unmatched service and support.

We accomplish this by offering application-designed precision tools, saws, and custom solutions that optimize job and process performance. Our confidence hinges over 130 years of experience focusing on your needs and your success. We take great pride in manufacturing long-lasting, easy-to-use tools that provide consistent and reliable performance.

Today, Starrett offers five product categories: Precision Measurement Tools, Metrology Equipment, Granite-based Engineered Solutions, Saw Blades, and Jobsite and Shop Tools.

Whether you need to modify a standard tool, require assistance in selecting the best saw blade for your cutting application, or desire a custom solution for your business, we have the breadth of knowledge to assist you.

We are committed to providing you with complete solutions created for your exact needs. Problem solving is part of what we do every day. If the right tool for your application does not exist, contact us – we would appreciate the opportunity to build it.

D. A. Starrett

President and CEO

## MICROMETERS

In the hands of a skilled operator, the precision micrometer is the most accurate hand-held tool available. When close measurements are necessary, the micrometer is the ideal tool for the job because measurement and reading are on the same axis and the anvil end is supported by a strong frame.

19




## SLIDE CALIPERS

Our calipers are light, comfortable, easy-to-use, and constructed with features that have made Starrett slide calipers the machinist's first choice for many years.

89




## HEIGHT GAGES

Height gages measure the distance from a reference surface, such as a surface plate, to some feature of a part, and can do so with exceptional accuracy. We also offer a comprehensive range of scribes, attachments and accessories for all of your height gaging needs.

107



## DEPTH GAGES

We offer a choice of depth products varying in form, complexity, cost and accuracy, from the most accurate depth micrometers (electronic, dial and vernier) to the less complex precise rule gages and combination rule gages.

123




## INDICATORS AND GAGES

We offer a variety of each of the major classes: mechanical dial, electronic display, lever style test and back plunger. Indicator requirements are very specific and Starrett offers everything you need: a broad line of each indicator type, an extensive range of accessories to configure and position the gage, and as needed, an indicator-based, custom engineered solution.

133




# PRECISION TOOLS



## BORE GAGES

Our line of bore gages is extensive, with products available for a broad range of applications. Some are available with interchangeable measuring heads for different diameters or extensions for depth. They can have electronic displays (some with output), micrometer-type vernier scales or a dial (similar to an indicator).

205



## TOOL SETS

We offer a selection of tool sets that combine basic tools such as a 0-1" micrometer, 0-6" caliper and a few other fundamental measuring tools in a single set for apprentices or beginners. Some are designed for the requirements of a type of application or are industry-specific.

221



## DATA COLLECTION SYSTEMS

DataSure® Wireless Data Collection is a state-of-the-art system for real-time collection and recording of measurement data. From measurement to input, it reduces steps, saves time and can completely eliminate error in the data collection process. We also offer several newer technology products for wire-based data collection, SmartCable for single tools and the 4-Port Gage Multiplexer.

225



## GAGE AMPLIFIERS, HARDNESS AND SURFACE TESTERS

We have added to and updated our tester line significantly in recent years. Our bench hardness testers range from relatively simple analog models to electronic versions with broad capabilities. We also offer several portable hardness testers, two new surface roughness testers, an electronic durometer, an ultrasonic thickness gage and a full range of test blocks and accessories.

235



## SPECIAL GAGING

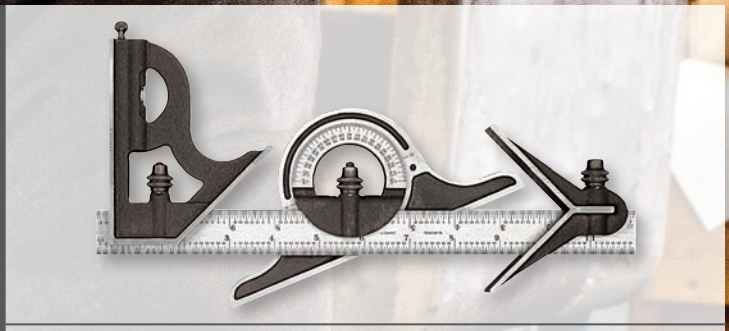
Standing out from other precision tool providers through our willingness to work directly with customers to design and manufacture custom tools for applications that standard products cannot perform. For over 50 years, we have provided solutions to industries including energy, aerospace, automotive, food packaging, high-technology plastics, medical components, and to NASA and other government agencies.

255

## SQUARES

Invented by our founder, the combination square was our first product and today, our brand is considered to be the best available. This section offers a range of high quality solid squares, tri-squares specialty products and accessories that is especially broad and deep.

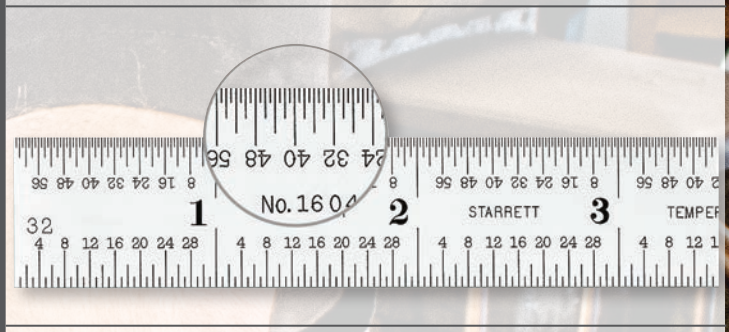
269



## PRECISION RULES, STRAIGHT EDGES AND PARALLELS

Our comprehensive line offers a choice of temper, 10 English and 8 metric graduation styles with several width, thickness and length options and a full range of accessories and holders. Straight edges and parallels made with the same care and accuracy as our precision rules are also available.

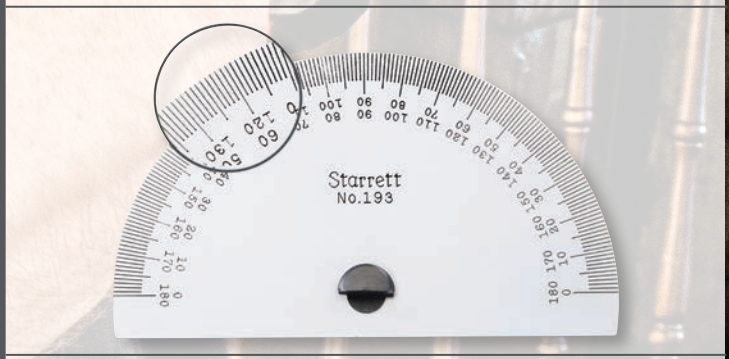
287




## PROTRACTORS AND ANGLE MEASUREMENT

We offer a variety of tools with a sharply graduated 180° scales intersected by a movable blade, a bevel protractor, protractor/depth gages and special drill point gage. We also have available an indicator protractor head for use with custom engineered applications.

309




## CALIPERS, DIVIDERS AND TRAMMELS

Manufacturing calipers and dividers since about 1890, we continue to build them with the same level of quality today. Even with many more options available today, these tools are still the best choice for many measurement transfer, scribing and other jobs. We also offer trammel heads, divider points and attachments.

315



## HOLE AND SLOT GAGES

We offer several varieties of small hole gage sets as well as telescoping gages for larger holes. Our taper gages are inserted into a hole or slot, with the diameter determined by the reading on the tool's etched scale.

321



# PRECISION TOOLS




## FIXED GAGE STANDARDS

Fixed Gage Standards include a comprehensive choice of standard gages that quickly check dimensions on a variety of workpieces. They are very useful for in-process and final inspection. Products include pin gages, drill gages, sheet and wire gages, center gages, screw pitch gages, radius gages, ball and diameter gages, angle gages, thickness gages and feeler stock.

327



## PRECISION SHOP TOOLS

This section offers quality tools that do not measure, but are needed frequently in manufacturing. Tools such as work positioning tools, scribers, punches, vises and lubricant are an integral part of any shop or manufacturing industry.

343



## MACHINISTS' LEVELS

We offer a selection of machinists' levels to suit a variety of precision work typically required in industry. Our machinists' levels are manufactured with ground surfaces designed specifically for machine shop and tool room use.

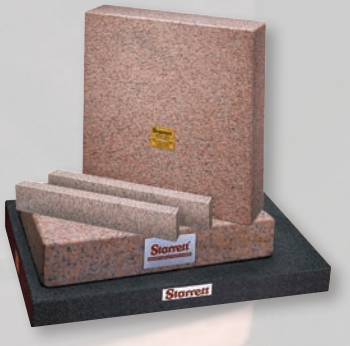
371




## STARRETT-WEBBER GAGE BLOCKS

We offer high-grade steel gage blocks for shop floor use, longer-lasting and non-corroding ceramic blocks. Top-of-the-line croblox® Chromium Carbide, are very stable, non-corrosive and have excellent wringability. A variety of sets are available in square- and rectangular-block versions. We also offer individual replacement blocks and a range of related accessories.

377




## GRANITE SURFACE PLATES

Products and services range from standard surface plates and metrology accessories to engineering collaboration for unique solutions and complex assemblies. Our skilled technicians build your product in our state-of-the-art, environmentally controlled manufacturing facility.

411

## VISION SYSTEMS

Video-based measurement systems combine high-resolution images, powerful-intuitive software and precision mechanical platforms to deliver superb accuracy and repeatable measurement results for a wide range of precision measurement applications

425



## OPTICAL COMPARATORS

Optical comparators provide a time tested, cost effective solution for non-contact measurement. Optical comparators are used for an exceptionally wide range of dimensional inspection and measurement applications.

455



## MATERIAL TEST AND FORCE MEASUREMENT

Turnkey system solutions for material testing, force analysis and force measurement. Our systems distinguish themselves from the competition by making it easy to create and perform a test, and manage test results. We offer a full range of test frames, software, load cell sensors, test fixtures and more.

477



## LASER MEASUREMENT

We offer laser-based, non-contact, dimensional measurement systems that are employed on the factory floor for quality monitoring, process control and inspection. Key elements that differentiate our products are: measurement accuracy and precision, system reliability, easy to use software, and effective and courteous training, technical support and service.

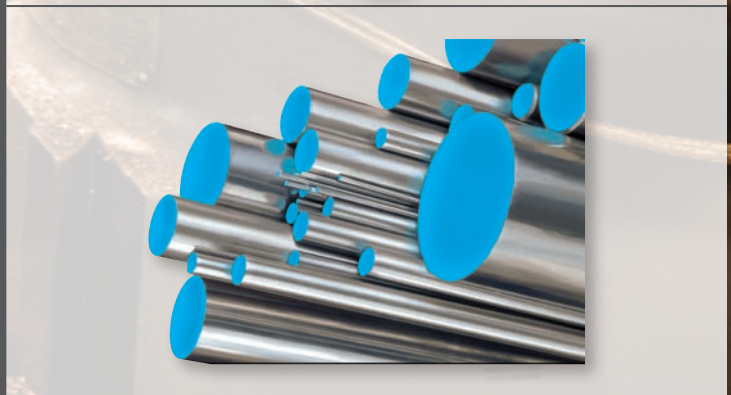
493




## PRECISION GROUND FLAT STOCK AND DRILL ROD

We stock a full range of sizes in O1, A2, D2, A6, W1 and Low Carbon Steel. Specials can be produced in as little as 5 days at our North Carolina manufacturing facility. Starrett Ground Flat Stock and Drill Rod is of the highest quality, in fact we use it in the production of many of our own Precision Measuring Tools.

513

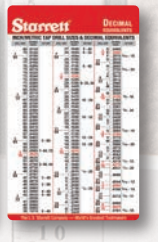


# PRECISION TOOLS










## VOCATIONAL AND EDUCATIONAL

Our educational literature is used as a resource in the machinist's shop, the classroom or for the everyday end-user. It ranges from posters that can be hung in the workshop to booklets that explain how to utilize your Starrett tools. Pocket cards and memo pads are also available for those who need precise measurements while on the job or in the classroom.

535

## REFERENCE TABLES

541

## INDEX

559




# ABOUT STARRETT







# Distinctly American – The Standard of Precision Worldwide

There are some things that are uniquely American – the dreams of freedom and a better life inspired by the sight of the Statue of Liberty, a bald eagle soaring in flight, the awe inspiring majesty of the Lincoln Memorial or the simple pleasure of a minor league baseball game on a warm summer evening.

For those who work with their hands to build or manufacture, using a Starrett tool for a critical measurement is part of the economic vitality so essential to the uniqueness of America.

Today, Starrett tools are manufactured, marketed and used worldwide. With over five generations of practical innovation, exceptional quality and unmatched precision, the Starrett brand remains distinctly American.



L.S. Starrett Company World Headquarters
Athol, Massachusetts, USA
























## A Global Manufacturer for Over Half a Century

Starrett's success as a global manufacturer began in the 1950's with the establishment of facilities in Brazil and the United Kingdom. Today, Starrett has nine manufacturing locations worldwide: Brazil, The U.K., China, and six in the United States.

Most of the products in this catalog are made at a Starrett U.S. facility. The rest are sourced from one of our global locations.

Regardless of the country of origin, the Starrett name is your assurance of unmatched precision and quality. After more than 130 years, Starrett remains "The World's Greatest Toolmaker" – setting the continuing standard of excellence.









# Contact Information

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**STARRETT CONSTRUCTION DIVISION**
4130 Faber Place Drive, Suite 105
N. Charleston, SC 29405

**STARRETT WEBBER GAGE DIVISION**
24500 Detroit Road
Cleveland, OH 44145-2579
Telephone: (440) 835-0001
Fax: (440) 892-9555

**STARRETT GRANITE DIVISION**
Starrett Tru-Stone Technologies
P. O. Box 430
1101 Prosper Drive
Waite Park, MN 56387
Telephone: (320) 251-7171
Fax: (320) 259-5073

**STARRETT LASER MEASUREMENT DIVISION**
Starrett-Bytewise Measurement Systems
1150 Brookstone Centre Pkwy.
Columbus, GA 31904
Telephone: (706) 323-5142

### Industrial Distribution

Ample stocks of Starrett products to meet your needs are maintained by leading industrial distributors worldwide.

Your Starrett distributors have a thorough knowledge of the Starrett line and can help you with your inquires. They are readily available to provide you with quick and reliable support. Be sure to make use of their valuable services.

## International Locations

**BRAZIL**
**Starrett Indústria e Comércio Ltda.**
Itu, São Paulo, Brazil
Telephone: 55 11 2118-8000
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**SCOTLAND**
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**Starrett Precision Optical Ltd.**
Jedburgh, Scotland
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**China**
**Starrett Tools (Suzhou) Company Limited**
Suzhou, China
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Fax: 86 512 67415697

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**AUSTRALIA**
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# Precision

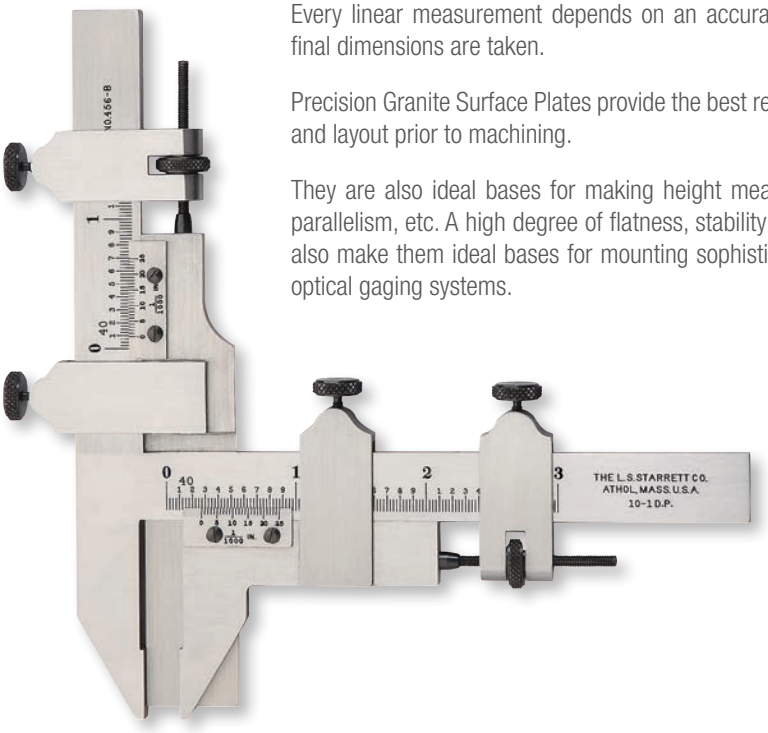
At Starrett, we understand precision. For generations, the precision that we build into our products has allowed our customers to ensure the quality of their products. Precision is something we take very seriously.

## Primary Standards

To ensure accuracy, manufacturers must enforce strict quality control processes. This starts with applying primary standards for measurement and inspection. This will ultimately lead to consistent, reliable gaging results.

Precision gage blocks are the primary standards vital to dimensional quality control in the manufacture of interchangeable parts. These blocks are used for calibrating precision measuring tools and for setting numerous comparative type gages.

However, even gage blocks are held to their own level of higher standards: Grand Master Blocks.

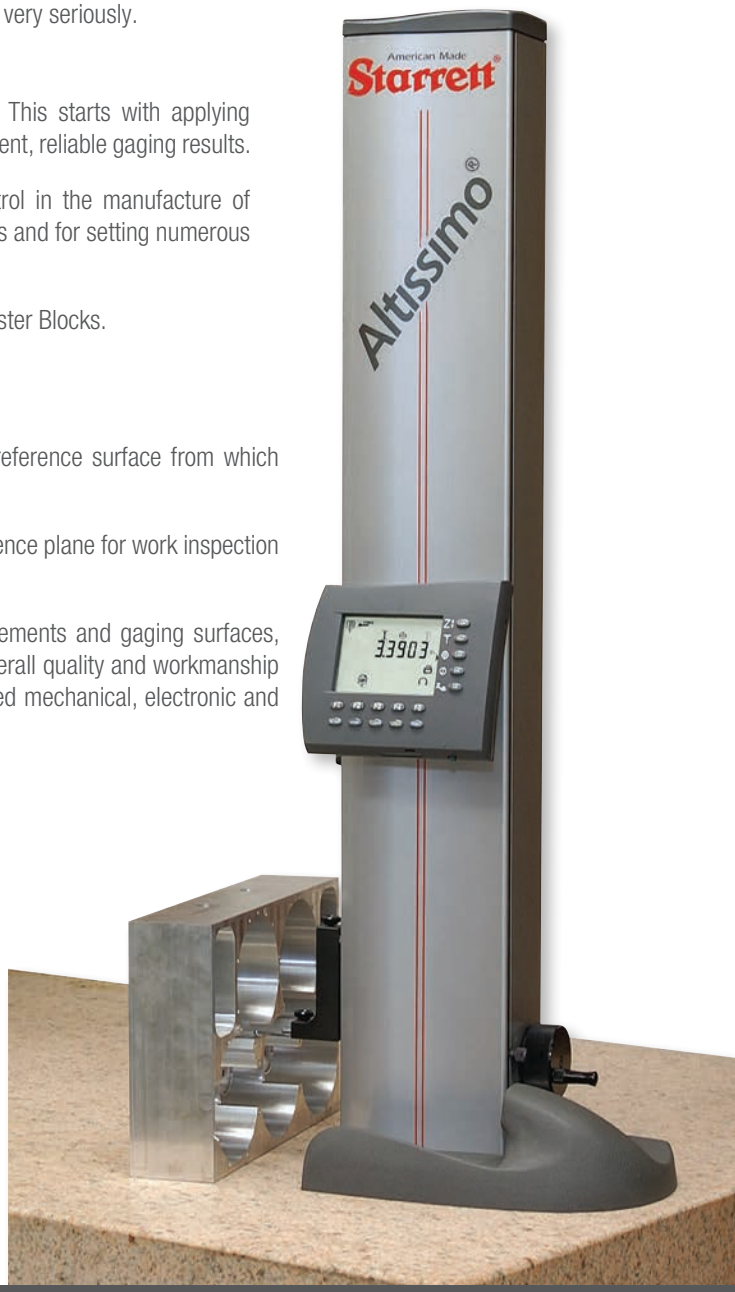



## Accurate Reference Surfaces

Every linear measurement depends on an accurate reference surface from which final dimensions are taken.

Precision Granite Surface Plates provide the best reference plane for work inspection and layout prior to machining.

They are also ideal bases for making height measurements and gaging surfaces, parallelism, etc. A high degree of flatness, stability, overall quality and workmanship also make them ideal bases for mounting sophisticated mechanical, electronic and optical gaging systems.






## Accuracy

Starrett precision measuring tool accuracies are based on their traceability through our grand master gage blocks as certified by the National Institute of Standards and Technology (NIST).

Worldwide, no one else has produced the accuracy and stability of Starrett-Webber croblox® Grand Masters.

They were produced in 1955 out of chromium carbide material to an accuracy within one millionth of an inch (.0000254mm) and have been checked periodically by the National Bureau of Standards and the National Institute of Standards and Technology (NIST). They have remained stable over this period.

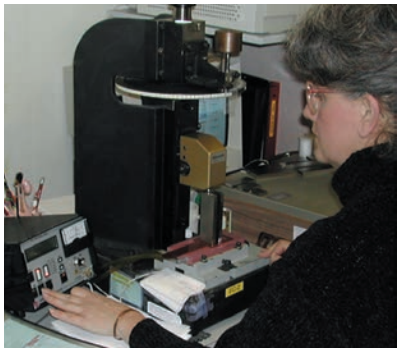
# Quality



Starrett precision measuring products are inspected for accuracy with standards traceable to our grand master gage blocks.

After a period of use, precision measuring tools require regular preventative maintenance, periodic calibration and, sometimes, repair.

Starrett offers calibration services at several of our facilities, each with different emphasis, capabilities and certificates as detailed below.



## Calibration and Repair

### STARRETT TOOLS AND GAGES – ATHOL, MA

- Calibration of Starrett Precision Tools
- Repair, refurbishing, and rebuilding of your Starrett tools by the same craftsmen who originally made them
- Accredited by A2LA in accordance with ANSI/NCSL Z540-1 and ISO/IEC 17025

Cert. No. 760.01

### *STARRETT WEBBER GAGE DIVISION – CLEVELAND, OH

- Accredited calibrations of Linear Gage Blocks, Webber Height Gages and Standard Reference Bars, Angle Gage Blocks, True Squares, Optical Cubes, Optical Polygons and Optical Flats
- Accredited by NVLAP in accordance with ANSI/NCSL Z540-1 and ISO/IEC 17025*
- Calibrations also performed in accordance with ISO 10012-1 and former MIL-STD-45662A

Administered by N.I.S.T.
Lab Code 200038-0



### *STARRETT GRANITE DIVISION – WAITE PARK, MN

- Calibration of granite surface plates, granite parallels, granite straight edges, granite tri-squares, granite angle plates and granite squares.
- Surface plate, granite metrology and accessory resurfacing
- Starrett Granite Surface Plates meet or exceed U.S. Federal Specification GGG-P-463c.
- NIST-traceable calibration certificate provided that is ISO/IEC 17025* compliant
- ISO 9001:2000 certified and A2LA accredited per the ISO/IEC 17025* standard

Cert. No. 200.01

### STARRETT METROLOGY DIVISION – LAGUNA HILLS, CA

- Factory or field calibration and repairs of Optical Comparator and Vision Systems performed by our factory trained experts
- First generation NIST traceable documentation for all calibration artifacts and standards



### *STARRETT CALIBRATION SERVICES™ – DUNCAN, SC

**321 Tucapau Road, PO Box 537, Duncan, SC 29334**
**Tel.: 864-433-8407**

- Fast, economical calibration for all major brands
- Repair of all major brands with parts in stock
- Accredited by A2LA in accordance with ANSI/NCSL Z540-1, and ISO/IEC 17025*

Cert. No. 1387.02

* Accreditations are site-specific and tool-specific. The Scope of Accreditation is available upon request to each location.
Specifications and Certifications are subject to change.

### Calibration Certificate

**(AVAILABLE BY REQUEST)**

The Calibration Certificate includes the information that is on the SLC and the actual readings taken during the calibration of that tool. The certificate includes an environmental control statement, actual before and after data, standards used to perform calibration, applicable NIST test number, and uncertainty statement. The certificate conforms to the requirements of ANSI/NCSL Z540-1, ISO/IEC 17025 and ISO Guide 25.

### Standard Letter of Certification (SLC)

The Standard Letter of Certification certifies that the listed tool is a product of The L.S. Starrett Company and meets all applicable federal or manufacturing specifications. It has a unique serial number, tolerance parameter, and traceability to The National Institute of Standards and Technology (NIST).

Many of our tools are available with a redemption card for a Standard Letter of Certification. Their catalog numbers have the letters "W/SLC".

# Innovation

## New Products

Product and technology innovation has been at the core of The L. S. Starrett Company since our inception. The restless, creative energy of our founder, dedicated to "continuous improvement" long before that phrase came into common usage, is as much a part of our company in the 21st century as it was in the 19th.

The table below lists products we have added to our Precision Tool Catalog since its last printing.

Beyond catalog products, we devote significant resources to developing highly innovative, application-focused solutions, as described on the following pages.


| Precision and Hand Tools | Page |
|---|---|
| 3753B Electronic Depth Gages | 126 |
| 3808, 3809, 3908 and 3909 Dial Test Indicators | 140 |
| 647, 647M Dial Comparator Indicators | 164 |
| 2900 Electronic Indicators | 172 |
| 84A, 84MA Dial Bore Gages | 216 |
| AccuPlug™ Bore Gages | 217 |
| 300W Wooden Tool Box | 224 |
| 3810A Digital Portable Hardness Tester | 245 |
| RT500 Roundess Tester | 247 |
| RT800 Roundess Tester | 248 |
| SR300 and SR400 Surface Roughness Testers | 250 |
| 3805B Electronic Durometer | 252 |
| 3813 Coating Thickness Gage | 254 |
| 698 and 699 Video Borescopes | 367 |
| MVR - Manual Vision Metrology System | 428 |
| AVR - Automatic Vision Metrology System | 432 |
| HDV - Horizontal Digital Video Projector | 438 |
| KineMic - KMR | 440 |
| M2 and M3 Software | 452 |
| D1 Dimensioning Software | 454 |
| Material Testers and Force Measurement Systems and Software | 477 |
| Laser Measurement - Profile360 and Tire Industry | 493 |





2900-1 and 2900-6 Electronic Indicator




647 Dial Comparator Gage Indicator




3805B Electronic Durometer




Profile360




FMS1000




3250 Dial Height Gage

## APPLICATION-FOCUSED CUSTOM SOLUTIONS

**WHEN YOU HAVE A SPECIAL MEASUREMENT PROBLEM, WE WILL HELP YOU FIND THE SOLUTION.**

One way Starrett stands out from other precision tool providers is our willingness to work directly with customers to develop custom tools.

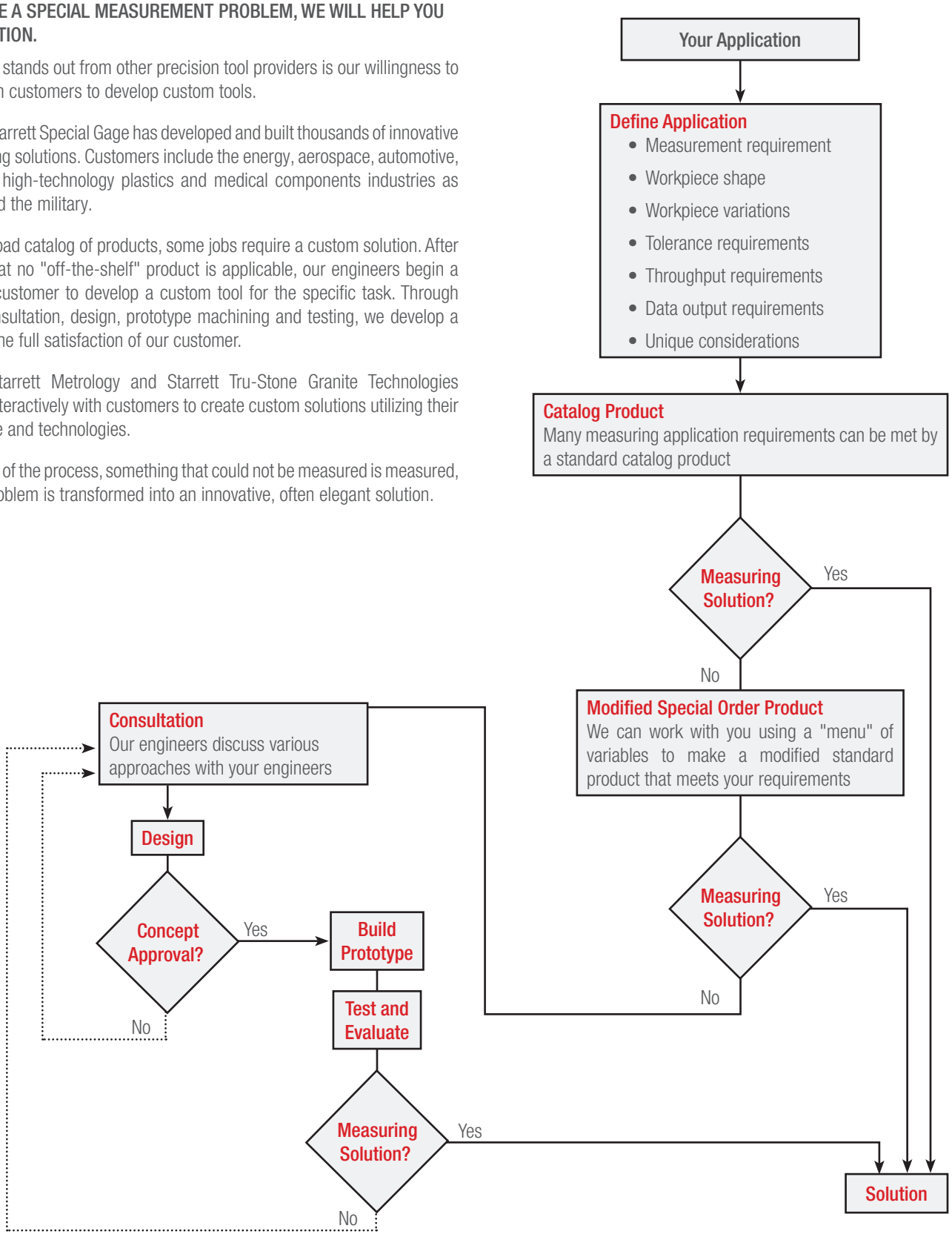
Over 50 years, Starrett Special Gage has developed and built thousands of innovative custom measuring solutions. Customers include the energy, aerospace, automotive, food packaging, high-technology plastics and medical components industries as well as NASA and the military.

Even with our broad catalog of products, some jobs require a custom solution. After we determine that no "off-the-shelf" product is applicable, our engineers begin a dialog with the customer to develop a custom tool for the specific task. Through a process of consultation, design, prototype machining and testing, we develop a specification to the full satisfaction of our customer.

Similarly, the Starrett Metrology and Starrett Tru-Stone Granite Technologies Divisions work interactively with customers to create custom solutions utilizing their specific expertise and technologies.

At the conclusion of the process, something that could not be measured is measured, and a difficult problem is transformed into an innovative, often elegant solution.

### THE CUSTOM SOLUTIONS DEVELOPMENT PROCESS



# Custom Engineered Solutions

## Handheld Tools and Gages

An interactive process between customer and Starrett engineering staffs created a gage that measures the diameter of hot steel flat stock while in the heat treatment process. An accurate measurement takes only two seconds of contact, reducing radiant heat transfer and part spoilage.

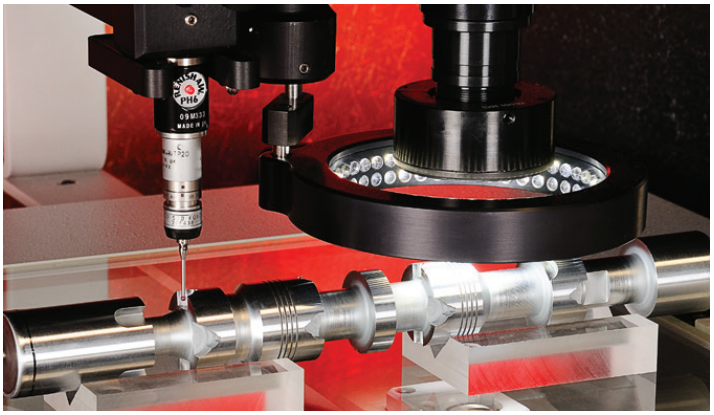
Its electronic indicator locks the reading in the display for safe reading and is accurate to within ±.003".



## Engineered Metrology Systems

This application was custom developed with vision and touch probe sensors. As is the case with many recent systems, two or even three sensors are part of the custom solution.

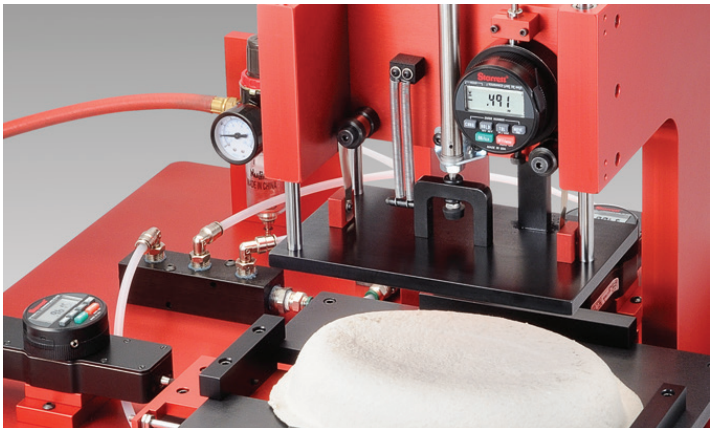
The Starrett Metrology Division works closely with customers to find solutions for complex applications on a regular basis. Their expertise is as important to the solution as the excellence of our system hardware.



## Custom Gage Fixtures

We have worked with many customers to develop a gage to measure a specific food container, some with lids that must fit precisely – not too tight or loose. These containers are a perfect example of something that defies measurement with a standard tool.

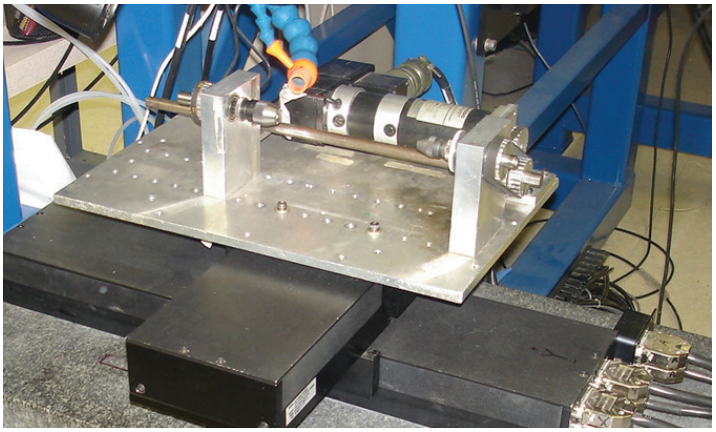
The gage below uses pneumatics to withdraw probes for fast, easy and accurate placement and unloading.



## Granite-Based Engineered Solutions

A medical devices manufacturer could not reliably measure a moving tube on a complex 7-axis laser micro machining system because of persistent vibration.

After extensive design consultation with our Starrett Granite Division, the vibration-dampening attributes of granite stabilized beam delivery, allowing measurement of the tubes at a molecular level.





# General Information

## Specifications and Availability

The information and specifications in this catalog were accurate at the time of publication. Specifications and availability of products, however, are subject to change without notice.

## Quality Assurance

Starrett tools are made to the highest standard of quality and workmanship. We want every tool in the hands of our customers to be accurate and satisfactory. If any tool is found not to be of Starrett quality, please contact our customer service department to arrange a return of that tool. Any tool proved to be defective in material or workmanship will, at our discretion, be repaired or replaced at no Charge.

Please note that we cannot replace or give credit for tools that have been improperly used, stamped or mutilated, or tools that have been altered or repaired by personnel not authorized by The L.S. Starrett Company. We will be pleased to quote a price to repair such tools.

## Accuracy

At the time of manufacture, Starrett precision measuring tools meet or exceed accuracy and performance requirements of national and international standards, and are traceable to the United States National Institute of Standards and Technology.

## Starrett Value

No manufacturer's precision tools are guaranteed to work for life, regardless of the use or abuse they receive. It is worthy to note, however, that we at The L.S. Starrett Company regularly service and repair our precision measuring tools that have been passed from generation to generation. You can count on Starrett for full value.

## Repair and Calibration

We offer expert repair and calibration services at several of our facilities as noted on previous pages. Please contact the appropriate facility to arrange for these services.

## Custom Solutions and Special Orders

As noted, we have built thousands of special tools to meet the unique needs of our customers, and we welcome the opportunity to work with you to meet your special requirements. Please contact our Special Gage Division at (978) 249-3551, or contact the international location that is your supplier.

## How and Where to Order Starrett Products

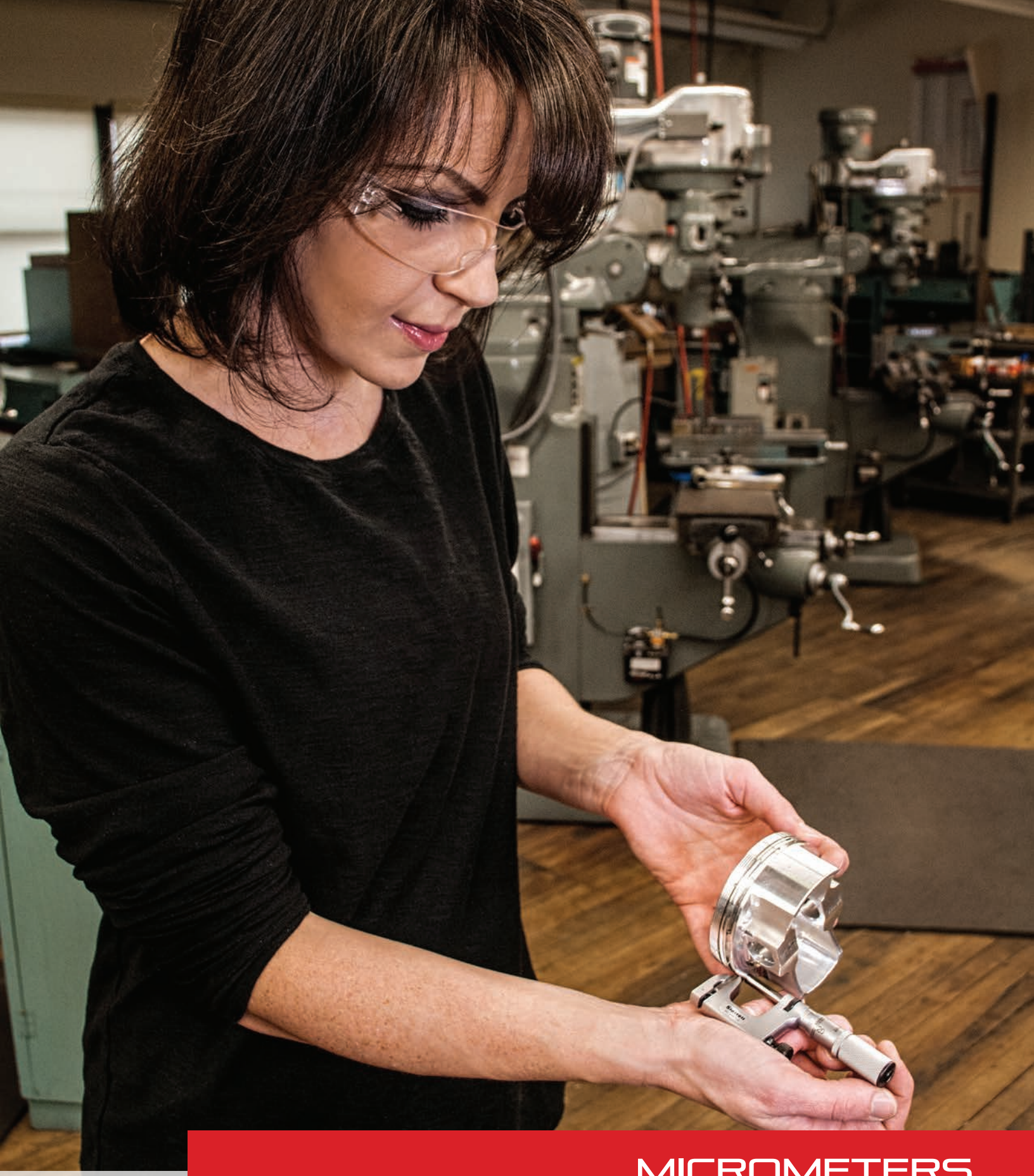
Starrett tools are sold through authorized distributors. Orders should be placed with a Starrett distributor in your area. Please check our website or contact us for assistance in locating your nearest distributor.

Please note that we do not list distributors for our Metrology Products (Vision Systems and Optical Comparators) due to their technically complex and application-specific nature. Please contact our Metrology Division in Laguna Hills, CA at (949) 348-1213 for assistance in finding the best distributor for your application, product and location.

## Product Price

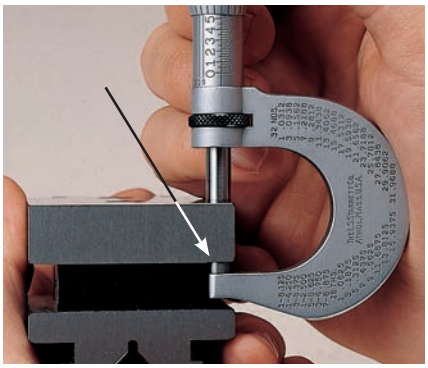
Please contact your distributor for prices of Starrett products. In most cases, we do not quote prices directly to customers. From time to time, we offer promotions with stated prices valid for a defined period. Such promotions are listed on our website and detailed in printed promotional material. If you require help finding a participating distributor, please contact us.



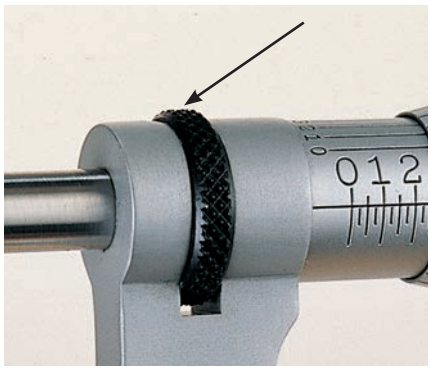


# MICROMETERS

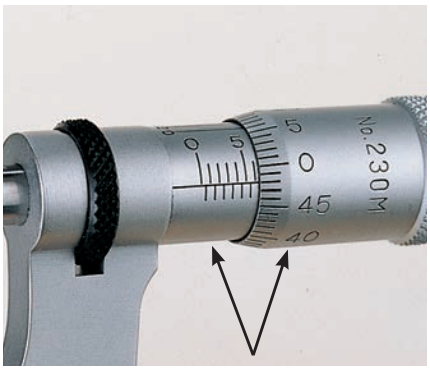
# STARRETT RELIABLE PRECISION MICROMETER DESIGN AND MANUFACTURING FEATURES



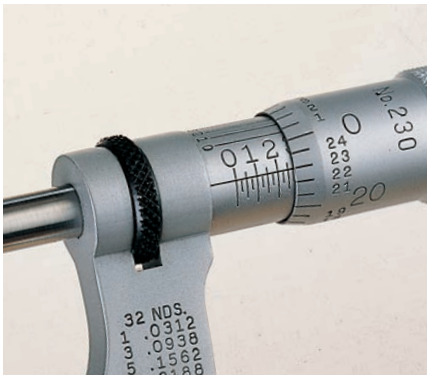
**Tapered frame – a Starrett original feature –** permits measurements in narrow slots and tight places. Standard with Starrett.



**Ring-type lock nut** convenient to use. Permits locking of spindle at any reading.



**Easy to read** with distinct black figures against satin-chrome finish.



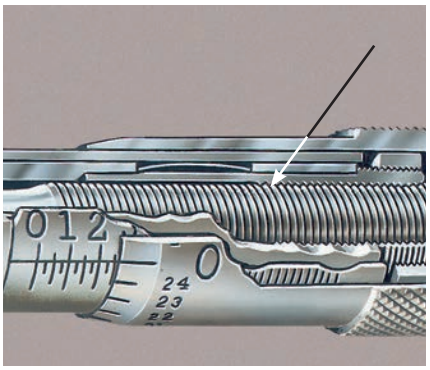
**Staggered graduations, advanced design, a Starrett original feature.** Quick reading figures on inch reading micrometers. Every graduation numbered for quick, positive identification. Easy to read with distinct black figures against satin-chrome finish.



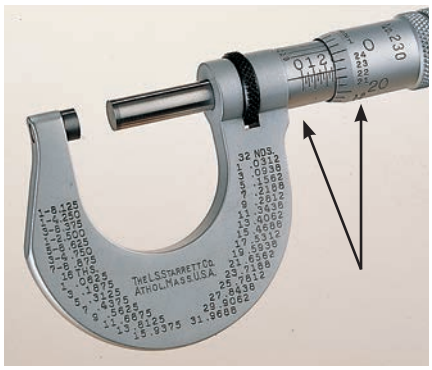
**Friction thimble**, smooth uniform pressure independent of "feel."



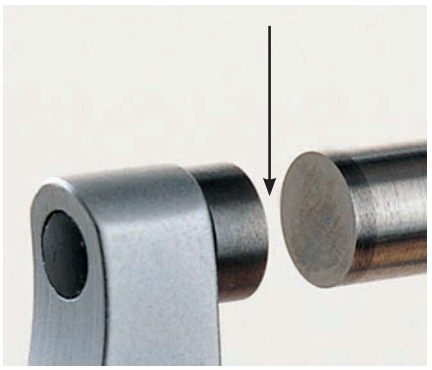
**Ratchet stop/speeder** for consistent measurements and to speed opening or closing of tool.



**Extra Hard Threads with Extreme Lead Accuracy.** Special high carbon steel gives harder threads which are hardened, stabilized, and precision ground from the solid to ensure long and accurate life.



**Balanced design; plus no-glare satin chrome finish** makes the tool easy to hold and read, as well as resistant to stains, corrosion and wear.



**Micro-Lapped "Mirror" Finish on the measuring faces – a Starrett original feature** that ensures more accurate measurements. Available with carbide faces or hardened, high-carbon steel faces.

# Micrometer Quality and Accuracy

Product quality and accuracy cannot be valid unless referenced to a quality and accuracy standard.

All Starrett precision measuring tool standards meet or exceed accuracy and performance specifications of national and international standards and are traceable to the National Institute of Standards and Technology.

The Starrett Company does not rely on statistical sampling inspection. Every precision measuring tool is individually inspected.

All Starrett micrometers have the same accurate heads as outlined in the chart. Inaccuracies because of size can be minimized if the tools are set accurately to standard, and measurements are carried out in a similar position with similar pressure.

**Starrett Micrometer Accuracy Standards (Unless Otherwise Noted on the Catalog Page)**

| Type | Range | Readout | Accuracy |
|---|---|---|---|
| Mechanical | 1" | .001" | ±.0001" |
| | 1" | .0001" | ±.00005" |
| | 25mm | 0.01mm | ±0.002mm |
| | 25mm | 0.001mm | ±0.002mm |
| Electronic | 1" | .00005" | ±.0001" |
| | 25mm | 0.001mm | ±0.002mm |

**Key to Starrett Micrometer Numbering System**

| | |
|---|---|
| **Prefixes** | |
| R | Reverse Reading |
| S | Micrometer Set |
| T | .0001" Reading |
| V | 0.001mm or 0.002mm Reading, as specified |
| **Suffixes** | |
| F | Friction Thimble |
| L | Lock Nut |
| M | Metric |
| N | Non-Rotating |
| P | Plain |
| R | Ratchet Stop |
| S | Speeder |
| TN | Threaded Hub and Check Nut |
| W/SLC | Standard Letter of Certification |
| X | Micro-lapped Carbide Measuring Faces |
| Z | With Case |
| ZZ | Case Only |

## How to Adjust Starrett Micrometers

Adjustments to Starrett Micrometers are rarely needed; however, if it becomes necessary, they can be readily adjusted in two easy operations as follows:



1. If any play should develop in the spindle screw threads due to wear of the spindle nut after long use, first back off the thimble, insert the spanner wrench in the slot of the adjusting nut and tighten just enough to eliminate play. Illustration shows how easily this is done.



2. After carefully cleaning all dirt or grit from the measuring faces of anvil and spindle, bring them together and insert the spanner wrench in the small slot of the sleeve. Then turn the sleeve until the line on the sleeve coincides with the zero line on the thimble as shown.

## Measuring Tips from Our Experience

- Most obvious to everyone is to keep the work to be measured and the micrometer anvil and spindle faces clean.
- For very fine measurements, the micrometer should be set to zero or to a standard by your "feel", by the friction thimble, or by the ratchet, whichever you will be using.
- The most popular micrometer option has been the ratchet speeder because it does three things well: it speeds opening and closing, it applies uniform pressure from the ratchet, and it allows for using the thimble for individual "feel".
- The speeder is helpful because it takes forty turns to cover the range of a typical English-reading tool and fifty turns to cover the range of a metric-reading tool.
- Large micrometers especially should be set to a standard in the same approximate position in which they will be used, that is, vertical or horizontal, to minimize any frame flexure influence.
- Too much speed in approaching the work will result in an inaccurate measurement.
- If the micrometer has been set to a flat standard, you can get approximately .0001" (0.0025mm) difference when measuring over a round because the same pressure is being applied to a point or line contact.
- Carbide or hardened steel measuring faces are a matter of choice. Carbide wears longer but many craftsmen think they get a better "feel" with highly finished steel measuring surfaces.
- Insulating pads on micrometers are a matter of personal preference. With the Starrett balanced micrometer design, there is no need for insulation. Insulation from hand heat is usually more beneficial on long sections, such as end measuring rods.

# How to Read a Starrett Micrometer

## Graduated in Thousandths of an Inch

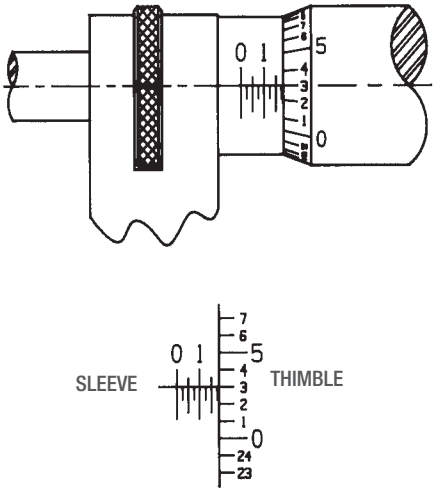
### .001"

The pitch of the screw thread on the spindle is 40 threads per inch. One revolution of the thimble advances the spindle face toward or away from the anvil face precisely 1/40" or .025 inches.

The reading line on the sleeve is divided into 40 equal parts by vertical lines that correspond to the number of threads on the spindle. Therefore, each vertical line designates 1/40" or .025 inches. Lines vary in length for easy reading. Every fourth line, which is longer than the others, designates a hundred thousandth. For example: the line marked "1" represents .100" and the line marked "2" represents .200", etc.

The beveled edge of the thimble is divided into 25 equal parts with each line representing .001" and every line numbered consecutively. Rotating the thimble from one of these lines to the next moves the spindle longitudinally 1/25 of .025", or .001". Rotating two divisions represents .002", etc. Twenty-five divisions indicate a complete revolution of .025" or 1/40 of an inch.

To read the micrometer in thousandths, multiply the number of vertical divisions visible on the sleeve by .025", and to this add the number of thousandths indicated by the line on the thimble which coincides with the reading line on the sleeve.




READING .178"

**EXAMPLE:**

| | |
|---|---|
| The "1" line on sleeve is visible, representing | .100" |
| There are 3 additional lines visible, each representing .025"; 3 x .025" | = .075 |
| Line "3" on the thimble coincides with the reading line on the sleeve, each line representing .001"; 3 x .001" | = .003" |
| The micrometer reading is | 178" |

## Graduated in Ten-Thousandths of an Inch

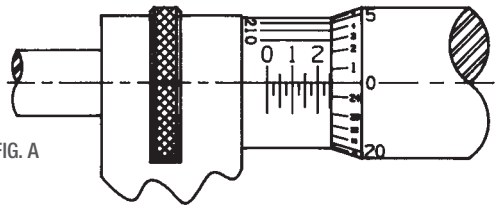
### .0001"

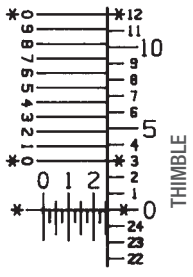
Starrett micrometers graduated in ten-thousandths of an inch read like micrometers graduated in thousandths, except that an additional reading in ten-thousandths is obtained from a vernier scale on the sleeve.

The vernier consists of ten divisions on the sleeve, which occupy the same space as nine divisions on the thimble (Fig. B). Therefore, the difference between the width of one of the ten spaces on the vernier and one of the nine spaces on the thimble is one-tenth of a division on the thimble, or one ten-thousandth (.0001").

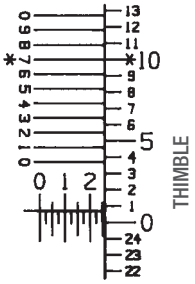
To read a ten-thousandths micrometer, first obtain the thousandths reading, then see which of the lines on the vernier coincides with a line on the thimble. If it is the line marked "1" on the sleeve, add one ten-thousandth, if it is the line marked "2", add two ten-thousandths, etc.

FIG. A






SLEEVE
**FIG. B**
Reading .2500"




SLEEVE
**FIG. C**
Reading .2507"

**FIGURE C – READING .2507"**

| | |
|---|---|
| The "2" line on sleeve is visible, representing | .200" |
| There are two additional lines visible,each representing .025" | .050" |
| The reading line on the sleeve lies between the "0" and "1" on the thimble indicating that a vernier reading must be added | ---- |
| The "7" line is the only line on the vernier that coincides with a line on the thimble, representing 7 x .0001" | = .0007" |
| The micrometer reading is | .2507" |

## Graduated in Hundredths of a Millimeter

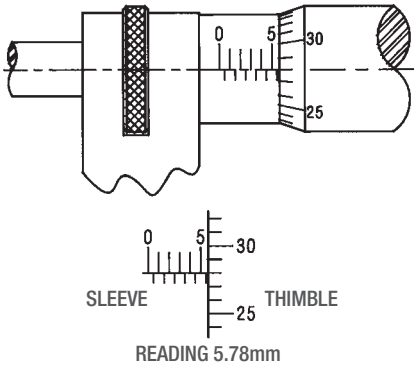
### 0.01MM

The screw head pitch is one-half millimeter (0.5mm). One revolution of the thimble advances the spindle face toward or away from the anvil face precisely 0.5mm.

The reading line on the sleeve is graduated above the line in millimeters (1.0mm) with every fifth millimeter being numbered. Each millimeter is also divided in half (0.5mm) below the reading line. Two revolutions of the thimble to advances the spindle 1.0mm.

The beveled edge of the thimble is divided into fifty equal parts, with each line representing 0.01mm and every fifth line being numbered. Rotating the thimble from one of these lines to the next moves the spindle longitudinally 0.01mm; rotating two divisions represents 0.02mm, etc.

To read the micrometer, add the number of millimeters and half-millimeters visible on the sleeve to the number of hundredths of a millimeter indicated by the thimble graduation indicated by the reading line.




**EXAMPLE:**

| | |
|---|---|
| The 5mm sleeve graduation is visible..... | 5.00mm |
| One additional 0.5mm line is visible on the sleeve..... | 0.50mm |
| Line 28 on the thimble coincides with the reading line on the sleeve, so 28 x 0.01mm..... | = 0.28mm |
| The micrometer reading is..... | 5.78mm |

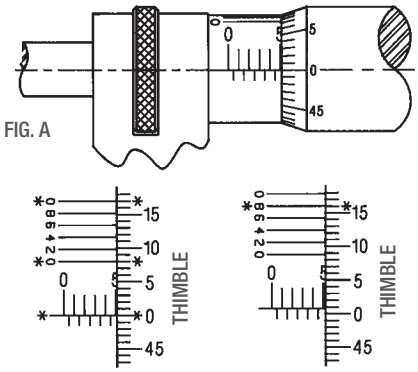
## Graduated in Two-Thousandths of a Millimeter

### 0.002MM

Metric vernier micrometers graduated in 0.002mm are used like those graduated in hundredths of a millimeter (0.01mm), except that an additional reading in two-thousandths of a millimeter (0.002mm) is obtained from a vernier scale on the sleeve.

The vernier consists of five divisions on the sleeve, which occupy the same space as nine divisions on the thimble (Fig. B). Therefore, the difference between the width of one of the five spaces on the vernier and one of the nine spaces on the thimble is one-fifth or two-tenths of a division on the thimble, or two-thousandths (0.002mm).

To read a 0.002mm micrometer, first obtain the hundredth of a millimeter (0.01mm) reading, then see which of the lines on the vernier coincides with a line on the thimble. If it is the line marked "2" add 0.002mm, if it is the line marked "4" add 0.004mm, etc.




SLEEVE **FIG. B** Reading 5.000mm

SLEEVE **FIG. C** Reading 5.008mm

**FIGURE C – READING 5.008mm**

| | |
|---|---|
| The 5mm sleeve graduation is visible..... | 5.000mm |
| No additional lines on the sleeve are visible..... | 0.000mm |
| The reading line on the sleeve lies between zero and the first line on the thimble, indicating that a vernier reading must be aded..... | ---- |
| Line 8 on the vernier is the only line that coincides with a line on the thimble..... | 0.008mm |
| The micrometer reading is..... | 5.008mm |

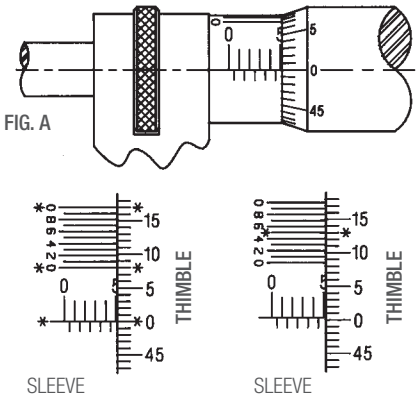
## Graduated in One-Thousandth of a Millimeter

### 0.001MM

Reading a 0.001mm micrometer is exactly like reading a 0.002mm micrometer except that there are ten divisions on the vernier occupying the same space as nine divisions on the thimble (Fig. B). Therefore, the difference between the width of one of the spaces on the vernier and one of the nine spaces on the thimble is one-tenth of a division on the thimble, or one-thousandth (0.001mm).

First obtain the hundredth of a millimeter (0.01mm) reading. Next, see which of the lines on the vernier coincides with a line on the thimble. If it is the first line add

0.001mm to the reading, if it is the second line add 0.002mm, etc. Only every second vernier line is numbered on a 0.001mm reading tool because of space congestion.




SLEEVE **FIG. B** Reading 5.000mm

SLEEVE **FIG. C** Reading 5.005mm

**FIGURE C – READING 5.005mm**

| | |
|---|---|
| The 5mm sleeve graduation is visible, representing..... | 5.000mm |
| No additional lines on the sleeve are visible.. | 0.000mm |
| The reading line on the sleeve lies between zero and the first line on the thimble, indicating that a vernier reading must be added..... | ---- |
| Line 5 on the vernier is the only line that coincides with a line on the thimble..... | 0.005mm |
| The micrometer reading is..... | 5.005mm |

# Electronic Micrometers

## 795 Electronic Micrometers (with output)

**0-4"/0-100MM**

## 796 Electronic Micrometers (without output)

**0-4"/0-100MM**

795 and 796 Electronic Micrometers provide an IP67 level of protection against coolant, water, chips, dirt, dust, and other contaminants in hostile shop environments.

The 795 includes an RS232 output port for data transmission and works well with Starrett DataSure® Wireless Data Collection Systems. The 796 has all of the features of the 795 except that is does not include output.

These full-featured electronic micrometers are built with customary Starrett quality and workmanship.

The family of 795 and 796 Electronic Micrometers are now available with measuring capacities to 4" (100mm).



795XFL-1 with a DataSure End Node



### Features and Specifications

- Large, easy-to-read (.275"/7mm), high-contrast LCD digital readout
- IP67 level of protection against coolant, water, dust and dirt
- Starrett no-glare satin chrome finish on thimble and sleeve
- Balanced, tapered frame for comfortable and accurate measuring
- Extremely hard, and stable one piece spindle, the heart of our accuracy and smooth operating one-piece friction thimble
- Two 3-volt batteries included for more than one year of normal usage
- Automatic OFF after 20 minutes of nonuse
- Inch/millimeter conversion
- Measurement HOLD button
- Ability to zero tool at any position as well as retain and return to the true zero reading of the micrometer
- Resolution: .00005" (0.001mm)
- Accuracies: ±.0001" (±.002mm)
- 795 Micrometers include RS232 output
- Output data to Starrett SPC Plus hardware and software and to PCs
- Works well with Starrett DataSure Wireless Data Collection Systems



| 795 Electronic Micrometers with Output | | | | | | |
|---|---|---|---|---|---|---|
| | Friction Thimble, Spindle Lock, Shell and Thimble Inch Grads. | | Ratchet Stop, Lock Nut, Shell and Thimble Inch Grads. | | Friction Thimble, Spindle Lock, Shell and Thimble Metric Grads. | |
| Range | Cat. No. | EDP | Cat. No. | EDP | Cat. No. | EDP |
| 0-1" and 0-25mm | 795XFL-1 | 67827 | 795XRL-1 | 69085 | 795MEXFL-25 | 69077 |
| 1-2" and 25-50mm | 795XFL-2 | 69074 | 795XRL-2 | 69086 | 795MEXFL-50 | 69078 |
| 2-3" and 50-75mm | 795XFL-3 | 69075 | 795XRL-3 | 69087 | 795MEXFL-75 | 69079 |
| 3-4" and 75-100mm | 795XFL-4 | 69076 | 795XRL-4 | 69088 | 795MEXFL-100 | 69080 |
| **796 Electronic Micrometers without output** | | | | | | |
| 0-1" and 0-25mm | 796XFL-1 | 67828 | 796XRL-1 | 69089 | 796MXFL-25 | 69084 |
| 1-2" and 25-50mm | 796XFL-2 | 69081 | 796XRL-2 | 69090 | | |
| 2-3" and 50-75mm | 796XFL-3 | 69082 | 796XRL-3 | 69091 | | |
| 3-4" and 75-100mm | 796XFL-4 | 69083 | 796XRL-4 | 69092 | | |

| 795 Electronic Micrometer Accessories | | |
|---|---|---|
| 1m Shielded Cable to Starrett 795 | PT62680-1 | 62021 |
| 2m Shielded Cable to Starrett 795 | PT62680-2 | 62022 |
| 3m Shielded Cable to Starrett 795 | PT62680-3 | 62023 |
| Adaptor from PT62680-1, PT62680-2 and PT62680-3 to PC (RS232) | PT61768 | 66454 |
| DataSure® End Node | 1500-3A-2N | 12531 |
| Two 3-volt Batteries, CR2032 | PT99492 | 65650 |

| Sets | | | |
|---|---|---|---|
| Range | Cat. No. | EDP | Description |
| 0-3" and 0-75mm | S795AXFLZ | 69910 | Electronic Micrometer Set, includes 795XFL-1, 795XFL-2 and 795XFL-3 |
| 0-4" and 0-100mm | S795BXFLZ | 69911 | Electronic Micrometer Set, includes 795XFL-1, 795XFL-2, 795XFL-3 and 795XFL-4 |
| 0-3" and 0-75mm | S796AXRLZ | 69912 | Electronic Micrometer Set, includes 796XRL-1, 796XRL-2 and 796XRL-3 |
| 0-4" and 0-100mm | S796BXRLZ | 69913 | Electronic Micrometer Set, includes 796XRL-1, 796XRL-2, 796XRL-3 and 796XRL-4 |

All 795 and 796 Micrometers include a protective case. All except 1" and 0-25mm sizes furnished with standards.

| Key to Starrett Micrometer Numbering System | |
|---|---|
| **Prefixes** | |
| R | Reverse Reading |
| S | Micrometer Set |
| T | .0001" Reading |
| V | 0.001mm or 0.002mm Reading, as specified |
| **Suffixes** | |
| F | Friction Thimble |
| L | Lock Nut |
| M | Metric |
| N | Non-Rotating |
| P | Plain |
| R | Ratchet Stop |
| S | Speeder |
| TN | Threaded Hub and Check Nut |
| W/SLC | Standard Letter of Certification |
| X | Micro-lapped Carbide Measuring Faces |
| Z | With Case |
| ZZ | Case Only |




## IP PROTECTION

An IP number is composed of two numbers, the first referring to protection against solid objects and the second against liquids.

**First number 6**: Totally protected against dust

**Second number 7**: Protection against submersion in water under standardized conditions of pressure for 30 minutes

All 795 and 796 Micrometers include IP67 protection



# ELECTRONIC MICROMETERS

## 3732 ELECTRONIC MICROMETERS (WITHOUT OUTPUT)

### 0-6"/0-150MM

The 3732 Electronic Micrometer is a full-featured precision measuring tool built with customary Starrett quality and workmanship. The 3732 includes a large, easy-to-read, high contrast LCD digital readout for clear readings. With its automatic OFF functionality, smooth friction thimble for uniform pressure, and balanced frame design, the 3732 provides comfortable and accurate measuring.

| 3732 Inch/Metric Micrometers without Output | | | | | | | |
|---|---|---|---|---|---|---|---|
| | | Range | | Resolution | | Accuracy | |
| Cat. No. | EDP | Inch | Approx. mm | Inch | mm | Inch | mm |
| 3732XFL-1 | 12268 | 0-1" | 0-25.4 | 0.00005 | 0.001 | ± 0.0001 | ± 0.002 |
| 3732XFL-2 | 12269 | 1-2" | 25.4-50.8 | 0.00005 | 0.001 | ± 0.0001 | ± 0.003 |
| 3732XFL-3 | 12270 | 2-3" | 50.8-76.2 | | | | |
| 3732XFL-4 | 12271 | 3-4" | 76.2-101.6 | 0.00005 | 0.001 | ± 0.00015 | ± 0.004 |
| 3732XFL-5 | 12272 | 4-5" | 101.6-127 | 0.0001 | 0.001 | ± 0.00015 | ± 0.004 |
| 3732XFL-6 | 12273 | 5-6" | 127-152.4 | | | | |
| **3732 Inch/Metric Micrometer Sets without Output** | | | | | | | |
| S3732BXFLZ | 12726 | 0-1" to 3-4" | 0-25.4 to 76.2-101.6 | 0 to 4 Inch Set of Four Micrometers in metal case | | | |
| S3732CXFLZ | 12727 | 0-1" to 5-6" | 0-25.4 to 101.6-152.4 | 0 to 6 Inch Set of Six Micrometers in metal case | | | |
| **3732 Metric/Inch Micrometers without Output** | | | | | | | |
| Cat. No. | EDP | mm | Approx. Inch | mm | Inch | mm | Inch |
| 3732MEXFL-25 | 12274 | 0-25 | 0-.984 | 0.001 | 0.00005 | ± 0.002 | ± 0.0001 |
| 3732MEXFL-50 | 12275 | 25-50 | .984-1.968 | 0.001 | 0.00005 | ± 0.003 | ± 0.0001 |
| 3732MEXFL-75 | 12276 | 50-75 | 1.968-2.953 | | | | |
| 3732MEXFL-100 | 12277 | 75-100 | 2.953-3.937 | 0.001 | 0.00005 | ± 0.004 | ± 0.0001 |
| 3732MEXFL-125 | 12278 | 100-125 | 3.937-4.921 | 0.001 | 0.0001 | ± 0.004 | ± 0.0001 |
| 3732MEXFL-150 | 12279 | 125-150 | 4.921-5.905 | | | | |
| **3732 Micrometer Accessories** | | | | | | | |
| PT99492 | 65650 | CR2032 3-volt battery for 3732 Micrometers | | | | | |

### FEATURES AND SPECIFICATIONS

- Automatic OFF after 30 minutes of nonuse
- .250" (6.35mm) spindle diameter
- No-glare black wrinkle finish on frame
- No-glare satin chrome finish on thimble and sleeve
- Ring-type knurled lock nut for quick and sure locking
- English/Metric models feature inch graduations on shell and thimble
- Metric/English (ME) models have mm graduations on shell and thimble
- Instant inch/millimeter conversion
- Measurement HOLD button
- Ability to zero tool at any position
- Ability to retain and return to the true zero reading of the micrometer
- PRESET button to install any reading at any position
- Includes one 3-volt battery for over one year of normal usage
- Includes fitted plastic case



3732XFL-4



3732XFL-1



S3732CXFLZ



# Electronic Micrometers

## 733 Electronic Micrometers (with output)

### 0-24"/0-600MM

- Same features as the 3732, plus output jack allows data transmission, either through a traditional wire or by connecting to a Starrett DataSure® Wireless Data Collection System end node
- Wide variety of sizes up to 24" with output

**733 Electronic Micrometers with Standard Inch Graduations**

| Range | | Resolution | | | |
|---|---|---|---|---|---|
| Inch | Approx. mm | Inch | mm | Cat. No. | EDP |
| 0 - 1 | 0 - 25.4 | .00005 | 0.001 | 733XFL-1 | 64239 |
| | | | | 733XFL-1 W/SLC | 66905 |
| 1 - 2 | 25.4 - 50.8 | | | 733XFLZ-2 | 64241 |
| 2 - 3 | 50.8 - 76 | .00005 | 0.001 | 733XFLZ-3 | 64242 |
| 3 - 4 | 76 - 101 | | | 733XFLZ-4 | 64243 |
| 4 - 5 | 101 - 127 | .0001 | 0.001 | 733XFLZ-5 | 64244 |
| 5 - 6 | 127 - 152 | | | 733XFLZ-6 | 64245 |
| 6 - 7 | 152 - 178 | | | 733XFLZ-7 | 64246 |
| 7 - 8 | 178 - 203 | | | 733XFLZ-8 | 64247 |
| 8 - 9 | 203 - 228 | | | 733XFLZ-9 | 64248 |
| 9 - 10 | 228 - 254 | | | 733XFLZ-10 | 64249 |
| 10 - 11 | 254 - 279 | | | 733XFLZ-11 | 64250 |
| 11 - 12 | 279 - 305 | | | 733XFLZ-12 | 64251 |
| 12 - 13 | 305 - 330 | | | 733XFLZ-13 | 64415 |
| 13 - 14 | 330 - 355 | | | 733XFLZ-14 | 64416 |
| 14 - 15 | 355 - 381 | .0001 | 0.001 | 733XFLZ-15 | 64417 |
| 15 - 16 | 381 - 406 | | | 733XFLZ-16 | 64418 |
| 16 - 17 | 406 - 432 | | | 733XFLZ-17 | 64419 |
| 17 - 18 | 432 - 457 | | | 733XFLZ-18 | 64420 |
| 18 - 19 | 457 - 482 | | | 733XFLZ-19 | 64421 |
| 19 - 20 | 482 - 508 | | | 733XFLZ-20 | 64422 |
| 20 - 21 | 508 - 533 | | | 733XFLZ-21 | 64423 |
| 21 - 22 | 533 - 559 | | | 733XFLZ-22 | 64424 |
| 22 - 23 | 559 - 584 | | | 733XFLZ-23 | 64425 |
| 23 - 24 | 584 - 609 | | | 733XFLZ-24 | 64426 |

All except 1" size furnished with standards.

**733 Electronic Micrometers with Standard Millimeter Graduations**

| Range | | Resolution | | | |
|---|---|---|---|---|---|
| mm | Approx. Inch | mm | Inch | Cat. No. | EDP |
| 0 - 25 | 0 - .984 | 0.001 | .00005 | 733MEXFL-25 | 65440 |
| 25 - 50 | .984 - 1.968 | | | 733MEXFLZ-50 | 65441 |
| 50 - 75 | 1.968 - 2.950 | 0.001 | .00005 | 733MEXFLZ-75 | 66079 |
| 75 - 100 | 2.950 - 3.930 | | | 733MEXFLZ-100 | 66080 |
| 100 - 125 | 3.930 - 4.920 | 0.001 | .0001 | 733MEXFLZ-125 | 66081 |
| 125 - 150 | 4.920 - 5.900 | | | 733MEXFLZ-150 | 66082 |
| 150 - 175 | 5.900 - 6.890 | | | 733MEXFLZ-175 | 66083 |
| 175 - 200 | 6.890 - 7.870 | | | 733MEXFLZ-200 | 66084 |
| 200 - 225 | 7.870 - 8.850 | | | 733MEXFLZ-225 | 66085 |
| 225 - 250 | 8.850 - 9.840 | | | 733MEXFLZ-250 | 66086 |
| 250 - 275 | 9.840 - 10.820 | | | 733MEXFLZ-275 | 66087 |
| 275 - 300 | 10.820 - 11.810 | | | 733MEXFLZ-300 | 66088 |
| 300 - 325 | 11.810 - 12.790 | | | 733MEXFLZ-325 | 66089 |
| 325 - 350 | 12.790 - 13.770 | | | 733MEXFLZ-350 | 66090 |
| 350 - 375 | 13.770 - 14.760 | 0.001 | .0001 | 733MEXFLZ-375 | 66091 |
| 375 - 400 | 14.760 - 15.740 | | | 733MEXFLZ-400 | 66092 |
| 400 - 425 | 15.740 - 16.730 | | | 733MEXFLZ-425 | 66093 |
| 425 - 450 | 16.730 - 17.710 | | | 733MEXFLZ-450 | 66094 |
| 450 - 475 | 17.710 - 18.700 | | | 733MEXFLZ-475 | 66095 |
| 475 - 500 | 18.700 - 19.680 | | | 733MEXFLZ-500 | 66096 |
| 500 - 525 | 19.680 - 20.660 | | | 733MEXFLZ-525 | 66097 |
| 525 - 550 | 20.660 - 21.650 | | | 733MEXFLZ-550 | 66098 |
| 550 - 575 | 21.650 - 22.630 | | | 733MEXFLZ-575 | 66099 |
| 575 - 600 | 22.630 - 23.620 | | | 733MEXFLZ-600 | 66100 |

All except 1" and 0-25mm sizes furnished with standards.




733 Micrometer with DataSure End Node

**733 Electronic Micrometer Accessories**

| Description | Cat. No. | EDP |
|---|---|---|
| Protective case for 733 Micrometers | 957 | 66565 |
| Deluxe padded case for 25mm 733 Micrometers | 949 | 63874 |
| Computer cable to PC | 733SCKB | 69888 |
| Cable to computer running SPC Data Collection Software | 733SCU | 69898 |
| Connection to 7612 or 7613 Multiplexer | 733SCM | 69893 |
| One 3-Volt Battery CR2450 for 733 Micrometers | PT61120 | 65446 |

**733 Micrometer Specifications**

| Description | Inch | mm |
|---|---|---|
| Resolution through 4" (100mm) | .00005" | 0.001mm |
| Resolution over 4" (100mm) | .0001" | 0.001mm |
| Accuracy* | ±.0001" | ±0.002mm |

* Accuracies above 1" (25mm) are as good as setting to a gage because the mechanical and electronic components are the same on all ranges.



# Digital Micrometers

## S216 Digital Micrometer Set

**0-3"**

Set of three digital micrometers – furnished with ratchet stop, lock nut, and standards, in case.

- Set consists of three micrometers: 0-1", 1-2", and 2-3"
- .001" is read directly from the counter
- .0001" is read from the sleeve
- Clear, easily read numbers
- Balanced frame design and extremely hard and stable one-piece spindle

| S216 Digital Micrometer Set | |
|---|---|
| Cat. No. | EDP |
| ST216AXRLZ | 66526 |




## 216, 216M Digital Micrometers

**0-12"/0-300MM**

This is the 216 Mechanical Digital Micrometer – simple to use even by the inexperienced. The anvil and spindle are sized at .250" (6.35mm).

### Readability Features

- Clear, easily read numbers reduce errors
- No-glare black finish on the frame
- Starrett no-glare satin chrome finish on thimble and sleeve
- .001" or .01mm is read directly from the counter
- .0001" or .001mm is read from the vernier scale on the micrometer sleeve

### Ease-of-Handling Features

- Balanced frame design for comfortable and accurate measuring
- Ring-type knurled lock nut for quick and sure locking
- A choice of smooth friction thimble for uniform pressure on the 1-4" sizes or the combination ratchet and speeder for uniform pressure and quicker adjustment on all sizes
- Gracefully designed tapered frame for use in narrow slots and tight places

### Accuracy and Long-Life Features

- Extremely hard and stable one-piece spindle (the heart of our accuracy)

# 216, 216M Digital Micrometers

## 216 Digital Micrometers

| Graduations | Range | Measuring Faces | Ratchet Stop and Lock Nut Cat. No. | Ratchet Stop and Lock Nut EDP | Friction Thimble and Lock Nut Cat. No. | Friction Thimble and Lock Nut EDP | Plain Cat. No. | Plain EDP |
|---|---|---|---|---|---|---|---|---|
| .001" | 0-1" | Steel | 216RL-1 | 55953 | 216FL-1 | 55954 | 216P-1 | 55952 |
| | | Carbide | 216XRL-1 | 55955 | 216XFL-1 | 55956 | | |
| .001" | 1-2" | Steel | 216RL-2 | 56153 | 216FL-2 | 56257 | | |
| | 2-3" | | 216RL-3 | 56205 | 216FL-3 | 56206 | | |
| | 3-4" | | 216RL-4 | 56208 | 216FL-4 | 56209 | | |
| | 4-5" | | 216RL-5 | 63470 | | | | |
| | 5-6" | | 216RL-6 | 63471 | | | | |
| .001" | 6-7" | Carbide | 216XRL-7 | 63628 | | | | |
| | 7-8" | | 216XRL-8 | 63629 | | | | |
| | 8-9" | | 216XRL-9 | 63630 | | | | |
| | 9-10" | | 216XRL-10 | 63631 | | | | |
| | 10-11" | | 216XRL-11 | 63632 | | | | |
| | 11-12" | | 216XRL-12 | 63633 | | | | |
| .0001" | 0-1" | Carbide | T216XRL-1 | 55959 | T216XFL-1 | 55960 | | |
| | | | T216XRL-1 W/SLC | 66904 | T216XFL-1 W/SLC | 66903 | | |
| | 1-2" | | T216XRL-2 | 56156 | T216XFL-2 | 56157 | | |
| | 2-3" | | T216XRL-3 | 63491 | T216XFL-3 | 63634 | | |
| | 3-4" | | T216XRL-4 | 63492 | T216XFL-4 | 63635 | | |
| | 4-5" | | T216XRL-5 | 63493 | | | | |
| | 5-6" | | T216XRL-6 | 63494 | | | | |
| | 6-7" | | T216XRL-7 | 63495 | | | | |
| | 7-8" | | T216XRL-8 | 63496 | | | | |
| | 8-9" | | T216XRL-9 | 63497 | | | | |
| | 9-10" | | T216XRL-10 | 63498 | | | | |
| | 10-11" | | T216XRL-11 | 63499 | | | | |
| | 11-12" | | T216XRL-12 | 63500 | | | | |

## Cases Only for 216 and 216M Digital Micrometers

| Fits Micrometer Range inch | Fits Micrometer Range mm | Cat. No. | EDP |
|---|---|---|---|
| 0-1" | 0-25mm | 942 | 55961 |
| 1-2" | 25-50mm | 216ZZ-2 | 56171 |
| 2-3" | 50-75mm | 922 | 55222 |
| 3-4" | 75-100mm | 952 | 55223 |
| 4-5" | 100-125mm | 953 | 55224 |
| 5-6" | 125-150mm | 954 | 55225 |
| 6-7" | 150-175mm | 930 | 55276 |
| 7-8" | 175-200mm | 931 | 55277 |
| 8-9" | 200-225mm | 932 | 55278 |
| 9-10" | 225-250mm | 933 | 55279 |
| 10-11" | 250-275mm | 934 | 55280 |
| 11-12" | 275-300mm | 935 | 55281 |

## 216M Digital Micrometers

| Graduations | Range | Measuring Faces | Ratchet Stop and Lock Nut Cat. No. | Ratchet Stop and Lock Nut EDP | Friction Thimble and Lock Nut Cat. No. | Friction Thimble and Lock Nut EDP |
|---|---|---|---|---|---|---|
| 0.01mm | 0-25mm | Carbide | 216MXRL-25 | 55983 | 216MXFL-25 | 55984 |
| | 25-50mm | | 216MXRL-50 | 65602 | | |
| | 50-75mm | | 216MXRL-75 | 65603 | | |
| | 75-100mm | | 216MXRL-100 | 65604 | | |
| | 100-125mm | | 216MXRL-125 | 64351 | | |
| | 125-150mm | | 216MXRL-150 | 64352 | | |
| | 150-175mm | | 216MXRL-175 | 64353 | | |
| | 175-200mm | | 216MXRL-200 | 64354 | | |
| | 200-225mm | | 216MXRL-225 | 64355 | | |
| | 225-250mm | | 216MXRL-250 | 64356 | | |
| | 250-275mm | | 216MXRL-275 | 64357 | | |
| | 275-300mm | | 216MXRL-300 | 64358 | | |
| 0.001mm | 0-25mm | Carbide | V216MXRL-25 | 56037 | V216MXFL-25 | 56036 |
| | 25-50mm | | V216MXRL-50 | 64348 | | |
| | 50-75mm | | V216MXRL-75 | 64349 | | |
| | 75-100mm | | V216MXRL-100 | 64350 | | |



# OUTSIDE MICROMETERS

## 232, 232M OUTSIDE MICROMETERS

### 0-1/2"/0-12.5MM

These micrometers are the 1/2" (13mm) companions of the top-of-the-line 230 Micrometers. The spindle and anvil are sized at .200" (5mm).

#### FEATURES AND SPECIFICATIONS

- Starrett satin chrome finish – no glare – resists rust
- Advanced sleeve design with staggered lines and distinct figures for precise and easy readability
- Convenient decimal equivalents on inch tools
- Rigid one-piece frame of drop forged steel
- Extremely hard and stable one-piece spindle (the heart of our accuracy)
- Quick and easy adjustment
- Balanced frame and thimble design ensure easy handling and better readability
- Ring-type knurled lock nut for quick and sure locking
- Combination ratchet and speeder for uniform pressure and quicker adjustment
- Gracefully designed tapered frame for use in narrow slots and tight places

| 232 and 232M Outside Micrometers | | | |
|---|---|---|---|
| **Cat. No.** | **EDP** | **Range** | **Graduation** |
| 232RL | 50953 | 0-1/2" | .001" |
| T232RL | 50955 | | .0001" |
| T232XRL | 50968 | | |
| 232MRL | 50954 | 0-13mm | 0.01mm |
| V232MXRL | 64231 | | 0.002mm |
| **Attractive, Protective Case for 232 and 232M Outside Micrometers** | | | |
| 921 | 55213 | Case for 1/2" (13mm) Micrometers | |




## 230, 230M OUTSIDE MICROMETERS

### 0-1"/0-25MM

This is the jewel of precision micrometers used by skilled workmen worldwide. The spindle and anvil are sized at .235" (6mm) to reach places most micrometers cannot reach.

#### FEATURES AND SPECIFICATIONS

- Same as our 232 Outside Micrometers plus quick-reading figures – every thousandth numbered on inch tools
- Same as our 232 Outside Micrometers with a choice of smooth friction thimble for uniform pressure or the combination ratchet and speeder for uniform pressure and quicker adjustment

| 230 and 230M Outside Micrometers (0-1" Range) | | |
|---|---|---|
| **Cat. No.** | **EDP** | **Graduation** |
| 230P | 50932 | .001" |
| 230RL | 50935 | |
| 230FL | 50938 | |
| T230RL | 50943 | .0001" |
| T230XRL | 50944 | |
| T230XRL W/SLC | 64401 | |
| T230FL | 50946 | |
| T230XFL | 50947 | |
| T230XFL W/SLC | 66916 | |
| V230MXRL | 56017 | 0.001mm |
| V230MXFL | 56016 | |
| **Deluxe Padded Case for 230 and 230M Outside Micrometers** | | |
| 910 | 55397 | Case for 1" (25mm) Micrometers |



# Outside Micrometers

## 2A, 2MA Outside Micrometers with Attachment

### 0-2"/0-50MM

These micrometers are versions of the 2 and 2M that include an attachment to handle measurements from 0-1" or 0-25mm, thereby extending the total range from 0-2" or 50mm.

Easily and quickly attached to the anvil of the micrometer, it is only necessary to tighten a locking screw to make the conversion. The anvil extension is hardened, ground and lapped. No-glare satin chrome finish.

| 2 and 2M Outside Micrometers | | | |
|---|---|---|---|
| **Cat. No.** | **EDP** | **Range** | **Graduation** |
| T2XRL<br>T2XFL | 50024<br>50025 | 1-2" | .0001" |
| 2MXRL<br>V2MXRL | 50026<br>63793 | 25-50mm | 0.01mm<br>0.001mm |
| **2A and 2MA Outside Micrometer** | | | |
| 2ARL | 50027 | 0-2" | .001" |
| 2MARL | 50029 | 0-50mm | 0.01mm |
| **Deluxe Padded Case for 2, 2A, 2M and 2MA Outside Micrometers** | | | |
| **Cat. No.** | **EDP** | **Description** | |
| 912 | 55399 | Case for 2" and 50mm Micrometers | |




| Key to Starrett Micrometer Numbering System | |
|---|---|
| **Prefixes** | |
| R | Reverse Reading |
| S | Micrometer Set |
| T | .0001" Reading |
| V | 0.001mm or 0.002mm Reading, as specified |
| **Suffixes** | |
| F | Friction Thimble |
| L | Lock Nut |
| M | Metric |
| N | Non-Rotating |
| P | Plain |
| R | Ratchet Stop |
| S | Speeder |
| TN | Threaded Hub and Check Nut |
| W/SLC | Standard Letter of Certification |
| X | Micro-lapped Carbide Measuring Faces |
| Z | With Case |
| ZZ | Case Only |

## 2, 2M Outside Micrometers

### 1-2"/25-50MM

These micrometers are the 2" (50mm) companions of the top-of-the-line 230 Micrometer.

The spindle and anvil are sized at .235" (6mm) to reach places other micrometers cannot.

#### Readability Features

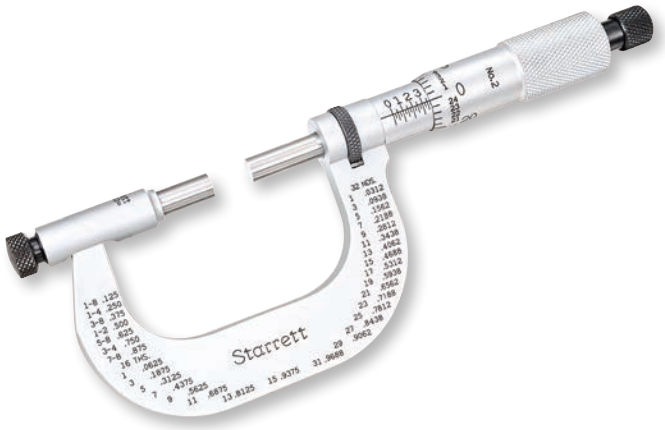
- Starrett satin chrome finish – no glare – resists rust
- Advanced sleeve design with staggered and distinct figures for precise and easy readability
- Convenient decimal equivalents on inch tools

#### Ease-of-Handling Features

- Balanced frame and thimble design ensure easy handling and better readability
- Ring-type knurled lock nut for quick and sure locking
- A choice of smooth friction thimble for uniform pressure or the combination ratchet and speeder for uniform pressure and quicker adjustment
- Gracefully designed tapered frame for use in narrow slots and tight places

#### Accuracy and Long-Life Features

- Rigid one-piece frame of drop forged steel
- Extremely hard and stable one-piece spindle (the heart of our accuracy)
- Appropriate 1" or 25mm gage block standard furnished with micrometers



# Micrometers

## 231, 231M Micrometers with Insulated Frames

### 0-1"/0-25MM

This is a slightly heavier micrometer with thermal insulators mounted on the frame front and rear. This spindle and anvil are sized at .250" (6.35mm).

#### Readability Features

- Starrett satin chrome finish – no glare – resists rust
- Advanced sleeve design with staggered lines and distinct figures for precise and easy readability
- Quick-reading figures – every thousandth numbered on inch tools

#### Ease-of-Handling Features

- Balanced frame and thimble design ensure easy handling and better readability
- Ring-type knurled lock nut for quick and sure locking
- A combination ratchet and speeder for uniform pressure and quicker adjustment on all sizes
- Gracefully designed tapered frame for use in narrow slots and tight places

#### Accuracy and Long-Life Features

- Rigid one-piece frame of drop forged steel
- Extremely hard and stable one-piece spindle (the heart of our accuracy)
- Quick and easy adjustment

## 221 Hi-Precision Micrometer

### 0-1"

- Permits direct readings in ten-thousandths of an inch (.0001") without a vernier, plus automatic control of spindle pressure
- Black graduated inner thimble and sleeve reading in thousandths and red graduated outer thimble and sleeve with large, widely spaced graduations which give direct readings in ten-thousandths

#### Readability Features

- Exclusive constant pressure mechanism eliminates "feel" and ensures constant spindle pressure for all readings
- Starrett satin chrome finish – no glare – resists rust
- Advanced sleeve design with staggered lines and distinct figures for precise and easy readability
- Convenient decimal equivalents on inch tools

#### Ease-of-Handling Features

- Balanced frame and thimble design for easy handling and better readability
- Ring-type knurled lock nut for quick and sure locking
- Gracefully designed tapered frame for use in narrow slots and tight places

#### Accuracy and Long-Life Features

- Rigid one-piece frame of drop forged steel
- Extremely hard and stable one-piece spindle (the heart of our accuracy)
- Quick and easy adjustment

| 231 and 231M Micrometers (0-1" Range) | | | |
|---|---|---|---|
| **Cat. No.** | **EDP** | **Range** | **Graduation** |
| T231XRL | 63967 | 0-1" | .0001" |
| V231MXRL | 63969 | 0-25mm | 0.001mm |
| **Deluxe Padded Case for 231 and 231M Micrometers** | | | |
| **Cat. No.** | **EDP** | **Description** | |
| 942 | 55961 | Case for 1" (25mm) Micrometers | |

| 221 Hi-Precision Micrometer (0-1" Range) | | |
|---|---|---|
| **Cat. No.** | **EDP** | **Graduation** |
| T221XL | 50754 | .0001" |
| **Deluxe Padded Case for 221 Hi-Precision Micrometer** | | |
| **Cat. No.** | **EDP** | **Description** |
| 910 | 55397 | Case for 1" (25mm) Micrometers |









# Stainless Steel Micrometers

## 1230, 1230M Stainless Steel Micrometers

**0-1"/0-25MM**

## 1212, 1212M Stainless Steel Micrometers

**1-2"/25-50MM**

This micrometer is made from stainless steel for use under adverse atmospheric and operating conditions.

| 1230 and 1230M Stainless Steel Micrometers | | | |
|---|---|---|---|
| **Cat. No.** | **EDP** | **Range** | **Graduation** |
| 1230XRL | 53196 | 0-1" | .001" |
| T1230XRL | 53197 | | .0001" |
| V1230MXRL | 64263 | 0-25mm | 0.001mm |
| **1212 and 1212M Stainless Steel Micrometers** | | | |
| 1212XRL | 53178 | 1-2" | .001" |
| T1212XRL | 53179 | | .0001" |
| V1212MXRL | 64264 | 25-50mm | 0.001mm |
| **Deluxe Padded Cases for 1212 and 1212M Stainless Steel Micrometers** | | | |
| **Cat. No.** | **EDP** | **Description** | |
| 910 | 55397 | Case for 1" (25mm) Micrometers | |
| 912 | 55399 | Case for 2" (50mm) Micrometers | |

1" and 25mm Models sent in fitted case. 2" and 50mm Models packed one in a box without case.

### Readability Features

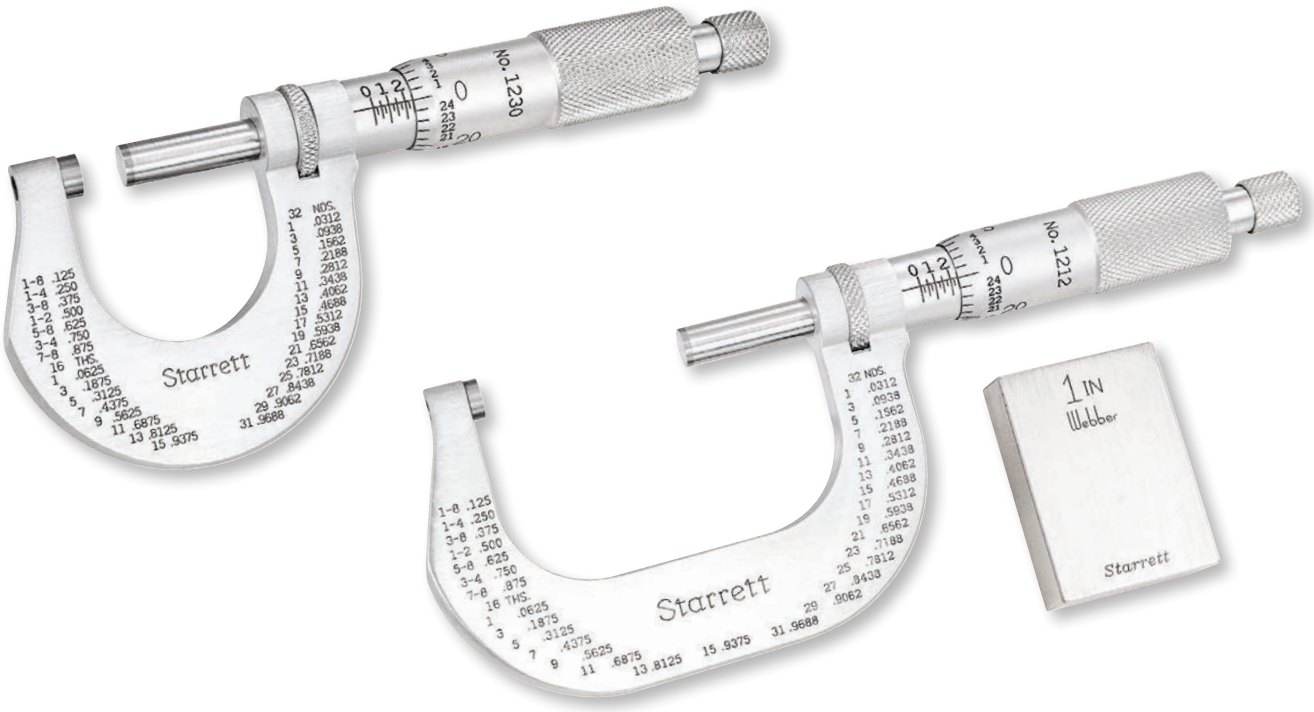
- Satin finish stainless steel – no glare – rust and stain resistant
- Advanced sleeve design with staggered lines and distinct figures for precise and easy readability
- Convenient decimal equivalents on inch tools

### Ease-of-Handling Features

- Balanced frame and thimble design ensure easy handling and better readability
- Ring-type knurled lock nut for quick and sure locking
- The combination ratchet and speeder for uniform pressure and quicker adjustment
- Gracefully designed tapered frame for use in narrow slots and tight places

### Accuracy and Long-Life Features

- Rigid one-piece frame of drop forged steel
- Extremely hard and stable one-piece spindle (the heart of our accuracy)
- Quick and easy adjustment
- Gage block standard supplied for 1-2" micrometer



# Outside Micrometers



## 226, 226M Outside Micrometers

### 1-6"/25-150MM

- Rugged construction and extremely attractive design
- For craftsmen who want a precision micrometer with a distinctive Starrett design and finish
- Strong ribbed frame with smooth black enamel finish and polished steel ribs and hub

| 226 Outside Micrometers (.001" Graduation) | | | | |
|---|---|---|---|---|
| | Ratchet Stop and Lock Nut | | Standard (extra) | |
| Range | Cat. No. | EDP | Cat. No. | EDP |
| 0-1" | 226RL-1 | 12209 | | |
| 1-2" | 226RL-2 | 50820 | 234B-1 | 51017 |
| 2-3" | 226RL-3 | 50825 | 234B-2 | 51019 |
| 3-4" | 226RL-4 | 50830 | 234B-3 | 51021 |
| 4-5" | 226RL-5 | 50835 | 234B-4 | 51023 |
| 5-6" | 226RL-6 | 50840 | 234B-5 | 51025 |
| **226 Outside Micrometers, Carbide Faces (.0001" Graduation)** | | | | |
| 0-1" | T226XRL-1 | 12211 | | |
| 1-2" | T226XRL-2 | 50903 | 234B-1 | 51017 |
| 2-3" | T226XRL-3 | 50904 | 234B-2 | 51019 |
| 3-4" | T226XRL-4 | 50905 | 234B-3 | 51021 |
| 4-5" | T226XRL-5 | 50906 | 234B-4 | 51023 |
| 5-6" | T226XRL-6 | 50907 | 234B-5 | 51025 |
| **226M Outside Micrometers, Carbide Faces (0.001mm Graduation)** | | | | |
| 0-25mm | V226MXRL-25 | 12212 | | |
| 25-50mm | V226MXRL-50 | 64265 | 234MB-25 | 51018 |
| 50-75mm | V226MXRL-75 | 64266 | 234MB-50 | 51020 |
| 75-100mm | V226MXRL-100 | 64267 | 234MB-75 | 51022 |
| 100-125mm | V226MXRL-125 | 64268 | 234MB-100 | 51024 |
| 125-150mm | V226MXRL-150 | 64269 | 234MB-125 | 51026 |

| Micrometer Cases for 226 and 226M Outside Micrometers | | |
|---|---|---|
| Description | Cat. No. | EDP |
| for 1" (25mm) | 910 | 55397 |
| for 2" (50mm) | 913 | 55400 |
| for 3" (75mm) | 922 | 55222 |
| for 4" (100mm) | 952 | 55223 |
| for 5" (125mm) | 953 | 55224 |
| for 6" (150mm) | 954 | 55225 |



## S226, S226M Micrometer Sets with Standards in Case

### 0-6"/0-150MM

These sets are recommended for mechanics, automotive service and machine shops, toolrooms, inspection departments, and wherever gaging involves a wide range of measurements. Furnished in an attractive, protective cases to keep micrometer and standards readily accessible.

### Readability Features

- Starrett satin chrome finish – no glare – resists rust
- Advanced sleeve design with staggered lines and distinct figures for precise and easy readability
- Quick-reading figures – every thousandth numbered on inch tools

### Ease-of-Handling Features

- Balanced frame and thimble design ensure easy handling and better readability
- Ring-type knurled lock nut for quick and sure locking

### Accuracy and Long-Life Features

- Rugged frame ribbed for extra strength
- Extremely hard and stable one-piece spindle (the heart of our accuracy)
- Quick and easy adjustment

| S226 and S226M Micrometer Sets | | | | |
|---|---|---|---|---|
| Range | Cat. No. | EDP | Graduation | Set Description |
| 0-3" | S226ARLZ<br>ST226AXRLZ | 50854<br>56448 | .001"<br>.0001" | Includes 1", 2" and 3" Micrometers, Two Standards, Adjusting Wrench |
| 0-6" | S226BRLZ<br>ST226BXRLZ | 50862<br>56798 | .001"<br>.0001" | Includes 1", 2", 3", 4", 5" and 6" Micrometers, Set of Five Standards, Adjusting Wrench |
| 0-75mm | SV226MAXRLZ | 65237 | 0.001mm | Includes 25mm, 50mm and 75mm Micrometers, Two Standards, Adjusting Wrench |
| 0-150mm | SV226MBXRLZ | 65238 | 0.001mm | Includes 25mm, 50mm, 75mm, 100mm, 125mm and 150mm Micrometers, Set of Five Standards, Adjusting Wrench |

| Cases Only for S226 and S226M Micrometer Sets | | |
|---|---|---|
| Cat. No. | EDP | Description |
| 955 | 55226 | Case for 0-3" and 0-75mm Micrometer Sets |
| 956 | 55227 | Case for 0-6" and 0-150mm Micrometer Sets |



# Outside Micrometers

## 436.1 Outside Micrometers

**0-6"**

These are the most popular precision micrometers used by skilled workmen worldwide. They are accurate, rugged, and easy to use.

The 0-6" and 0-150mm sizes have rugged spindles and anvils at .250" (6.35mm) diameter.

No one in the world has a list of micrometers that caters to individual taste like Starrett. If you don't see what you want please ask for it.

| 436.1 Outside Micrometers (0-1" Range) | | 436.1 Outside Micrometers (1-2" Range) | | |
|---|---|---|---|---|
| **Cat. No.** | **EDP** | **Cat. No.** | **EDP** | **Graduation** |
| 436.1P-1 | 67990 | 436.1P-2 | 68001 | .001" |
| 436.1XP-1 | 67991 | | | |
| 436.1RL-1 | 67993 | 436.1RL-2 | 68002 | |
| 436.1XRL-1 | 67994 | 436.1XRL-2 | 68003 | |
| 436.1XRL-1 W/SLC | 67995 | | | |
| 436.1FL-1 | 67996 | 436.1FL-2 | 68004 | |
| T436.1XP-1 | 67992 | | | .0001" |
| T436.1XRL-1 | 67997 | T436.1XRL-2 | 68005 | |
| T436.1XRL-1 W/SLC | 67998 | T436.1XRL-2 W/SLC | 68006 | |
| T436.1XFL-1 | 67999 | T436.1XFL-2 | 68007 | |
| T436.1XFL-1 W/SLC | 68000 | T436.1XFL-2 W/SLC | 68008 | |
| **436.1 Outside Micrometers (2-3" Range)** | | **436.1 Outside Micrometers (3-4" Range)** | | |
| 436.1P-3 | 68009 | | | .001" |
| 436.1RL-3 | 68010 | 436.1RL-4 | 68017 | |
| 436.1XRL-3 | 68011 | 436.1XRL-4 | 68018 | |
| 436.1FL-3 | 68012 | | | |
| T436.1XRL-3 | 68013 | T436.1XRL-4 | 68019 | .0001" |
| T436.1XRL-3 W/SLC | 68014 | T436.1XRL-4 W/SLC | 68020 | |
| T436.1XFL-3 | 68015 | T436.1XFL-4 | 68021 | |
| T436.1XFL-3 W/SLC | 68016 | T436.1XFL-4 W/SLC | 68022 | |
| **436.1 Outside Micrometers (4-5" Range)** | | **436.1 Outside Micrometers (5-6" Range)** | | |
| 436.1RL-5 | 68023 | 436.1RL-6 | 68029 | .001" |
| 436.1XRL-5 | 68024 | 436.1XRL-6 | 68030 | |
| T436.1XRL-5 | 68025 | T436.1XRL-6 | 68031 | .0001" |
| T436.1XRL-5 W/SLC | 68026 | T436.1XRL-6 W/SLC | 68032 | |
| T436.1XFL-5 | 68027 | T436.1XFL-6 | 68033 | |
| T436.1XFL-5 W/SLC | 68028 | T436.1XFL-6 W/SLC | 68034 | |

Sent in fitted plastic case.

### Features and Specifications

- Starrett satin chrome finish – no glare – resists rust
- Advanced sleeve design with staggered lines and distinct figures for precise and easy readability
- Balanced frame and thimble design ensure easy handling
- Ring-type knurled lock nut for quick and sure locking
- Smooth friction thimble for uniform pressure, the combination ratchet and speeder for uniform pressure and quicker adjustment, or a plain micrometer that depends on your own "feel"
- Gracefully designed tapered frame for use in narrow slots and tight places
- Rigid steel frame ribbed for extra strength on sizes through 6" (150mm)
- Extremely hard and stable one-piece spindle (the heart of our accuracy)
- Quick and easy adjustment




See following page for listing of Cases and Standards

# Outside Micrometers

## 436 Outside Micrometers

### 6-24"

Same balanced design as the smaller sizes but proportioned to these larger sizes with .300" (7.6mm) anvil and spindle diameters for ease of use on larger work.

All the same features as the 0-6" and 0-150mm ranges 436.1 Micrometers, except:

- Larger sizes are furnished with combination ratchet and speeder for uniform pressure and quicker adjustment
- Rigid and stable special cast iron frame with perforations for lightness and ribbed for strength and stability

| 436 Outside Micrometers | | | |
|---|---|---|---|
| **Cat. No.** | **EDP** | **Range** | **Graduation** |
| 436RL-7 | 51684 | 6-7" | .001" |
| 436XRL-7 | 51698 | | |
| T436XRL-7 | 51702 | | .0001" |
| 436RL-8 | 51712 | 7-8" | .001" |
| 436XRL-8 | 51726 | | |
| T436XRL-8 | 51730 | | .0001" |
| 436RL-9 | 51740 | 8-9" | .001" |
| 436XRL-9 | 51754 | | |
| T436XRL-9 | 51758 | | .0001" |
| 436RL-10 | 51768 | 9-10" | .001" |
| 436XRL-10 | 51782 | | |
| T436XRL-10 | 51786 | | .0001" |
| 436RL-11 | 51796 | 10-11" | .001" |
| 436XRL-11 | 51810 | | |
| T436XRL-11 | 51814 | | .0001" |
| 436RL-12 | 51824 | 11-12" | .001" |
| 436XRL-12 | 51838 | | |
| T436XRL-12 | 51842 | | .0001" |
| 436XRLZ-13 | 51871 | 12-13" | .001" |
| 436XRLZ-14 | 51872 | 13-14" | |
| 436XRLZ-15 | 51873 | 14-15" | |
| 436XRLZ-16 | 51874 | 15-16" | |
| 436XRLZ-17 | 51875 | 16-17" | |
| 436XRLZ-18 | 51876 | 17-18" | |
| 436XRLZ-19 | 51877 | 18-19" | |
| 436XRLZ-20 | 51878 | 19-20" | |
| 436XRLZ-21 | 51879 | 20-21" | |
| 436XRLZ-22 | 51880 | 21-22" | |
| 436XRLZ-23 | 51881 | 22-23" | |
| 436XRLZ-24 | 51882 | 23-24" | |

7-12" models sent without case, packed one each to a box.
13-24" models are furnished in a case at no extra charge.




| Standards for Inch Micrometers | | |
|---|---|---|
| **Cat. No.** | **EDP** | **Description** |
| 234B-1 | 51017 | 1" Standard for 2" Micrometers |
| 234B-2 | 51019 | 2" Standard for 3" Micrometers |
| 234B-3 | 51021 | 3" Standard for 4" Micrometers |
| 234B-4 | 51023 | 4" Standard for 5" Micrometers |
| 234B-5 | 51025 | 5" Standard for 6" Micrometers |
| 234B-6 | 51027 | 6" Standard for 7" Micrometers |
| 234B-7 | 51029 | 7" Standard for 8" Micrometers |
| 234B-8 | 51031 | 8" Standard for 9" Micrometers |
| 234B-9 | 51033 | 9" Standard for 10" Micrometers |
| 234B-10 | 51035 | 10" Standard for 11" Micrometers |
| 234B-11 | 51037 | 11" Standard for 12" Micrometers |
| 234B-12 | 51039 | 12" Standard for 13" Micrometers |
| 234A-13 | 50993 | 13" Standard for 14" Micrometers |
| 234A-14 | 50995 | 14" Standard for 15" Micrometers |
| 234A-15 | 50997 | 15" Standard for 16" Micrometers |
| 234A-16 | 50999 | 16" Standard for 17" Micrometers |
| 234A-17 | 51001 | 17" Standard for 18" Micrometers |
| 234A-18 | 51003 | 18" Standard for 19" Micrometers |
| 234A-19 | 51005 | 19" Standard for 20" Micrometers |
| 234A-20 | 51007 | 20" Standard for 21" Micrometers |
| 234A-21 | 51009 | 21" Standard for 22" Micrometers |
| 234A-22 | 51011 | 22" Standard for 23" Micrometers |
| 234A-23 | 51013 | 23" Standard for 24" Micrometers |
| **Holster and Cases for Inch and Millimeter Micrometers** | | |
| 914 | 64165 | Leather Holster for 1" (25mm) Micrometers |
| 910 | 55397 | Case for 1" (25mm) Micrometers |
| 913 | 55400 | Case for 2" (50mm) Micrometers |
| 922 | 55222 | Case for 3" (75mm) Micrometers |
| 952 | 55223 | Case for 4" (100mm) Micrometers |
| 953 | 55224 | Case for 5" (125mm) Micrometers |
| 954 | 55225 | Case for 6" (150mm) Micrometers |
| 930 | 55276 | Case for 7" (175mm) Micrometers |
| 931 | 55277 | Case for 8" (200mm) Micrometers |
| 932 | 55278 | Case for 9" (225mm) Micrometers |
| 933 | 55279 | Case for 10" (250mm) Micrometers |
| 934 | 55280 | Case for 11" (275mm) Micrometers |
| 935 | 55281 | Case for 12" (300mm) Micrometers |

# OUTSIDE MICROMETERS

## 436.1M, 436.2M, 436M OUTSIDE MICROMETERS

### 0-600MM

Same basic design features as inch models

| Standards for Millimeter Micrometers | | |
|---|---|---|
| **Cat. No.** | **EDP** | **Description** |
| 234MB-25 | 51018 | 25mm Standard for 50mm Micrometers |
| 234MB-50 | 51020 | 50mm Standard for 75mm Micrometers |
| 234MB-75 | 51022 | 75mm Standard for 100mm Micrometers |
| 234MB-100 | 51024 | 100mm Standard for 125mm Micrometers |
| 234MB-125 | 51026 | 125mm Standard for 150mm Micrometers |
| 234MB-150 | 51028 | 150mm Standard for 175mm Micrometers |
| 234MB-175 | 51030 | 175mm Standard for 200mm Micrometers |
| 234MB-200 | 51032 | 200mm Standard for 225mm Micrometers |
| 234MB-225 | 51034 | 225mm Standard for 250mm Micrometers |
| 234MB-250 | 51036 | 250mm Standard for 275mm Micrometers |
| 234MB-275 | 51038 | 275mm Standard for 300mm Micrometers |
| 234MB-300 | 51040 | 300mm Standard for 325mm Micrometers |
| 234MA-325 | 50994 | 325mm Standard for 350mm Micrometers |
| 234MA-350 | 50996 | 350mm Standard for 375mm Micrometers |
| 234MA-375 | 50998 | 375mm Standard for 400mm Micrometers |
| 234MA-400 | 51000 | 400mm Standard for 425mm Micrometers |
| 234MA-425 | 51002 | 425mm Standard for 450mm Micrometers |
| 234MA-450 | 51004 | 450mm Standard for 475mm Micrometers |
| 234MA-475 | 51006 | 475mm Standard for 500mm Micrometers |
| 234MA-500 | 51008 | 500mm Standard for 525mm Micrometers |
| 234MA-525 | 51010 | 525mm Standard for 550mm Micrometers |
| 234MA-550 | 51012 | 550mm Standard for 575mm Micrometers |
| 234MA-575 | 51014 | 575mm Standard for 600mm Micrometers |

| Holster and Cases for Inch and Millimeter Micrometers | | |
|---|---|---|
| **Cat. No.** | **EDP** | **Description** |
| 914 | 64165 | Leather Holster for 1" (25mm) Micrometers |
| 910 | 55397 | Case for 1" (25mm) Micrometers |
| 913 | 55400 | Case for 2" (50mm) Micrometers |
| 922 | 55222 | Case for 3" (75mm) Micrometers |
| 952 | 55223 | Case for 4" (100mm) Micrometers |
| 953 | 55224 | Case for 5" (125mm) Micrometers |
| 954 | 55225 | Case for 6" (150mm) Micrometers |
| 930 | 55276 | Case for 7" (175mm) Micrometers |
| 931 | 55277 | Case for 8" (200mm) Micrometers |
| 932 | 55278 | Case for 9" (225mm) Micrometers |
| 933 | 55279 | Case for 10" (250mm) Micrometers |
| 934 | 55280 | Case for 11" (275mm) Micrometers |
| 935 | 55281 | Case for 12" (300mm) Micrometers |

| Key to Starrett Micrometer Numbering System | |
|---|---|
| **Prefixes** | |
| R | Reverse Reading |
| S | Micrometer Set |
| T | .0001" Reading |
| V | 0.001mm or 0.002mm Reading, as specified |
| **Suffixes** | |
| F | Friction Thimble |
| L | Lock Nut |
| M | Metric |
| N | Non-Rotating |
| P | Plain |
| R | Ratchet Stop |
| S | Speeder |
| TN | Threaded Hub and Check Nut |
| W/SLC | Standard Letter of Certification |
| X | Micro-lapped Carbide Measuring Faces |
| Z | With Case |
| ZZ | Case Only |

| 436.1M & 436M Outside Micrometers | | | |
|---|---|---|---|
| **Cat. No.** | **EDP** | **Range** | **Graduation** |
| 436.1MP-25 | 68047 | 0-25mm | 0.01mm |
| 436.1MRL-25 | 68048 | | |
| 436.2MXRL-25 | 12755 | | |
| 436.1MXFL-25 | 68050 | | |
| V436.2MXRL-25 | 12766 | | 0.001mm |
| 436.1MRL-50 | 68052 | 25-50mm | 0.01mm |
| 436.1MXRL-50 | 68053 | | |
| V436.1MXRL-50 | 68054 | | 0.001mm |
| 436.1MRL-75 | 68055 | 50-75mm | 0.01mm |
| 436.1MXRL-75 | 68056 | | |
| V436.1MXRL-75 | 68057 | | 0.001mm |
| 436.1MRL-100 | 68058 | 75-100mm | 0.01mm |
| 436.1MXRL-100 | 68059 | | |
| V436.1MXRL-100 | 68060 | | 0.001mm |
| 436.1MRL-125 | 68061 | 100-125mm | 0.01mm |
| 436.1MXRL-125 | 68062 | | |
| V436.1MXRL-125 | 68063 | | 0.001mm |
| 436.1MRL-150 | 68064 | 125-150mm | 0.01mm |
| 436.1MXRL-150 | 68065 | | |
| V436.1MXRL-150 | 68066 | | 0.001mm |
| 436MXRL-175 | 51706 | 150-175mm | 0.01mm |
| 436MXRL-200 | 51734 | 175-200mm | |
| 436MXRL-225 | 51762 | 200-225mm | |
| 436MXRL-250 | 51790 | 225-250mm | |
| 436MXRL-275 | 51818 | 250-275mm | |
| 436MXRL-300 | 51846 | 275-300mm | |
| 436MXRLZ-325 | 64301 | 300-325mm | |
| 436MXRLZ-350 | 64302 | 325-350mm | |
| 436MXRLZ-375 | 64303 | 350-375mm | |
| 436MXRLZ-400 | 64304 | 375-400mm | |
| 436MXRLZ-425 | 64305 | 400-425mm | |
| 436MXRLZ-450 | 64306 | 425-450mm | |
| 436MXRLZ-475 | 64307 | 450-475mm | |
| 436MXRLZ-500 | 64308 | 475-500mm | |
| 436MXRLZ-525 | 64309 | 500-525mm | |
| 436MXRLZ-550 | 64310 | 525-550mm | |
| 436MXRLZ-575 | 64311 | 550-575mm | |
| 436MXRLZ-600 | 64312 | 575-600mm | |

25-150mm models sent in fitted plastic case. 175-300mm models sent without case, packed one each to a box. 325-600mm models are furnished in a case at no extra charge.





# Micrometer Sets

## S436.1, S436 Micrometer Sets with Standards, in Attractive, Protective Cases

### 0-24"

Recommended for mechanics, automotive service and machine shops, toolrooms, inspection departments, and wherever gaging involves a wide range of measurements. All sets come with attractive, protective cases which keep micrometers and standards together, readily accessible.

For further information on each type of micrometer, refer to the listing on the previous pages.

| Standards for S436.1 and S436 Micrometer Sets | | | With SLC* | |
|---|---|---|---|---|
| Cat. No. | EDP | Description | Cat. No. | EDP |
| S234C | 50852 | Set of Two Standards Only | | |
| S234D | 51897 | Set of Three Standards Only | | |
| S234E | 50860 | Set of Five Standards Only | S234E W/SLC* | 66878 |
| S234G | 51929 | Set of Eleven Standards Only | S234G W/SLC* | 66877 |
| S234F | 51917 | Set of Six Standards Only | S234F W/SLC* | 66879 |
| S234J | 64146 | Set of Twelve Standards Only | | |

| Cases for S436.1 and S436 Micrometer Sets | | |
|---|---|---|
| Cat. No. | EDP | Description |
| 955 | 55226 | Case Only for S436A Sets |
| 936 | 55295 | Case Only for S436B Sets |
| 956 | 55227 | Case Only for S436C Sets |
| 938 | 55298 | Case Only for S436E Sets |
| 937 | 55297 | Case Only for S436D Sets |
| S436FZZ | 64339 | Case Only for S436F Sets |

* Includes redemption card for Standard Letter of Certification (SLC).

| S436.1 Micrometer Sets | | | | |
|---|---|---|---|---|
| Cat. No. | EDP | Range | Graduation | Set Description |
| S436.1ARLZ | 68035 | 0-3" | .001" | Each Set Includes: 1", 2" and 3" Micrometers, with Two Standards |
| S436.1AXRLZ | 68036 | | .0001" | |
| ST436.1AXRLZ | 68037 | | | |
| ST436.1AXFLZ | 68038 | | | |
| S436.1BRLZ | 68039 | 0-4" | .001" | Each Set Includes: 1", 2", 3" and 4" Micrometers, with Three Standards |
| S436.1BXRLZ | 68040 | | .0001" | |
| ST436.1BXRLZ | 68041 | | | |
| ST436.1BXFLZ | 68042 | | | |
| S436.1CRLZ | 68043 | 0-6" | .001" | Each Set Includes: 1", 2", 3", 4", 5" and 6" Micrometers, with Five Standards |
| S436.1CXRLZ | 68044 | | .0001" | |
| ST436.1CXRLZ | 68045 | | | |
| ST436.1CXFLZ | 68046 | | | |
| **S436 Micrometer Sets** | | | | |
| S436ERLZ | 51931 | 0-12" | .001" | Each Set Includes: 1", 2", 3", 4", 5", 6", 7", 8", 9", 10", 11" and 12" Micrometers, with Eleven Standards |
| S436EXRLZ | 52012 | | .0001" | |
| ST436EXRLZ | 52030 | | | |
| S436DRLZ | 51919 | 6-12" | .001" | Each Set Includes: 7", 8", 9", 10", 11" and 12" Micrometers, with Six Standards |
| S436DXRLZ | 64463 | | .0001" | |
| ST436DXRLZ | 64465 | | | |
| S436FXRLZ | 64466 | 12-24" | .001" | Set Includes: 13", 14", 15", 16", 17", 18", 19", 20", 21", 22", 23" and 24" Micrometers, with Twelve Standards |

Box type cases available for sets 0-6", 6-12", 12-24" with 6, 12, or 24 micrometers and flat type cases available for sets 0-3" or 0-4" with 3 or 4 micrometers.





## S436.1M, S436M Micrometer Sets with Standards, in Attractive, Protective Cases

### 0-600MM

Recommended for mechanics, automotive service and machine shops, toolrooms, inspection departments, and wherever gaging involves a wide range of measurements. All sets come with attractive, protective cases which keep micrometers and standards together, readily accessible.

For further information on each type of micrometer, refer to its listing on the previous pages.

| S436.1M Micrometer Sets | | | | |
|---|---|---|---|---|
| **Cat. No.** | **EDP** | **Range** | **Graduation** | **Set Description** |
| S436.1MARLZ | 68067 | 0-75mm | 0.01mm | Each Set Includes: 25mm, 50mm and 75mm Micrometers, with Two Standards |
| S436.1MAXRLZ | 68068 | | | |
| SV436.1MAXRLZ | 68069 | | 0.001mm | |
| S436.1MBRLZ | 68070 | 0-100mm | 0.01mm | Each Set Includes: 25mm, 50mm, 75mm and 100mm Micrometers with Three Standards |
| S436.1MBXRLZ | 68071 | | | |
| SV436.1MBXRLZ | 68072 | | 0.001mm | |
| S436.1MCRLZ | 68073 | 0-150mm | 0.01mm | Each Set Includes: 25mm, 50mm, 75mm, 100mm, 125mm and 150mm Micrometers, with Five Standards |
| S436.1MCXRLZ | 68074 | | | |
| SV436.1MCXRLZ | 68075 | | 0.001mm | |
| **S436M Micrometer Sets** | | | | |
| S436MEXRLZ | 52014 | 0-300mm | 0.01mm | Set Includes: 25, 50, 75, 100, 125, 150, 175, 200, 225, 250, 275 and 300mm Micrometers, with Eleven Standards |
| S436MDXRLZ | 64461 | 150-300mm | 0.01mm | Set Includes: 175, 200, 225, 250, 275 and 300mm Micrometers, with Six Standards |
| S436MFXRLZ | 64462 | 300-600mm | 0.01mm | Set Includes: 325, 350, 375, 400, 425, 450, 475, 500, 525, 550, 575 and 600mm Micrometers, with Twelve Standards |

Box type cases available for sets 0-150mm, 150-300mm, 300-600mm with 6, 12, or 24 micrometers and flat type cases available for sets 0-75mm or 0-100mm with 3 or 4 micrometers.

| Standards for S436.1M and S436M Micrometer Sets | | |
|---|---|---|
| **Cat. No.** | **EDP** | **Description** |
| S234MC | 51893 | Set of Two Standards Only |
| S234MD | 51901 | Set of Three Standards Only |
| S234ME | 51913 | Set of Five Standards Only |
| S234MF | 51925 | Set of Six Standards Only |
| S234MG | 51937 | Set of Eleven Standards Only |
| S234MJ | 64467 | Set of Twelve Standards Only |
| **Cases for S436.1M and S436M Micrometer Sets** | | |
| **Cat. No.** | **EDP** | **Description** |
| 955 | 55226 | Case Only for S436MA Sets |
| 936 | 55295 | Case Only for S436MB Sets |
| 956 | 55227 | Case Only for S436MC Sets |
| 938 | 55298 | Case Only for S436ME Sets |
| 937 | 55297 | Case Only for S436MD Sets |
| S436FZZ | 64339 | Case Only for S436MF Sets |

# Anvil Micrometers

## 224, 224M Interchangeable Anvil Micrometers

**0-24"/0-600MM**

Unusual flexibility, plus a wide range of measurement makes the 224 Satin-Chrome Micrometers very popular in machine or automotive repair shops and for all applications requiring a versatile micrometer.

Each micrometer is equipped with a series of easily interchangeable anvils, thus providing the full range in steps of 1" or 25mm with a single micrometer. Suitable wrenches are furnished to make necessary adjustments.

These larger sizes have .300" (7.6mm) anvil and spindle diameters for ease of use on larger work.

**224, 224M Interchangeable Anvil Micrometers**

| Range | Graduation | With Ratchet Stop, Lock Nut, In Case Cat. No. | EDP | 234 Standards Furnished |
|---|---|---|---|---|
| 0-4" | .001" | 224AARLZ | 50770 | 1", 2", 3" |
| 2-6" | | 224ARLZ | 50772 | 2", 3", 4", 5" |
| 6-9" | | 224BRLZ | 50774 | 6", 7", 8" |
| 6-12" | | 224GRLZ | 50776 | 6", 7", 8", 9", 10", 11" |
| 9-12" | | 224CRLZ | 50778 | 9", 10", 11" |
| 12-16" | | 224DRLZ | 50780 | 12", 13", 14", 15" |
| 16-20" | | 224ERLZ | 50782 | 16", 17", 18", 19" |
| 20-24" | | 224JRLZ | 50784 | 20", 21", 22", 23" |
| 0-100mm | 0.01mm | 224MAARLZ | 50771 | 25, 50, 75mm |
| 50-150mm | | 224MARLZ | 50773 | 50, 75, 100, 125mm |
| 150-300mm | | 224MGRLZ | 50777 | 150, 175, 200, 225, 250, 275mm |
| 300-400mm | | 224MDRLZ | 50781 | 300, 325, 350, 375mm |
| 400-500mm | | 224MERLZ | 50783 | 400, 425, 450, 475mm |
| 500-600mm | | 224MJRLZ | 50785 | 500, 525, 550, 575mm |

### Readability features

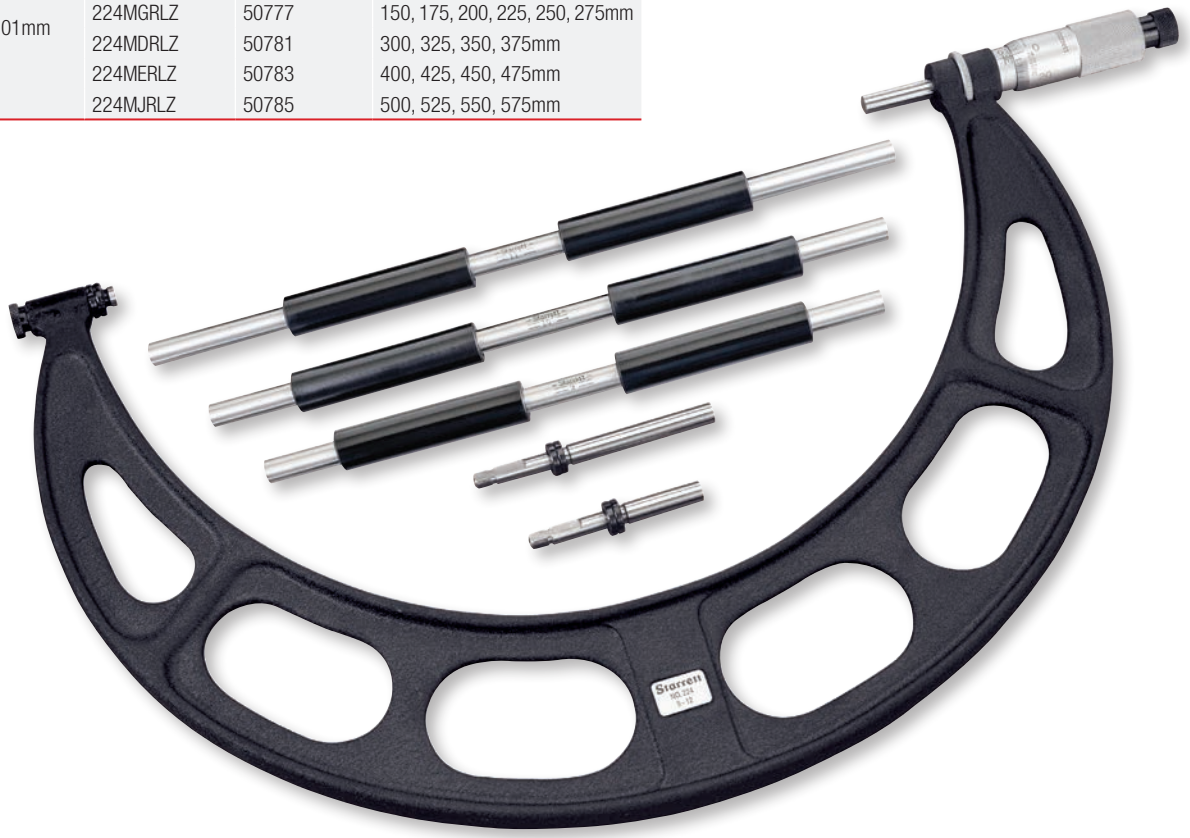
- Starrett satin chrome finish – no glare – resists rust
- Advanced sleeve design with staggered lines and distinct figures for precise and easy readability
- Large thimble diameter with distinct figures

### Ease-of-Handling Features

- Balanced frame and thimble design ensure easy handling and better readability
- Ring-type knurled lock nut for quick and sure locking
- Combination ratchet and speeder for uniform pressure and quicker adjustment

### Accuracy and Long-Life Features

- Rigid and stable special cast iron frame with appropriate perforations for lightness and ribbed for strength and stability
- Extremely hard and stable one-piece spindle (the heart of our accuracy)
- Quick and easy sleeve adjustment



# Anvil Micrometers

## 714, 714M Electronic Interchangeable Anvil Outside Micrometers (with output)

### 0-24"/0-600MM

This micrometer is the same as our 224 Micrometers except that it has an electronic readout and the following extra features and benefits:

**714 Electronic Interchangeable Anvil Micrometers With Standard Inch Graduations on Shell and Thimble**

| Range | | Resolution | | | |
|---|---|---|---|---|---|
| Inch | Approx. mm | Inch | mm | Cat. No. | EDP |
| 0 - 4" | 0 - 101mm | .00005" | 0.001mm | 714AAFLZ | 64427 |
| 2 - 6" | 51 - 152mm | | | 714AFLZ | 64428 |
| 6 - 9" | 152 - 228mm | | | 714BFLZ | 64429 |
| 6 - 12" | 152 - 305mm | | | 714GFLZ | 64430 |
| 9 - 12" | 228 - 305mm | .0001" | 0.001mm | 714CFLZ | 64431 |
| 12 - 16" | 305 - 406mm | | | 714DFLZ | 64432 |
| 16 - 20" | 406 - 508mm | | | 714EFLZ | 64433 |
| 20 - 24" | 508 - 609mm | | | 714JFLZ | 64434 |

**714M Electronic Interchangeable Anvil Micrometers With Standard Millimeter Graduations on Shell and Thimble**

| Range | | Resolution | | | |
|---|---|---|---|---|---|
| mm | Approx. Inch | mm | Inch | Cat. No. | EDP |
| 0 - 100mm | 0 - 3.930" | 0.001mm | .00005" | 714MEAAFLZ | 66108 |
| 50 - 150mm | 1.968 - 5.900" | | | 714MEAFLZ | 66109 |
| 150 - 300mm | 5.900 - 11.810" | | | 714MEGFLZ | 66111 |
| 300 - 400mm | 11.810 - 15.740" | 0.001mm | .0001" | 714MEDFLZ | 66112 |
| 400 - 500mm | 15.740 - 19.680" | | | 714MEEFLZ | 66113 |
| 500 - 600mm | 19.680 - 23.620" | | | 714MEJFLZ | 66110 |

**Cable Information for 714 and 714M Electronic Interchangeable Anvil Micrometers**

| Part No. | EDP | Description |
|---|---|---|
| PT61963 | 66636 | Computer Interface Cable Complete to PC (RS232C) |
| PT61768 | 66454 | Adaptor from PT22938 Cable to PC (RS232C) |
| PT22938 | 64059 | Shielded Cable to 761/772 Starrett Modules and PT61768 Adaptor |
| PT61120 | 65446 | One 3-Volt Battery CR2450 |

Adjusting wrenches furnished with each tool.
Micrometer furnished in protective case with 234 Standards.



### Readability Features

- Large, right-sized, high-contrast LCD digital readout is easy to read and reduces errors
- Resolution – .00005" and 0.001mm
- Conventional inch or millimeter graduations standard
- Starrett no-glare satin chrome finish on thimble and sleeve

### Accuracy and Long-Life Features

- One 3-volt battery furnished for dependable power and over one year's normal usage
- Automatic OFF after 30 minutes of nonuse

### Full-Function Action Features

- Instant inch/millimeter conversion
- "ME" millimeter models will turn on in the millimeter mode after installation of a new battery
- Measurement HOLD button
- Ability to zero tool at any position
- Ability to retain and return to the true zero reading of the micrometer
- PRESET button to install any reading at any position
- Ability to install minimum and maximum limits
- Output data to Starrett SPC Plus hardware and software and to PCs
- Works well with Starrett DataSure® Wireless Data Collection Systems

# Tubular Micrometers

## 724, 724M Tubular Bow Type Micrometers with Interchangeable Anvils

**12-60"/300 -1500MM**

These micrometers are made for better precision measurement of large outside dimensions. They provide perfect balance, sensitive feel, ease of handling, and less measuring effort due to their advanced tubular design. Frames are built of special steel formed to exacting tubular design specifications and welded by a carefully controlled process. This produces a hollow tubular frame of the lightest weight, extreme rigidity, and standard coefficient of expansion.

Because of the interchangeable anvils, the 724 is well suited for diversified gaging and provides a wide range of measurement in steps of 1 inch or 25mm.

The micrometer head is large and well balanced with .300" (7.6mm) diameter anvil and spindle and with larger bearing surfaces on the threads.

| 724 Tubular Bow Type Micrometers | | | | |
|---|---|---|---|---|
| | | With Lock Nut, In Case | | |
| Range Inch | Graduation | Cat. No. | EDP | 234 Standards Furnished |
| 12-18" | .001" | 724LZ-18 | 52994 | 12", 13", 14", 15", 16", 17" |
| 18-24" | | 724LZ-24 | 52995 | 18", 19", 20", 21", 22", 23" |
| 24-30" | | 724LZ-30 | 52996 | 25", 27", 29" |
| 30-36" | | 724LZ-36 | 52997 | 31", 33", 35" |
| 36-42" | | 724LZ-42 | 52998 | 37", 39", 41" |
| 42-48" | | 724LZ-48 | 52999 | 43", 45", 47" |
| 48-54" | | 724LZ-54 | 53000 | 49", 51", 53" |
| 54-60" | | 724LZ-60 | 53001 | 55", 57", 59" |
| **724M Tubular Bow Type Micrometers** | | | | |
| 300-450mm | 0.01mm | 724MLZ-450 | 64318 | 300, 325, 350, 375, 400, 425mm |
| 450-600mm | | 724MLZ-600 | 64319 | 450, 475, 500, 525, 550, 575mm |
| 600-750mm | | 724MLZ-750 | 64320 | 625, 675, 725mm |
| 750-900mm | | 724MLZ-900 | 64321 | 775, 825, 875mm |
| 900-1050mm | | 724MLZ-1050 | 64322 | 925, 975, 1025mm |
| 1050-1200mm | | 724MLZ-1200 | 64323 | 1075, 1125, 1175mm |
| 1200-1350mm | | 724MLZ-1350 | 64324 | 1225, 1275, 1325mm |
| 1350-1500mm | | 724MLZ-1500 | 64325 | 1375, 1425, 1475mm |

Adjusting wrenches furnished with each tool.
Furnished with 234 Standards in attractive, protective case.

### Readability Features

- Starrett satin chrome finish – no glare – resists rust
- Advanced sleeve design with staggered lines and distinct figures for precise and easy readability
- Large thimble diameter with distinct figures

### Ease-of-Handling Features

- Balanced frame and thimble design for easy handling and better readability
- Ring-type knurled lock nut for quick and sure locking

### Accuracy and Long-Life Features

- Hollow tubular frame design combining lightest possible weight with rigidity
- Extremely hard and stable one-piece spindle (the heart of our accuracy)
- Standards with insulated grips
- It is recommended that these micrometers be checked with standards in the approximate position (vertical or horizontal) that they will be used. We do not recommend .0001" or 0.001mm readings on these micrometers.Larger sizes, carbide faces and ratchet stop are available on special order.




724LZ-18

# Tubular Micrometers

## 736, 736M Tubular Bow Type Micrometers with Fixed Anvil

**12-30"/300-750MM**

This micrometer, available on special order, is similar to the 724 Micrometer. All features are identical to the 724, except that it has a fixed anvil, and is furnished in inch and millimeter sizes from 12-30" and 25mm increments from 300-750mm.

Order by catalog number and range through our Special Order Department. Example: 736LZ-28 (this orders a micrometer with a 27-28" range with lock nut and standard, in an attractive, protective case.)

### Readability Features

- Starrett satin chrome finish – no glare – resists rust
- Advanced sleeve design with staggered lines and distinct figures for precise and easy readability
- Large thimble diameter with distinct figures

### Ease-of-Handling Features

- Balanced frame and thimble design ensure easy handling and better readability
- Ring-type knurled lock nut for quick and sure locking

### Accuracy and Long-Life Features

- Hollow tubular frame design combining lightest possible weight with rigidity
- Extremely hard and stable one-piece spindle (the heart of our accuracy)
- 234 Standards furnished with micrometers




| Key to Starrett Micrometer Numbering System | |
|---|---|
| **Prefixes** | |
| R | Reverse Reading |
| S | Micrometer Set |
| T | .0001" Reading |
| V | 0.001mm or 0.002mm Reading, as specified |
| **Suffixes** | |
| F | Friction Thimble |
| L | Lock Nut |
| M | Metric |
| N | Non-Rotating |
| P | Plain |
| R | Ratchet Stop |
| S | Speeder |
| TN | Threaded Hub and Check Nut |
| W/SLC | Standard Letter of Certification |
| X | Micro-lapped Carbide Measuring Faces |
| Z | With Case |
| ZZ | Case Only |

### Ultralight "C" Frame Gages

Rigid honeycomb aluminum diameter gage weighs five times less than solid frame gages. Unit shown has interchangeable anvils for 36-42" range. The gage is used as a dial indicator snap gage set to produce nominal dimension, or as an indicating micrometer. The micrometer head with .0001" graduations and the .0005" dial indicator ensure quick, accurate readings.

Ultralights are available from 24-72" (600-1800mm) I.D. or O.D. and can be designed for up to 72" (1800mm) throat depth for thickness measurement.

# MICROMETER STANDS

## 3206 OUTSIDE MICROMETER STAND

- This stand converts outside micrometers to a sturdy bench gage for batch inspection of small parts
- Useful as a handy bench vise or assembly fixture
- Gripping surfaces are two nylon pads which are replaceable
- Ball joint construction allows head to be positioned as much as 30° off perpendicular in any direction
- Positive lock on the base
- Base dimension is 6-3/8" long x 3-1/2" wide x 3/4" thick (162mm long x 89mm wide x 19mm thick)
- Tilting head clamping capability is 3/4" (19mm) thick x 1" (25mm) throat depth
- Accommodates all Starrett 1/2" (13mm) and 1" (25mm) outside micrometers, 2 and 2A 2" outside micrometers and 210, 220, 483, 485, 569 special purpose outside micrometers

| 3206 Outside Micrometer Stand | | |
|---|---|---|
| **Cat. No.** | **EDP** | **Description** |
| 3206 | 68917 | Outside Micrometer Stand |



# Special Function Micrometers

## Special Function Micrometers

Throughout its history, The L.S. Starrett Company has manufactured a multitude of special hand tools and gages for thousands of customers in many different industries. Illustrated on these first two pages are typical examples of Starrett special toolmaking. The following pages show special function tools that we make as regular items because they are commonly used in industry.

Special toolmaking activities are coordinated under the direction of special order sales engineers who oversee each order from the time it is entered until shipment is made. Complete manufacturing facilities and engineering counsel are available.

Customers are invited to submit drawings and specifications for prompt quotation. Please direct these to the attention of:

The L.S. Starrett Company
Special Order Department
121 Crescent Street
Athol, MA 01331-1915

## Micrometer Head Speeds Gaging

A specially shaped micrometer frame, to access an I.D. on an odd shaped part, is equipped with the Starrett 204 Quick-Adjusting Micrometer Head. This tool greatly increases the speed with which measurements can be taken. Pressing a button on the thimble allows the spindle to slide along its axis to any position within its range. Releasing the button re-engages the spindle threads, and thimble rotation is then used for final size adjustment. The 204 Micrometer Head can be mounted on frames designed to suit your particular applications. Quotations and a concept print for your application can be obtained by submitting a product drawing with the thickness dimension(s) circled to:

The L.S. Starrett Co.
Special Gage Division
121 Crescent Street
Athol, MA 01331-1915.

## Special 725 Deep Throat Tubular Micrometer

With sliding, interchangeable anvils and locking lever, 7-1/2" (185mm) depth, 0-6" (0-150mm) range.





Special 436 Micrometer with dial indicator head. Range 3-4" (75-100mm). Other ranges also available.



Starrett can manufacture extra large micrometers, like this special 724 Micrometer of tubing type construction, range 72-78" (1800-1950mm), with interchangeable anvils.

# Mul-T-Anvil Micrometers

## 220, 220M Mul-T-Anvil Micrometers

### 0-2"/0-50MM

This tool was a new development in micrometer design and patent is held by Starrett. This micrometer will handle a wide variety of measurements impossible to obtain with regular micrometers, such as measuring the wall thickness of tubing, cylindrical walls from a hole or slot to an edge, many hard-to-reach locations, and the thickness of screw heads, shoulder lengths, etc.

This micrometer can be furnished with .0001" graduations, but we recommend .001" or 0.01mm for easier and more accurate readings. The Starrett Company, with our years of experience, recommends this because the anvils on this type of tool are not backed up by a frame as in a regular micrometer and could bend slightly.

| 220 Mul-T-Anvil Micrometers with Round and Flat Anvils and Carbide Faced Spindle | | | | | |
|---|---|---|---|---|---|
| | | Ratchet Stop, Lock Nut | | Friction Thimble, Lock Nut | |
| Range | Graduation | Cat. No. | EDP | Cat. No. | EDP |
| 0-1" | .001" | 220XRL-1 | 66430 | 220XFL-1 | 50746 |
| 0-25mm | 0.01mm | 220MXRL-25 | 65050 | | |
| Deluxe Case Only | | 220ZZ-1 | 55209 | | |
| **220M Mul-T-Anvil Micrometers With Round and Flat Anvils, Carbide Faced Spindle and 234B-1" or 234MB-25mm End Measuring Rod or Standard** | | | | | |
| 1-2" | .001" | 220XRL-2 | 66432 | 220XFL-2 | 66433 |
| 25-50mm | 0.01mm | 220MXRL-50 | 66434 | | |
| Deluxe Case Only | | 220ZZ-2 | 55210 | | |

V-Anvil only: Order PT13017, EDP 71399
1" and 25mm models sent in fitted case.
2" and 50mm models packed one in a box without case.




### Ease-of-Handling Features

- Balanced frame and thimble design ensure easy handling, better readability
- Ring-type knurled lock nut for quick and sure locking
- A choice of friction thimble or combination ratchet/speeder for uniform pressure
- Interchangeable anvils are rigidly held in the vise type frame and quickly interchanged by a single lock screw adjustment
- Two hardened anvils furnished – round anvil approximately .120" diameter (3mm) and flat anvil approximately .125" (3mm) and .060" (1.5mm) thick
- "V" Anvil for measuring thickness of screw heads and shoulder lengths available separately
- Accommodates special anvils up to 5/16" (8mm) thick
- Can be used as a height gage by removing the vise jaw

### Readability Features

- Starrett satin chrome finish – no glare – resists rust
- Advanced sleeve design with staggered lines and distinct figures for precise and easy readability
- Quick-reading figures – every thousandth numbered on inch tools

### Accuracy and Long-Life Features

- Rigid one-piece frame of drop forged steel
- Extremely hard and stable one-piece spindle (the heart of our accuracy)
- Quick and easy adjustment
- Tool is accurate to ± .0002" or ± 0.004mm

# Mul-t-Anvil Micrometers

## 790, 790M Electronic Multi-Anvil Micrometers (with output)

### 0-1"/0-25MM

Same as our 220 Micrometer with electronic readout.

| 790 Electronic Multi-Anvil Micrometers with Standard Inch Graduations on Shell and Thimble With Round and Flat Anvils | | |
|---|---|---|
| **Cat. No.** | **EDP** | **Description** |
| 790AFL-1 | 64048 | 0-1"/0-25mm Range |
| **790M Electronic Multi-Anvil Micrometers with Standard Millimeter Graduations on Shell and Thimble With Round and Flat Anvils** | | |
| 790MEAFL-25 | 66071 | 0-25mm/0-1" Range |
| **Cable Information** | | |
| 733SCKB | 69888 | Computer cable to PC |
| 733SCU | 69898 | Cable to computer running SPC Data Collection Software |
| 733SCM | 69893 | Connection to 7612 or 7613 Multiplexier |
| PT61120 | 65446 | One 3-Volt Battery CR2450 |




### Readability Features

- Large LCD digital readout is easy to read and reduces errors
- Resolution – .00005" and 0.001mm
- Conventional inch or millimeter graduations standard
- Attractive no-glare black wrinkle finish on the frame
- Starrett no-glare satin chrome finish on thimble and sleeve

### Accuracy and Long-Life Features

- One 3-volt battery furnished for over a year of normal usage
- Automatic OFF after 30 minutes of nonuse
- Tool is accurate to ± .0002" or ± 0.004mm

### Full-Function Action Features

- Instant inch/millimeter conversion
- "ME" millimeter model will turn on in the millimeter mode after installation of a new battery
- Measurement HOLD button
- Ability to zero tool at any position
- Ability to retain and return to the true zero reading of the micrometer
- PRESET button to install any reading at any position
- Ability to install minimum and maximum limits
- Output data to Starrett SPC Plus hardware and software and to PCs
- Works well with Starrett DataSure® Wireless Data Collection Systems

# Sheet Metal Micrometers

## 222, 222M Sheet Metal Micrometers

### 0-1"/0-25MM

These micrometers reach over the edge of sheet metal and take measurements away from the edge toward the center. Also for other gaging jobs where a deep throat micrometer is needed. Rounded anvil on 1" (25mm) size gives a point contact for more accurate gaging; flat anvil is also available. The 1/2" and 13mm micrometers have satin chrome frames; 1" and 25mm micrometer frames have black wrinkle finish.

| Cat. No. | EDP | Anvil | Graduation |
|---|---|---|---|
| **222 Sheet Metal Micrometers, 2" Throat Depth (0-1/2" Range)** | | | |
| 222RL-1/2 | 50756 | Flat | .001" |
| 222XRL-1/2 | 50757 | Flat | .001" |
| **222 Sheet Metal Micrometers, 6" Throat Depth (0-1" Range)** | | | |
| 222AXR-1 | 50762 | Rounded | .001" |
| 222BXR-1 | 50763 | Flat | .001" |
| **222M Sheet Metal Micrometers, 50mm Throat Depth (0-13mm Range)** | | | |
| 222MRL-13 | 50758 | Flat | 0.01mm |
| **222M Sheet Metal Micrometers, 150mm Throat Depth (0-25mm Range)** | | | |
| 222MAXR-25 | 66435 | Rounded | 0.01mm |
| 222MBXR-25 | 66436 | Flat | 0.01mm |
| **Case for 222 and 222M Sheet Metal Micrometers** | | | |
| 222ZZ-1 | 55212 | Case for 222 Micrometers | |

0-1" range and 0-25mm range micrometers sent with rounded anvil unless otherwise ordered.
Packed one in a box without case.

### Readability Features

- Starrett satin chrome finish – no glare – resists rust
- Advanced sleeve design with staggered lines and distinct figures for precise and easy readability
- Convenient decimal equivalents on Inch tools

### Ease-of-Handling Features

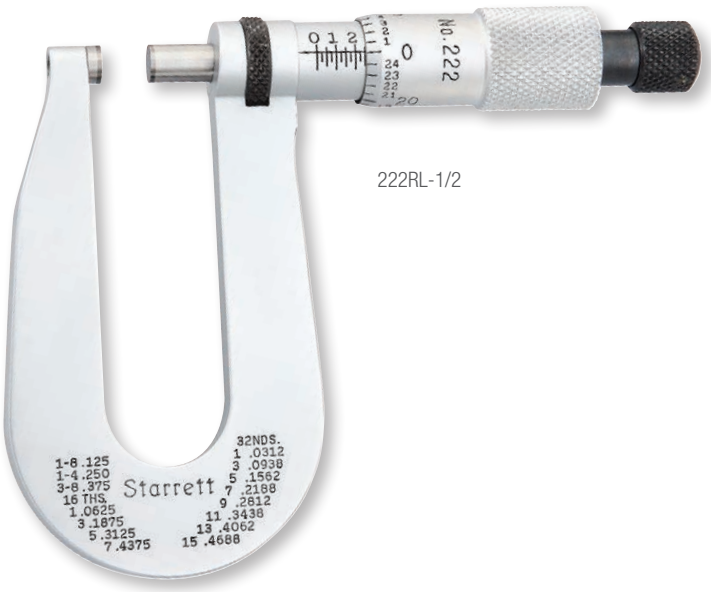
- Balanced frame and thimble design ensure easy handling and better readability
- Combination ratchet and speeder for uniform pressure and quicker adjustment
- Ring-type knurled lock nut for quick and sure locking (on 1/2" and 13mm range models)

### Accuracy and Long-Life Features

- Rigid one-piece frame of drop forged steel, ribbed for strength and stability
- Extremely hard and stable one-piece spindle (the heart of our accuracy)
- Quick and easy adjustment




222AXR-1




222RL-1/2

# Sheet Metal Micrometers

## 764 Electronic Sheet Metal Micrometers (with output)

### 0-1"/0-25MM

This micrometer is the same as our 222 Micrometer, except that it has an electronic readout and is available in the 1" (25mm) and 25mm ranges. Rounded anvil gives a point contact for more accurate gaging; flat anvil also available.

| 764 Electronic Sheet Metal Micrometers, 6" Throat Depth with Standard Inch Graduations on Shell and Thimble | | |
|---|---|---|
| **Cat. No.** | **EDP** | **Description** |
| 764AXFL | 66445 | 0-1"/0-25mm Range, Round Anvil |
| 764BXFL | 66525 | 0-1"/0-25mm Range, Flat Anvil |
| **764M Electronic Sheet Metal Micrometers, 150mm Throat Depth with Standard Millimeter Graduations on Shell and Thimble** | | |
| 764MEAXFL | 66446 | 0-25mm/0-1" Range, Round Anvil |
| **Cable Information for 764 and 764M Electronic Sheet Metal Micrometers** | | |
| **Part No.** | **EDP** | **Description** |
| PT61963 | 66636 | Computer Interface Cable Complete to PC (RS232C) |
| 733SCKB | 69888 | Computer cable to PC |
| 733SCU | 69898 | Cable to computer running SPC Data Collection Software |
| 733SCM | 69893 | Connection to 7612 or 7613 Multiplexier |

Packed one in a box without case.

### Readability Features

- Large, right-sized, high-contrast LCD digital readout is easy to read and reduces errors
- Resolution: .00005" and 0.001mm
- Conventional inch or millimeter graduations standard
- Attractive no-glare black wrinkle finish on the frame
- Starrett no-glare satin chrome finish on thimble and sleeve

### Accuracy and Long-Life Features

- One 3-volt battery furnished for over a year of normal usage
- Automatic OFF after 30 minutes of nonuse

### Full-Function Action Features

- Instant inch/millimeter conversion
- "ME" millimeter model will turn on in the millimeter mode after installation of a new battery
- Measurement HOLD button
- Ability to zero tool at any position
- Ability to retain and return to the true zero reading of the micrometer
- PRESET button to install any reading at any position
- Ability to install minimum and maximum limits
- RS232 data output port
- Works well with Starrett DataSure® Wireless Data Collection Systems

| Key to Starrett Micrometer Numbering System | |
|---|---|
| **Prefixes** | |
| R | Reverse Reading |
| S | Micrometer Set |
| T | .0001" Reading |
| V | 0.001mm or 0.002mm Reading, as specified |
| **Suffixes** | |
| F | Friction Thimble |
| L | Lock Nut |
| M | Metric |
| N | Non-Rotating |
| P | Plain |
| R | Ratchet Stop |
| S | Speeder |
| TN | Threaded Hub and Check Nut |
| W/SLC | Standard Letter of Certification |
| X | Micro-lapped Carbide Measuring Faces |
| Z | With Case |
| ZZ | Case Only |



# Tube Micrometers

## 569, 569M Tube Micrometers

### 0-1"/0-25MM

For measuring the wall thickness of tubing and other parts with cylindrical walls. Also for measuring from a hole to an edge (note minimum hole sizes in table). Rigid steel "half" frame with smooth black enamel finish. Anvil diameter = 0.185".

#### Readability Features

- Starrett satin chrome finish – no glare – resists rust
- Advanced sleeve design with staggered lines and distinct figures for precise and easy readability
- Convenient decimal equivalents on inch tools

#### Ease-of-Handling Features

- Balanced frame and thimble design ensure easy handling and better readability

#### Accuracy and Long-Life Features

- Rigid steel frame ribbed for strength and stability
- Extremely hard and stable one-piece spindle (the heart of our accuracy)
- Quick and easy adjustment

| 569 Tube Micrometers (0-1" Range) | | | | |
|---|---|---|---|---|
| **Cat. No.** | **EDP** | **Graduation** | **Minimum Hole Size** | **Description** |
| 569AXP | 66437 | .001" | 3/16" | Carbide Faced Spindle |
| 569BXP | 66439 | | 3/8" | Carbide Faced Spindle |
| **569M Tube Micrometers (0-25mm Range)** | | | | |
| 569MAXP | 66438 | 0.01mm | 4.8mm | Carbide Faced Spindle |
| 569MBXP | 66440 | | 9.5mm | Carbide Faced Spindle |
| **Deluxe Case for 569 and 569M Tube Micrometers** | | | | |
| **Cat. No.** | **EDP** | **Description** | | |
| 910 | 55397 | Deluxe case only for the 569 | | |

Special anvils also can be furnished, priced on application. Sent in fitted case.




## 769 Electronic Tube Micrometers (with output)

### 0-1"/0-25MM

This micrometer is the same as our 569 with an electronic readout and the following additional features and benefits:

#### Readability Features

- Large LCD digital readout is easy to read and reduces errors
- Resolution: .00005" and 0.001mm
- Conventional inch or millimeter graduations standard
- Attractive no-glare black wrinkle finish on the frame
- Starrett no-glare satin chrome finish on thimble and sleeve

#### Accuracy and Long-Life Features

- One 3-volt battery furnished for over a year of normal usage
- Automatic OFF after 30 minutes of nonuse

#### Full-Function Action Features

- Instant inch/millimeter conversion
- "ME" model turns on in millimeter mode after battery installation
- Measurement HOLD button
- Ability to zero tool at any position
- Ability to retain and return to the true zero reading of the micrometer
- PRESET button to install any reading at any position
- Ability to install minimum and maximum limits
- RS232 data output port
- Works well with Starrett DataSure® Wireless Data Collection Systems

| 769 Electronic Tube Micrometers, Standard Inch Graduations | | |
|---|---|---|
| **Cat. No.** | **EDP** | **Description** |
| 769AXFL | 66447 | 0-1"/0-25mm Range, Carbide Faced Spindle |
| **769 Electronic Tube Micrometers, Standard Millimeter Graduations** | | |
| 769MEAXFL | 66448 | 0-25mm/0-1" Range, Carbide Faced Spindle |
| **Cable Information for 769 Electronic Tube Micrometers** | | |
| PT61963 | 66636 | Computer Interface Cable Complete to PC (RS232C) |
| 733SCKB | 69888 | Computer cable to PC |
| 733SCU | 69898 | Cable to computer running SPC Data Collection Software |
| 733SCM | 69893 | Connection to 7612 or 7613 Multiplexier |



# Crankshaft Micrometers

## 436-3 1/2, 436M-88 Automotive Crankshaft Micrometers

### 1-1/2– 3-1/2"/38-88MM

This micrometer is designed for automotive work and especially for crankshaft measuring. It is also well suited for all other work within its capacity. It measures the diameter of the journal bearing and main bearing of most crankshafts since the micrometer has a range from 1-1/2" (38mm) – 3-1/2" (88mm).

| 436-3 1/2 Automotive Crankshaft Micrometers (1-1/2 – 3-1/2" Range) | | |
|---|---|---|
| **Cat. No.** | **EDP** | **Graduation** |
| T436RLS-3 1/2 | 65493 | .0001" |
| **436M-88 Automotive Crankshaft Micrometers (38-88mm Range)** | | |
| V436MRLS-88 | 65600 | 0.002mm |
| **Case for 436-3 1/2 and 436M-88 Automotive Crankshaft Micrometers** | | |
| 733ZZ-4 | 66139 | Protective Case |

Carbide measuring faces available on special order. Specify "X" after catalog number.



### Readability Features

- Starrett satin chrome finish – no glare – resists rust
- Advanced sleeve design with staggered lines and distinct figures for precise and easy readability
- Quick-reading figures – every thousandth numbered on inch tools
- The reading point is on the under side of the sleeve, plainly visible while measuring. It's a very useful feature when measuring between webs.

### Ease-of-Handling Features

- Balanced frame and thimble design ensure easy handling and better readability
- Ring-type knurled lock nut for quick and sure locking
- Combination ratchet and speeder for uniform pressure and quicker adjustment
- Gracefully designed tapered frame for use in narrow slots and tight places
- 2" (50mm) range
- 2-5/8" (66mm) throat depth

### Accuracy and Long-Life Features

- Rigid one-piece frame of drop forged steel, ribbed for extra strength
- Extremely hard and stable one-piece spindle (the heart of our accuracy)
- Appropriate standard included



# MICROMETERS

## 458, 458M AUTOMOTIVE DISC BRAKE MICROMETERS

### .300-2"/7.6-50MM

- Measures depth of wear grooves in disc of brake systems
- 3" (75mm) frame with a 3-1/2" (88mm) depth to allow additional reach
- Flat carbide spindle and a carbide anvil with a 60° point

### READABILITY FEATURES

- Starrett satin chrome finish – no glare – resists rust
- Advanced sleeve design for precise, easy readability
- Quick-reading figures – every thousandth numbered on inch tools

### EASE-OF-HANDLING FEATURES

- Balanced frame and thimble design ensure easy handling and better readability
- Combination ratchet and speeder for uniform pressure and quicker adjustment
- Gracefully designed tapered frame for use in narrow slots and tight places
- 3-1/2" (88mm) throat depth

### ACCURACY AND LONG-LIFE FEATURES

- Rigid one-piece steel frame
- Extremely hard and stable one-piece spindle (the heart of our accuracy)
- Carbide measuring face on the spindle and carbide "V" anvil
- Quick and easy adjustment

| .300-2" Range | | | |
|---|---|---|---|
| **Range** | **Graduation** | **Cat. No.** | **EDP** |
| .300-1.300" | .001" | 458AXR | 67534 |
| | | 458AXRS* | 67535 |
| 1-2" | .001" | 458BXR | 67536 |
| | | 458BXRS* | 67537 |
| **7.6-50mm Range** | | | |
| 7.6-33mm | 0.01mm | 458MAXR | 67538 |
| | | 458MAXRS** | 67539 |
| 25-50mm | 0.01mm | 458MBXR | 67540 |
| | | 458MBXRS** | 67541 |

* with 26852-0 Gage Block Standard.
** with 26853-0 Gage Block Standard.



## 260, 260M GROOVE MICROMETERS

### INCH/MM

Quickly and easily measures widths of internal or external grooves and lands.

### READABILITY FEATURES

- Starrett satin chrome finish – no glare – resists rust
- Advanced sleeve design with staggered lines and distinct figures for precise and easy readability
- Quick-reading figures – every thousandth numbered on inch tools

### EASE-OF-HANDLING FEATURES

- Balanced design to ensure easy handling and better readability
- Has a reach of 1-5/8" (41mm) maximum hole depth
- Each measuring disc is 9/32" (7mm) diameter and .025" (0.63mm) thick
- Will measure groove widths .050-1.050" (1.27-26.6mm)
- Will measure land widths from 0-1" and 0-25mm

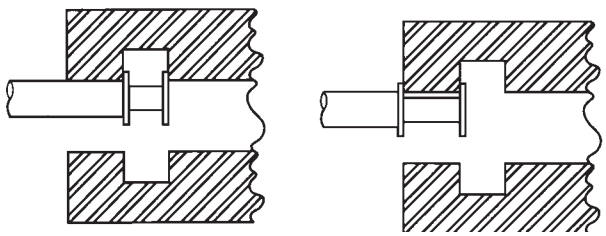
### ACCURACY AND LONG-LIFE FEATURES

- Extremely hard and stable one-piece spindle (the heart of our accuracy)
- Hardened, ground, and lapped measuring discs
- Quick and easy adjustment
- This tool is accurate to ±.0004" or ±0.01mm

| 260 and 260M Groove Micrometer | | | | | |
|---|---|---|---|---|---|
| **Cat. No.** | **EDP** | **Graduation** | **Range Groove Widths*** | **Land Widths** | **Max. Hole Depth** |
| 260Z | 67987 | .001" | .050"-1.050" | 0-1.000" | 1 5/8" |
| 260MZ | 67988 | 0.01mm | 1.27-26.27mm | 0-25mm | 41mm |

* Add .050" to 260Z (1.27mm to 260MZ) micrometer reading.





# MICROMETERS

## 223, 223M PAPER GAGE MICROMETERS

### 0-11/32"/0-8.75MM

This micrometer is designed for use in paper mills, printing shops, paper warehouses, rubber plants, etc. for accurately, quickly measuring the thickness of paper, cardboard, chipboard, rubber, plastics, and other similar products, up to 11/32" (8.75mm).

| 223 and 223M Paper Gage Micrometers (0-11/32"/0-8.75mm Range) | | |
|---|---|---|
| **Cat. No.** | **EDP** | **Graduation** |
| 223RL | 50768 | .001" |
| 223MRL | 64336 | 0.01mm |
| **Case for 223 Paper Gage Micrometers** | | |
| **Cat. No.** | **EDP** | **Description** |
| 921 | 55213 | Protective Case |

### READABILITY FEATURES

- Starrett satin chrome finish – no glare – resists rust
- Advanced sleeve design with staggered lines and distinct figures for precise and easy readability
- Convenient decimal equivalents on inch tool

### EASE-OF-HANDLING FEATURES

- Balanced frame and thimble design ensure easy handling and readability
- Ring-type knurled lock nut for quick and sure locking
- Combination ratchet and speeder for uniform pressure and quick adjustment
- Anvil and spindle faces are 7/16" (11mm) diameter to prevent compressing the material being measured and to ensure accurate readings
- The floating anvil automatically adjusts itself to any surface condition
- Convenient finger-holding ring is also provided

### ACCURACY AND LONG-LIFE FEATURES

- Rigid one-piece frame of drop forged steel
- Extremely hard and stable one-piece spindle (the heart of our accuracy)
- Quick and easy adjustment



# MICROMETERS

## 486, 486M BLADE TYPE MICROMETERS WITH NON-ROTATING SPINDLE

### 0-12"/0-150MM

Here is another special function Starrett micrometer. It is designed for fast and accurate measurements of circular form tools, diameter and depth of narrow grooves, slots, keyways, recesses, and depths between lands and fins.

| 486 Blade Type Micrometers (0-12" Range) | | | |
|---|---|---|---|
| **Range** | **Graduation** | **Cat. No.** | **EDP** |
| 0-1" | .001" | 486P-1 | 52499 |
| 1-2" | | 486P-2 | 52501 |
| 2-3" | | 486P-3 | 52503 |
| 3-4" | | 486P-4 | 52505 |
| 4-5" | | 486P-5 | 52507 |
| 5-6" | | 486P-6 | 52509 |
| 6-7" | | 486P-7 | 67094 |
| 7-8" | | 486P-8 | 67095 |
| 8-9" | | 486P-9 | 67096 |
| 9-10" | | 486P-10 | 67097 |
| 10-11" | | 486P-11 | 67098 |
| 11-12" | | 486P-12 | 67099 |
| **486M Blade Type Micrometers (0-150mm Range)** | | | |
| 0-25mm | 0.01mm | 486MP-25 | 64257 |
| 25-50mm | | 486MP-50 | 64258 |
| 50-75mm | | 486MP-75 | 64259 |
| 75-100mm | | 486MP-100 | 64260 |
| 100-125mm | | 486MP-125 | 64261 |
| 125-150mm | | 486MP-150 | 64262 |

#### READABILITY FEATURES

- Starrett satin chrome finish – no glare – resists rust
- Advanced sleeve design with staggered lines and distinct figures for precise and easy readability

#### EASE-OF-HANDLING FEATURES

- Speeder for quicker adjustment on all sizes
- Non-rotating spindle prevents blade from turning in narrow slots or rolling off shoulder
- The blades are .030" (0.8mm) thick
- Blades will measure to 5/16" (8mm) depths

#### ACCURACY AND LONG-LIFE FEATURES

- Rigid steel frame ribbed for extra strength on sizes through 6" (150mm)
- Extremely hard and stable one-piece spindle (the heart of our accuracy)
- Quick and easy adjustment

| Cases for 486 and 486M Blade Type Micrometers | | |
|---|---|---|
| **Range** | **Cat. No.** | **EDP** |
| 1", 25mm | 913 | 55400 |
| 2", 50mm | 922 | 55222 |
| 3", 75mm | 952 | 55223 |
| 4", 100mm | 953 | 55224 |
| 5", 125mm | 954 | 55225 |
| 6", 150mm | 930 | 55276 |

| Cases for 486 & 486M Blade Type Micrometers | | |
|---|---|---|
| **Range** | **Cat.** | **EDP** |
| 7", 175mm | 931 | 55277 |
| 8", 200mm | 932 | 55278 |
| 9", 225mm | 933 | 55279 |
| 10", 250mm | 934 | 55280 |
| 11", 275mm | 935 | 55281 |
| 12", 300mm | 436ZZ-13 | 55282 |



# MICROMETERS

## 786 ELECTRONIC BLADE-TYPE MICROMETERS WITH NON-ROTATING SPINDLE (WITH OUTPUT)

### 0-5"/0-125MM

This micrometer is the same as our 486 with electronic readout and the following additional features:

| 786 Electronic Blade-Type Micrometers With Standard Inch Graduations on Shell and Thimble | | | | | |
|---|---|---|---|---|---|
| Range | | Resolution | | | |
| Inch | Approx. mm | Inch | mm | Cat. No. | EDP |
| 0 - 1" | 0-25.4mm | .00005" | 0.001mm | 786P-1 | 65225 |
| 1 - 2" | 25.4-51mm | | | 786P-2 | 65226 |
| 2 - 3" | 51-76mm | | | 786P-3 | 65227 |
| 3 - 4" | 76-101mm | | | 786P-4 | 65228 |
| 4 - 5" | 101-127mm | .0001" | 0.001mm | 786P-5 | 65229 |

| 786 Electronic Blade-Type Micrometers With Standard Millimeter Graduations on Shell and Thimble | | | | | |
|---|---|---|---|---|---|
| Range | | Resolution | | | |
| mm | Approx. Inch | mm | Inch | Cat. No. | EDP |
| 0 - 25mm | 0-.984" | 0.001mm | .00005" | 786MEP-25 | 66118 |
| 25 - 50mm | .984-1.968" | | | 786MEP-50 | 66126 |
| 50 - 75mm | 1.968-2.950" | | | 786MEP-75 | 66127 |
| 75 - 100mm | 2.950-3.930" | | | 786MEP-100 | 66128 |
| 100 - 125mm | 3.930-4.920" | | | 786MEP-125 | 66129 |

| Cable Information for 786 Electronic Blade-Type Micrometers | | |
|---|---|---|
| Part No. | EDP | Description |
| 733SCKB | 69888 | Computer cable to PC |
| 733SCU | 69898 | Cable to computer running SPC Data Collection Software |
| 733SCM | 69893 | Connection to 7612 or 7613 Multiplexier |
| PT61120 | 65446 | One 3-Volt Battery CR2450 |

Attractive, protective case available by ordering 733ZZ and one size larger than the micrometer. Example: For 786P-2, order 733ZZ-3.

### READABILITY FEATURES

- Large LCD digital readout is easy to read and reduces errors
- Conventional inch or millimeter graduations standard
- Attractive no-glare black wrinkle finish on the frame
- Starrett no-glare satin chrome finish on thimble and sleeve

### ACCURACY AND LONG-LIFE FEATURES

- One 3-volt battery furnished for over a year of normal usage
- Automatic OFF after 30 minutes of nonuse

### FULL-FUNCTION ACTION FEATURES

- Instant inch/millimeter conversion
- "ME" millimeter models will turn on in the millimeter mode after installation of a new battery
- Measurement HOLD button
- Ability to zero tool at any position
- Ability to retain and return to the true zero reading of the micrometer
- PRESET button to install any reading at any position
- Ability to install minimum and maximum limits
- RS232 data output port
- Works well with Starrett DataSure® Wireless Data Collection Systems

| Key to Starrett Micrometer Numbering System | |
|---|---|
| **Prefixes** | |
| R | Reverse Reading |
| S | Micrometer Set |
| T | .0001" Reading |
| V | 0.001mm or 0.002mm Reading, as specified |
| **Suffixes** | |
| F | Friction Thimble |
| L | Lock Nut |
| M | Metric |
| N | Non-Rotating |
| P | Plain |
| R | Ratchet Stop |
| S | Speeder |
| TN | Threaded Hub and Check Nut |
| W/SLC | Standard Letter of Certification |
| X | Micro-lapped Carbide Measuring Faces |
| Z | With Case |
| ZZ | Case Only |



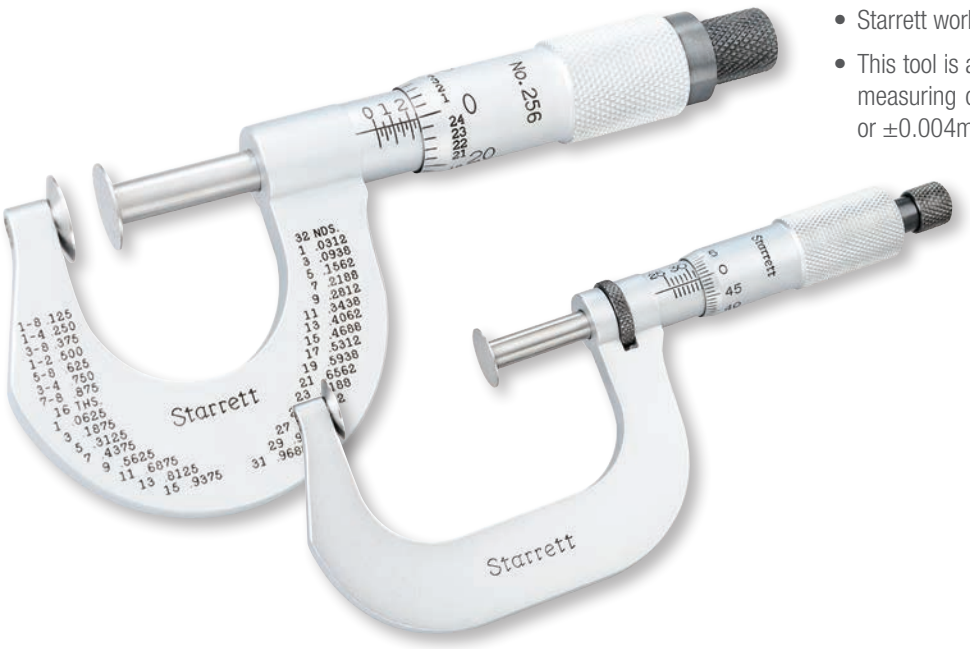
# Disc-Type Micrometers

## 256, 256M Disc-Type Micrometers with Rotating or Non-Rotating Spindles

### 0-3"/0-75MM

These tools are used to measure the thickness of work sections such as ribs, lands, fins, cutting edges on form tools, and chordal thickness of gear teeth. Because of their large anvil and spindle faces, the 1" and 25mm sizes are also useful for measuring the thickness of sheet materials like paper, cardboard, rubber, and plastics.

| 256 Disc-Type Micrometers (.001" Graduation) | | |
|---|---|---|
| **Range** | **Cat. No.** | **EDP** |
| 0-1" | 256RL-1 | 51236 |
| 0-1" | 256PN-1 | 56469 |
| 1-2" | 256RL-2 | 55940 |
| 2-3" | 256RL-3 | 55941 |
| **256M Disc-Type Micrometers (0.01mm Graduation)** | | |
| 0-25mm | 256MRL-25 | 51238 |
| 0-25mm | 256MPN-25 | 56470 |
| 25-50mm | 256MRL-50 | 55942 |
| 50-75mm | 256MRL-75 | 55943 |
| **Cases for 256 and 256M Disc-Type Micrometers** | | |
| **Description** | **Cat. No.** | **EDP** |
| Deluxe case for 1" and 25mm micrometers | 910 | 55397 |
| Deluxe case for 2" and 50mm micrometers | 912 | 55399 |
| Deluxe case for 3" and 75mm micrometers | 922 | 55222 |




### Readability Features

- Starrett satin chrome finish – no glare – resists rust
- Advanced sleeve design with staggered lines and distinct figures for precise and easy readability
- Quick-reading figures – every thousandth numbered on inch tools
- Convenient decimal equivalents on 1" and 2" reading tools

### Ease-of-Handling Features

- Balanced frame and thimble design ensure easy handling and better readability
- Ring-type knurled lock nut for quick and sure locking
- The combination ratchet and speeder for uniform pressure and quicker adjustment on all sizes
- Gracefully designed tapered frame for use in narrow slots and tight places
- Anvil and spindle discs are 1/2" (12.7mm) diameter tapering to .015" (0.4mm) edge thickness making it possible to enter narrow grooves and recesses
- Available in the 1" and 25mm sizes with rotating or non-rotating spindle

### Accuracy and Long-Life Features

- Rigid one-piece frame of drop forged steel
- Extremely hard and stable one-piece spindle (the heart of our accuracy)
- Quick and easy adjustment
- Starrett workmanship
- This tool is accurate to ±.00015" or ± 0.003mm measuring over the whole surface and ±.0002" or ±0.004mm measuring on the edges

# Disc-Type Micrometers

## 756 Electronic Disc-Type Micrometer with Rotating Spindle (with output)

**0-1"/0-25MM**

The same as our 256 with an electronic readout and the following additional features and benefits:

| 756 Electronic Disc-Type Micrometer | | |
|---|---|---|
| **Cat. No.** | **EDP** | **Description** |
| 756FL-1 | 64042 | 0-1"/0-25mm range, with standard inch graduations on shell and thimble |
| **756M Electronic Disc-Type Micrometer** | | |
| 756MEFL-25 | 66134 | 0-25mm/0-1" range, with standard millimeter graduations on shell and thimble |
| **Cable Information for 756 and 756M Electronic Disc-Type Micrometers** | | |
| **Part No.** | **EDP** | **Description** |
| 733SCKB | 69888 | Computer cable to PC |
| 733SCU | 69898 | Cable to computer running SPC Data Collection Software |
| 733SCM | 69893 | Connection to 7612 or 7613 Multiplexer |
| PT61120 | 65446 | One 3-Volt Battery CR2450 |
| **Case for 756 and 756M Electronic Disc-Type Micrometers** | | |
| 949 | 63874 | Protective case |




### Readability Features

- Large, right-sized, high-contrast LCD digital readout is easy to read and reduces errors
- Resolution: .00005" and 0.001mm
- Conventional inch or millimeter graduations standard
- Attractive no-glare black wrinkle finish on the frame
- Starrett no-glare satin chrome finish on thimble and sleeve

### Accuracy and Long-Life Features

- One 3-volt battery furnished for dependable power and over one year's normal usage
- Automatic OFF after 30 minutes of nonuse
- Anvil and spindle discs are 1/2" (12.7mm) diameter tapering to 0.15" (0.4mm) edge thickness making it possible to enter narrow grooves and recesses
- Tool is accurate to ±.00015" or ±0.003mm measuring over the whole surface and ±.0002" or ±0.004mm measuring on the edge

### Full-Function Action Features

- Instant inch/millimeter conversion
- "ME" millimeter model will turn on in the millimeter mode after installation of a new battery
- Measurement HOLD button
- Ability to zero tool at any position
- Ability to retain and return to the true zero reading of the micrometer
- PRESET button to install any reading at any position
- Ability to install minimum and maximum limits
- RS232 data output port
- Works well with Starrett DataSure® Wireless Data Collection Systems

# MICROMETERS

## 576, 576M, 577, 577M, 211 MICROMETERS WITH ROUNDED ANVILS

### 0-1/2"/0-13MM; 0-1"/0-25MM

These three micrometers are all extremely useful for measuring the wall thickness of parts such as solid and split bearings, tubing, sleeves, collars, rings, various cylinders, and also measuring from the inside of a hole to an edge. All three have a rounded anvil which contacts the inside curved surface and a flat spindle for contacting the outside of the work, thus producing single point contact. This permits accurate gaging of curved surface thickness in thousandths of an inch or hundredths of a millimeter.

| 576, 577 and 211 Micrometers (0-1" Range) | | | |
|---|---|---|---|
| **Cat. No.** | **EDP** | **Range** | **Graduation** |
| 576XR | 66441 | 0-1/2" | .001" |
| 577XP | 66443 | 0-1" | |
| 211XP | 66428 | 0-1" | |
| **576M and 577M Micrometers (0-25mm Range)** | | | |
| 576MXR | 66442 | 0-13mm | 0.01mm |
| 577MXP | 66444 | 0-25mm | |
| **Cases for 576, 576M, 577, 577M and 211 Micrometers** | | | |
| **Cat. No.** | **EDP** | **Description** | |
| 910 | 55397 | Attractive protective case for 211 and 577 Micrometers | |
| 921 | 55213 | Attractive protective case for 576 Micrometers | |

Ball Attachment 247 used for rounded anvil effect is also available for other standard micrometers.

### CAPACITY:

- The 576 can get into holes as small as 5/16 of an inch (8mm) and measure up to 1/2 inch (13mm)
- The 577 can get into holes as small as 3/8 of an inch (9.5mm) and measure up to 1 inch (25mm)
- The 211 can get into holes as small as 5/8 of an inch (16mm) and measure up to 1 inch (25mm)

### READABILITY FEATURES

- Starrett satin chrome finish – no glare – resists rust
- Advanced sleeve design with staggered lines and distinct figures for precise and easy readability
- Convenient decimal equivalents on inch tools

### EASE-OF-HANDLING FEATURES

- Balanced frame and thimble design ensure easy handling and readability
- Gracefully designed tapered frame for narrow slots and tight places

### ACCURACY AND LONG-LIFE FEATURES

- Rigid steel frames
- Extremely hard and stable one-piece spindle (the heart of our accuracy)
- Quick and easy adjustment



# MICROMETERS

## 788 ELECTRONIC MICROMETERS WITH ROUNDED ANVIL (WITH OUTPUT)

### 0-1"/0-25MM

This micrometer is similar to our 211, except that it has an electronic readout and the following extra features and benefits:

| 788 and 788M Electronic Micrometers | | |
|---|---|---|
| **Cat. No.** | **EDP** | **Description** |
| 788XFL | 66449 | 0-1"/0-25mm range, with standard inch graduations on shell and thimble |
| 788MEXFL | 66450 | 0-25mm/0-1" range, with standard millimeter graduations on shell and thimble |
| **Cable Information for 788 Electronic Micrometers** | | |
| **Part No.** | **EDP** | **Description** |
| 733SCKB | 69888 | Computer cable to PC |
| 733SCU | 69898 | Cable to computer running SPC Data Collection Software |
| 733SCM | 69893 | Connection to 7612 or 7613 Multiplexier |
| PT61120 | 65446 | One 3-Volt Battery CR2450 |
| **Case for 788 and 788M Electronic Micrometers** | | |
| 949 | 63874 | Case for 788 Micrometers |

### READABILITY FEATURES

- Large, high-contrast LCD digital readout reduces errors
- Resolution: .00005" and 0.001mm
- Conventional inch or millimeter graduations standard
- Attractive no-glare black wrinkle finish on the frame
- Starrett no-glare satin chrome finish on thimble and sleeve

### ACCURACY AND LONG-LIFE FEATURES

- One 3-volt battery furnished for dependable power and over one year's normal usage
- Automatic OFF after 30 minutes of nonuse

### FULL-FUNCTION ACTION FEATURES

- Instant inch/millimeter conversion
- "ME" millimeter model will turn on in the millimeter mode after installation of a new battery
- Measurement HOLD button
- Ability to zero tool at any position
- Ability to retain and return to the true zero reading of the micrometer
- PRESET button to install any reading at any position
- Ability to install minimum and maximum limits
- RS232 data output port
- Works well with Starrett DataSure® Wireless Data Collection Systems



# MICROMETERS

## 205 STEEL MILL MICROMETER

### 0-1"

This micrometer is specially designed for gaging hot metal sheet in steel mills and has many features for safer, faster, and more accurate measurements. Micrometer has rugged construction throughout, and is attached to a convenient wooden handle, correctly shaped for a firm grip. Allows measurements to be made while the micrometer can be comfortably held at a safe distance from the hot metal.

### READABILITY FEATURES

- Starrett satin chrome finish – no glare – resists rust
- Advanced sleeve design with staggered lines and distinct figures for precise and easy readability
- Quick-reading figures – every thousandth numbered on inch tools
- Convenient decimal equivalents on inch tools
- Extra long bevel on thimble with heavy cut graduations

### EASE-OF-HANDLING FEATURES

- Both spindle and anvil are beveled to easily slide onto the work
- Large, reversible wing lock nut is easy to lock or release, even when wearing heavy gloves
- Rugged frame construction and heavy duty spindle of .270" diameter

### ACCURACY AND LONG-LIFE FEATURES

- Rigid one-piece frame of drop forged steel
- Extremely hard and stable one-piece spindle (the heart of our accuracy)
- Quick and easy adjustment by either the anvil or by a simple sleeve adjustment

| 247 Micrometer Ball Attachments, .200" Diameter Balls | | |
|---|---|---|
| **Cat. No.** | **EDP** | **Description** |
| 247A | 51174 | For 2, 226 (old style), 230 and 577 Micrometers and 263 Micrometer Heads, .235" diameter Anvil and Spindle |
| 247B | 51175 | For 224A, 224AA and 436 Micrometers, .270" diameter anvil and spindle |
| 247C | 51176 | For 232 Micrometers and 463 Micrometer Heads, .200" diameter anvil and spindle |
| 247D | 51177 | For 216, 226 (new style), 231, 436.1, 733, 795, 796, 3732, 1212 and 1230 Micrometers, .250" diameter anvil and spindle |
| 247E | 51178 | For 224B through J, 238, 239, 436 Micrometers and 663 Micrometer Heads, .300" diameter anvil and spindle |
| **247M Micrometer Ball Attachments, 5mm Diameter Balls** | | |
| 247MA | 51179 | For 2M and 230M Micrometers and 263M Micrometer Heads, 6mm diameter anvil and spindle |
| 247MB | 51180 | For 436M Micrometers, 6.8mm diameter anvil and spindle |
| 247MD | 56691 | For 216M and 436.1M Micrometers, 6.35mm diameter anvil and spindle |
| 247ME | 56692 | For 224MB through J, 238M, 436M Micrometers and 663M Micrometer Heads, 7.6mm diameter anvil and spindle |

## 247, 247M MICROMETER BALL ATTACHMENTS

### INCH/MM

Outside micrometers and micrometer heads having spindle sizes listed below can be instantly converted for measuring wall thickness of tubing, split and full bearings, sleeves and other parts with rounded surfaces by means of the 247 Ball Attachment.

### FEATURES

- Easily applied by snapping on to end of either anvil or spindle, thus permitting two attachments to be used together
- Balls are hardened, measure .200" and 5mm in diameter, and move freely in the retainer, insuring positive contact with anvil and spindle
- The diameters, .200" or 5mm, of each ball used must be subtracted from the micrometer reading
- All metal construction

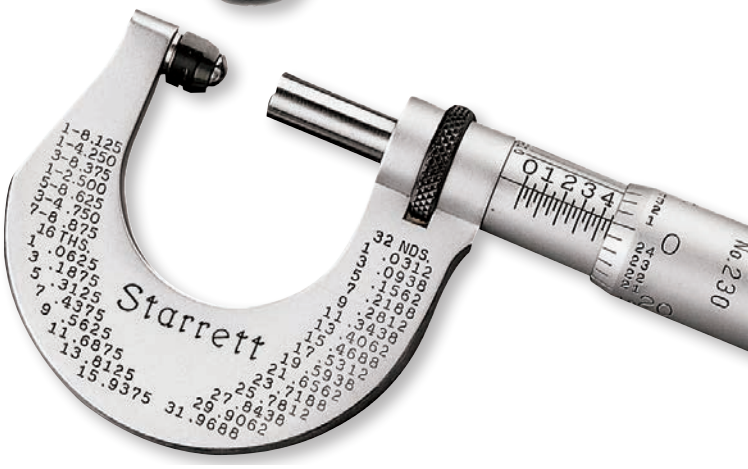
| 205 Steel Mill Micrometer | | | | |
|---|---|---|---|---|
| **Cat. No.** | **EDP** | **Range** | **Graduation** | **Description** |
| 205HL | 50730 | 0-1" | .001" | Lock nut, with handle |




205HL



247A



# MICROMETERS

## 575, 575M, 585, 585M SCREW THREAD MICROMETERS FOR MEASURING PITCH DIAMETER

### 0-1"/0-25MM; 1-2"/25-50MM

These micrometers have a pointed spindle and a double V-anvil, both shaped to contact the screw thread as shown in the drawing. The micrometer reading therefore gives the pitch diameter.*

| 575 and 585 Screw Thread Micrometers (.001" Graduation) | | | |
|---|---|---|---|
| **Range, Threads Per inch** | **Capacity, Pitch Diameter** | **Cat. No.** | **EDP** |
| 7-9 | 0-1" | 575AP | 56159 |
| 10-13 | | 575BP | 56160 |
| 14-18 | | 575CP | 56161 |
| 20-24 | | 575DP | 56162 |
| 28-30 | | 575EP | 56163 |
| 32-40 | | 575FP | 56164 |
| 4 1/2 - 6 | 1-2" | 585AP | 56165 |
| 7-9 | | 585BP | 56166 |
| 10-13 | | 585CP | 56167 |
| 14-18 | | 585DP | 56168 |
| 20-24 | | 585EP | 56169 |
| 28-30 | | 585FP | 56170 |
| **575M and 585M Screw Thread Micrometers (0.01mm Graduation)** | | | |
| **Range, Pitch in mm** | **Capacity, Pitch Diameter** | **Cat. No.** | **EDP** |
| 3-4 | 0-25mm | 575MAP | 56321 |
| 2-2.5 | | 575MBP | 56322 |
| 1.25-1.75 | | 575MCP | 56323 |
| 0.75-1 | | 575MDP | 56324 |
| 0.5-0.7 | | 575MEP | 56325 |
| 0.35-0.45 | | 575MFP | 56326 |
| 4.5-6 | 25-50mm | 585MAP | 56327 |
| 3-4 | | 585MBP | 56328 |
| 2-2.5 | | 585MCP | 56329 |
| 1.25-1.75 | | 585MDP | 56330 |
| **Cases** | | | |
| **Description** | | **Cat. No.** | **EDP** |
| Attractive protective case for 575 | | 910 | 55397 |
| Attractive protective case for 585 | | 912 | 55399 |

Swivel anvil available on special order – also in capacities over 2" (50mm).
575 sent in fitted case.
585 packed one in a box without case.

| Key to Starrett Micrometer Numbering System | |
|---|---|
| **Prefixes** | |
| R | Reverse Reading |
| S | Micrometer Set |
| T | .0001" Reading |
| V | 0.001mm or 0.002mm Reading, as specified |
| **Suffixes** | |
| F | Friction Thimble |
| L | Lock Nut |
| M | Metric |
| N | Non-Rotating |
| P | Plain |
| R | Ratchet Stop |
| S | Speeder |
| TN | Threaded Hub and Check Nut |
| W/SLC | Standard Letter of Certification |
| X | Micro-lapped Carbide Measuring Faces |
| Z | With Case |
| ZZ | Case Only |

* **MEASURING TIP**: These tools are accurate for general purposes, especially if set to a thread plug gage of the size to be measured.

### READABILITY FEATURES

- Starrett satin chrome finish – no glare – resists rust
- Advanced sleeve design with staggered lines and distinct figures for precise and easy readability
- Decimal equivalents on inch tools

### EASE-OF-HANDLING FEATURES

- Balanced frame and thimble design for easy handling and better readability
- Gracefully designed tapered frame for use in narrow slots and tight places
- Furnished with fixed (non-rotating) anvil, but swivel anvils available on special order
- Available in capacity over 2" or 50mm (special order)

### ACCURACY AND LONG-LIFE FEATURES

- One-piece frame of drop forged steel
- Extremely hard and stable one-piece spindle (the heart of our accuracy)
- Quick and easy adjustment
- Design allows 50% to 75% contact with the thread to be measured, thereby insuring contact with the pitch diameter at all times
- Design also ensures against contact with the root area of the thread
- Tools are accurate to ±.0002" or 0.004mm

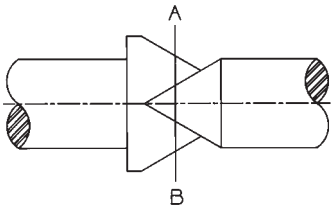
### 575 AND 585 – INCH

For measuring American Unified National series and Unified J series screw threads. 585 micrometers come with a one-inch standard at no extra cost.

### 575M AND 585M – METRIC

For measuring I.S.O. metric and MJ screw threads. 585M micrometers come with a 25mm standard at no extra cost.




With the 575AP 0-1", pitch diameter is read directly in inches, since the line AB corresponds to the 0 reading.

# Thread Comparator Micrometers

## 210, 210M Screw Thread Comparator Micrometers

### 0-7/8"/0-22MM

This micrometer is ideal for quick comparisons of thread accuracy in screw cutting operations, measuring in small grooves or recesses where regular micrometers cannot be used, and for many other applications.

**NOTE:** Does not measure pitch diameter. For such measurements, 575 or 585 Thread Micrometers are recommended.

#### Readability Features

- Starrett satin chrome finish – no glare – resists rust
- Advanced sleeve design with staggered lines and distinct figures for precise and easy readability
- Convenient decimal equivalents on inch reading tools

#### Ease-of-Handling Features

- Balanced frame and thimble design ensure easy handling and better readability
- Gracefully designed tapered frame for narrow slots and tight places

#### Accuracy and Long-Life Features

- Rigid steel frame
- Extremely hard and stable one-piece spindle (the heart of our accuracy)
- The 210 has 60° conical anvil and spindle faces with 1/64" (0.4mm) flats on the ends of the points
- Quick and easy adjustment

| 210 and 210M Screw Thread Comparator Micrometers (0-7/8" Range) | | | |
|---|---|---|---|
| **Cat. No.** | **EDP** | **Range** | **Graduation** |
| 210AP | 50731 | 0-7/8" | .001" |
| 210MAP | 64334 | 0-22mm | 0.01mm |
| **Case for 210 and 210M Screw Thread Comparator Micrometers** | | | |
| **Cat. No.** | **EDP** | **Description** | |
| 910 | 55397 | Attractive protective case | |




## 760 Electronic Screw Thread Comparator Micrometer (with output)

### 0-1"/0-25MM

Same features as our 210 with electronic readout and the following additional features and benefits:

#### Readability Features

- Large LCD digital readout is easy to read and reduces errors
- Resolution: .00005" and 0.001mm
- Conventional inch or millimeter graduations standard
- Attractive no-glare black wrinkle finish on the frame
- Starrett no-glare satin chrome finish on thimble and sleeve

#### Accuracy and Long-Life Features

- One 3-volt battery furnished for over a year of normal usage
- Automatic OFF after 30 minutes of nonuse

#### Full-Function Action Features

- Instant inch/millimeter conversion
- "ME" millimeter model turns on in millimeter mode after battery installation
- Measurement HOLD button
- Zero tool at any position and return to true zero reading
- PRESET button to install any reading at any position
- Ability to install minimum and maximum limits
- RS232 data output port
- Works well with Starrett DataSure® Wireless Data Collection Systems

| 760 and 760M Electronic Screw Thread Comparator Micrometer | | |
|---|---|---|
| **Cat. No.** | **EDP** | **Description** |
| 760FL | 64051 | 0-1"/0-25mm range, standard inch graduations on shell and thimble |
| 760MEFL | 66135 | 0-25mm/0-1" range, standard millimeter graduations on shell and thimble |
| **Case for 760 and 760M Electronic Screw Thread Comparator Micrometers** | | |
| 731ZZ-2 | 65163 | Attractive protective case |
| **Cable Information for 760 and 760M Electronic Screw Thread Comparator Micrometers** | | |
| **Part No.** | **EDP** | **Description** |
| 733SCKB | 69888 | Computer cable to PC |
| 733SCU | 69898 | Cable to computer running SPC Data Collection Software |
| 733SCM | 69893 | Connection to 7612 or 7613 Multiplexier |
| PT61120 | 65446 | One 3-Volt battery CR2450 |

# MICROMETERS

## 483, 483M, 485 V-ANVIL MICROMETERS

### .093-2"/2-25MM | .078-1"

Used to check out-of-roundness from centerless grinding or other machining operations. Also used for measuring odd fluted taps, milling cutters, and reamers.

#### READABILITY FEATURES

- Direct measuring of three and five-fluted tools
- Starrett satin chrome finish – no glare – resists rust
- Advanced sleeve design for precise and easy readability
- Quick-reading figures – every thousandth numbered on inch tools

#### EASE-OF-HANDLING FEATURES

- Balanced frame and thimble design ensure easy handling and readability
- Ring-type knurled lock nut for quick and sure locking
- Combination ratchet and speeder for uniform pressure and quick adjustment

#### ACCURACY AND LONG-LIFE FEATURES

- Rigid one-piece frame of drop forged steel
- Extremely hard and stable one-piece spindle (the heart of our accuracy)
- Carbide facing on spindle and anvils for extra long wear
- Quick and easy adjustment

| 483, 483M and 485 V-Anvil Micrometers | | | | |
|---|---|---|---|---|
| **Cat. No.** | **EDP** | **Range** | **Graduation** | **No. of Flutes it will Measure** |
| T483XRL-1 | 52491 | .093-1" | .0001" | 3 |
| T483XRL-2 | 52494 | 1-2" | .0001" | 3 |
| T485XRL | 52497 | .078-1" | .0001" | 5 |
| 483MXRL-25 | 56046 | 2-25mm | 0.01mm | 3 |
| 485MXRL | 56047 | | | 5 |
| **Cases for 483, 483M and 485 V-Anvil Micrometers** | | | | |
| **Cat. No.** | **EDP** | **Description** | | |
| 939 | 55331 | Attractive protective case for 1" and 25mm sizes | | |
| 483ZZ-2 | 55332 | Attractive protective case for 2" size | | |



## 225, 225M WIRE MICROMETERS

### 0-.400"/0-10MM

This is another regularly offered special function Starrett micrometer designed to measure diameter of wire up to .400" (10mm).

#### READABILITY FEATURES

- Starrett satin chrome finish – no glare – resists rust
- Advanced sleeve design with staggered lines and distinct figures for precise and easy readability
- Quick-reading figures – every thousandth numbered on inch tools

#### EASE-OF-HANDLING FEATURES

- Smooth friction thimble for uniform pressure
- Hex body which stops the micrometer from rolling over when placed on a flat surface
- The throat is flat to support the wire when measuring
- The anvil and spindle extend below the flat surface

#### ACCURACY AND LONG-LIFE FEATURES

- Extremely hard and stable one-piece spindle (the heart of our accuracy)
- Quick and easy adjustment

| 225 Wire Micrometers (0-.400" Range) | | |
|---|---|---|
| **Cat. No.** | **EDP** | **Graduation** |
| T225F | 50814 | .0001" |
| **225M Wire Micrometers (0-10mm Range)** | | |
| V225MF | 64255 | 0.001mm |



# MICROMETERS

## 207, 207M, 208, 208M STAINLESS STEEL CAN SEAM MICROMETERS

207 and 208 Can Seam Micrometers are made of stainless steel and designed to measure the thickness and depth of can seams.

The 207 Micrometer is used to measure the seam at outside bottom edge of dome on top of aerosol cans. The 208 Micrometer is used to measure thickness of seam at top and bottom of flat-topped cans. The 208D Micrometer is used to measure thickness and depth of all standard can seams.

### READABILITY FEATURES

- Satin finish stainless steel – no glare – rust and stain resistant
- Advanced sleeve design with staggered lines and distinct figures for precise and easy readability
- Quick-reading figures – every thousandth numbered on inch tools

### EASE-OF-HANDLING FEATURES

- The 207 has a snub nose which permits measuring aerosol type cans

### ACCURACY AND LONG-LIFE FEATURES

- Extremely hard and stable one-piece spindle (the heart of our accuracy)
- Quick and easy adjustment

| 207 and 208 Stainless Steel Can Seam Micrometers (0-.375" Range) | | | |
|---|---|---|---|
| **Cat. No.** | **EDP** | **Graduation** | **Description** |
| 207Z | 56173 | | Snub nose for aerosol cans |
| 208Z | 56175 | .001" | Without depth gage |
| 208DZ | 56176 | | With depth gage (.200" range) |
| **207M and 208M Stainless Steel Can Seam Micrometers (0-9.5mm Range)** | | | |
| 207MZ | 64337 | | Snub nose for aerosol cans |
| 208MZ | 64338 | 0.01mm | Without depth gage |
| 208MDZ | 63191 | | With depth fage (5mm range) |

Depth range on 208D is .200". Depth range on 208MD is 5mm.




## 209, 209M CAN CURL MICROMETERS

### 0-.500"/0-12.5MM

The 209 features a special rest foot and finger ring for consistent measurement of the curl thickness on aerosol cans with 1" (25mm) diameter domed tops.

### READABILITY FEATURES

- Starrett satin chrome finish – no glare – resists rust
- Advanced sleeve design with staggered lines and distinct figures for precise and easy readability
- Quick-reading figures – every thousandth numbered on inch tools
- Convenient decimal equivalents on inch tools

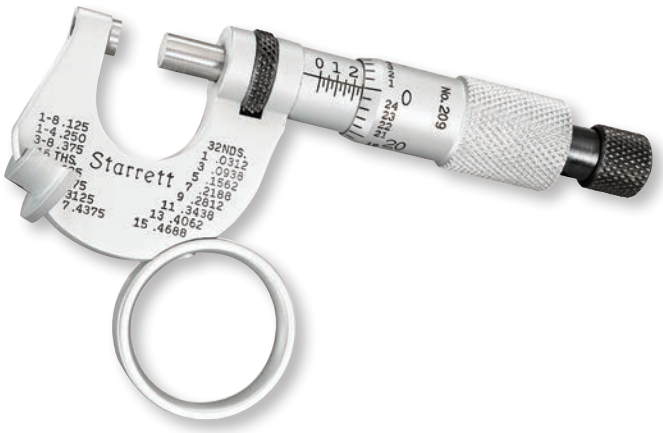
### EASE-OF-HANDLING FEATURES

- Balanced frame and thimble design ensure easy handling and better readability
- Ring-type knurled lock nut for quick and sure locking
- Combination ratchet and speeder for uniform pressure and quicker adjustment
- Finger ring for ease of measuring

### ACCURACY AND LONG-LIFE FEATURES

- Special rest foot to locate the tool for good accuracy
- Extremely hard and stable one-piece spindle (the heart of our accuracy)
- Quick and easy adjustment

| 209 Can Curl Micrometers (0-.500" Range) | | |
|---|---|---|
| **Cat. No.** | **EDP** | **Graduation** |
| 209RL | 56473 | .001" |
| **209M Can Curl Micrometers (0-12.5mm Range)** | | |
| 209MRL | 64364 | 0.01mm |



# MICROMETERS

## 228 HUB MICROMETER

**0-1"**

The 228 Hub Micrometer is an ideal tool for precision measuring of hub thickness, for insertion through small holes to measure thickness, and for many other related uses. Micrometer has a specially designed shallow frame which makes it possible to easily pass through a 3/4" (19mm) hole.

| 228 Hub Micrometer (0-1" Range) | | |
|---|---|---|
| **Cat. No.** | **EDP** | **Graduation** |
| 228XRL | 50921 | .001" |
| **Case** | | |
| **Cat. No.** | **EDP** | **Description** |
| 228ZZ | 55228 | Deluxe case for 228 Hub Micrometer |

### READABILITY FEATURES

- Starrett satin chrome finish – no glare – resists rust
- Advanced sleeve design with staggered lines and distinct figures for precise and easy readability
- Quick-reading figures – every thousandth numbered on inch tools

### EASE-OF-HANDLING FEATURES

- Balanced frame and thimble design ensure easy handling and better readability
- Ring-type knurled lock nut for quick and sure locking
- Combination ratchet and speeder for uniform pressure and quicker adjustment

### ACCURACY AND LONG-LIFE FEATURES

- Rigid one-piece frame of drop forged steel
- Extremely hard and stable one-piece spindle (the heart of our accuracy)
- Quick and easy adjustment



# Micrometer Heads

## 261L, 261ML Micrometer Heads with Non-Rotating Spindles

### 0-1/2"/0-13MM

Because the spindle does not rotate, these tools are useful in driving positioning tables directly without an intermediate connecting device. They are also useful in gaging jobs where scratches on the work surface cannot be tolerated or where there is risk of distortion when spindle meets work – as in measuring soft or elastic materials. Spindle wear is also reduced since there is no rotational friction as its face contacts the work.

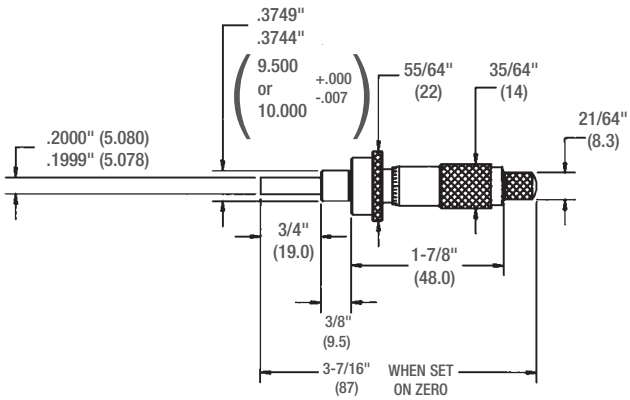
- Ring-type lock nut for quick and sure locking at any setting
- A speeder for quicker adjustment – this is not a ratchet stop. The tool is dependent on your own "feel"

| 261L Micrometer Heads (0-1/2" Range) | | | |
|---|---|---|---|
| **Cat. No.** | **EDP** | **Graduation** | **Description** |
| 261L | 55944 | .001" | Speeder, lock nut |
| **261ML Micrometer Heads (0-13mm Range)** | | | |
| 261ML* | 64346 | 0.01mm | Specify clamping diameter (9.5mm or 10mm) |

* 9.5mm clamping diameter sent unless otherwise specified.




261L




261L, 0-1/2" and 261ML (0-13mm) dimensions

## Micrometer Heads

The following pages show the full line of Starrett standard micrometer heads that have been designed and developed over the years working with the needs of our customers. The micrometer heads are invaluable for use on electronic equipment, machine tools, fixtures, special gaging and other equipment where precise movement and adjustment are required.

Dimensional specifications are available upon request.

Special features are described with each tool, but all of these tools have these features that benefit the user:

- Starrett satin chrome finish – no glare – resists rust on all reading surfaces
- Advanced sleeve design with staggered lines and distinct figures for precise and easy readability
- Quick-reading figures on all inch reading tools
- Extremely hard and stable one-piece spindle (the heart of our accuracy and long life)
- Micro-lapped measuring face for flatness and squareness
- Quick and easy adjustment

## Special Heads

In addition to standard micrometer heads, Starrett has also designed and manufactured many special types of micrometer heads for widely diversified applications requiring micrometer accuracy in settings and adjustments. These special heads are designed to exact specifications for specialized usage with wavemeters and other equipment in the electronics industry, machine tools, fixtures, special gages, tools, and all special mountings. They can be furnished to suit your particular requirements in a wide choice of sizes, range and graduations.

We design and build to your special need, so if you don't see what you want, please ask for it.

For quotations or recommendations, write:
The L.S. Starrett Co.
Special Order Department
121 Crescent Street
Athol, MA 01331



# Micrometer Heads

## 464P Micrometer Heads

0-1/4"

## 460A, 460MA Micrometer Heads

0-1/4"/0-6.5MM

## 460B, 460MB Micrometer Heads

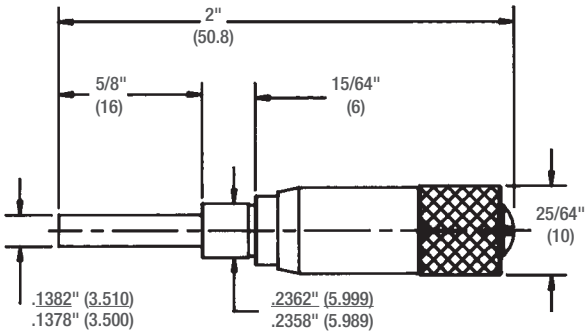
0-1/2"/0-13MM

These are plain micrometer heads with no lock nut or ratchet.

| 464P, 460A, 460MA, 460B and 460MB Micrometer Heads | | | |
|---|---|---|---|
| **Range** | **Graduation** | **Cat. No.** | **EDP** |
| 0-1/4" | .001" | 464P | 56657 |
| 0-1/4" | .001" | 460A | 64444 |
| 0-6.5mm | 0.01mm | 460MA | 64445 |
| 0-1/2" | .001" | 460B | 64446 |
| 0-13mm | 0.01mm | 460MB | 64447 |




460B

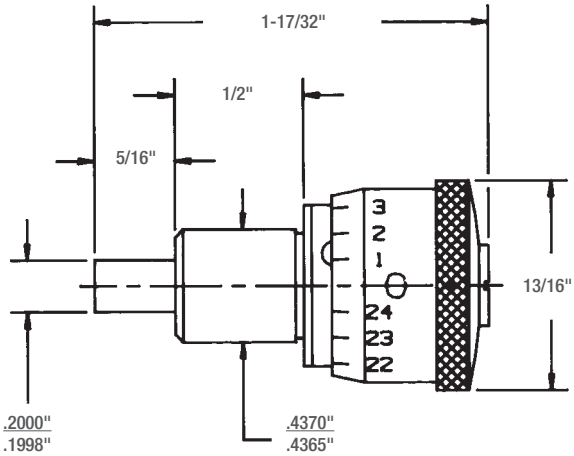



460B, 0-1/2" and 460MB (0-13mm) dimensions

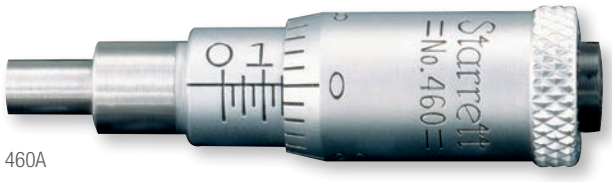
| Key to Starrett Micrometer Numbering System | |
|---|---|
| **Prefixes** | |
| R | Reverse Reading |
| S | Micrometer Set |
| T | .0001" Reading |
| V | 0.001mm or 0.002mm Reading, as specified |
| **Suffixes** | |
| F | Friction Thimble |
| L | Lock Nut |
| M | Metric |
| N | Non-Rotating |
| P | Plain |
| R | Ratchet Stop |
| S | Speeder |
| TN | Threaded Hub and Check Nut |
| W/SLC | Standard Letter of Certification |
| X | Micro-lapped Carbide Measuring Faces |
| Z | With Case |
| ZZ | Case Only |



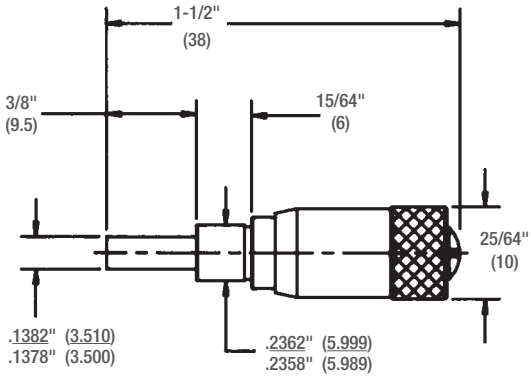

464P




464P, 0-1/4" dimensions




460A




460A, 0-1/4"and 460MA (0-6.5mm) dimensions

# MICROMETER HEADS

## 463 MICROMETER HEADS

0-1/2"/0-13MM

## 1463 STAINLESS STEEL MICROMETER HEADS

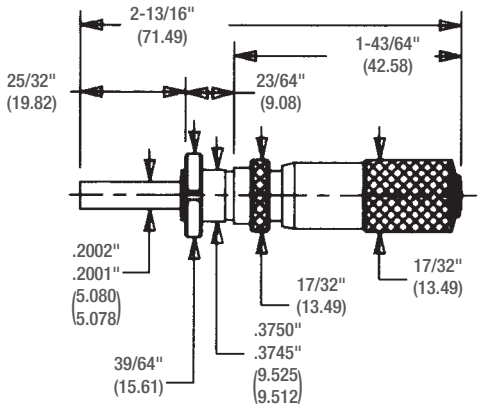
0-1/2"/0-13MM

The 463 and 1463 Micrometer head are exactly the same, except that the 1463 is made from rust-resistant stainless steel. The reading surfaces are satin finished stainless steel for easy readability. Heads are available with the features below:

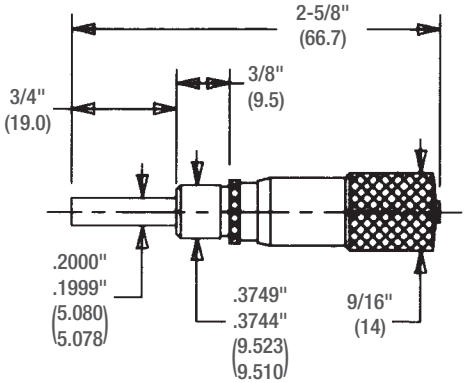
- Either combination ratchet and speeder for uniform pressure and quicker adjustment, or plain micrometer heads that depend on your own feel
- Ring-type lock nut for quick and sure locking at any setting
- Reverse reading, if needed
- Plain or carbide spindle faces

**463 and 1463 Micrometer Heads**

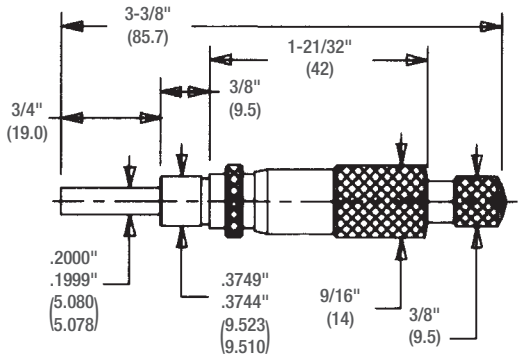
| Range | Graduation | Cat. No. | EDP |
|---|---|---|---|
| 0-1/2" | .001" | 463P | 52440 |
| | | 463P-38TN | 67112 |
| | | 463L | 52442 |
| | | 463XL | 52451 |
| | | 463L-38TN | 67113 |
| | | 463RL | 52443 |
| | | 463XRL | 64687 |
| | | RV463RL | 57073 |
| | | RV463XRL | 64688 |
| 0-1/2" | .0001" | T463P | 52446 |
| | | T463L | 52448 |
| | | T463XL | 64689 |
| | | T463RL | 52449 |
| | | T463XRL | 65052 |
| 0-13mm | 0.01mm | 463MP | 52444 |
| | | 463MRL | 52452 |
| | | 463MXRL | 64691 |
| 0-13mm | 0.002mm | V463MRL | 65053 |
| | | RV463MRL | 60845 |
| 0-1/2" | .001" | 1463RL | 53207 |
| | .0001" | T1463RL | 53209 |
| 0-13mm | 0.002mm | V1463MRL | 64344 |




463L-38TN, 0-1/2" dimensions




463P, 0-1/2" and 463MP (0-13mm) dimensions




463RL, 0-1/2" and 463MRL (0-13mm) dimensions



# MICROMETER HEADS

## 762 ELECTRONIC MICROMETER HEADS WITH ROTATING OR NON-ROTATING SPINDLES (WITH OUTPUT)

### 0-2"/0-50MM

#### READABILITY FEATURES

- Large digital readout is easy to read, reducing errors
- Conventional inch or millimeter graduations standard
- Attractive black wrinkle finish on frame
- Starrett no-glare satin chrome finish on thimble and sleeve

#### EASE-OF-HANDLING FEATURES

- Ring-type knurled lock nut
- Smooth friction thimble for uniform pressure on regular heads and combination ratchet and speeder on non-rotating heads

#### ACCURACY AND LONG-LIFE FEATURES

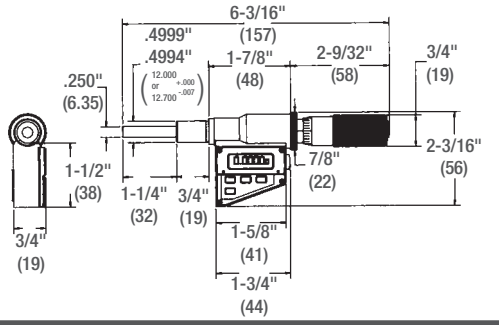
- Extremely hard and stable one-piece spindle (the heart of our accuracy)
- One 3-volt battery furnished for over a year of normal usage
- Auto OFF after 30 minutes of nonuse

#### FULL-FUNCTION ACTION FEATURES

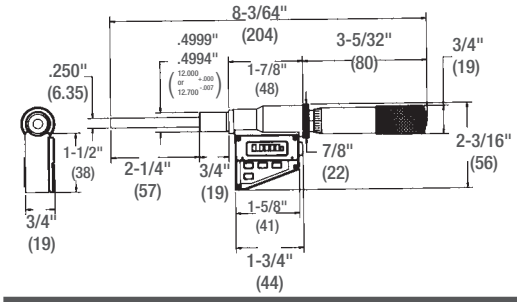
- Inch/millimeter conversion
- "ME" millimeter models turn on in millimeter mode after battery installation
- Measurement HOLD button
- Ability to zero tool at any position
- Ability to retain and return to the true zero reading of the micrometer
- PRESET button to install any reading at any position
- RS232 data output port
- Works well with Starrett DataSure® Wireless Data Collection Systems

| | 762 Micrometer Specifications | |
|---|---|---|
| | Inch | mm |
| Resolution | .00005" | 0.001mm |
| Accuracy | ±.0001" per Inch | ±0.003mm per 25mm |




0-1" (0-25mm) dimensions




0-2" (0-50mm) dimensions

| 762 Electronic Micrometer Heads with Standard Inch Graduations on Shell and Thimble | | | |
|---|---|---|---|
| Range | Description* | Cat. No. | EDP |
| 0-1"/0-25mm | Friction thimble, lock nut, carbide face | 762XFL | 65058 |
| | Ratchet stop, lock nut, carbide face, non-rotating spindle | 762NXRL | 65060 |
| 0-2"/0-50mm | Friction thimble, lock nut, carbide face | 762XFL-2 | 65062 |
| **762M Electronic Micrometer Heads with Standard Millimeter Graduations on Shell and Thimble** | | | |
| 0-25mm/0-1" | Friction thimble, lock nut, carbide face | 762MEXFL-25 | 66077 |
| 0-50mm/0-2" | Friction thimble, lock nut, carbide face | 762MEXFL-50 | 66137 |

| Cable Information for 762 and 762M Electronic Micrometer Heads | | |
|---|---|---|
| Description | Part No. | EDP |
| Computer cable to PC | 733SCKB | 69888 |
| Cable to computer running SPC Data Collection Software | 733SCU | 69898 |
| Connection to 7612 or 7613 Multiplexier | 733SCM | 69893 |
| One 3-Volt Battery CR2450 | PT61120 | 65446 |

*1/2" (12.7mm) clamping diameter sent unless otherwise specified.

# MICROMETER HEADS

## 363, 363M DIGITAL MICROMETER HEADS

### 0-1"/0-25MM

#### READABILITY FEATURES

- Clear, easily read numbers reduce errors
- No-glare black finish on the frame
- Starrett no-glare satin chrome finish on thimble and sleeve
- .001" or 0.01mm is read directly from the counter
- Reverse reading, if needed

#### EASE-OF-HANDLING FEATURES

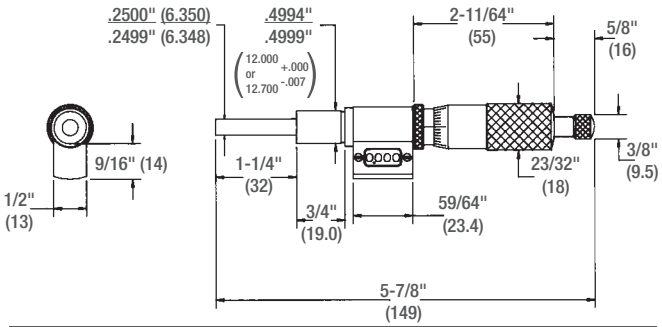
- Ring-type knurled lock nut for quick and sure locking
- Choice of smooth friction thimble for uniform pressure or combination ratchet and speeder for uniform pressure and quicker adjustment

#### ACCURACY AND LONG-LIFE FEATURES

- Extremely hard and stable one-piece spindle (the heart of our accuracy)

| 363 Digital Micrometer Heads (0-1" Range) | | |
|---|---|---|
| **Cat. No.** | **EDP** | **Graduation** |
| 363L | 56297 | .001" |
| 363RL | 56298 | |
| 363FL | 56299 | |
| RV363RL | 57072 | |
| **363M Digital Micrometer Heads (0-25mm Range)** | | |
| 363ML* | 56302 | 0.01mm |
| 363MRL* | 56303 | |
| 363MFL* | 56304 | |

* Specify clamping diameter (12 or 12.7mm). 12.7mm sent unless otherwise ordered.




363RL, 0-1" and 363MRL (0-25mm) dimensions



## 63, 63M LONG RANGE MICROMETER HEADS

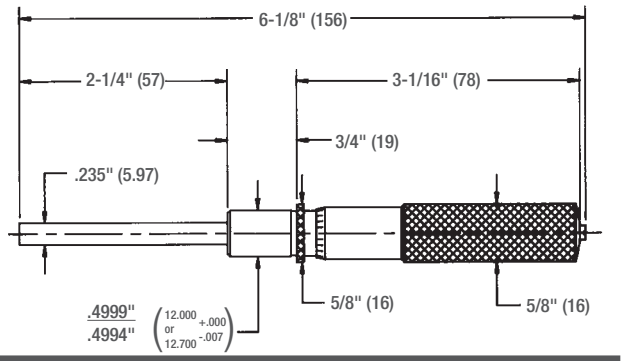
### 0-2"/0-50MM

When long spindle travel is required, the 63 Micrometer heads provide a range that will handle most applications, such as in electronic equipment, machine tools, special gages, tooling, etc.

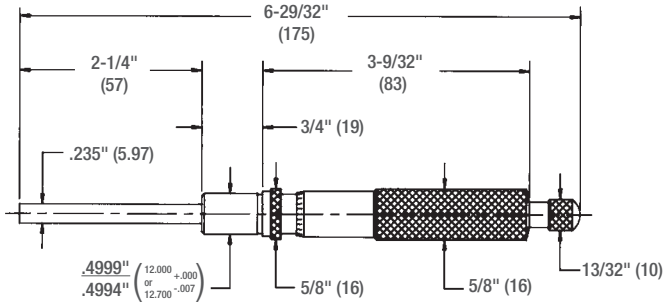
- With or without ring-type lock nut for quick and sure locking
- With or without the combination ratchet and speeder for uniform pressure and quicker adjustment

| 63 Micrometer Heads (0-2" Range) | | |
|---|---|---|
| **Cat. No.** | **EDP** | **Graduation** |
| 63P | 50305 | .001" |
| 63L | 50306 | .001" |
| 63RL | 50307 | .001" |
| T63P | 50308 | .0001" |
| T63RL | 50309 | .0001" |
| **63M Micrometer Heads (0-50mm Range)** | | |
| 63MRL* | 55939 | 0.01mm |
| V63MRL* | 64343 | 0.002mm |

* 0-25mm models specify clamping diameter 12mm or 12.7mm. 12.7mm sent unless otherwise ordered.




63P, 0-2" and 63MP (0-50mm) dimensions




63RL, 0-2" and 63MRL (0-50 mm) dimensions



# Micrometer Heads

## 263 and 1263 Micrometer Heads

### 0-1"/0-25MM

- Reading surfaces satin-finished for easy readability
- No-glare, satin chrome finish on the 263, rust-resistant, stainless steel on the 1263
- Available with reverse reading, if needed
- Ring-type knurled lock nut for quick and sure locking
- Choice of smooth friction thimble for uniform pressure, combination ratchet and speeder for uniform pressure and quicker adjustment, or a plain micrometer head that depends on your own "feel"
- Spindle face available plain or with carbide
- Furnished with 1/2" (12.7mm) or 3/8" (9.5mm) diameter clamping surface

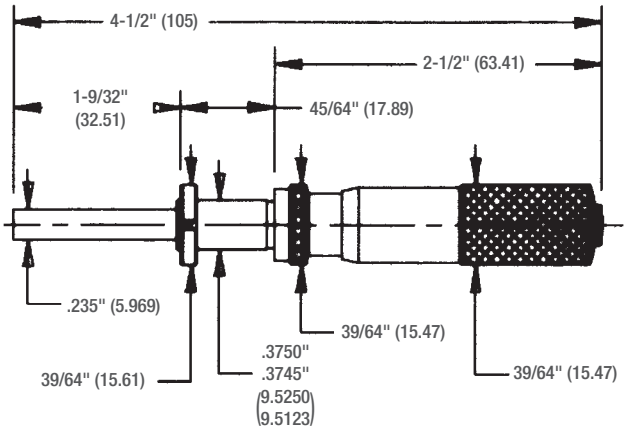
**263 and 263M Micrometer Heads**

| Range | Graduation | Cat. No. | EDP |
|---|---|---|---|
| 0-1" | .001" | 263P | 51251 |
| | | 263P-38 | 67108 |
| | | 263P-38TN | 67110 |
| | | 263L | 51253 |
| | | 263XL | 51265 |
| | | 263L-38 | 67109 |
| | | 263L-38TN | 67111 |
| | | 263RL | 51254 |
| | | 263FL | 51256 |
| | | RV263RL | 57071 |
| 0-1" | .0001" | T263P | 51258 |
| | | T263L | 51260 |
| | | T263XL | 65054 |
| | | T263RL | 51261 |
| 0-25mm | 0.01mm | 263MP* | 51275 |
| | | 263ML* | 51276 |
| | | 263MRL* | 51257 |
| | | 263MXL* | 65055 |
| 0-25mm | 0.001mm | V263MRL* | 55962 |
| | | RV263MRL* | 64948 |
| | | V263MXRL* | 65056 |

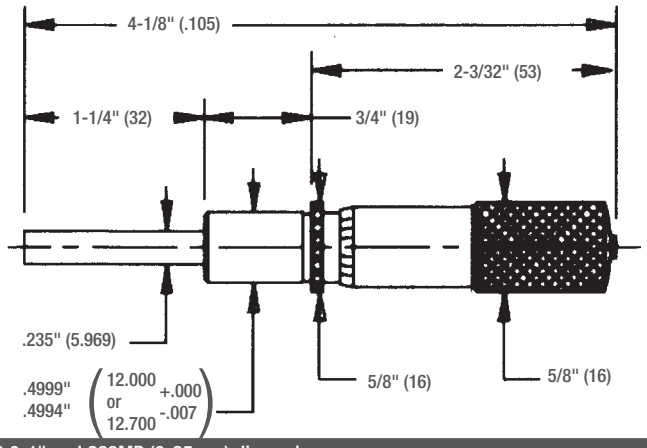
**1263 and 1263M Stainless Steel Micrometer Heads**

| Range | Graduation | Cat. No. | EDP |
|---|---|---|---|
| 0-1" | .001" | 1263L | 53200 |
| | | 1263RL | 53201 |
| 0-1" | .0001" | T1263RL | 53203 |
| 0-25mm | 0.001mm | V1263MRL* | 64345 |

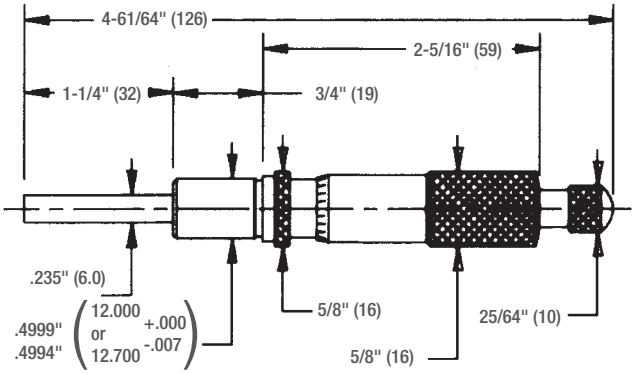
* 0-25mm models specify clamping diameter 12 or 12.7mm. 12.7mm sent unless otherwise ordered.




263L-38TN, 0-1" dimensions




263P, 0-1" and 263MP (0-25mm) dimensions




263RL, 0-1" and 263MRL (0-25mm) dimensions



# MICROMETER HEADS

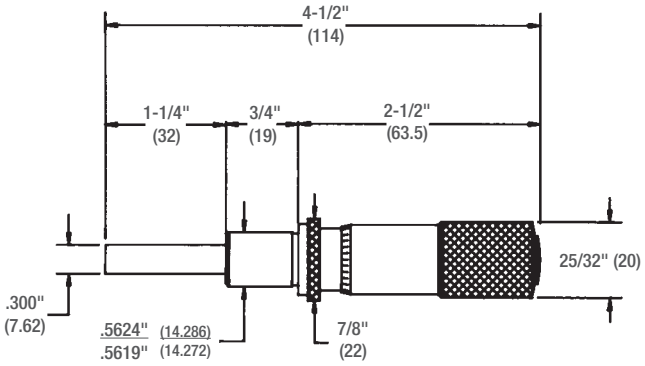
## 663, 663M HEAVY DUTY MICROMETER HEADS

### 0-1"/0-25MM

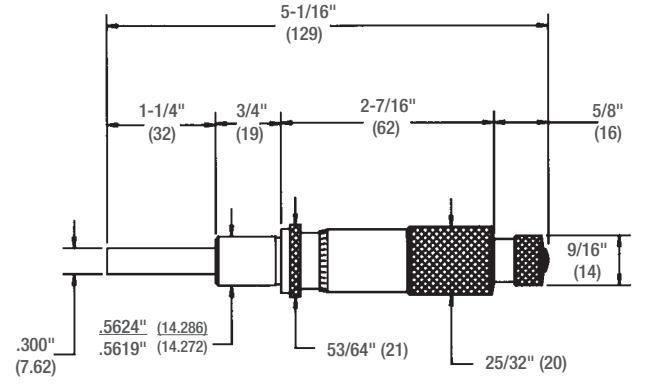
The 663 is similar to the 263 but features heavy duty construction with a larger diameter spindle, clamping surface and thimble.

- Available with lock nut and the combination ratchet and speeder for uniform pressure and quicker adjustment, or a plain micrometer head with lock nut only
- Ring-type lock nut for quick and sure locking

| 663 Heavy Duty Micrometer Heads (0-1" Range) | | |
|---|---|---|
| **Cat. No.** | **EDP** | **Graduation** |
| 663L | 52772 | .001" |
| 663RL | 52773 | |
| T663L | 52777 | .0001" |
| T663RL | 52778 | |
| **663M Heavy Duty Micrometer Heads (0-25mm Range)** | | |
| 663MRL | 52774 | 0.01mm |
| V663MRL | 64342 | 0.001mm |




663L, 0-1" and 663ML (0-25mm) dimensions




663RL, 0-1" and 663MRL (0-25mm) dimensions



## 262, 262M MICROMETER HEADS WITH NON-ROTATING SPINDLES

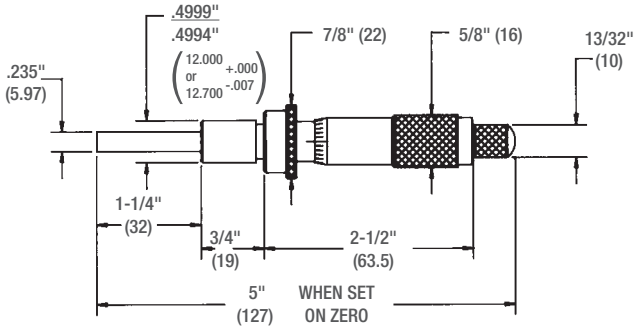
### 0-1"/0-25MM

Because the spindle does not rotate, this tool is useful in driving positioning tables directly without an intermediate connecting device. It is also useful in gaging jobs where scratches on the work surface cannot be tolerated, or where there is risk of distortion when spindle meets work – as in measuring soft or elastic materials. Spindle wear is also reduced, since there is no rotational friction when its face contacts the work.

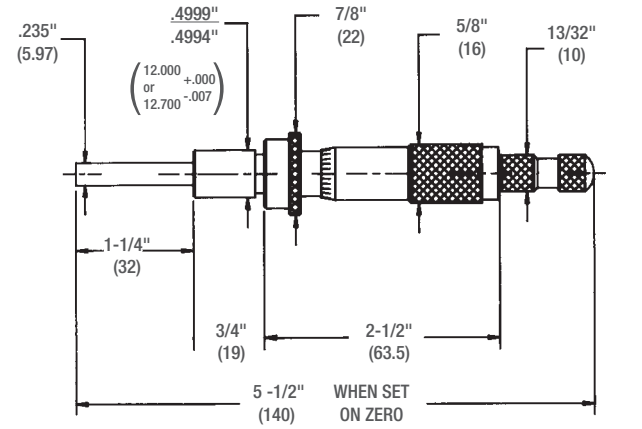
- Ring-type lock nut for quick and sure locking at any setting
- Available with or without the combination ratchet and speeder for uniform pressure and quicker adjustment

| 262 Micrometer Heads (0-1" Range) | | |
|---|---|---|
| **Cat. No.** | **EDP** | **Graduation** |
| 262L | 55945 | .001" |
| 262RL | 55946 | |
| **262M Micrometer Heads (0-25mm Range)** | | |
| 262ML* | 64347 | 0.01mm |
| 262MRL* | 65051 | |

0-25mm models specify clamping diameter 12mm or 12.7mm. 12.7mm sent unless otherwise ordered.




262L, 0-1" and 262ML (0-25mm) dimensions




262RL, 0-1" and 262MRL (0-25mm) dimensions



# Micrometer Heads

## 465, 465M, 468, 468M Direct-Reading, Large Micrometer Heads

### 0-2"/0-50MM

These large micrometer heads are designed for use with electronic equipment requiring ultra-fine adjustment for machine tools, fixtures, special gages and tools, special mountings, or wherever micrometer accuracy in setting and adjustment is required.

Another highly useful feature is the spindle adjustment, which permits adjusting the spindle length approximately ±1/16" (1.5mm). If the spindle is to be located against a definite stop and a different zero position is required, first loosen the cap screw in the end of the thimble, position the spindle to the desired location, then holding the spindle in position, rotate the thimble to zero and retighten the cap screw. In achieving this adjustable feature, we have still retained our positive taper-lock large thimble bearing.

The 468 Micrometer heads are exactly the same as the 465, except that they have double figures in red and black on the sleeve and thimble, permitting reading both ways with the spindle moving in either direction. This feature is invaluable on many instruments and microwave applications.




T465XSP-1




T468XSP-1 with double figures in red and black on sleeve and thimble for reading both ways.

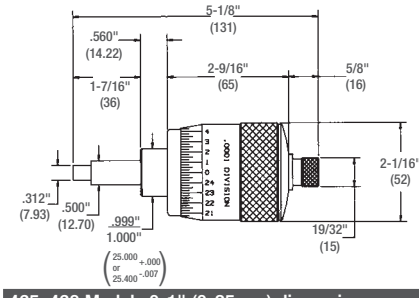
### Readability, Accuracy and Long-Life Features:

- 2-1/16" (52mm) thimble diameter with widely spaced .0001" or 0.002mm graduations for direct reading
- All graduations are direct reading – no vernier lines to match
- All reading surfaces have Starrett satin chrome finish as the no-glare background for the sharp lines and figures
- All graduations on sleeves and thimbles have advanced styling with staggered graduations for easy reading
- The spindle is carbide faced for long life
- Thimble and sleeve are made of aluminum to reduce weight
- Furnished with a speeder (not a ratchet) for quicker adjustment
- Extremely hard and stable one-piece spindle for accuracy and long-life
- Micro-lapped measuring face for flatness and squareness
- Quick and easy adjustment

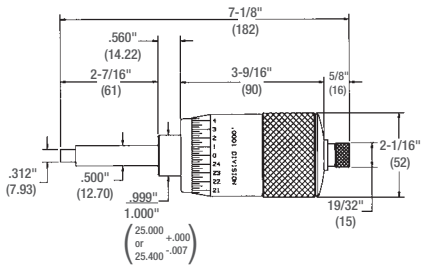
| 465 Mircometer Heads | | | |
|---|---|---|---|
| **Cat. No.** | **EDP** | **Range** | **Graduation** |
| T465XSP-1 | 67121 | 0-1" | .0001" |
| T465XSP-2 | 67122 | 0-2" | |
| 465MXSP-25* | 67123 | 0-25mm | 0.002mm |
| 465MXSP-50* | 67124 | 0-50mm | |
| **468 Micrometer Heads** | | | |
| T468XSP-1 | 67125 | 0-1" | .0001" |
| T468XSP-2 | 67126 | 0-2" | |
| 468MXSP-25* | 67127 | 0-25mm | 0.002mm |
| 468MXSP-50* | 67128 | 0-50mm | |

* Metric models specify clamping diameter 25 or 25.4mm. 25.4mm sent unless otherwise ordered.

| Key to Starrett Micrometer Numbering System | |
|---|---|
| **Prefixes** | |
| R | Reverse Reading |
| S | Micrometer Set |
| T | .0001" Reading |
| V | 0.001mm or 0.002mm Reading, as specified |
| **Suffixes** | |
| F | Friction Thimble |
| L | Lock Nut |
| M | Metric |
| N | Non-Rotating |
| P | Plain |
| R | Ratchet Stop |
| S | Speeder |
| TN | Threaded Hub and Check Nut |
| W/SLC | Standard Letter of Certification |
| X | Micro-lapped Carbide Measuring Faces |
| Z | With Case |
| ZZ | Case Only |




465, 468 Models 0-1" (0-25mm) dimensions




465, 468 Models 0-2" (0-50mm) dimensions

# MICROMETER HEADS

## 469, 469M LARGE, SUPER-PRECISION MICROMETER HEADS

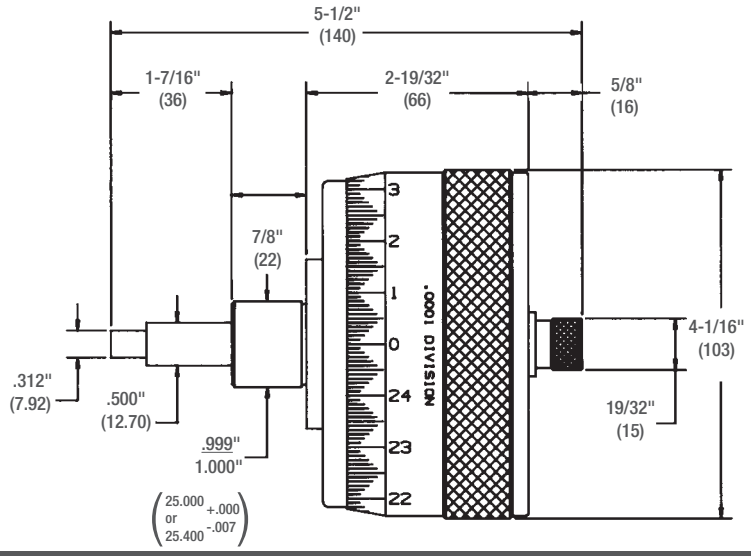
### 0-1"/0-25MM

These are our most accurate micrometer heads. They are also available on special order with double graduations in red and black on the sleeve and thimble, permitting readings both ways with the spindle moving in either direction.

These micrometer heads have a 4-1/16" (103mm) thimble diameter and are graduated to .0001", .000050", 0.001mm, or 0.002mm for direct reading. They also have staggered graduations for easy counting and reading of lines. Spindle is carbide faced for long life.

| 469 Large, Super-Precision Micrometer Heads (0-1" Range) | | |
|---|---|---|
| **Cat. No.** | **EDP** | **Graduation** |
| T469HXSP | 67129 | .000050" |
| T469XSP | 67130 | .0001" |
| **469M Large, Super-Precision Micrometer Heads (0-25mm Range)** | | |
| 469MHXSP* | 67131 | 0.001mm |
| 469MXSP* | 67132 | 0.002mm |

* Metric models specify clamping diameter 25 or 25.4mm. 25.4mm sent unless otherwise ordered.
Also available on special order with double graduations for reading both ways with spindle moving in either direction.




469, 0-1" and 469m (0-25mm) dimensions



# Bench Micrometers

## 777 Electronic Bench Micrometers (with output)

### 0-1"/0-25MM

The 777 Electronic Bench Micrometer is especially suited for precision measurements where the work must be brought to the gage.

Work is staged between the anvil and spindle on an adjustable table, which can be raised to a selected height and locked in position by turning a knurled thumb screw on back of the base. Made of cast iron with black wrinkle finish, the base is heavily proportioned to sustain gage accuracy and assure stability in use. It stands on three machined pads.

| With Standard Inch Graduations on Shell and Thimble | | |
|---|---|---|
| **Cat. No.** | **EDP** | **Description** |
| 777XFLZ | 67135 | 0-1"/0-25mm Range |
| **With Standard Millimeter Graduations on Shell and Thimble** | | |
| 777MEXFLZ | 67136 | 0-25mm/0-1" Range |
| **Cable Information** | | |
| **Part No.** | **EDP** | **Description** |
| 733SCKB | 69888 | Computer cable to PC |
| 733SCU | 69898 | Cable to computer running SPC Data Collection Software |
| 733SCM | 69893 | Connection to 7612 or 7613 Multiplexier |
| PT61120 | 65446 | One 3-Volt Battery CR2450 |




### Readability Features

- Large, right-sized, high-contrast LCD digital readout is easy to read and reduces errors
- Conventional inch or millimeter graduations standard
- Attractive no-glare black wrinkle finish on the frame

### Ease-of-Handling Features

- Ring-type knurled lock nut for quick and sure locking
- Smooth friction thimble for uniform pressure

### Accuracy and Long-Life Features

- Extremely hard and stable one-piece spindle
- The spindle and anvil are carbide faced for long life
- One 3-volt battery furnished for dependable power and over one year's normal usage
- Automatic OFF after 30 minutes of nonuse
- Starrett workmanship

### Full-Function Action Features

- Instant inch/millimeter conversion
- "ME" millimeter model will turn on in the millimeter mode after installation of a new battery
- Measurement HOLD button
- Ability to zero tool at any position
- Ability to retain and return to the true zero reading of the micrometer
- PRESET button to install any reading at any position
- Ability to install minimum and maximum limits
- RS232 data output port
- Works well with DataSure® Wireless Data Collection Systems

# Bench Micrometers

## 673, 673M Direct-Reading Bench Micrometers

### 0-2"/0-50MM

The 673 Bench Micrometer is a high precision instrument, ideal for bench use either in a shop environment or inspection laboratory. It can be used as a comparator measuring to fifty-millionths of an inch (.000050") or two-thousandths of a mm (0.002mm) or for direct measuring to .0001" or 0.002mm. Work lengths up to 2" or 50mm can be measured.

- The base is a heavy, rigid casting, incorporating at the left end a movable anvil which actuates a linear, friction-free motion transfer mechanism between the anvil and the indicator. This assures high accuracy.
- The large thimble diameter, approximately 3" (77mm), makes possible widely spaced graduations that are easy to read without a vernier scale reference
- Advanced, staggered design and quick reading graduations in combination with Starrett no-glare satin chrome finish on both thimble and sleeve also contribute to easier, faster readings
- The head is furnished with a speeder and has a special ring-type lock nut which firmly holds the spindle at any setting without distortion
- Another useful feature is the adjustable work table centered beneath the anvil and spindle. Work can be accurately aligned between the anvil and spindle by adjusting the table to the proper height and locking it in position.
- The spindle and anvil are carbide faced for long life
- This bench micrometer can also be used with the 776 Electronic Gage Amplifier by using the 673A Adaptor for the 715-2 Cartridge-Type Electronic Gaging Head to read to ten-millionths of an inch (.000010") or 0.0001mm

**673 and 673M Direct-Reading Bench Micrometers**

| Cat. No. | EDP | Range | | Graduation | | Work Table |
|---|---|---|---|---|---|---|
| | | Micrometer Head | Dial Indicator | Micrometer Head | Dial Indicator | |
| 673XZ | 67191 | 0-2" | .006" (0-3-0) | .0001" | .000050" | 2-1/4" dia. and 7/8" vertical adjustment |
| 673MXZ | 67192 | 0-50mm | 0.2mm (0-10-0) | 0.002mm | 0.002mm | 57mm dia. and 22mm vertical adjustment |
| 673A | 52891 | Adaptor for 715-2 Cartridge Type Electronic Gaging Head | | | | |

Anvil Pressure Adjustment – 8 oz. to 3 lb (0.23 to 1.36kg)



673M with 717 amplifier

### How to Use for Direct Measure and as a Comparator

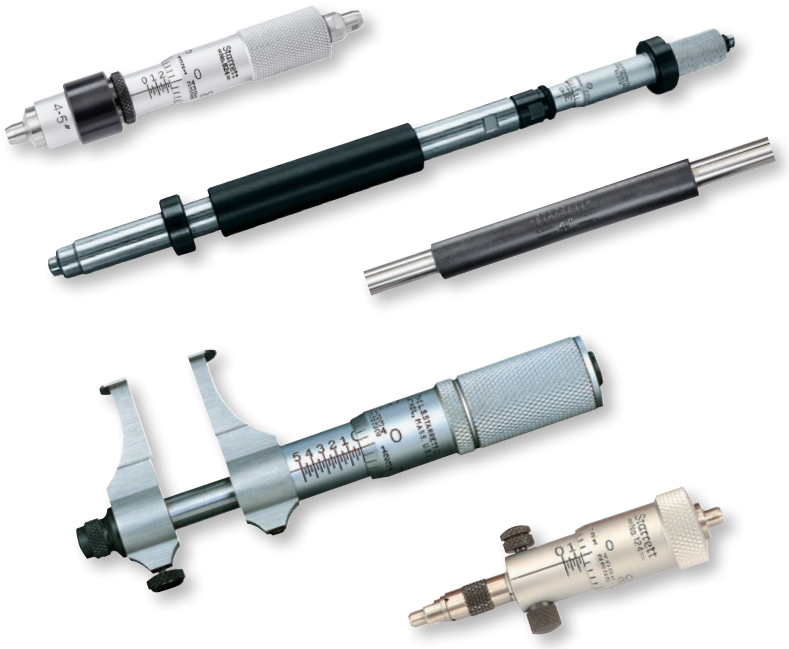
For direct measuring, the micrometer head is set to zero and the dial indicator is set to zero by the bezel adjustment. Any workpiece within the 2" (50mm) range can then be measured by the micrometer head in ten-thousandths of an inch (.0001" or 0.002mm). The indicator must read zero for each measurement.

If used as a comparator, first set the head and the indicator to zero as previously explained. Then adjust the micrometer head to the desired dimension to be checked. After retracting the anvil, work is placed on the table between anvil and spindle and the anvil is then released so anvil and spindle contact the work. Plus or minus deviation from the nominal work size is then read from the dial indicator in fifty-millionths of an inch (.000050") or 0.002mm.

# End Measuring Rods

## Precision End Measuring Rods and Inside Micrometers

The following pages show our varied line of precision end measuring rods and inside micrometers. The variations are fixed-range or adjustable-range micrometers and solid or tubular measuring rods.



Unless otherwise noted under the individual tools, all have these features:

- Balanced design for better feel and accurate measurement
- All contact points are hardened and ground for better accuracy and long life
- Satin chrome finish on all micrometer heads and reading surfaces that resist rust and also make for easy reading by providing a no-glare background for the sharp lines and figures
- Hardened and stabilized spindle for accuracy and long life
- Advanced sleeve design with staggered lines and distinct figures for precise and easy readability
- Quick and easy adjustment
- Starrett workmanship
- Inside Micrometers 121, 124, 823 and 824 by design have a firmer rotation than regular micrometers. This is to limit the tendency of the micrometer head to rotate when withdrawn from the workpiece.

## Measuring Tips for Inside Measurements

Whether to use a two-point or three-point contact measuring tool is usually a matter of preference, but there are some differences.

A two-point contact rod-type inside micrometer shown in this section is usually lighter, easier to handle, and more versatile over long ranges from approximately 6-107" (150-2700mm). Any two-point contact micrometer, regardless of range, can probe a hole better to find the geometry of that hole than a three-point contact.

Most three-point contact tools have setting rings to ensure accuracy. If you desire very close tolerance work with two-point contact inside micrometers, it is recommended that they be set to a ring gage or to an outside micrometer.

A three-point contact micrometer shown in the Bore Gages section has an advantage in that it can be seated in position more quickly than a two-point contact tool. Usually these tools can also be read to a finer accuracy. The three-point tool will tell the maximum true diameter that can enter the hole a little faster than a two-point contact tool.

Micrometer heads used in these tools are accurate to ±.0001" or 0.002mm, but overall accuracy on tools that add rods is dependent on good practice and technique.

To ensure accuracy, these practices should be followed:

- Always make sure that there are no specks of dirt between the clamping surfaces of the rods and micrometer heads
- Tighten all rods uniformly, not too tight, not too loose, but a fairly firm assembly
- Assemble long sections vertically or, with support, horizontally
- Because temperature can affect long rods used in these tools, they should be assembled in the same environment in which they will be used

For additional information, refer to the Bore Gage Section.

# End Measuring Rods

## 234, 234M End Measuring Rods with Spherical Ends

### 1-24"/25-600MM

These rods or "standards" are for checking and setting micrometers of 2" capacity and larger, and are also used on machine tools for comparing gages, checking precision measuring tools, for measuring parallel surfaces, and many other types of work.

They are made of special tool steel in rod form with ends hardened and accurately lapped to a spherical radius.

Available plain or with insulated handles to minimize expansion by heat when held in the hand. 1-6" (25-150mm) sizes are 1/4" (6.3mm) diameter; 7-11" (175-275mm) sizes, 3/8" (9.5mm) diameter; 12-24" (300-600mm) sizes are 7/16" (11mm) diameter.

**NOTE:** These standards are the ones used for all micrometers furnished with standards. Larger sizes available on special order.

| Standards for S436.1 & S436 Micrometer Sets | | | With SLC | |
|---|---|---|---|---|
| Cat. No. | EDP | Description | Cat. No. | EDP |
| S234C | 50852 | Set of two standards only | | |
| S234D | 51897 | Set of three standards only | | |
| S234E | 50860 | Set of five standards only | S234E W/SLC | 66878 |
| S234G | 51929 | Set of eleven standards only | S234G W/SLC | 66877 |
| S234F | 51917 | Set of six standards only | S234F W/SLC | 66879 |
| S234J | 64146 | Set of twelve standards only | | |

| Standards for S436.1M & S436M Micrometer Sets | | |
|---|---|---|
| Cat. No. | EDP | Description |
| S234MC | 51893 | Set of two standards only |
| S234MD | 51901 | Set of three standards only |
| S234ME | 51913 | Set of five standards only |
| S234MF | 51925 | Set of six standards only |
| S234MG | 51937 | Set of eleven standards only |
| S234MJ | 64467 | Set of twelve standards only |

| 234 End Measuring Rods | | | | |
|---|---|---|---|---|
| | With Insulating Handle | | Without Insulating Handle | |
| Length | Cat. No. | EDP | Cat. No. | EDP |
| 1" | 234A-1 | 50969 | 234B-1 | 51017 |
| 2" | 234A-2 | 50971 | 234B-2 | 51019 |
| 3" | 234A-3 | 50973 | 234B-3 | 51021 |
| 4" | 234A-4 | 50975 | 234B-4 | 51023 |
| 5" | 234A-5 | 50977 | 234B-5 | 51025 |
| 6" | 234A-6 | 50979 | 234B-6 | 51027 |
| 7" | 234A-7 | 50981 | 234B-7 | 51029 |
| 8" | 234A-8 | 50983 | 234B-8 | 51031 |
| 9" | 234A-9 | 50985 | 234B-9 | 51033 |
| 10" | 234A-10 | 50987 | 234B-10 | 51035 |
| 11" | 234A-11 | 50989 | 234B-11 | 51037 |
| 12" | 234A-12 | 50991 | 234B-12 | 51039 |
| 13" | 234A-13 | 50993 | | |
| 14" | 234A-14 | 50995 | | |
| 15" | 234A-15 | 50997 | | |
| 16" | 234A-16 | 50999 | | |
| 17" | 234A-17 | 51001 | | |
| 18" | 234A-18 | 51003 | | |
| 19" | 234A-19 | 51005 | | |
| 20" | 234A-20 | 51007 | | |
| 21" | 234A-21 | 51009 | | |
| 22" | 234A-22 | 51011 | | |
| 23" | 234A-23 | 51013 | | |
| 24" | 234A-24 | 51015 | | |

| 234M End Measuring Rods | | | | |
|---|---|---|---|---|
| | With Insulating Handle | | Without Insulating Handle | |
| Length | Cat. No. | EDP | Cat. No. | EDP |
| 25mm | 234MA-25 | 50970 | 234MB-25 | 51018 |
| 50mm | 234MA-50 | 50972 | 234MB-50 | 51020 |
| 75mm | 234MA-75 | 50974 | 234MB-75 | 51022 |
| 100mm | 234MA-100 | 50976 | 234MB-100 | 51024 |
| 125mm | 234MA-125 | 50978 | 234MB-125 | 51026 |
| 150mm | 234MA-150 | 50980 | 234MB-150 | 51028 |
| 175mm | 234MA-175 | 50982 | 234MB-175 | 51030 |
| 200mm | 234MA-200 | 50984 | 234MB-200 | 51032 |
| 225mm | 234MA-225 | 50986 | 234MB-225 | 51034 |
| 250mm | 234MA-250 | 50988 | 234MB-250 | 51036 |
| 275mm | 234MA-275 | 50990 | 234MB-275 | 51038 |
| 300mm | 234MA-300 | 50992 | 234MB-300 | 51040 |
| 325mm | 234MA-325 | 50994 | | |
| 350mm | 234MA-350 | 50996 | | |
| 375mm | 234MA-375 | 50998 | | |
| 400mm | 234MA-400 | 51000 | | |
| 425mm | 234MA-425 | 51002 | | |
| 450mm | 234MA-450 | 51004 | | |
| 475mm | 234MA-475 | 51006 | | |
| 500mm | 234MA-500 | 51008 | | |
| 525mm | 234MA-525 | 51010 | | |
| 550mm | 234MA-550 | 51012 | | |
| 575mm | 234MA-575 | 51014 | | |
| 600mm | 234MA-600 | 51016 | | |



# INSIDE MICROMETERS

## 128, 128M COMBINATION HEAD WITH INSIDE MICROMETER

The combination head for inside micrometers combines the precision of a dial indicator sensor and the linear accuracy of a micrometer. This combination of indicator and micrometer reduces the need for operator "feel" and provides faster readings with increased reliability.

This head is interchangeable with the 128 End Rods and extension combinations.

**For direct measurements**, the dial indicator hand and the telltale hand must both register zero before reading the micrometer. As a comparator, the micrometer is first set to the nominal dimension and ± deviation from zero is read from the dial indicator. The gage should be rocked to obtain a minimum reading on the indicator. Out-of-roundness can also be checked – any variation being shown by the indicator.

**For inch-reading tools**, the head can be adjusted within a range of 2". It extends the overall range by an additional 5". The special 81-138J Jeweled Non-Shock Indicator is graduated .0005", range ±.040" and reads 0-40 on both the plus and minus dials.

**For millimeter-reading tools**, the head can be adjusted within a range of 50mm. This extends the overall range an additional 125mm. The special 81-181J Jeweled Non-Shock Indicator is graduated 0.01mm, range ±1mm and reads 0-100mm on both the plus and minus dials.

The 10" (250mm) master should be used vertically with the shoulder on the indicator end of the head, seated squarely, as shown in photo.

**128 and 128M Combination Head with Inside Micrometer Sets**

| Cat. No. | EDP | Description |
|---|---|---|
| 128 | 64381 | Inch-reading combination head with setting master |
| 128M | 68117 | Millimeter-reading combination head with setting master |

## 128, 128M SETS

### 6-294"/150-7350MM



Each set consists of a satin-chrome micrometer head which can be used in combination with any one or more of a series of rigid, tubular steel measuring rods to obtain the required length.

The micrometer head is a modification of our 63, which has a 2" (50mm) range. The head has a basic length of 4" (100mm) which can be lengthened to 6" (150mm) by means of its measuring range. Besides those listed on the lead page of this section, the 128 Sets have these additional features:

- For inside measurements from 6-294" (150-7350mm) (longer sizes are also available on special order)
- Interchangeable tubular steel measuring rods and extension rods are lightweight with extreme rigidity. Rods screw into each other and seat against hardened ground and lapped surfaces necessary for high accuracy. Rod diameter 5/8" (16mm).
- Rods are provided with insulated handles to minimize expansion from hand heat. All rods marked with length
- All rod anvil contacts are hardened and ground
- All measuring rod anvil contacts are adjustable (plain extension rods are not adjustable)
- Adjustable, ground steel supporting collars (placed in "V" grooves when used in the horizontal position)



**128 and 128M Micrometer Head Sets**

| Range with Micrometer Head | Movement of Screw | Grad. | Description | Range with Combination Head | Cat. No. | EDP |
|---|---|---|---|---|---|---|
| 6-78" | 2" | .001" | With (1) 4-6" head, (1) each 2", 4", 6", 8", 10", 12" rods, (1) 12" ext., (2) 24" ext. | 11-83" | 128AZ | 64375 |
| 6-150" | 2" | .001" | With (1) 4-6" head, (1) each 2", 4", 6", 8", 10", 12" rods, (1) 12" ext., (5) 24" ext. | 11-155" | 128BZ | 64376 |
| 6-294" | 2" | .001" | With (1) 4-6" Head, (1) each 2", 4", 6", 8", 10", 12" rods, (1) 12" ext., (11) 24" ext. | 11-299" | 128CZ | 64377 |
| 150-1950mm | 50mm | 0.01mm | With (1) 100-150mm head, (1) ea. 50, 100, 150, 200, 250, 300mm rods, (1) 300mm ext., (2) 600mm ext. | 300-2100mm | 128MAZ | 64378 |
| 150-3750mm | 50mm | 0.01mm | With (1) 100-150mm head, (1) ea. 50, 100, 150, 200, 250, 300mm rods, (1) 300mm ext., (5) 600mm ext. | 300-3900mm | 128MBZ | 64379 |
| 150-7350mm | 50mm | 0.01mm | With (1) 100-150mm head, (1) ea. 50, 100, 150, 200, 250, 300mm rods, (1) 300mm ext., (11) 600mm ext. | 300–7500mm | 128MCZ | 64380 |

# MICROMETER SETS



## 124, 124M SOLID-ROD INSIDE MICROMETER SETS

### 2-32"/50-800MM

These are the most popular inside micrometers because of their lightness, ease of use, and range. They are very useful for measuring inside diameters of cylinders and rings, measuring parallel surfaces, etc.

The desired range is obtained by assembling rods and spacing collars to the micrometer head. Measuring rods are provided with a shoulder that is set accurately in the micrometer head and locked in position. When assembling rods to the A and B heads, the reading line on the micrometer head should be lined up with the marking on each rod (except for the 2-3" and the 50-75mm rods).

Rod diameters are approximately 1/4" (6mm) on the A and B sizes, and approximately 11/32" (8.5mm) on the C size. Each rod has individual length adjustment for the anvil by means of special wrenches furnished.

- Measuring rods are solid and assembled on one side of the micrometer head
- Insulated rods marked with length
- Hardened and ground anvils on rods, adjustable for length. Head anvil is hardened and ground
- Quick-reading figures – every thousandth numbered on inch reading tools
- Convenient handle is available to provide reach for use in deep holes. Handle screws into the micrometer head in place of the dummy screw, which is opposite a rod lock screw. Distance from the end of the handle to the center line is 6-1/4" (158mm).








H124 Head

| 124 Solid-Rod Inside Micrometer Sets (.001" Graduation) | | | | | | | |
|---|---|---|---|---|---|---|---|
| | | | | Without Case | | With Case | |
| Range | Screw Movement | Measuring Rods | Spacing Collars | Cat. No. | EDP | Cat. No. | EDP |
| 2-8" | 1/2" | 6 | One 1/2" | 124A | 50540 | 124AZ | 50542 |
| 2-12" | 1/2" | 10 | One 1/2" | 124B | 50544 | 124BZ | 50546 |
| 8-32" | 1" | 4 | One 1" Two 2" | 124C | 50548 | 124CZ | 50550 |
| 2-32" | 1/2 and 1" (2 heads) | Set 124A and 124C | | 124D | 50552 | 124DZ | 50554 |
| **124M Solid-Rod Inside Micrometer Sets (0.01mm Graduation)** | | | | | | | |
| 50-200mm | 13mm | 6 | One 12mm | 124MA | 50541 | 124MAZ | 56141 |
| 50-300mm | 13mm | 10 | One 12mm | 124MB | 50545 | 124MBZ | 56142 |
| 200-800mm | 25mm | 4 | One 25mm Two 50mm | 124MC | 50549 | 124MCZ | 56143 |
| 50-800mm | 13 and 25mm (2 heads) | Comprised of sets 124MA and 124MC | | 124MD | 50553 | 124MDZ | 56144 |
| **Accessory for 124 and 124M Solid-Rod Inside Micrometer Sets** | | | | | | | |
| **Description** | | | | | | **Cat. No.** | **EDP** |
| 6-1/4" (158mm) handle | | | | | | 124H | 50556 |

# MICROMETER SETS

## 823, 823M TUBULAR INSIDE MICROMETER SETS

### 1-1/2-40"/40-1000MM

The 823 Micrometers are highly useful tools for internal linear measurements such as measuring cylinders, rings, setting calipers, comparing gages and measuring parallel surfaces.

The extension rods are made of steel tubing, light in weight, yet extremely rigid. Rods are approximately 3/8" (9.5mm) diameter to meet the requirements of mechanics who prefer this larger diameter. By removing the hardened and ground anvil ends (end caps) of the micrometer head, the rods may be attached to either or both ends of the micrometer as preferred. Each rod may be individually adjusted for wear by the hardened and ground anvil at the end.

- Tubular measuring rods are lightweight, yet extremely rigid. Rods are insulated, with the exception of 1/2" (13mm) and 1" (25mm) sizes.
- Each rod is marked with length
- Hardened and ground anvils on rods are adjustable for length. Head anvil is hardened and ground.
- Interchangeable anvils on both 1/2" (13mm) and 1" (25mm) heads
- Quick reading figures – every thousandth numbered on inch reading tools
- Lock nut furnished on 1" (25mm) heads
- 5-1/2" (140mm) long, convenient handle furnished on A, B, F micrometers may be clamped where it will provide correct balance and reach



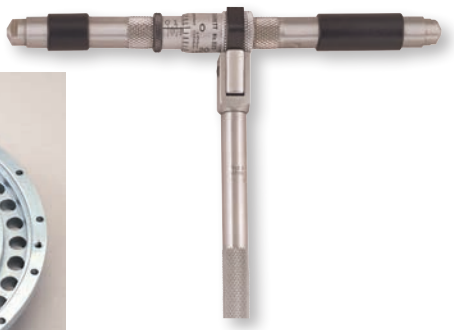


823AZ 1-1/2-8" set with tool, rods, handle and wrenches

| 823 Tubular Inside Micrometer Sets (.001" Graduation) | | | | |
|---|---|---|---|---|
| **Range** | **Movement of Screw** | **Description** | **Cat. No.** | **EDP** |
| 1-1/2-8" | 1/2" | With 5 rods and handle | 823AZ | 53050 |
| 1-1/2-12" | | With 8 rods and handle | 823BZ | 53052 |
| 4-24" | 1" | With 7 rods | 823CZ | 53054 |
| 4-32" | | With 8 rods | 823DZ | 53055 |
| 4-40" | | With 10 rods | 823EZ | 53056 |
| 1-1/2-32" | 1/2 and 1" (2 heads) | With 10 rods and handle | 823FZ | 53058 |
| **823M Tubular Inside Micrometer Sets (0.01mm Graduation)** | | | | |
| 40-200mm | 13mm | With 6 rods and handle | 823MAZ | 53051 |
| 40-300mm | | With 8 rods and handle | 823MBZ | 53053 |
| 100-1000mm | 25mm | With 10 rods | 823MEZ | 53057 |

Each set furnished in attractive, protective case with assembly instructions for various measurements.





Rods attachable as shown to either one or both ends of the head ensures the best balance, feel, and ease of reading.

| Key to Starrett Micrometer Numbering System | |
|---|---|
| **Prefixes** | |
| R | Reverse Reading |
| S | Micrometer Set |
| T | .0001" Reading |
| V | 0.001mm or 0.002mm Reading, as specified |
| **Suffixes** | |
| F | Friction Thimble |
| L | Lock Nut |
| M | Metric |
| N | Non-Rotating |
| P | Plain |
| R | Ratchet Stop |
| S | Speeder |
| TN | Threaded Hub and Check Nut |
| W/SLC | Standard Letter of Certification |
| X | Micro-lapped Carbide Measuring Faces |
| Z | With Case |
| ZZ | Case Only |



823EZ 4-40" set with tool, rods, handle and wrenches.

# Inside Micrometers

## 121 Long Range Tubular Inside Micrometer Sets

**32-107"**

The 121 Tubular Inside Micrometers are designed for large internal measurements beyond the capacity of most other micrometers. Each set consists of a micrometer head mounted at the end of a tubular holder in which measuring rods can be inserted and adjusted to the desired size. Final size reading in thousandths of an inch (.001") is obtained using the micrometer head.

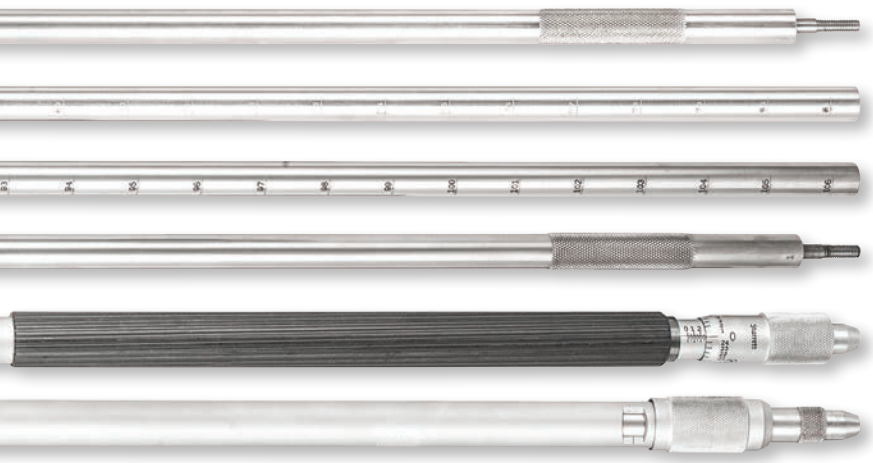
Rods and holder are made of steel tubing, light in weight, yet very rigid. Each rod is accurately graduated with inch divisions, which are set to the size desired by a line on the holder, and firmly held by a large, knurled clamping nut. The collet has a design that insures an extremely tight grip on the rods at any setting.

### Features

- Insulated rod holder to eliminate expansion by heat when hand held
- Attractive nickel-plated finish; satin-chrome finish on micrometer head reading surfaces
- Rods are accurately graduated in inches – micrometer head in thousandths of an inch
- Hardened and ground anvils. All rod anvils are adjustable.
- Quick, easy adjustment for micrometer screw

| 121 Long Range Tubular Inside Micrometer Sets (.001" Graduation) | | | | |
|---|---|---|---|---|
| Range | Movement of Screw | Description | Cat. No. | EDP |
| 32-57" | 1" | With 1 graduated measuring rod | 121AZ | 50492 |
| 32-82" | | With 2 graduated measuring rods and 1 extension rod | 121BZ | 50493 |
| 32-107" | | With 3 graduated measuring rods and 2 extension rods | 121CZ | 50494 |

Each set furnished in attractive, protective case.



## 824, 824M Fixed Range Inside Micrometers and Sets

**2-12"/50-150MM**

For those who prefer inside micrometers without interchangeable rods, Starrett offers this series of fixed range inside micrometers. The 824 and 824M can be ordered individually or in sets. All 824 and 824M Micrometers feature:

- Insulating handles on all sizes minimize possible expansion by heat when hand held
- Lock nuts (except 824AA and 824MAA)
- Adjustable contacts on thimble end
- Adjustable sleeve for head accuracy

| 824 Inside Micrometers (.001" Graduation) | | | |
|---|---|---|---|
| Range | Movement of Screw | Cat. No. | EDP |
| 2-3" | 1" | 824AA | 56665 |
| 3-4" | | 824A | 56666 |
| 4-5" | | 824B | 56667 |
| 5-6" | | 824C | 56668 |
| 6-7" | | 824D | 56669 |
| 7-8" | | 824E | 56670 |
| 8-9" | | 824F | 56671 |
| 9-10" | | 824G | 56672 |
| 10-11" | | 824H | 56673 |
| 11-12" | | 824J | 56674 |
| 6-8" | 2" | 824K | 56675 |
| 8-10" | | 824L | 56676 |
| 10-12" | | 824N | 56677 |
| **824M Inside Micrometers (0.01mm Graduation)** | | | |
| 50-75mm | 25mm | 824MAA | 64192 |
| 75-100mm | | 824MA | 64193 |
| 100-125mm | | 824MB | 64194 |
| 125-150mm | | 824MC | 64195 |

| 824 Fixed Range Inside Micrometer Sets | | | |
|---|---|---|---|
| Total Range | Description | Cat. No. | EDP |
| 2-6" | 4 micrometers, 1" range: 2-3", 3-4", 4-5", 5-6" | S824AZ | 56678 |
| 2-12" | 10 micrometers, 1" range: 2-3", 3-4", 4-5", 5-6", 6-7", 7-8", 8-9", 9-10", 10-11", 11-12" | S824BZ | 56679 |
| 6-12" | 3 micrometers, 2" eange: 6-8", 8-10", 10-12" | S824CZ | 56680 |
| 2-12" | 7 micrometers, (4) 1" range, (3) 2" range: 2-3", 3-4", 4-5", 5-6", 6-8", 8-10", 10-12" | S824DZ | 56681 |
| **824M Fixed Range Inside Micrometer Sets** | | | |
| 50-150mm | 4 micrometers, 25mm Range: 50-75mm, 75-100mm, 100-125mm, 125-150mm | S824MAZ | 64196 |



# Inside Micrometers

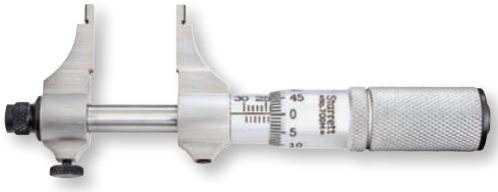
## 700, 700M Inside Micrometer Calipers

### .200-2"/5-50MM

Caliper-type jaws permit quick inside measurements accurate to ±.0002" or ±0.005mm. Jaws are hardened and ground on a radius for accurate feel without cramping.

- Satin chrome reading surface is glare free and resists rust
- Smooth friction thimble for consistent readings
- Lock screw

| 700 Inside Micrometer Calipers (.001" Graduation) | | |
|---|---|---|
| **Range** | **Cat. No.** | **EDP** |
| .200-1.200" | 700A | 52909 |
| 1-2" | 700B | 52911 |
| **700M Inside Micrometer Calipers (0.01mm Graduation)** | | |
| 5-30mm | 700MA | 56063 |
| 25-50mm | 700MB | 56064 |
| **Case for 700 and 700M Inside Micrometer Calipers** | | |
| **Description** | **Cat. No.** | **EDP** |
| Case for 700, 700M inside micrometer calipers | 940 | 55359 |





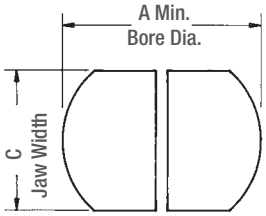
## 701 Internal Groove Micrometers

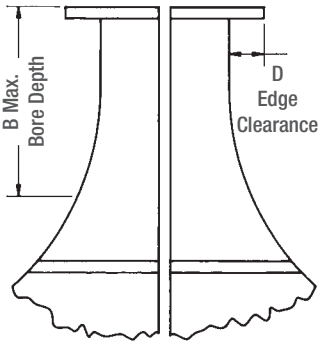
### .500-2.500"

Measures grooves for retaining rings and "O" rings, oil grooves, washer grooves, as well as bores and recesses. Depth of grooves up to 5/64" can be measured with 701A; and 7/32" with 701B. Tool is accurate to ±.0002".

- Hardened and ground gaging contacts are .030" thick
- Contacts have flush ends to gage grooves at the bottom of blind holes
- Satin chrome reading surface is glare free and resists rust
- Smooth friction thimble for consistent readings
- Lock screw

| 701 Internal Groove Micrometers (.001" Graduation) | | | | | |
|---|---|---|---|---|---|
| **Range** | **Min. Bore** | **Max. Depth Bore** | **Thickness Jaws** | **Cat. No.** | **EDP** |
| .500-1.500" | .500" | 1/2" | .030" | 701A | 52913 |
| 1.500-2.500" | 1.500" | 7/8" | | 701B | 52915 |
| **Case for 701 Internal Groove Micrometers** | | | | | |
| **Description** | | | | **Cat. No.** | **EDP** |
| Protective Case | | | | 940 | 55359 |




| | 701A | 701B |
|---|---|---|
| **Range** | **.5-1.5"** | **1.5-2.5"** |
| A | .5" | 1.5" |
| B | 1/2" | 3/4" |
| C | 3/8" | 3/8" |
| D | 3/32" | 9/32" |



# Depth Micrometers

## 749 Electronic Micrometer Depth Gage (with output)

### 0-12"/0-300MM

The 749 Electronic Depth Micrometer has a wide 0-12" (0-300mm) range for measuring the depth of most holes, slots, shoulders and projections.

| 749 Electronic Micrometer Depth Gages, Standard Inch Graduations on Shell and Thimble | | |
|---|---|---|
| **Cat. No.** | **EDP** | **Description** |
| 749BZ-6RL | 65063 | 0-6"/0-150mm range |
| 749BZ-12RL | 68854 | 0-12"/0-300mm range |
| **749M Electronic Micrometer Depth Gages, Standard Millimeter Graduations on Shell and Thimble** | | |
| 749MEBZ-150 | 66124 | 0-150mm/0-6" range |
| 749MEBZ-300 | 68855 | 0-300mm/0-12" range |

| Rods Only for 749 and 749M Electronic Micrometer Depth Gages | | | | | |
|---|---|---|---|---|---|
| **Inch** | **Part No.** | **EDP** | **mm** | **Part No.** | **EDP** |
| 0-1" | PT99486 | 72493 | 0-25mm | PT99143 | 66331 |
| 1-2" | PT99487 | 72494 | 25-50mm | PT99183 | 66332 |
| 2-3" | PT99488 | 72495 | 50-75mm | PT99190 | 66333 |
| 3-4" | PT99489 | 72496 | 75-100mm | PT99266 | 66334 |
| 4-5" | PT99490 | 72497 | 100-125mm | PT99267 | 66335 |
| 5-6" | PT99491 | 72498 | 125-150mm | PT99268 | 66336 |
| 6-7" | PT99457 | 11626 | 150-175mm | PT99531 | 11632 |
| 7-8" | PT99458 | 11627 | 175-200mm | PT99532 | 11633 |
| 8-9" | PT99459 | 11628 | 200-225mm | PT99533 | 11634 |
| 9-10" | PT99460 | 11629 | 225-250mm | PT99534 | 11635 |
| 10-11" | PT99461 | 11630 | 250-275mm | PT99535 | 11636 |
| 11-12" | PT99462 | 11631 | 275-300mm | PT99536 | 11637 |

| Cable Information for 749 and 749M Electronic Micrometer Depth Gages | | |
|---|---|---|
| **Part No.** | **EDP** | **Description** |
| PT61963 | 66636 | Computer interface cable complete to PC (RS232C) |
| PT61768 | 66454 | Adaptor from PT22938 cable to PC (RS232C) |
| PT22938 | 64059 | Shielded cable to 761/772 Starrett modules and PT61768 adaptor |
| PT61120 | 65446 | One 3-Volt battery CR2450 |

### Readability Features

- Large high-contrast LCD digital readout
- Resolution: .0001" (0.001mm)
- Inch or millimeter graduations standard
- No-glare black wrinkle finish frame
- No-glare satin chrome finish on thimble and sleeve

### Ease-of-Handling Features

- Ring-type knurled lock nut
- Combination ratchet and speeder

### Accuracy and Long-Life Features

- Ground and lapped one-piece spindle
- Base length 4" (100mm); rod diameter 5/32" (4mm)
- One 3-volt battery furnished with over one year's normal usage
- Automatic OFF after 30 minutes of nonuse
- Full-Function Action Features
- Instant inch/millimeter conversion
- "ME" millimeter model turns on in millimeter mode after battery installation
- Measurement HOLD button
- Ability to zero at any position and retain and return to true zero reading
- PRESET button to install any reading at any position
- Ability to install minimum and maximum limits
- RS232 data output port
- Works well with Starrett DataSure® Wireless Data Collection Systems

## Depth Micrometers

Our varied line of electronic, mechanical digital and regular depth micrometers are available with base lengths from 2-1/2-6" (63.5-150mm) and can measure depths up to 9" (225mm). They are also available with rotating or non-rotating blades. All heads used in our depth micrometers are accurate to ±.0001" or ±0.002mm.

Unless otherwise noted under the individual tools, they all have these features:

- A base shape design that will automatically position the fingers so that the base is easily held in place for measuring stability
- All precision screws are ground and lapped
- All bases and rods are hardened, ground, and lapped for permanent accuracy
- All reading surfaces have a satin chrome finish that resists rust and provides a no-glare background for the sharp lines and figures
- All measuring rods are adjustable
- Quick and easy adjustment



# Depth Micrometers

## 446, 446M Digital Micrometer Depth Gages

### 0-6"/0-150MM

446 Mechanical Digital Depth Micrometers are simple to use even by the inexperienced. Besides those listed on the lead page of this section, this tool has these additional features:

- Clear, easily read white numbers on black background reduce errors
- No-glare black finish on the frame
- .001" or 0.01mm is read directly from the counter
- Ring-type knurled lock nut for quick and sure locking
- Combination ratchet and speeder for uniform pressure and quicker adjustment
- Hardened, ground, and lapped base is 3" (75mm) long
- Measuring rods are 5/32" (4mm) diameter and are adjustable

| 446 Digital Micrometer Depth Gages (.001" Graduation) | | | |
|---|---|---|---|
| **Range** | **Rods** | **Cat. No.** | **EDP** |
| 0-3" | 3 | 446AZ-3RL | 56288 |
| 0-6" | 6 | 446AZ-6RL | 56289 |
| **446M Digital Micrometer Depth Gages (0.01mm Graduation)** | | | |
| 0-75mm | 3 | 446MAZ-75RL | 56294 |
| 0-150mm | 6 | 446MAZ-150RL | 56295 |

| Rods Only for 446 & 446M Digital Micrometer Depth Gages | | | | | |
|---|---|---|---|---|---|
| **For 446 (Inch)** | | | **For 446M (Millimeter)** | | |
| **Size** | **Part No.** | **EDP** | **Size** | **Part No.** | **EDP** |
| 0-1" | PT99381 | 72211 | 0-25mm | PT99391 | 72217 |
| 1-2" | PT99382 | 72212 | 25-50mm | PT99392 | 72218 |
| 2-3" | PT99383 | 72213 | 50-75mm | PT99393 | 72219 |
| 3-4" | PT99384 | 72214 | 75-100mm | PT99394 | 72220 |
| 4-5" | PT99385 | 72215 | 100-125mm | PT99395 | 72221 |
| 5-6" | PT99386 | 72216 | 125-150mm | PT99396 | 72222 |



446AZ-3RL



| Key to Starrett Micrometer Numbering System | |
|---|---|
| **Prefixes** | |
| R | Reverse Reading |
| S | Micrometer Set |
| T | .0001" Reading |
| V | 0.001mm or 0.002mm Reading, as specified |
| **Suffixes** | |
| F | Friction Thimble |
| L | Lock Nut |
| M | Metric |
| R | Ratchet Stop |
| S | Speeder |
| TN | Threaded Hub and Check Nut |
| W/SLC | Standard Letter of Certification |
| X | Micro-lapped Carbide Measuring Faces |
| Z | With Case |
| ZZ | Case Only |

# DEPTH MICROMETERS

## 449, 449M MICROMETER DEPTH GAGES WITH NON-ROTATING BLADES

### 0-6"/0-150MM

By holding the base in one hand, the .045" thick x 1/8" wide (1.2 x 3.2mm) blade can be turned with the fingers and positioned at any angle relative to the base. In operation, blade does not turn, but moves perpendicularly only, permitting depth measurement of narrow shoulders without the blade rolling off. This is also ideal for slots and recesses as narrow as .045" (1.2mm). Furnished with a 2-1/2" (63mm) or a 4" (100mm) base.

Also available with 3 rods for measuring 0-3" (0-75mm), or 6 rods for measuring 0-6" (0-150mm) in thousandths of an inch or 0.01mm.

This tool comes with the combination ratchet and speeder for uniform pressure and quicker adjustment.

| 449 Micrometer Depth Gages (.001" Graduation) | | | | | |
|---|---|---|---|---|---|
| Range | Base Length | Rods | Rod Size | Cat. No. | EDP |
| 0-3" | 2-1/2" | 3 | .045 x 1/8" | 449AZ-3R | 52318 |
| 0-6" | 2-1/2" | 6 | | 449AZ-6R | 52320 |
| 0-3" | 4" | 3 | | 449BZ-3R | 52322 |
| 0-6" | 4" | 6 | | 449BZ-6R | 52324 |
| **449M Micrometer Depth Gages (0.01mm Graduation)** | | | | | |
| 0-75mm | 63.5mm | 3 | 1.2 x 3.2mm | 449MAZ-75R | 56636 |
| 0-150mm | 63.5mm | 6 | | 449MAZ-150R | 56637 |
| 0-75mm | 100mm | 3 | | 449MBZ-75R | 56638 |
| 0-150mm | 100mm | 6 | | 449MBZ-150R | 56639 |

| Rods Only for 449M Micrometer Depth Gages | | | | | |
|---|---|---|---|---|---|
| For 449 (Inch) | | | For 449M (Millimeter) | | |
| Size | Part No. | EDP | Size | Part No. | EDP |
| 0-1" | PT99115 | 71838 | 0-25mm | PT99306 | 72476 |
| 1-2" | PT99116 | 71839 | 25-50mm | PT99307 | 72477 |
| 2-3" | PT99117 | 71840 | 50-75mm | PT99308 | 72478 |
| 3-4" | PT99118 | 71841 | 75-100mm | PT99309 | 72479 |
| 4-5" | PT99119 | 71842 | 100-125mm | PT99310 | 72480 |
| 5-6" | PT99120 | 71843 | 125-150mm | PT99311 | 72481 |

Longer rods are available by special order.




449AZ-3R



# DEPTH MICROMETERS

## 440, 440M, 445, 445M
### DEPTH MICROMETERS

**0-9" AND 0-12"/0-225MM**

- The depths of holes, slots, shoulders and projections can be measured to .001" or 0.01mm with these fine tools
- 440 Gages furnished with a 2-1/2" (63.5mm) base and 1/8" (3.2mm) diameter measuring rods
- 445 Gages furnished with choices of 3" (75mm), 4" (100mm), and 6" (150mm) bases and have 5/32" (4mm) diameter measuring rods
- Combination ratchet and speeder for uniform pressure and quicker adjustment
- Ring-type lock nut for quick and sure locking



440-3L



445AZRL


445AZ-6RL

| 440, 445 Depth Micrometers | | | | | |
|---|---|---|---|---|---|
| **Range** | **Base** | **Rods** | **Rod Dia.** | **Cat. No.** | **EDP** |
| 0-3" | 2-1/2" | 3 | 1/8" | 440Z-3L | 52113 |
| 0-6" | | 6 | | 440Z-6L | 52117 |
| 0-9" | | 9 | | 440Z-9L | 52121 |
| 0-3" | 2-1/2" | 3 | 1/8" | 440Z-3RL | 52115 |
| 0-6" | | 6 | | 440Z-6RL | 52119 |
| 0-9" | | 9 | | 440Z-9RL | 52123 |
| 0-3" | 3" | 3 | 5/32" | 445AZ-3RL | 52208 |
| 0-6" | | 6 | | 445AZ-6RL | 52212 |
| 0-9" | | 9 | | 445AZ-9RL | 52216 |
| 0-12" | | 12 | | 445AZ-12RL | 67117 |
| 0-3" | 4" | 3 | 5/32" | 445BZ-3RL | 52220 |
| 0-6" | | 6 | | 445BZ-6RL | 52224 |
| 0-9" | | 9 | | 445BZ-9RL | 52228 |
| 0-12" | | 12 | | 445BZ-12RL | 67118 |
| 0-3" | 6" | 3 | 5/32" | 445DZ-3RL | 52244 |
| 0-6" | | 6 | | 445DZ-6RL | 52248 |
| 0-9" | | 9 | | 445DZ-9RL | 52252 |
| 0-12" | | 12 | | 445DZ-12RL | 67119 |
| **440M, 445M Depth Micrometers** | | | | | |
| 0-75mm | 63.5mm | 3 | 3.2mm | 440MZ-75RL | 52116 |
| 0-150mm | | 6 | | 440MZ-150RL | 52120 |
| 0-225mm | | 9 | | 440MZ-225RL | 52124 |
| 0-75mm | 75mm | 3 | 4mm | 445MAZ-75RL | 52209 |
| 0-150mm | | 6 | | 445MAZ-150RL | 52213 |
| 0-225mm | | 9 | | 445MAZ-225RL | 52217 |
| 0-75mm | 100mm | 3 | 4mm | 445MBZ-75RL | 52221 |
| 0-150mm | | 6 | | 445MBZ-150RL | 52225 |
| 0-225mm | | 9 | | 445MBZ-225RL | 52229 |
| 0-75mm | 150mm | 3 | 4mm | 445MDZ-75RL | 52245 |
| 0-150mm | | 6 | | 445MDZ-150RL | 52249 |
| 0-225mm | | 9 | | 445MDZ-225RL | 52253 |

| Inch Reading Rods Only | | | | |
|---|---|---|---|---|
| | Fits 440 Models | | Fits 445 Models | |
| **Size** | **Part No.** | **EDP** | **Part No.** | **EDP** |
| 0-1" | PT99331 | 71973 | PT99341 | 71982 |
| 1-2" | PT99332 | 71974 | PT99342 | 71983 |
| 2-3" | PT99333 | 71975 | PT99343 | 71984 |
| 3-4" | PT99334 | 71976 | PT99344 | 71985 |
| 4-5" | PT99335 | 71977 | PT99345 | 71986 |
| 5-6" | PT99336 | 71978 | PT99346 | 71987 |
| 6-7" | PT99337 | 71979 | PT99347 | 71988 |
| 7-8" | PT99338 | 71980 | PT99348 | 71989 |
| 8-9" | PT99339 | 71981 | PT99349 | 71990 |
| 9-10" | | | PT99358 | 66673 |
| 10-11" | | | PT99359 | 66674 |
| 11-12" | | | PT99360 | 66675 |
| **Millimeter Reading Rods Only** | | | | |
| | Fits 440M Models | | Fits 445M Models | |
| **Size** | **Part No.** | **EDP** | **Part No.** | **EDP** |
| 0-25mm | PT99361 | 72193 | PT99371 | 72202 |
| 25-50mm | PT99362 | 72194 | PT99372 | 72203 |
| 50-75mm | PT99363 | 72195 | PT99373 | 72204 |
| 75-100mm | PT99364 | 72196 | PT99374 | 72205 |
| 100-125mm | PT99365 | 72197 | PT99375 | 72206 |
| 125-150mm | PT99366 | 72198 | PT99376 | 72207 |
| 150-175mm | PT99367 | 72199 | PT99377 | 72208 |
| 175-200mm | PT99368 | 72200 | PT99378 | 72209 |
| 200-225mm | PT99369 | 72201 | PT99379 | 72210 |

Longer rods available by special order.

# Depth Micrometers

## 443 Micrometer Depth Gages with Half Base

**0-9"**

- Exactly like the 445 Micrometer except that it has a half base
- 2" (50mm) half base permits measuring depths of holes and slots close to shoulders and between obstructions
- Rods have individual length adjustment and are 5/32" (4mm) in diameter

| 443 Micrometer Depth Gages | | | | |
|---|---|---|---|---|
| Range | No. of Rods | Graduation | Cat. No. | EDP |
| 0-3" | 3 | .001" | 443Z-3RL | 52171 |
| 0-6" | 6 | | 443Z-6RL | 52173 |
| 0-9" | 9 | | 443Z-9RL | 52175 |

| Inch Reading Rods Only | | |
|---|---|---|
| | 443 Models | |
| Size | Part No. | EDP |
| 0-1" | PT99341 | 71982 |
| 1-2" | PT99342 | 71983 |
| 2-3" | PT99343 | 71984 |
| 3-4" | PT99344 | 71985 |
| 4-5" | PT99345 | 71986 |
| 5-6" | PT99346 | 71987 |
| 6-7" | PT99347 | 71988 |
| 7-8" | PT99348 | 71989 |
| 8-9" | PT99349 | 71990 |
| 9-10" | PT99358 | 66673 |
| 10-11" | PT99359 | 66674 |
| 11-12" | PT99360 | 66675 |




443Z-3RL



# SLIDE CALIPERS

# Electronic Calipers

## 798 Electronic Calipers

### 0-12"/0-300MM

The 798 Electronic Caliper features a large, easy-to-read, high contrast LCD readout. It includes IP67 protection against coolants, water, chips, dust and dirt often found in machine shop environments. Its induction type linear encoder system and Inch/millimeter conversion makes Starrett precision measuring tools the right choice for any job.

| 798 Electronic Calipers | | | |
|---|---|---|---|
| **Range** | **Description** | **Cat. No.** | **EDP** |
| 0-6" (150mm) | Caliper with output | 798B-6/150 | 12521 |
| | Caliper with output | 798B-6/150 W/SLC | 12522 |
| | Caliper with output | 798BX-6/150 | 12782 |
| | Caliper without output | 798A-6/150 | 20798 |
| 0-8" (200mm) | Caliper with output | 798B-8/200 | 12523 |
| | Caliper with output | 798B-8/200 W/SLC | 12524 |
| | Caliper without output | 798A-8/200 | 20799 |
| 0-12" (300mm) | Caliper with output | 798B-12/300 | 12525 |
| | Caliper with output | 798B-12/300 W/SLC | 12526 |
| | Caliper without output | 798A-12/300 | 20800 |

| Accessories, Cables and Case Information for 798 Electronic Calipers | | |
|---|---|---|
| **Description** | **Cat. No.** | **EDP** |
| Center distance attachment | PT26151 | 64440 |
| Depth attachment | PT22431 | 64640 |
| Computer interface cable to PC (USB) with driver CD | PT63388 | 72517 |
| Replacement non-contact computer interface cable to PC (USB) | PT63329-1 | 12733 |
| Two 3-Volt batteries, CR2032 | PT99492 | 65650 |
| Deluxe padded case for 0-6" (150mm) calipers | 723ZZ-6/722ZZ-6 | 57070 |
| Finished wood case for 0-8" (200mm) calipers | 950 | 63878 |
| Finished wood case for 0-12" (300mm) calipers | 946 | 56695 |

*Includes redemption card for Standard Letter of Certification (SLC).

### Features

- IP67 level of protection
- Fine adjustment
- Hardened stainless steel measuring surfaces
- Large, easy-to-read, high-contrast LCD digital readout
- Induction type linear encoder system
- RS232 output
- Heavy-duty bar and slide
- Slide lock
- One 3-volt battery for over one year of normal usage
- In/mm conversion
- Zero at any position
- Auto-Off after 30 minutes
- Reactivation of display with no loss of position
- Works well with Starrett DataSure® Wireless Data Collection Systems

| Approximate Jaw Depths for 798 Electronic Calipers | | | |
|---|---|---|---|
| | **6" (150mm)** | **8" (200mm)** | **12" (300mm)** |
| **Outside** | 1-1/2" (38mm) | 1-7/8" (47.6mm) | 2-1/2" (63.5mm) |
| **Inside** | 5/8" (16mm) | 3/4" (19mm) | 3/4" (19mm) |




### IP Protection

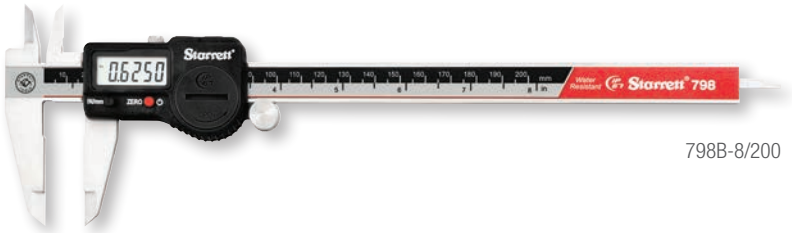
An IP number is composed of two numbers, the first referring to protection against solid objects and the second against liquids.

**First number 6**: Totally protected against dust

**Second number 7**: Protection against submersion in water under standardized conditions of pressure for 30 minutes




798B-6/150




798B-8/200




798B-12/300

# Electronic Calipers

## 799 Electronic Calipers

### 0-40"/0-1000MM

The 799 Electronic Caliper is light, comfortable, easy-to-use, and constructed with features that have made Starrett slide calipers the machinist's first choice for many years.

The 799 offers a slim, streamlined profile, a large, clear, easy-to-read LCD display, long battery life, and function buttons for zero and inch/mm.

799 are available in 0-6", 0-8", and 0-12" sizes and the newly available extended range 24" and 40". All sizes furnished in a fitted, protective case.

### Features (all sizes)

- Lightweight, ergonomic design
- Inch/millimeter conversion reads .0005" or 0.01mm
- Easy access to the single, long-life battery
- Last measuring position retained when shut off
- Hardened stainless steel body for long life
- Fine adjustment thumb wheel
- Lock screw to hold the slide in position
- Resolution is .0005" (0.01mm)
- Zero at any position

### 6", 8" and 12" Calipers Only

- Large easy-to-read LCD, .32" high characters
- Automatic shut-off after 5 minutes of nonuse
- Linear accuracy meets DIN862
- Integrated depth rod

### Extended Range 24" and 40" Calipers

- Preset and hold feature
- Minimum and maximum limits set
- I.D. jaw dimension is 0.800"/20.32mm
- LCD characters are .50" high
- Auto shut-off after 30 minutes of non-use




| 799 Electronic Calipers | | |
|---|---|---|
| **Range** | **Cat. No.** | **EDP** |
| 0-6" (150mm) | 799A-6/150 | 67410 |
| | 799A-6/150 W/SLC† | 67620 |
| 0-8" (200mm) | 799A-8/200 | 67412 |
| | 799A-8/200 W/SLC† | 67413 |
| 0-12" (300mm) | 799A-12/300 | 67621 |
| 0-24" (600mm) | 799AZ-24/600 | 11978 |
| 0-40" (1000mm) | 799AZ-40/1000 | 11979 |

| Accessories and Case Information for 799 Electronic Calipers | | |
|---|---|---|
| **Description** | **Cat. No.** | **EDP** |
| Center distance attachment* | PT26151 | 64440 |
| Depth attachment for 6", 9" and 150mm calipers | PT22431 | 64640 |
| 3 Volt battery; CR2032 | PT99492 | 65650 |
| Deluxe padded case for 0-6" (150mm) calipers | 723ZZ-6/722ZZ-6 | 57070 |
| Finished wood case for 0-8" (200mm) calipers | 950 | 63878 |
| Finished wood case for 0-12" (300mm) calipers | 946 | 56695 |

* See details in this section.
†Includes redemption card for Standard Letter of Certification (SLC).

| Approximate Jaw Depths for 799 Electronic Calipers | | | | | |
|---|---|---|---|---|---|
| | **6" (150mm)** | **8" (200mm)** | **12" (300mm)** | **24" (600mm)** | **40" (1000mm)** |
| **Outside** | 1-1/2" (38mm) | 2" 50.8mm) | 2-1/2" (63.5mm) | 4" (100mm) | 6" (150mm) |
| **Inside** | 5/8" (16mm) | 3/4" (19mm) | 23/32" (18.3mm) | 11/16" (17.46mm) | 11/16" (17.46mm) |

# Carbon Calipers

## 5000, 5001 and 5002 Carbon Fiber Calipers

**0-40"**

- Carbon fiber construction significantly reduces weight, improving maneuverability
- Titanium coated stainless steel outside measurement jaws for long life and superior flatness
- Coolant resistant
- Two preset modes, REF I and REF II, allow setting one mode to a setting master and a second to a zero setting
- Full-featured, sophisticated electronics with RS232 output
- Ideal for use with Starrett DataSure® Wireless Data Collection Systems using a 1500-3A-1N end node
- Will also transmit to PC through cable

### Features and Specifications

- CR2032 lithium battery included
- Clamping screw
- Protective wooden case
- Resolution: 0.0005"/0.01mm

### 5000 and 5002 Only

- mm/inch mode button
- On/Off button
- Hold feature will freeze the display when in REF I or REF II mode

### 5001 Only

- Mode and Set buttons
- Min/Max mode displays values referenced from the preset value of the REF mode the tool is in when entering MIN/MAX
- Tolerance mode to set upper and lower measurement tolerances
- Larger display with more information



5002BZ-16/400 with
PT06138 Step Contacts

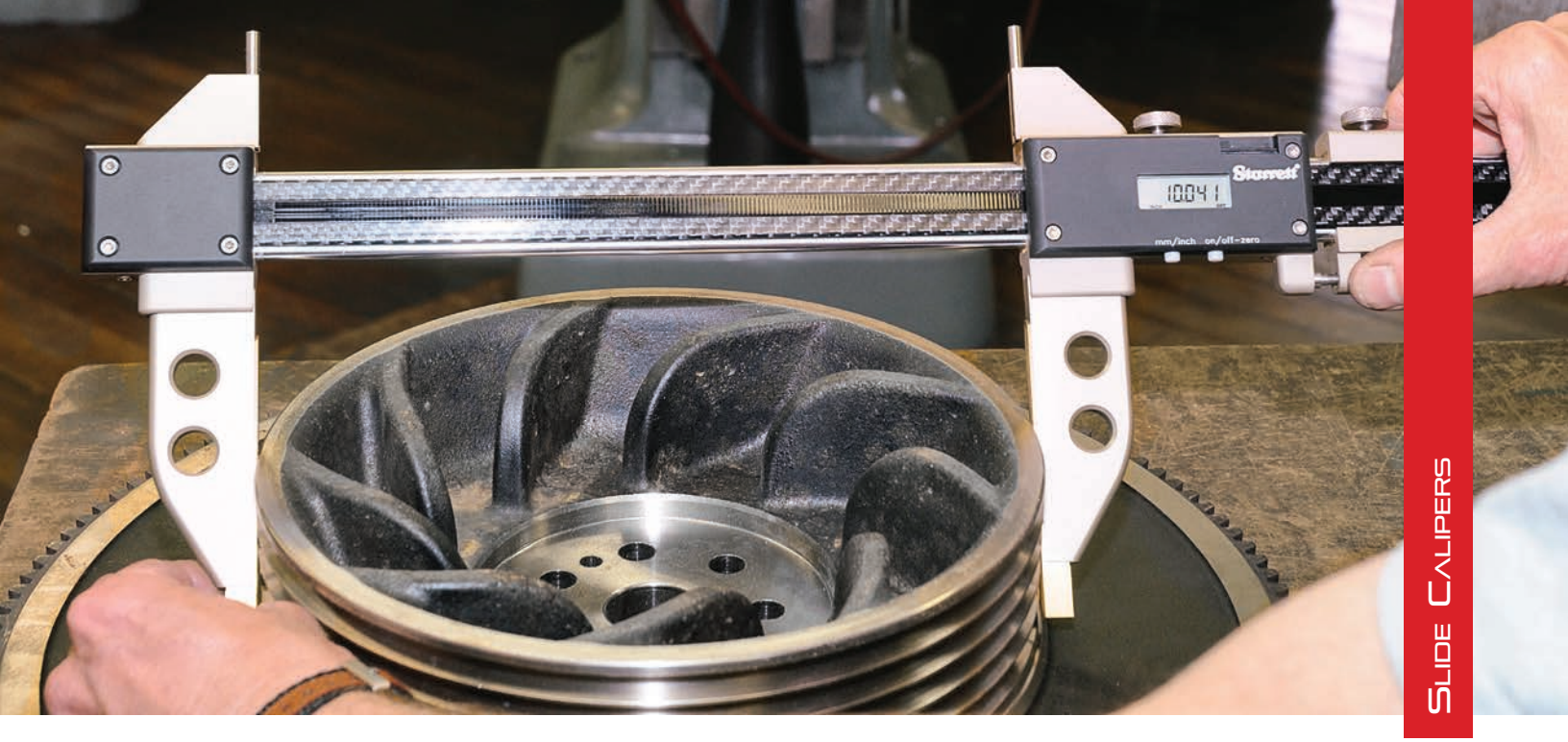


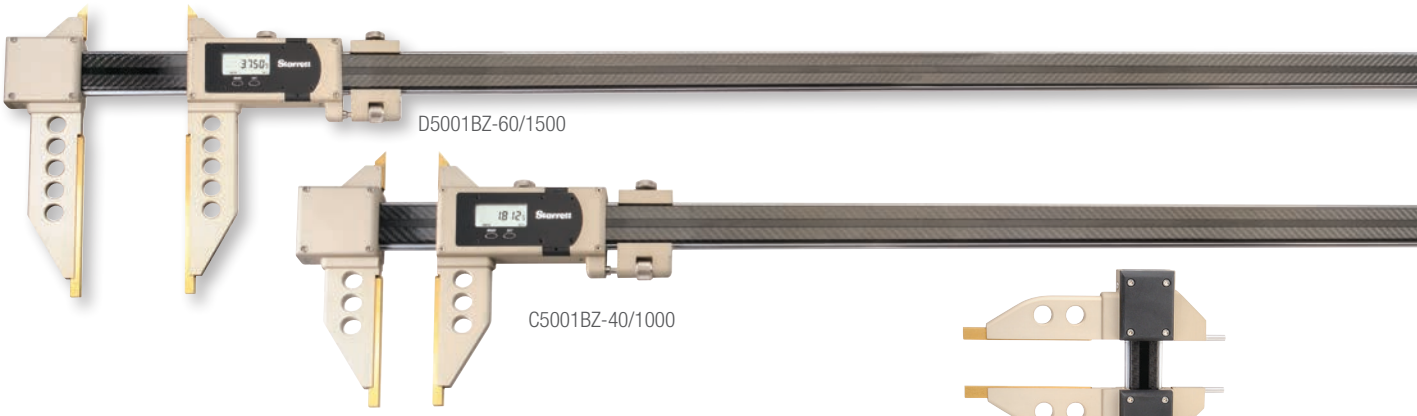
5002BZ-24/600 with
PT06139 Conical Contacts



5002BZ-40/1000 with
PT06137 Disc Contacts







D5001BZ-60/1500

C5001BZ-40/1000

B5000BZ-24/600

B5000BZ-20/500

## 5000 Carbon Fiber Calipers

| Cat. No. | EDP | Outside | Weight | Jaw Depth | Measuring Capacities Inside (w/Jaws) | Inside (w/top pins) |
|---|---|---|---|---|---|---|
| B5000BZ-20/500 | 14571 | 0-20" (0-500mm) | 2.43lb (1.10kg) | 4.921" (125mm) | 0.787-20" (20-500mm) | 0.394-20" (10-500mm) |
| B5000BZ-24/600 | 14572 | 0-24" (0-600mm) | 2.56lb (1.16kg) | 4.921" (125mm) | 0.787-24" (20-600mm) | 0.394-24" (10-600mm) |
| B5000BZ-40/1000 | 14573 | 0-40" (0-1000mm) | 3.09lb (1.40kg) | 4.921" (125mm) | 0.787-40" (20-1000mm) | 0.394-40" (10-1000mm) |

## 5001 Carbon Fiber Calipers

| Cat. No. | EDP | Outside | Weight | Jaw Depth |
|---|---|---|---|---|
| C5001BZ-40/1000 | 14574 | 0-40" (0-1000mm) | 5.51lb (2.50kg) | 5.906" (150mm) |
| D5001BZ-60/1500 | 14575 | 0-60" (0-1500mm) | 7.28lb (3.30kg) | 7.875" (200mm) |

## 5002 Carbon Fiber Calipers

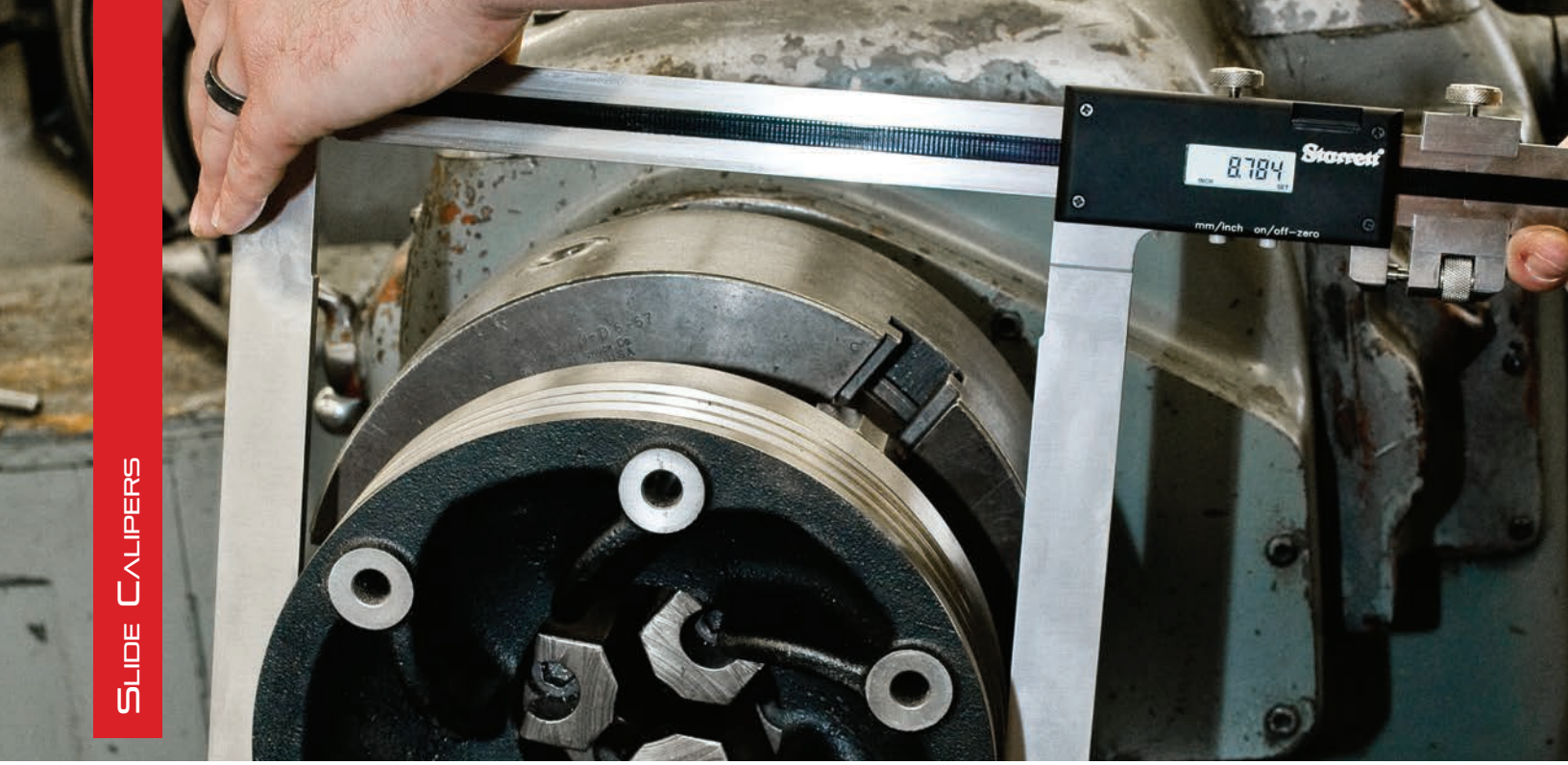
| Cat. No. | EDP | Outside | Weight |
|---|---|---|---|
| 5002BZ-16/400 | 14576 | 0-16" (0-400mm) | 1.65lb (0.75kg) |
| 5002BZ-24/600 | 14577 | 0-24" (0-600mm) | 1.98lb (0.90kg) |
| 5002BZ-40/1000 | 14578 | 0-40" (0-1000mm) | 3.31lb (1.50kg) |

## Accessories for 5002 Carbon Fiber Calipers

| Part No. | EDP | Description |
|---|---|---|
| PT06137 | 12829 | Disc Contacts |
| PT06138 | 12830 | Step Contacts |
| PT06139 | 12831 | Cone Contacts |

## Data Collection

| Part No. | EDP | Description |
|---|---|---|
| 797SCKB | 69890 | Uses cable direct to Computer with Excel |
| 797SCU | 29729 | To Computer running on SPC Data Collection software |



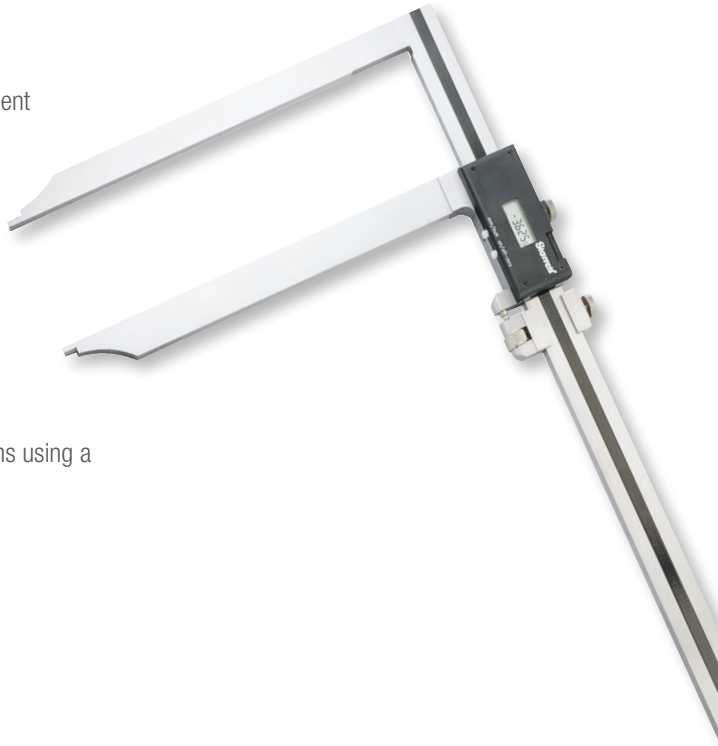

# Electronic Calipers

## 5005 Electronic Long Jaw Calipers

**0-24"/0-600MM**

The 5005 Electronic Calipers are built with extra long, 12" (300mm) jaws ideal for applications requiring precise O.D. or I.D. measurement in tight spaces that standard calipers can not reach.

### Features and Specifications



- Hardened stainless steel construction for long life
- Tight, smoothly fitted slides for maximum accuracy and easy adjustment
- Coolant resistant
- Lock nut to hold measurements
- Fine adjustment thumbwheel
- Inch/mm conversion
- Ability to set ZERO at any position
- Two preset modes to install any reading at any point
- Full-featured, sophisticated electronics with Opto RS232 output
- Ideal for use with Starrett DataSure® Wireless Data Collection Systems using a 1500-3A-1N end node
- Will also transmit to PC through cable
- CR2032 lithium battery included
- Large easy-to-read display with resolution of 0.0005"/0.01mm
- Packed in a wood case
- Computers with Excel use797SCKB
- Computers running SPC Data Collection use 797SCU

| 5005 Electronic Calipers | | | |
|---|---|---|---|
| **Range** | **Jaw Depth** | **Cat. No.** | **EDP** |
| 0-24" (0-600mm) | 12" (300mm) | F5005BZ-24/600 | 14588 |

# Electronic Calipers

## 5006 Electronic Groove Calipers

### Features and Specifications

- Standard Measuring Tip Diameter: .118" (3mm)
- Two Preset Modes
- Hold Feature will freeze the display when it is in preset mode
- On/Off Button
- RS232 port allows data transmission thru a DataSure® Wireless Data Collection System using a 1500-3A-1N End Node. Will also transmit through a connected cable
- CR2032 lithium battery included
- Includes wooden case
- Resolution: 0.0005" (0.01mm)
- Generous diameter and jaw depth capacities
- Ideal for measuring internal and external grooves on large workpieces
- Hardened stainless steel construction
- Coolant resistant
- RS232 output
- Work well with Starrett DataSure® Wireless Data Collection Systems




| 5006 Electronic Groove Caliper | |
|---|---|
| **Cat. No.** | **EDP** |
| 5006BZ-14/350 | 14589 |

| Data Colleciton | | |
|---|---|---|
| **Part No.** | **EDP** | **Description** |
| 797SCKB | 69890 | Uses cable direct to Computer with Excel |
| 797SCU | 29729 | To Computer running on SPC Data Collection software |

| | Specifications | |
|---|---|---|
| | **Groove Measuring Range** | **Max. Depth** |
| **Outside** | 0-12.5" (0-318mm) | 3.937" (100mm) |
| **Inside** | 1.654-15" (42-381mm) | 3.7" (94mm) |

# Dial Calipers

## 120, 120M Dial Calipers

**0-12"/0-300MM**

The Only American Made Dial Caliper …

This is one of the handiest measuring tools available, used by mechanics and toolmakers everywhere. It is direct reading, reliable and accurate.

### Readability Features

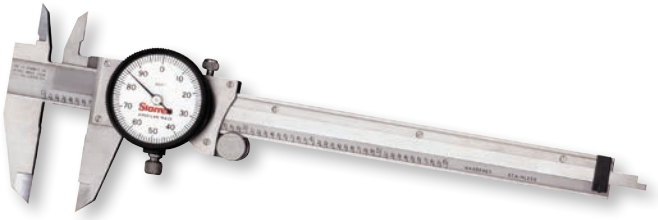
- Sharp, clear dial graduations of .001" or 0.02mm – .100" or 2mm in one revolution
- Sharp, black graduations on the satin finished bar, every .100" or 1mm
- Choice of black, red, or white inch dials; millimeter dials are yellow

### Ease-of-Handling Features

- Knife-edge contacts for both inside and outside measurements
- One hand use with the thumb-operated, fine adjustment roll
- Lock screw for dial bezel and for holding the sliding jaw in position
- Detachable depth rod available for 12" (300mm) model
- Parallel lines can be scribed on a workpiece by setting the caliper jaw to the required dimensions, locking the movable jaw with the lock screw and then using the front edge of the fixed jaw as the scribing surface

### Accuracy and Long-Life Features

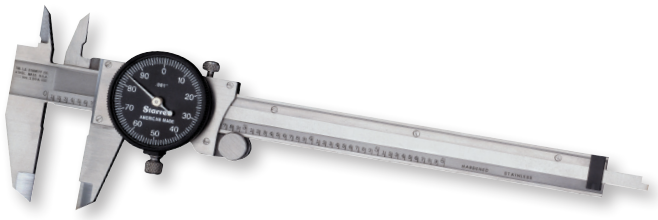
- Long-wearing carbide faces on outside contacts on model 120AX-6 and 120MX-150 only
- Hardened stainless steel bar, measuring surfaces, rack, gears and depth rod
- Positive, split-gear anti-backlash control
- Rack teeth point down to make it easy to shed foreign matter and thereby keep the area clean



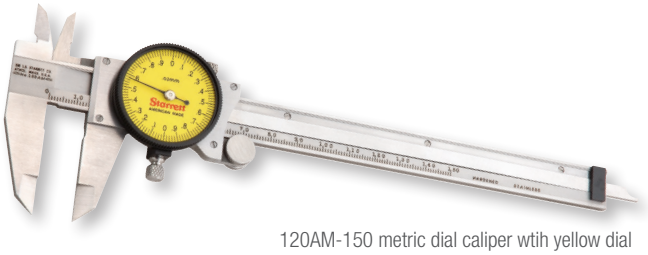
120A-6



R120A-6

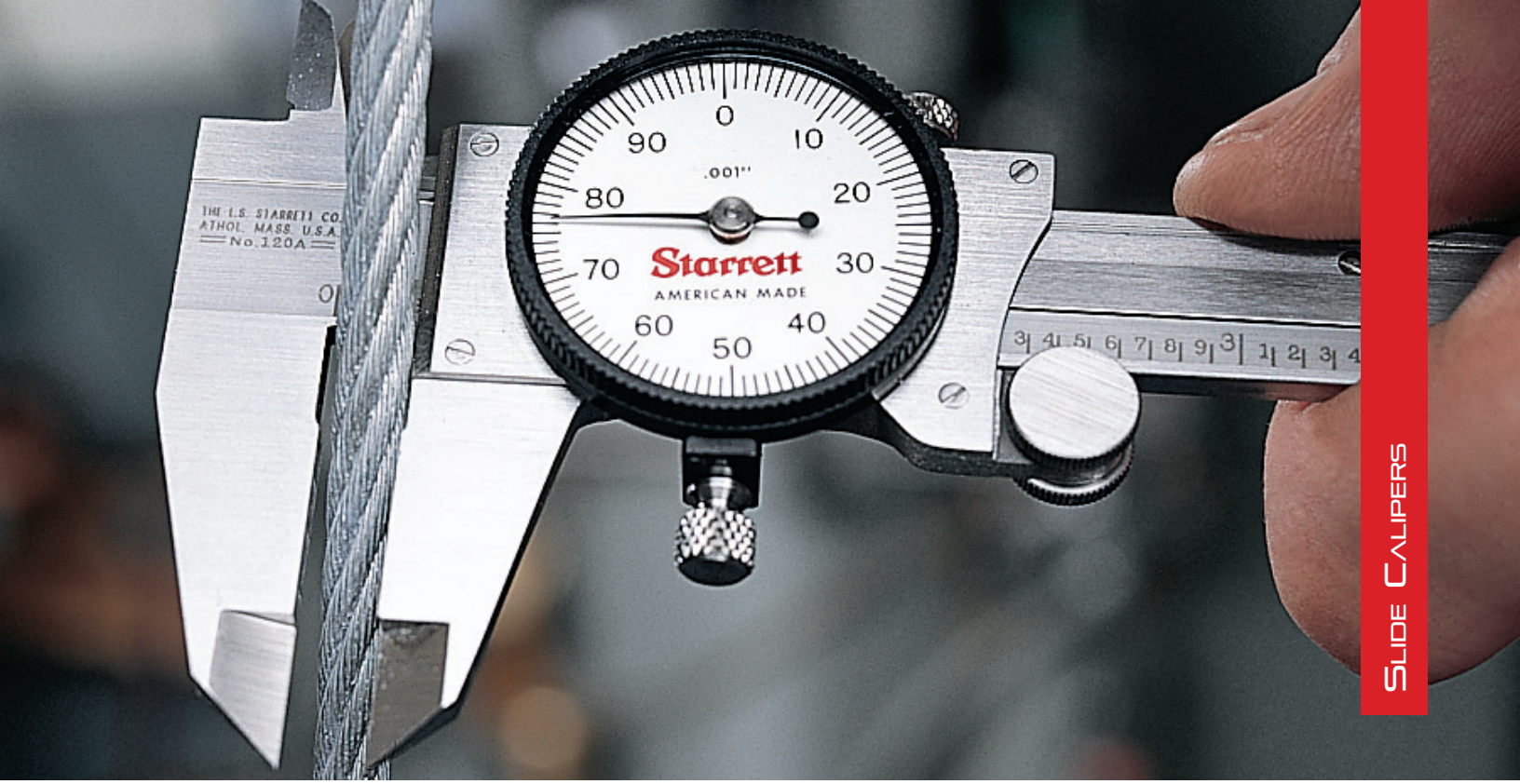


B120A-6



120AM-150 metric dial caliper wtih yellow dial








| 120 Dial Calipers (.001" Graduation) | | | | | | |
|---|---|---|---|---|---|---|
| | | Jaw Depth | | | | |
| Range | Dial Color | Inch | mm | Description | Cat. No. | EDP |
| 0-6" | White | 5/8" | 16mm | Caliper in fitted plastic case | 120A-6 | 64514 |
| | | | | Caliper in fitted plastic case | 120A-6 W/SLC† | 66568 |
| | | 1-1/2" | 38mm | Caliper in fitted plastic case | 120X-6 | 65909 |
| 0-6" | Black | 5/8" | 16mm | Caliper in fitted plastic case | B120A-6 | 64515 |
| | | 1-1/2" | 38mm | Caliper in fitted plastic case | B120A-6 W/SLC† | 66917 |
| 0-6" | Red | 5/8" | 16mm | Caliper in fitted plastic case | R120A-6 | 64516 |
| | | 3/4" | 19mm | Caliper in fitted plastic case | R120A-6 W/SLC† | 66918 |
| 0-9" | White | 5/8" | 16mm | Caliper in finished Wood case | 120AZ-9 | 64520 |
| | | 1-1/2" | 38mm | Caliper without Case | 120A-9 | 64517 |
| 0-12" | White | 3/4" | 19mm | Caliper in finished Wood case | 120Z-12 | 56693 |
| | | | | Caliper in finished Wood case | 120Z-12 W/SLC† | 66569 |
| | | 2-1/2" | 63mm | Caliper without Case | 120-12 | 56694 |
| | | | | Caliper without Case | 120-12 W/SLC† | 66919 |
| **120M Dial Calipers (0.02mm Graduation)** | | | | | | |
| 0-150mm | Yellow | | 16mm | Caliper in fitted plastic case | 120AM-150 | 66295 |
| | | | 38mm | Caliper, without case | 120AM-150 W/SLC† | 66920 |
| | | | | Caliper in fitted plastic case | 120MX-150 | 65910 |
| 0-225mm | Yellow | | 16mm | Caliper in wood case | 120MZ-225 | 64508 |
| | | | 38mm | Caliper without case | 120M-225 | 64509 |
| 0-300mm | Yellow | | 19mm | Caliper in wood case | 120MZ-300 | 64510 |
| | | | | Caliper in wood case | 120MZ-300 W/SLC† | 66922 |
| | | | 63mm | Caliper without case | 120M-300 | 64511 |
| | | | | Caliper without case | 120M-300 W/SLC† | 66921 |

| Accessories and Cases Only for 120 and 120M Dial Calipers | | |
|---|---|---|
| Description | Cat. No. | EDP |
| Center distance attachment* | PT26151 | 64440 |
| Depth attachment for 6", 9" and 150mm calipers | PT22431 | 64640 |
| Detachable depth rod for 12" calipers | PT26091 | 65100 |
| Deluxe padded case for 6" (150mm) calipers | 943 | 55971 |
| Finished wood case for 9" (225mm) calipers | 950 | 63878 |
| Finished wood case for 12" (300mm) calipers | 946 | 56695 |
| Leather holster for 6" (150mm) calipers | 915 | 64166 |

† Includes redemption card for Standard Letter of Certification (SLC).
* See details in this section.

# Dial Calipers

## 1202 Dial Calipers

### 0-12"

With the ability to provide quick, accurate measurement of O.D., I.D. and depth, the dial caliper is the most versatile precision hand tool on the market.

1202 Dial Calipers are based on the caliper that has been the first choice of metal working professionals for decades. 1202 Dial Calipers are available in 4", 6", 8" and 12" versions.

#### Readability Features

- Sharp, clear dial graduations of .001" with .100" per revolution (except for the 1202F Model – see below)
- Sharp, black graduations on the satin finished bar, every .100"

#### Ease-of-Handling Features

- Knife-edge contacts
- Thumb-operated fine adjustment roll
- Adjustable bezel
- Lock screws for sliding jaw and dial bezel

#### Accuracy and Long-Life Features

- Hardened stainless steel bar, measuring surfaces, rack, gears and depth rod
- Positive, spring-loaded double pinion anti-backlash control
- Fitted case

| 1202 Dial Calipers | | |
|---|---|---|
| **Range** | **Cat. No.** | **EDP** |
| 0-4" | 1202-4 | 68814 |
| 0-6" | 1202-6 | 66964 |
| 0-8" | 1202-8 | 66979 |
| 0-12" | 1202-12 | 66980 |
| **1202F Dial Calipers** | | |
| **Range** | **Cat. No.** | **EDP** |
| 0-6" Fractional | 1202F-6 | 68931 |
| 0-8" Fractional | 1202F-8 | 69757 |
| 0-12" Fractional | 1202F-12 | 69758 |



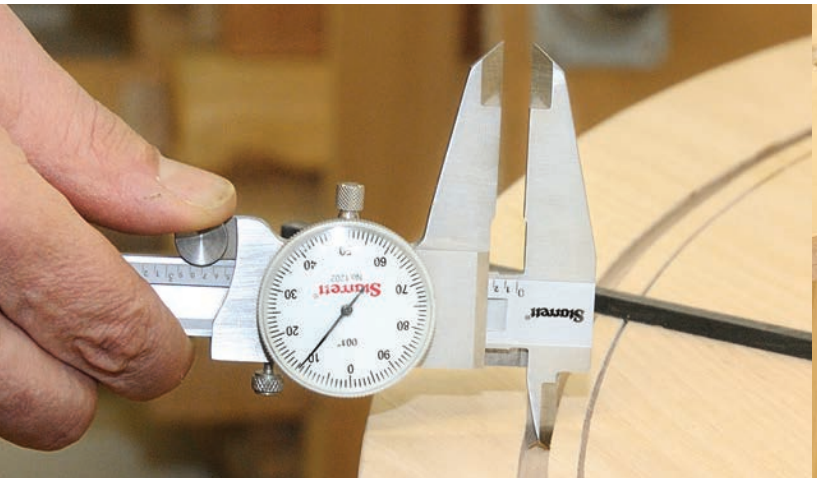

## 1202F Fractional Dial Calipers

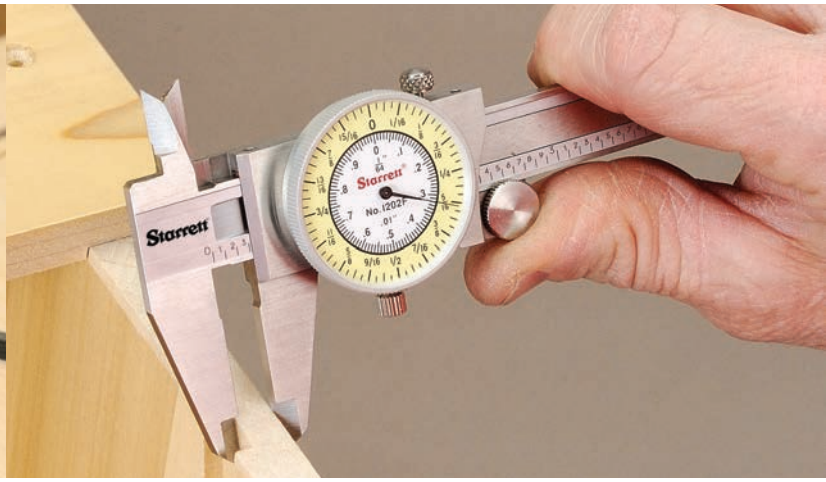
### 0-12"

The 1202F shows measurements as fractions on the yellow outer scale with 1/64th inch graduations, and decimal measurements on the white inner scale with 1/100th inch graduations.

#### Features

- 1/64" graduations on the yellow outer scale, and .01" on the white inner scale.
- Except for dial graduation and color, 1202F Calipers have the same features as other 1202 Dial Calipers





# Dial Calipers

## 120B, 120MB Dial Calipers with Long Nib Jaws

### 0-12"/0-300MM

This tool is a direct reading caliper with 3" (75mm) long jaws, ideal for heavy duty use and for gaining access to more measuring area than with conventional calipers. Strong inside and outside nibs measuring from zero for outside measuring and from .300" or 8mm for inside measuring.

## 120J Offset Dial Caliper

### 0-6"

This tool has an adjustable jaw for versatility when measuring different planes that can't be reached with a regular caliper. The reference jaw is adjustable in height to be either longer or shorter than the sliding jaw. All other features are the same as our 120 Dial Caliper.

- Adjustable jaw – 3-1/2" (88mm) long
- Extends up to 5/8" (16mm) longer than the sliding jaws
- Caliper in deluxe padded case

## Center Distance Attachment

### PT26151

A set of two jaws with body sizes of .400" and conical points, enabling the user to measure the center distance between holes or center-punched locations that are at least .400" apart and less than .400" in diameter.

- Can be used with metric calipers by setting the caliper to 10.16mm
- Will fit Starrett 797, 798 and 120, 6" through 12", 123, 6" through 24", and 1202, 4" through 12" sizes

**120B and 120MB Dial Calipers with Long Nib Jaws**

| Cat. No. | EDP | Range | Dial Color |
|---|---|---|---|
| 120B-12 | 65067 | 0-12" | White |
| 120MB-300 | 65154 | 0-300mm | Yellow |
| 120MB-300 W/SLC* | 66923 | | |

* Includes redemption card for Standard Letter of Certification (SLC).

**120J 0-6" Offset Dial Caliper**

| Cat. No. | EDP |
|---|---|
| 120JZ-6 | 65866 |

**Center Distance Attachment**

| Cat. No. | EDP |
|---|---|
| PT26151 | 64440 |



120B-12



120JZ-6



PT26151

# Vernier Calipers

## 123, 123M, 123EM Master Vernier Calipers

### 0-72" AND 0-24"/0-600MM

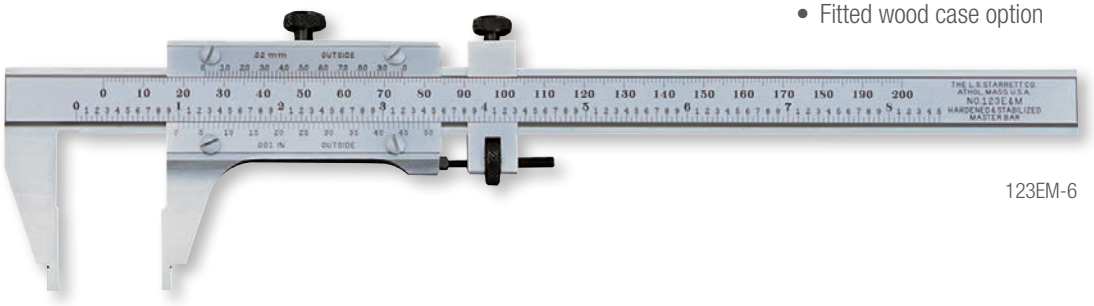
Ultimate example of slide caliper design. It is more accurate, has the easiest reading vernier style, is stronger and offered in much longer lengths than other slide calipers.

### Readability Features

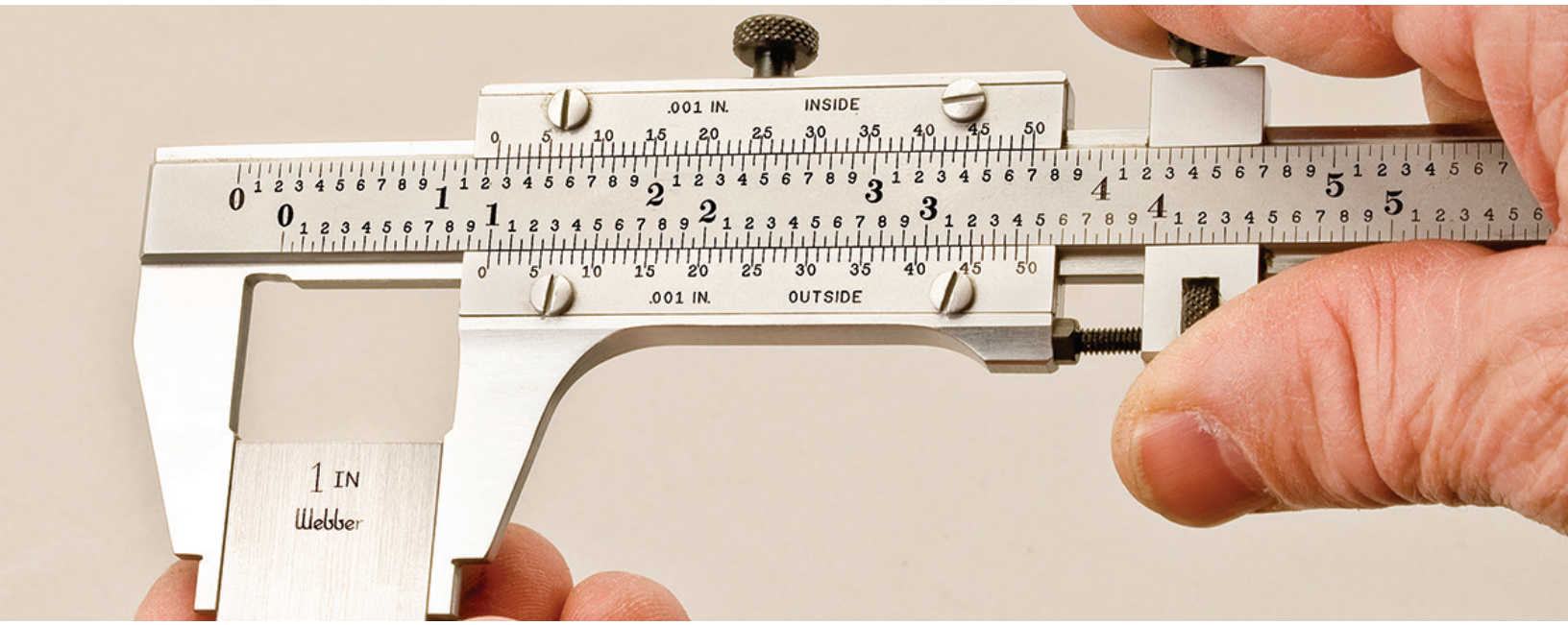
- Long 50-division vernier scales permit half as many bar graduations as conventional single-vernier tools. These widely-spaced graduations make it easy to read to .001" or 0.02mm
- The open-face design of the slide allows both the inside and outside vernier scale on the same side, thus allowing both verniers to be read without turning the tool over
- Black lines and figures against the Starrett satin chrome finish make reading a pleasure, not an effort
- Screw-type adjusting nut allows for fine measuring adjustments and lock nut holds measurements

### Long-Life and Accuracy Features

- Fine tool steel construction makes the jaws harder and longer-wearing than stainless tools. All tools through 24" (600mm) also have hardened and stabilized bars.
- Hardened, ground and lapped measuring surfaces
- Machine divided graduations for accuracy
- The combination straight and angular ways on the master bar allow for positive alignment of graduations and easy adjustment of the flush-fitting verniers
- Sizes through 24" have divider points on the back side to accurately set dividers and trammels
- Tools with inch and millimeter graduations on the same bar have outside readings only. (Inside readings must be compensated for by adding the nib width to the indicated reading.)
- The longer length of the adjusting jaw slide provides a longer bearing surface on the master bar, ensuring squareness with the solid jaw and extra resistance to springing
- Tight, smoothly fitted slides for maximum accuracy and easy adjustment
- Fitted wood case option



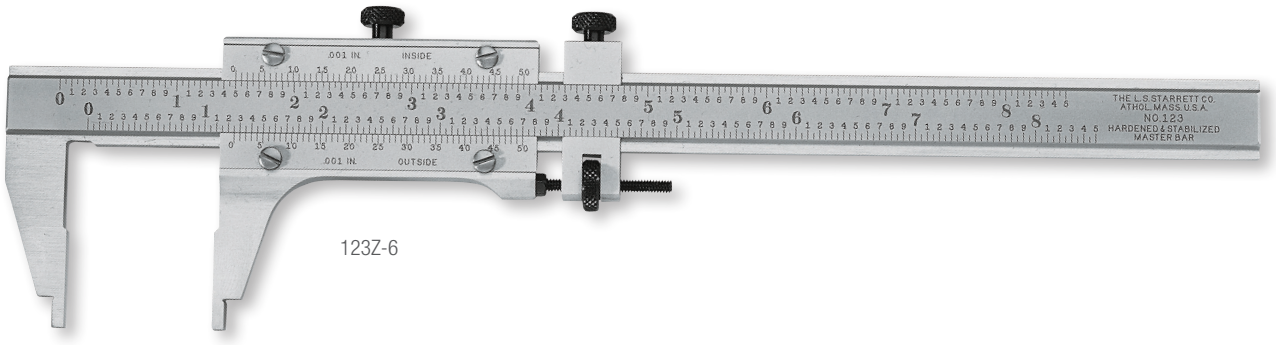
123EM-6



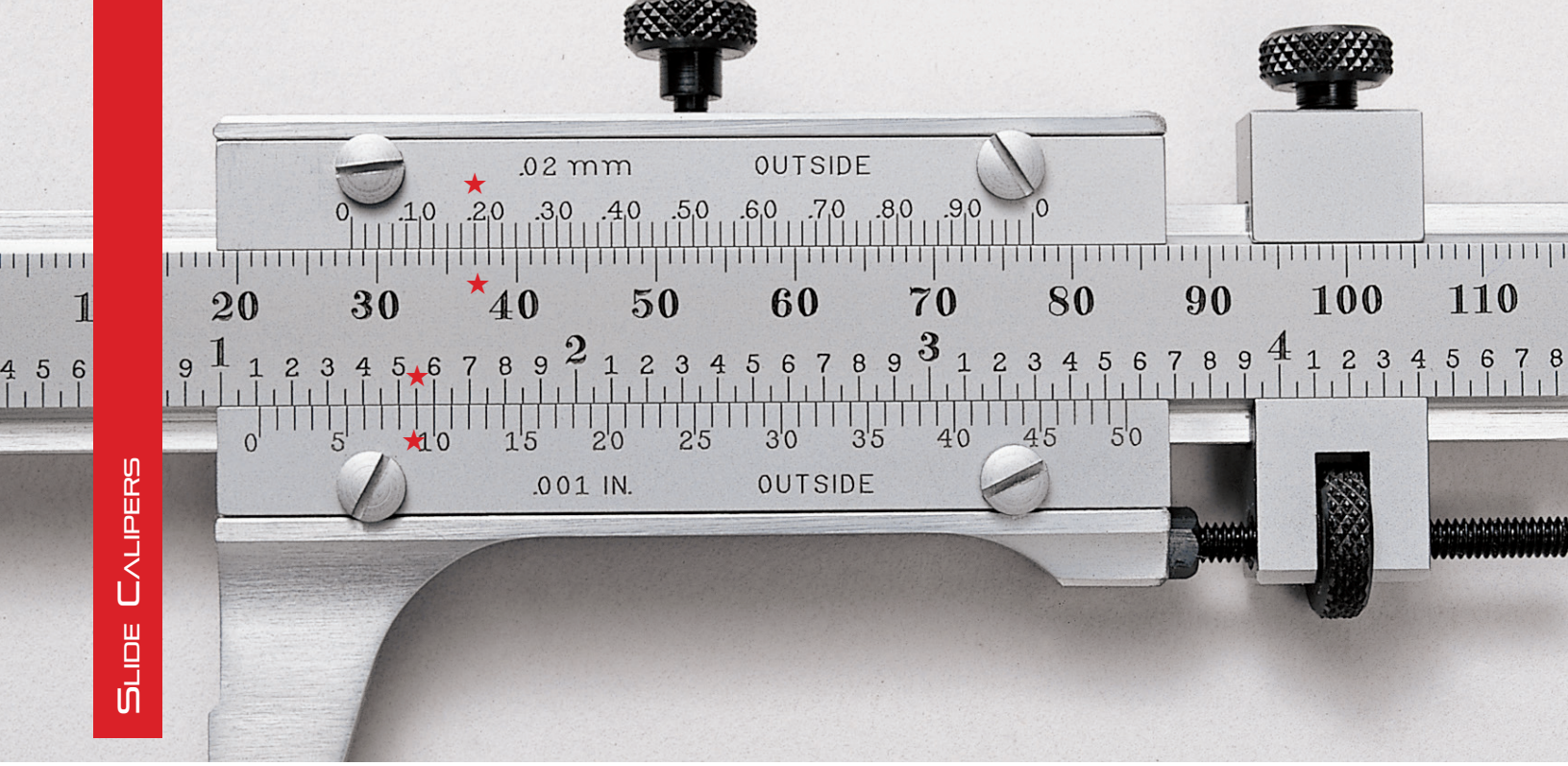
| 123 Master Vernier Calipers (.001" Graduation) | | | | | |
|---|---|---|---|---|---|
| **Range** | **Bar Width** | **Approx. Jaw Depth** | **Max. Nib Width Closed** | **Cat. No.** | **EDP** |
| 0-6" | 11/16" | 1-9/16" | .250" | 123Z-6 | 50524 |
| | | | | 123Z-6 W/SLC* | 66925 |
| | | | | 123-6 | 50525 |
| | | | | 123-6 W/SLC* | 66926 |
| 0-12" | 15/16" | 2-5/16" | .300" | 123Z-12 | 50526 |
| | | | | 123Z-12 W/SLC* | 66927 |
| | | | | 123-12 | 50527 |
| | | | | 123-12 W/SLC* | 66928 |
| 0-24" | 15/16" | 2-5/16" | .300" | 123Z-24 | 50528 |
| 0-36" | 1-3/8" | 3" | .500" | 123Z-36 | 50530 |
| 0-48" | 1-3/8" | 3" | .500" | 123Z-48 | 50532 |
| 0-60" | 2-1/2" | 4-1/2" | .750" | 123Z-60 | 64383 |
| | 1-3/8" | 3" | .500" | L123Z-60‡ | 63189 |
| 0-72" | 2-1/2" | 4-1/2" | .750" | 123Z-72 | 64374 |
| | 1-3/8" | 3" | .500" | L123Z-72‡ | 63190 |
| **123M Master Vernier Calipers (0.02mm Graduation)** | | | | | |
| 0-150mm | 17.46mm | 40mm | 6.4mm | 123M-150 | 56099 |
| 0-300mm | 23.81mm | 58mm | 7.6mm | 123MZ-300 | 56102 |
| | | | | 123M-300 | 56101 |
| 0-600mm | 23.81mm | 58mm | 7.6mm | 123MZ-600 | 56104 |
| **123EM Master Vernier Calipers (.001" and 0.02mm Graduation)** | | | | | |
| 0-6" (150mm) | 11/16" (17.46mm) | 1-9/16" (40mm) | .250" (6.35mm) | 123EMZ-6 | 50534 |
| | | | | 123EM-6 | 50535 |
| 0-12" (300mm) | 15/16" (23.81mm) | 2-5/16" (58mm) | .300" (7.62mm) | 123EMZ-12 | 50536 |
| | | | | 123EM-12 | 50537 |
| 0-24" (600mm) | 15/16" (23.81mm) | 2-5/16" (58mm) | .300" (7.62mm) | 123EMZ-24 | 50538 |

| For Inside Measurements on 123M and 123EM Master Vernier Calipers | | |
|---|---|---|
| **Cat. No.** | **Range** | **Add Nib Thickness Below to Caliper Reading** |
| 123 E and M | 0-6" or 150mm | .250" (Inch) or 6.35mm (Metric) |
| 123 E and M | 0-12" or 300mm | .300" (Inch) or 7.62mm (Metric) |
| 123 E and M | 0-24" or 600mm | .300" (Inch) or 7.62mm (Metric) |

‡ Lightweight versions weigh approximately 10lb for the 60" model and 12lb for the 72" model. Regular 60" model weighs approximately 32 lb and the regular 72" weighs approximately 36lb
Other sizes available on special order – priced on application. Special jaws priced on application.
Hardened Bars on 6", 12" and 24" models: these models are also furnished with center points for dividers.
* Includes redemption card for Standard Letter of Certification (SLC).




123Z-6




## How to Read a Starrett 50-Division Vernier Caliper Gage

### GRADUATED IN INCHES AND MILLIMETERS (DIRECT READING)

#### Inch Reading

- Refer to the lower bar graduations and the inch vernier plate. Inches are numbered in sequence over the full range of the bar. Every second graduation between the inch lines is numbered and equals .100". Each bar graduation is .050"
- The vernier plate is divided into 50 parts, each representing .001". Every fifth line is numbered – 5, 10, 15, 20 … 45, 50 – for easy counting
- To read the gage, first count how many inches and how many .050" lines lie between the zero line on the bar and the zero line on the vernier plate and add them
- Then count the number of graduations on the vernier plate from its zero line to the line that coincides with a line on the bar. Multiply the number of vernier plate graduations you counted by .001" and add this figure to the number of inches and .050" lines you counted on the bar. This is your total reading

#### Example

★ In the photo, the vernier plate zero line is one inch (1.000") plus .100" beyond the zero line on the bar, or 1.100". The 9th graduation on the vernier plate coincides with a line on the bar (as indicated by stars). 9 x .001" (.009") is therefore added to the 1.100" bar reading, and the total reading is 1.109"

#### Millimeter Reading

- Refer to the upper bar graduations and millimeter vernier plate. Each bar graduation is 1.00mm. Every tenth graduation is numbered in sequence – 10mm, 20mm, 30mm, 40mm, etc. – over the full range of the bar. This provides for direct reading in millimeters
- The vernier plate is divided into 50 parts, each representing 0.02mm. Every fifth line is numbered in sequence – 0.10mm, 0.20mm, 0.30mm … 0.80mm, 0.90mm – providing for direct reading in hundredths of a millimeter
- To read the gage, first count how many millimeters lie between the zero line on the bar and the zero line on the vernier plate
- Then find the graduation on the vernier plate that coincides with a line on the bar and note its value in hundredths of a millimeter. Add the vernier plate reading in hundredths of a millimeter to the number of millimeters you counted on the bar. This is your total reading

#### Example

★ In the photo, the vernier plate zero line is 28 millimeters beyond the zero line on the bar, and the 0.18mm graduation on the vernier plate coincides with a line on the bar (as indicated by stars). 0.18 millimeters is therefore added to the 28mm bar reading, and the total reading is 28.18 millimeters

# Vernier Calipers

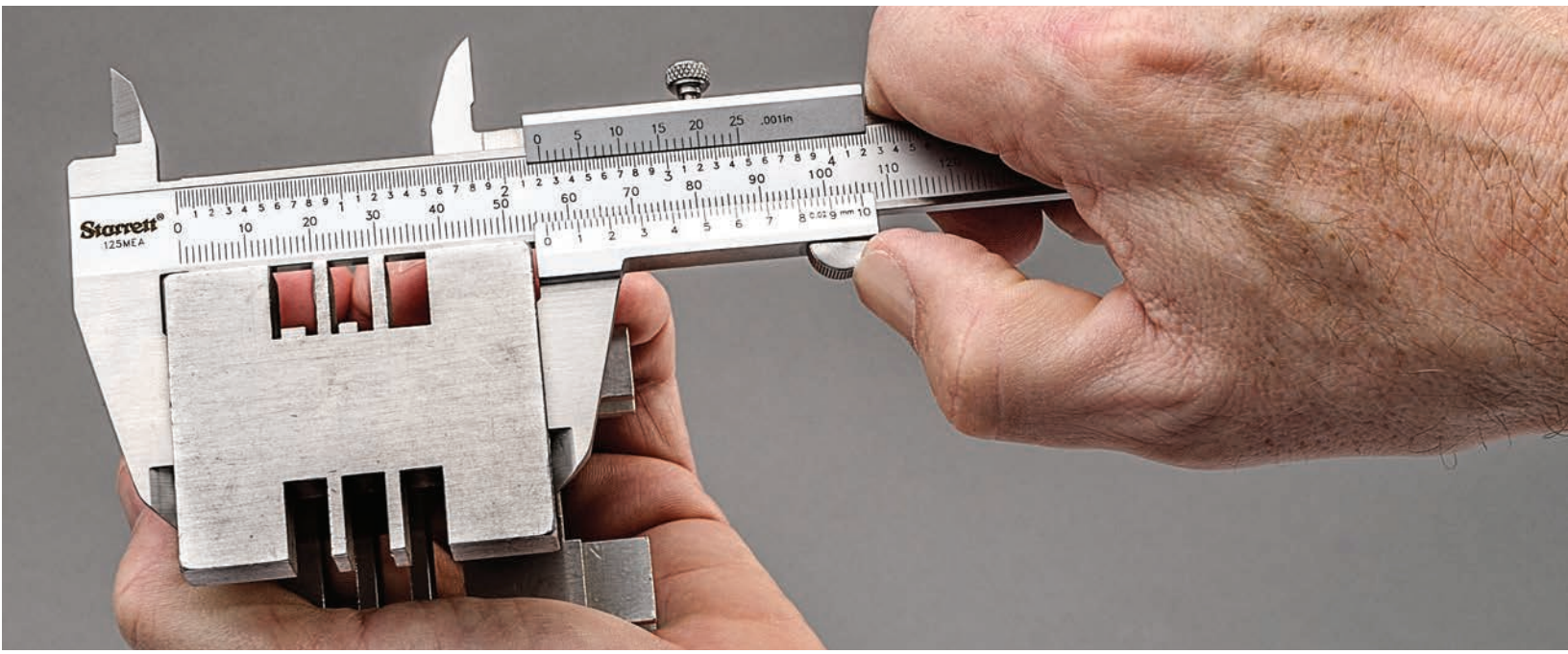
## 125 Vernier Calipers

### 0-12"/0-300MM

- High quality, basic vernier caliper that offers inch and metric measurement
- Lock screw for sliding jaw
- Hardened stainless steel depth rod
- Graduations: .001" inch, 0.020mm metric
- Sharp, black graduations on the satin finished bar
- Fitted plastic case



| 125 Vernier Calipers | | |
|---|---|---|
| Range | Cat. No. | EDP |
| 0-6" (0-150mm) | 125MEA-6/150 | 61660 |
| 0-8" (0-200mm) | 125MEA-8/200 | 61882 |
| 0-12" (0-300mm) | 125MEA-12/300 | 61886 |



# Vernier Calipers

## 456 Gear Tooth Vernier Calipers

### 20-2 DIAMETRAL PITCH

## 456M Gear Tooth Vernier Calipers

### 1-1/4-25MM MODULE

The 456 Gear Tooth Vernier Caliper is designed to measure in .001" or 0.02mm the thickness of gear teeth at the pitch line (the chordal thickness of the teeth) using the distance from the top of a tooth to the chord. For the same purpose, it can also be used for measuring hobs, form and thread tools, etc.

The thickness of a tooth at the pitch line is measured by an adjustable jaw after the addendum is set by the adjustable tongue. Each of these is adjusted independently by screws on the graduated bars.

| Graduation – .001" | | |
|---|---|---|
| **Range** | **Cat. No.** | **EDP** |
| 20-2 Diametral Pitch | 456AZ | 52420 |
| | 456A | 52422 |
| 10-1 Diametral Pitch | 456BZ | 52424 |
| | 456B | 52426 |
| **Graduation – 0.02mm** | | |
| 1-1/4-12mm Module | 456MAZ | 52421 |
| | 456MA | 52423 |
| 2-1/2-25mm Module | 456MBZ | 52425 |
| | 456MB | 52427 |

Available with carbide measuring surfaces on special order. Available with attractive, protective case – sent with case unless otherwise ordered. Packed one in a box.

### For Tool Operation:

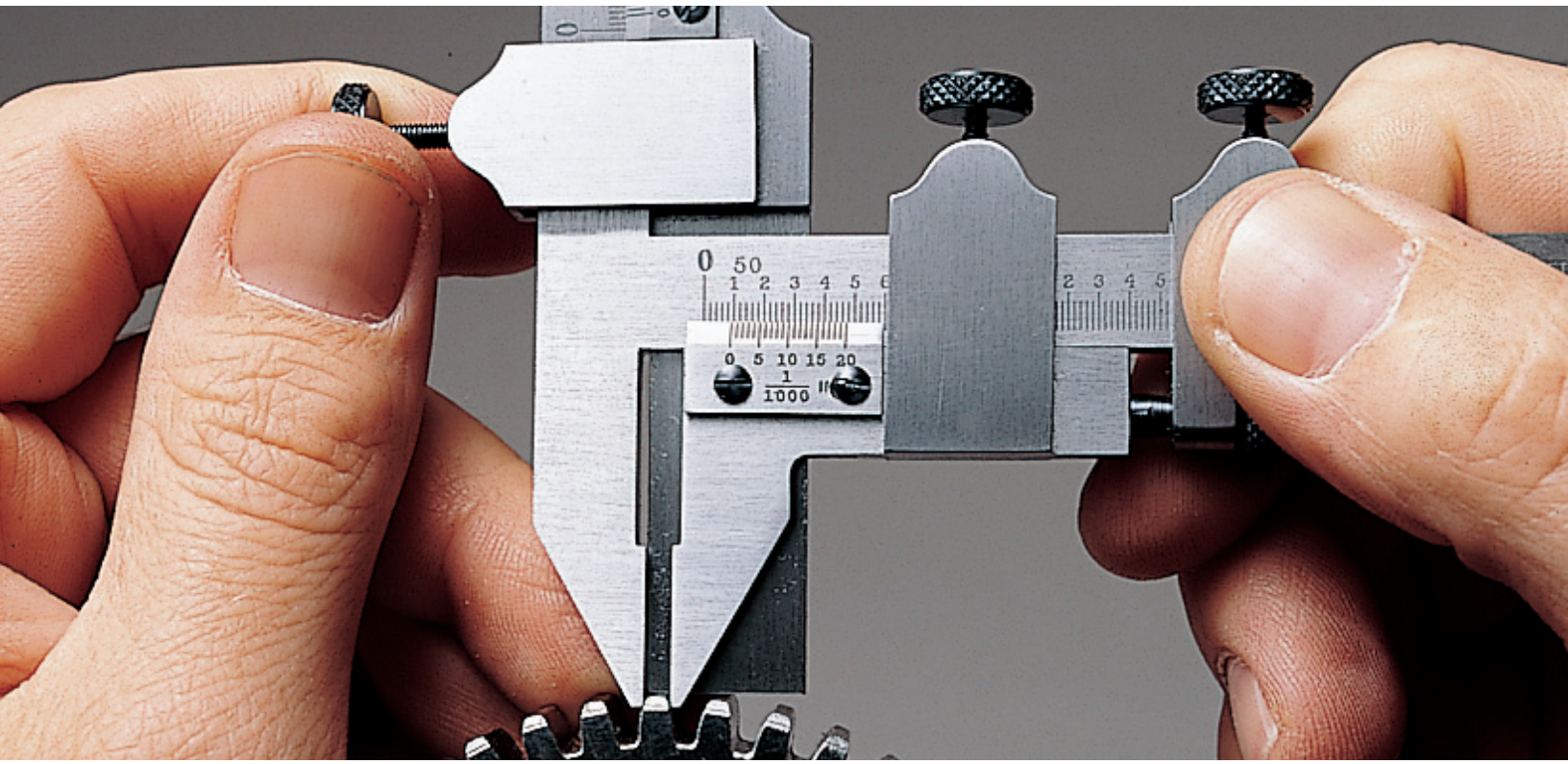
a. Find on the chart, furnished with the tool, the number of teeth of the gear in question, and find the corrected addendum (s"). This figure is for one diametral pitch for inch measure, so divide it by the diametral pitch number – this figure is also for a one millimeter module for metric measure, so multiply it by the required module number. This gives a corrected addendum for this particular number of teeth.

b. Next, measure the actual outside diameter of the gear and add or subtract one-half the difference between the theoretical gear diameter and actual measured gear diameter from the corrected addendum (s") found in the first step.

c. Set the new calculated addendum figure on the adjustable tongue of the tool.

d. Now, with the tongue on the top of the tooth, measure the chordal thickness with the horizontal vernier jaw and compare with the figure in the "t" column in the chart.

e. All inch graduations are read to .001". However the 456A is graduated by .020" increments and the 456B is graduated by .025" increments. 456MA and 456MB are read to 0.02mm and graduated by 0.5mm increments.



# Vernier Calipers

## 1223 Special Master Dial Indicator Vernier Calipers

**2-48"**

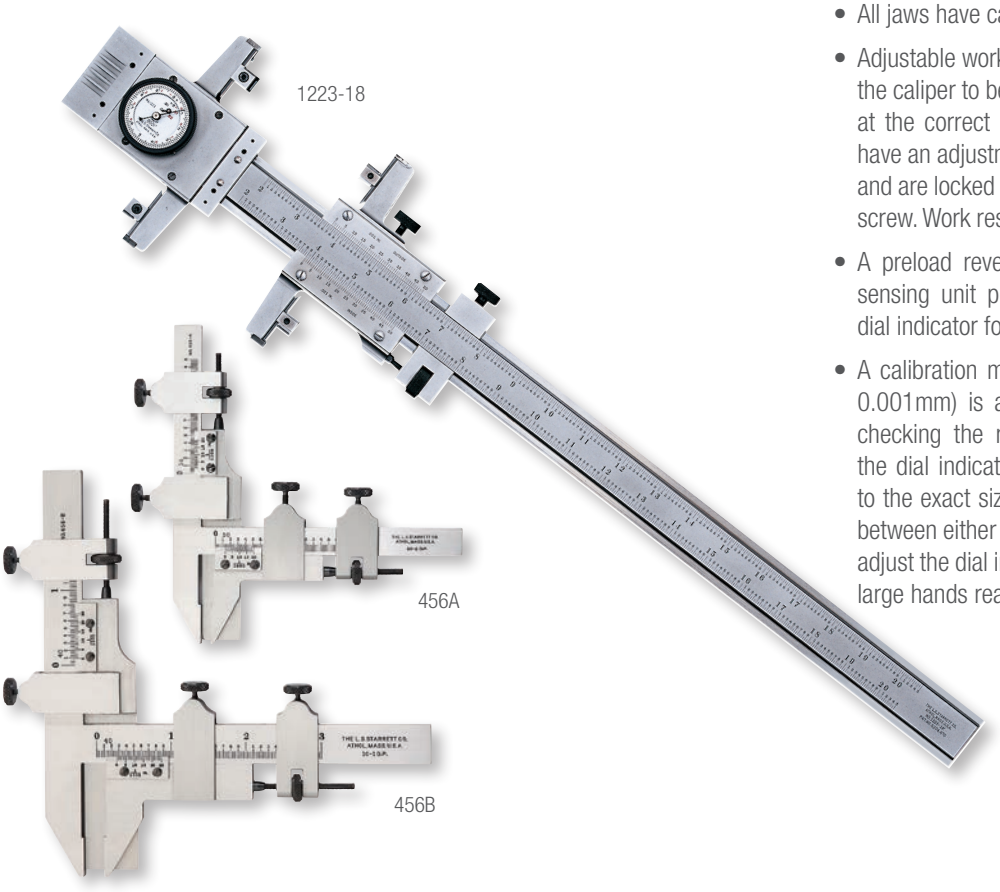
## 1223M Special Master Dial Indicator Vernier Calipers

**50-900MM**

The 1223 are so versatile that we make some models available as standard. However, special vernier tools like these can be built to your specifications by application through our Special Gage Department. The tool eliminates the need for skilled operator "feel" because it automatically sets in the correct gaging pressure.

| Range | Vernier Graduation | Dial Gage Head Grad. | Dial Gage Head Range | Work Rest Adjustment | Cat. No. | EDP |
|---|---|---|---|---|---|---|
| **Inch Reading** | | | | | | |
| 2-18" | .001" | .0001" | ±.020" | 1/8-1" | 1223-18 | 56137 |
| 2-24" | | | | | 1223-24 | 56138 |
| 2-36" | | | | | 1223-36 | 56139 |
| 2-48" | | | | | 1223-48 | 56140 |
| **Millimeter Reading** | | | | | | |
| 50-450mm | 0.02mm | 0.01mm | ±1mm | 3-25mm | 1223M-450 | 64366 |
| 50-600mm | | | | | 1223M-600 | 64382 |
| 50-900mm | | | | | 1223M-900 | 64373 |

Available with finished wood case – sent without case unless otherwise ordered. Calibration master available at extra charge. Packed one in a box.

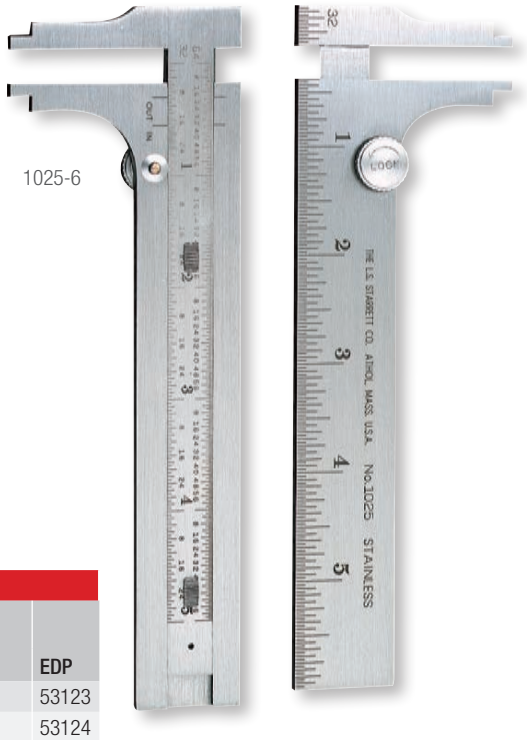



- Tool has the basic Starrett 123 Master Bar with all of its advantages
- The slide and the dial gage sensing unit have inside and outside measuring jaws
- Direct outside and inside measurements in .001" (or 0.02mm) are read from the vernier after the indicator is zeroed. Out-of-roundness can be checked within .0001" (or 0.01mm) using the dial gage
- The dial gage head or sensing unit has a slide mounted on preloaded ball bearings at the end of the caliper bar. Movement of the jaws on the sensing unit actuates a dial indicator graduated in .0001" (or 0.01mm) with one complete revolution reading .010" (or 1mm). The indicator has a total range of ±.020" (or ±1mm), each .010" indicated by a telltale hand. Plus graduations are shown in black and minus graduations are shown in red. The indicator can be set to zero by a fine adjustment screw or by the bezel.
- To use the caliper as a comparator, the vernier slide is set to the desired dimension and clamped. Plus or minus variations, outside or inside, are then read directly from the dial indicator
- All jaws have carbide measuring faces
- Adjustable work rests attached to the jaws permit the caliper to be placed on the work with the jaws at the correct measuring depth. The work rests have an adjustment range from 1/8-1" (3-25mm) and are locked in the desired position by a locking screw. Work rests are carbide-faced for long wear
- A preload reversing switch on the back of the sensing unit permits instant changeover of the dial indicator for outside or inside readings
- A calibration master accurate to ±.000050" (or 0.001mm) is also available at extra charge for checking the relation between the vernier and the dial indicator zero. To check, set the vernier to the exact size of the master, place the master between either the "inside" or "outside" jaws, and adjust the dial indicator so that both the small and large hands read zero

# Pocket Calipers

## 1025, 1025ME Stainless Steel Pocket Slide Calipers

### INCH READING 5", 6"/INCH AND MILLIMETER READING 5"/130MM




These handy tools permit quick, accurate outside and inside measurements. Their compact size fits easily in shop coat pockets. Calipers are made of fine quality stainless steel.

- Readings are made directly from the two lines marked "in" and "out" on one side of the stock
- Handy inch or millimeter scale on the back of the stock
- Knurled thumb pieces to activate the slide and slide stop prevents tool from being disassembled
- Knurled clamp screw with a left hand thread for easy one-hand operation
- Straight measuring surface for outside measuring and rounded nibs for inside or hole measurements

| 1025 Stainless Steel Pocket Slide Calipers | | | | | | | | |
|---|---|---|---|---|---|---|---|---|
| | Range | | Depth of | Width of | Graduations | | | |
| Size | Outside | Inside | Jaws | Nibs Closed | Slide | Stock | Cat. No. | EDP |
| 5" | 0-3-3/4" | 1/4-4" | 1-3/8" | 1/4" | 32nds and 64ths | 32nds | 1025-5 | 53123 |
| 6" | 0-4-3/4" | 1/4-5" | 1-3/8" | 1/4" | 32nds and 64ths | 32nds | 1025-6 | 53124 |
| **1025ME Stainless Steel Pocket Slide Calipers** | | | | | | | | |
| 5" (130mm) | 0-3-3/4" (0-96mm) | 1/4-4" (6–100mm) | 1-3/8" or 36mm | .236" or 6mm | 64ths and 1/2mm | mm | 1025ME-130 | 65860 |

| Cases for 1025 and 1025ME Pocket Slide Calipers | | |
|---|---|---|
| Description | Cat. No. | EDP |
| 5" and 130mm Vinyl Case | 1025ZZ-5 | 55269 |
| 6" Vinyl Case | 1025ZZ-6 | 55270 |

## 424 Stainless Steel Pocket Slide Calipers

### 3-1/2"

This extremely handy caliper gives direct readings of both circumference and diameter in a single setting.



- Especially useful for obtaining instant circumference and diameter measurements of rope, cordage, metal rods, pipe, tubing, etc. and for checking cutting speeds on lathe work
- 1-3/8" deep jaws will caliper a cylinder up to 2-3/4" diameter
- The upper edge of the slide is graduated from 0 to 11 circumference inches in 16ths and the lower edge

| 424 Stainless Steel Pocket Slide Caliper and Circumference Gage | | | | | | | |
|---|---|---|---|---|---|---|---|
| | Range | | Graduations | | | | |
| Size | Dia. | Circumference | Dia. | Circumference | Depth of Jaws | Cat. No. | EDP |
| 3-1/2" | 0-3-1/2" | 0-11" | 32nds | 16ths | 1-3/8" | 424 | 51527 |

Cutting Speed in Feet per Minute = Circumference divided by 12 x Revolutions per Minute



# HEIGHT GAGES

# Electronic Height Gages

## 2000 Altissimo® Electronic Height Gages

**0-24"/600MM**

Altissimo® Electronic Height Gages are innovative, easy-to-use, and loaded with Starrett-exclusive functions for easy-to-program measuring routines that run smoothly and reliably.




### Features

- A unique, ergonomically shaped base, hardened and ground, that fits your grip just right to easily move the gage and press the hot key
- Hot key allows you to select measuring results on the fly
- 0-24" Measuring Range
- Smart probe that can measure I.D. or O.D. without attachments
- Electronically adjusted probe force
- Large, easy-to-read interactive LCD with unique scanning meter for monitoring probe position
- Electronically adjustable beeper volume
- Bold screen icons indicate the current routine
- Three electronically adjustable resolutions
- Retains the last calibrated diameter of the measuring probe, even after the gage is shut down
- Dynamic bi-directional probing with point and scan modes
- Easy operation with speed wheel, which also has fine-adjust feature
- Locking mechanism for scribing
- Five measurement modes: (ID/OD, Center, TIR, Max/Min, Continuous Display)
- Instant inch/millimeter conversion
- Two selectable Datums and Presets
- Auto Power Off after two hours with retention of probe calibration
- Automatic calculation of eight measurement routines:
  - Center
  - Diameter
  - Height
  - Max
  - Min
  - TIR
  - Distance to last feature
  - Distance between last two points
- Rechargeable NiMH batteries with 100 hours of continuous life
- Seven setup functions:
  - Probe Calibration (2)
  - Beeper Volume
  - Display Resolution
  - Probe Force Adjustment
  - Printer On/Off
  - Force Calibration
- Optional probe kit features a variety of probes for many applications
- Gages include carbide probe, probe holder and probe calibration block
- RS232 data output port
- Starrett capacitive measurement system ensures the accuracy and reliability you expect
- Excellent value – loaded with features and competitively priced



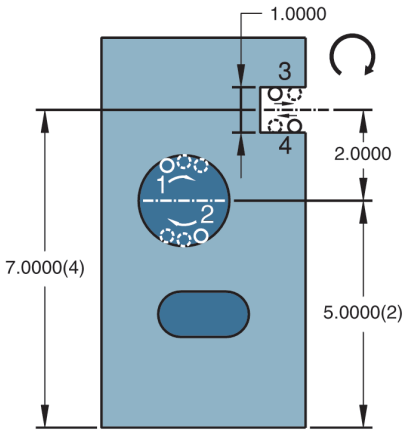

Large, easy-to-view /understand display shows the diameter of a hole or boss



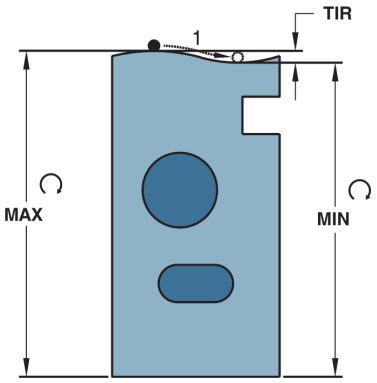

Display showing TIR



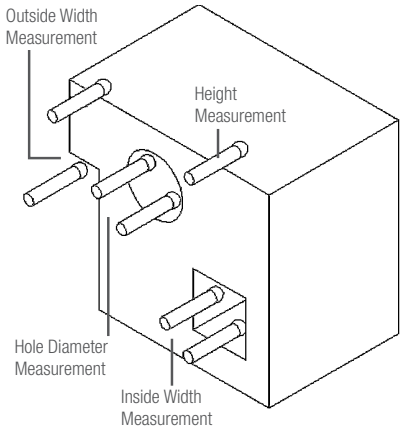

Interactive LCD with unique scanning meter for easy probe position viewing




Altissimo includes many routines including diameter of a bore (1 and 2), width of a slot or a rib (3 and 4), distance from datum to center of a hole or slot and distance between features




TIR mode can measure the high or low point of a diameter or other surface. The datum can then be set to the max or min value.







| Specifications: | |
|---|---|
| Measuring Range | 24"/600mm (Extendible to 30"/750mm by rotating the probe holder 180º) |
| Resolution | .0001"/.0005"/.001" (0.002mm/0.01mm/0.02mm) |
| Accuracy | ±.0003" (0.008mm) |
| Repeatability | ±.0002" (±0.002mm) |
| Power Source | NiMH Rechargeable Batteries (120V AC/60Hz Charger/Adaptor included). Operation time: 100+ hours, Recharging time: 10 hours |
| Included | .1875"/4.8mm Dia. Carbide Probe, Probe Holder |
| Accessories | AC Charger/Adaptor, Probe Calibration Block |
| Dimensions | Length 11" (279mm), Width 7-3/4" (197mm), Height 36-1/2" (927mm) |
| Weight | 40 lb (18 kg) |
| Perpendicularity | .0004" (0.010mm) |

# Electronic Height Gages

## Altissimo® Electronic Height Gages






Contact Wrench, PT27952



Optional Circular Carbide Scriber, PT27950

| Altissimo Electronic Height Gages with Standard Components | | |
|---|---|---|
| **Description** | **Cat. No.** | **EDP** |
| Height Gage | 2000-24 | 67008 |
| Height Gage, "Platinum" | 2001-24 | 67453 |
| Carbide Probe .1875" (4.8mm) Dia. (Standard) | PT27937 | 67009 |
| Probe Holder (Standard) | PT27940 | 67010 |
| Probe Calibration Block (Standard) | PT27944 | 67011 |
| **Accessories for Altissimo Electronic Height Gages** | | |
| **Description** | **Part No.** | **EDP** |
| **Accessory Set Includes:** | S2000AZ | 66997 |
| Probe Tip, 5-Way Adaptor | PT27948 | 67012 |
| .040" (1mm) Carbide Contact Point | PT23942 | 65255 |
| .078" (2mm) Carbide Contact Point | PT23914 | 64222 |
| .120" (3mm) Carbide Contact Point | PT23943 | 65256 |
| Contact Wrench | PT27952 | 67013 |
| .400" (10.2mm) Cylindrical Probe | PT27945 | 67014 |
| Circular Carbide Scriber | PT27950 | 67015 |
| Depth Gage Attachment | PT27949 | 67016 |
| Holder for Dovetail Indicators | PT27946 | 67017 |
| Replacement Battery Pack, NiMH 6V | PT62011 | 67018 |
| Power Supply Charger for USA and Canadian Configuration | PT62015 | 67002 |
| Power Supply Charger for United Kingdom Configuration | PT62130 | 67003 |
| Power Supply Charger for European Configuration | PT62131 | 67004 |
| Cable to 7612 or 7613 Multiplexer | 2000SCM | 69907 |
| Smart cable with USB keyboard output for the Altissimo Height Gage | 2000SCKB | 69908 |
| Cable to PC Running Data Collection SPC Software - USB | 2000SCU | 29728 |



# Electronic Height Gages

## 3751 Electronic Height Gage (without output)

### 0-6"/150MM

This height gage is light, portable and easy to use for vertical measurements within its range.

| 3751 Electronic Height Gage (0-6"/150mm Range) | | |
|---|---|---|
| **Cat. No.** | **EDP** | **Description** |
| 3751AZ-6/150 | 12221 | Height Gage, in Case |
| **Accessories and Cables for 3751 Electronic Height Gage** | | |
| PT99492 | 65650 | One 3-Volt Batteries, CR2032 |
| PT08680A | 51383 | Depth Attachment for 6" (150mm) Height Gages |
| 947 | 56756 | Wood Case Only |




### Readability Features

- Easy-to-read LCD .32" high characters

### Accuracy and Long Life Design Features

- Hardened, stainless steel bar for long life
- Depth attachment PT08680A available for measuring depth of holes, slots, and recesses
- Fine adjustment thumb roll for precision measurements
- Rounded nose scriber cuts clean, sharp lines with smoothness and less pressure
- Lock to hold the slide in position
- Hardened, ground, and lapped base with finger grooves provides ease of movement
- Easy access to single long-life battery, 3-volt CR2032
- Vertical bar is back from the edge of the nose for better stability
- Scriber can reference zero from the bottom of the base to get the full 6" (150mm) usable range
- Linear Accuracy: ±.001" (± 0.02mm)
- Resolution: .0005" (0.01mm)

### Action Features with Three Control Buttons

- Inch-millimeter conversion
- Zero at any position
- Manual ON/OFF plus a built in automatic OFF after 5 minutes of nonuse

# Electronic Height Gages

## 3752 Electronic Height Gages

The 3752 Electronic Height Gage is a full featured, versatile and economic solution for most height measurement applications.

All measuring information from these tools can be entered directly into Starrett Data Collection Systems for analysis, data collection and hard copy documentation. They are available in 0-12" and 0-24" ranges.

### Readability and Control Features

- Clear bar graduations in .100" and 5mm increments
- Large (.380"/9.65mm), easy-to-read LCD display reads to .0005" or 0.01mm
- Instant inch/millimeter conversion
- Carrier and scriber designed to read from zero
- "Hold" control feature retains a reading at any position
- Plus or minus indication allows reading in proper direction
- Ability to set zero at any position
- Manual On/Off plus a built-in automatic off after 30 minutes of nonuse

### Full Function Action Features

- Large positive action keypad
- Ability to retain and return to the true zero reading of the height gage
- PRESET button to install any reading at any position
- Ability to install minimum and maximum limits
- RS232 data output port
- Two 3-volt batteries furnished (CR2450)

| Specifications for 3752 Electronic Height Gages | |
|---|---|
| **Resolution** | .0005" (0.01mm) |
| **Graduations** | .100" (5mm) |
| **Overall** | ±.0015" (.04mm) 0-18" (0-450mm) Accuracy<br>±.002" (.05mm) 18-24" (450-600mm) |
| **Battery Life** | Over 1-1/2 Years Average Use |



3752, 0-12" Height Gage

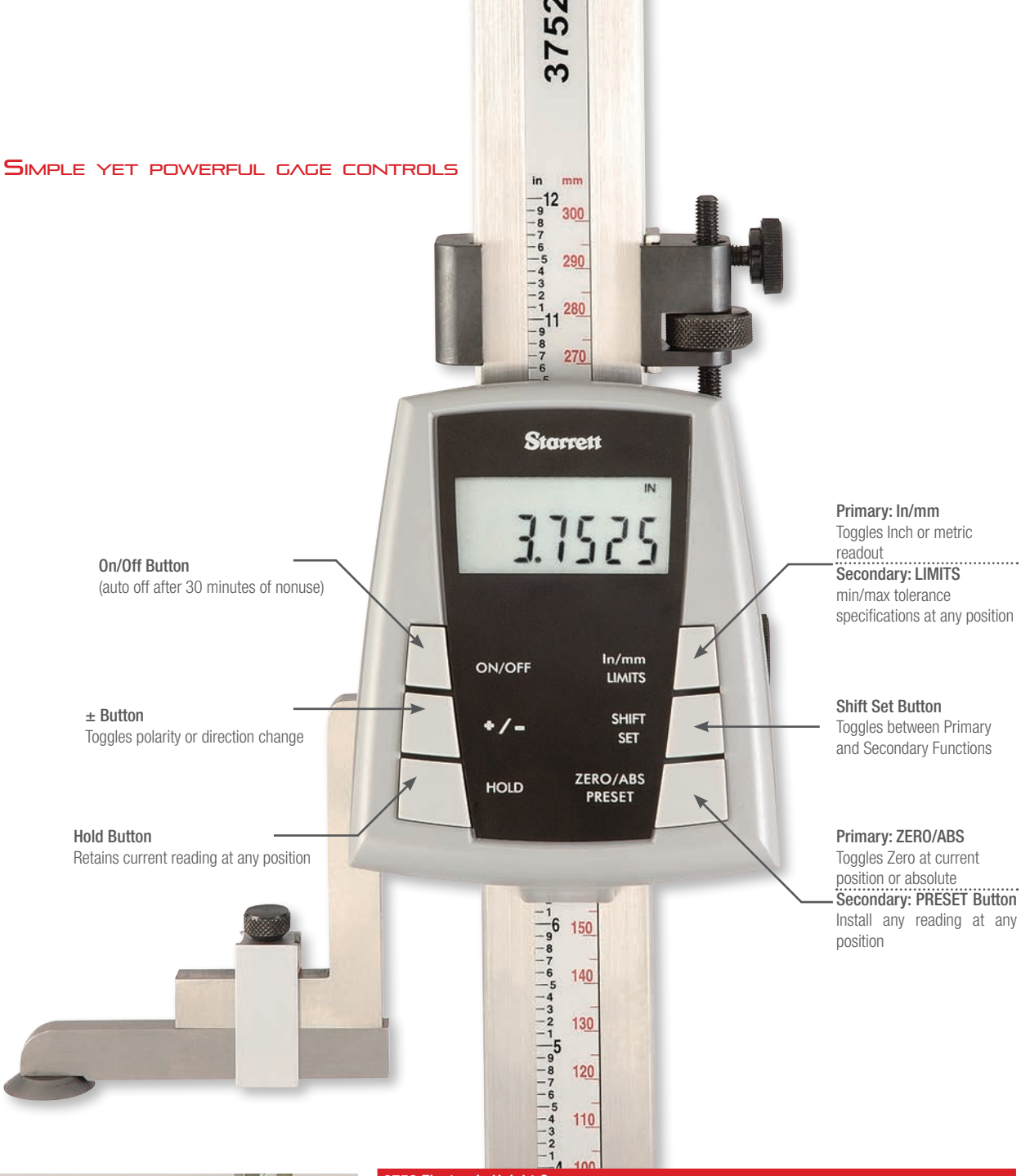
3752, 0-24" Height Gage

Both Height Gages shown with optional Auxilliary Circular Carbide Scriber, PT28131. Gages are furnished with Auxilliary Straight Carbide Scriber, PT22357.




Height gage with PT99454 indicator holder with 790AZ test indicator

## Simple yet powerful gage controls




**On/Off Button**
(auto off after 30 minutes of nonuse)

**± Button**
Toggles polarity or direction change

**Hold Button**
Retains current reading at any position

**Primary: In/mm**
Toggles Inch or metric readout

**Secondary: LIMITS**
min/max tolerance specifications at any position

**Shift Set Button**
Toggles between Primary and Secondary Functions

**Primary: ZERO/ABS**
Toggles Zero at current position or absolute

**Secondary: PRESET Button**
Install any reading at any position



| 3752 Electronic Height Gages | | | |
|---|---|---|---|
| **Range** | **Description** | **Cat. No.** | **EDP** |
| 0-12" (300mm) | Height Gage | 3752-12/300 | 68815 |
| 0-24" (600mm) | | 3752-24/600 | 68816 |

| Cables, Accessories, Cases for 3752 Electronic Height Gages | | |
|---|---|---|
| **Description** | **Cat. No.** | **EDP** |
| Interface Adaptor for Starrett Tools to PC | PT61768 | 66454 |
| 3-Volt Battery, CR2450 (2) Required | PT61120 | 65446 |
| Wood Case Only for 12" Gage | 928 | 55249 |
| Wood Case Only for 24" Gage | 945 | 56684 |
| Cable to PC Running Excel | 733SCKB | 69888 |
| Cable to PC Running SPC Data Collection Software | 733SCU | 69898 |
| Cable to 7612 or 7613 Multiplexer | 733SCM | 69893 |

Furnished without case unless otherwise ordered.

### Inch Reading

- Refer to the left side bar graduations and the inch vernier plate. Inches are numbered in sequence over the full range of the bar. Each bar graduation is .050". Every second graduation between the inch lines is numbered and equals .100".
- The vernier plate is divided into 50 parts, each representing .001". Every fifth line is numbered – 5, 10, 15 … 45, 50 – for easy counting.
- To read the gage, first count how many inches and how many .050" lines lie between the zero line on the bar and the zero line on the vernier plate and add them.
- Then count the number of graduations on the vernier plate from its zero line to the line that coincides with a line on the bar. Multiply the number of vernier plate graduations you counted by .001" and add this figure to the number of inches and .050" lines you counted on the bar. This is your total reading.

### Example

★ In the photo, the vernier plate zero line is five inches (5.000") plus .750" beyond the zero line on the bar, or 5.750". The 25th graduation on the vernier plate coincides with a line on the bar (as indicated by stars). 25 x .001 (.025") is therefore added to the 5.750" bar reading, and the total reading is 5.775".

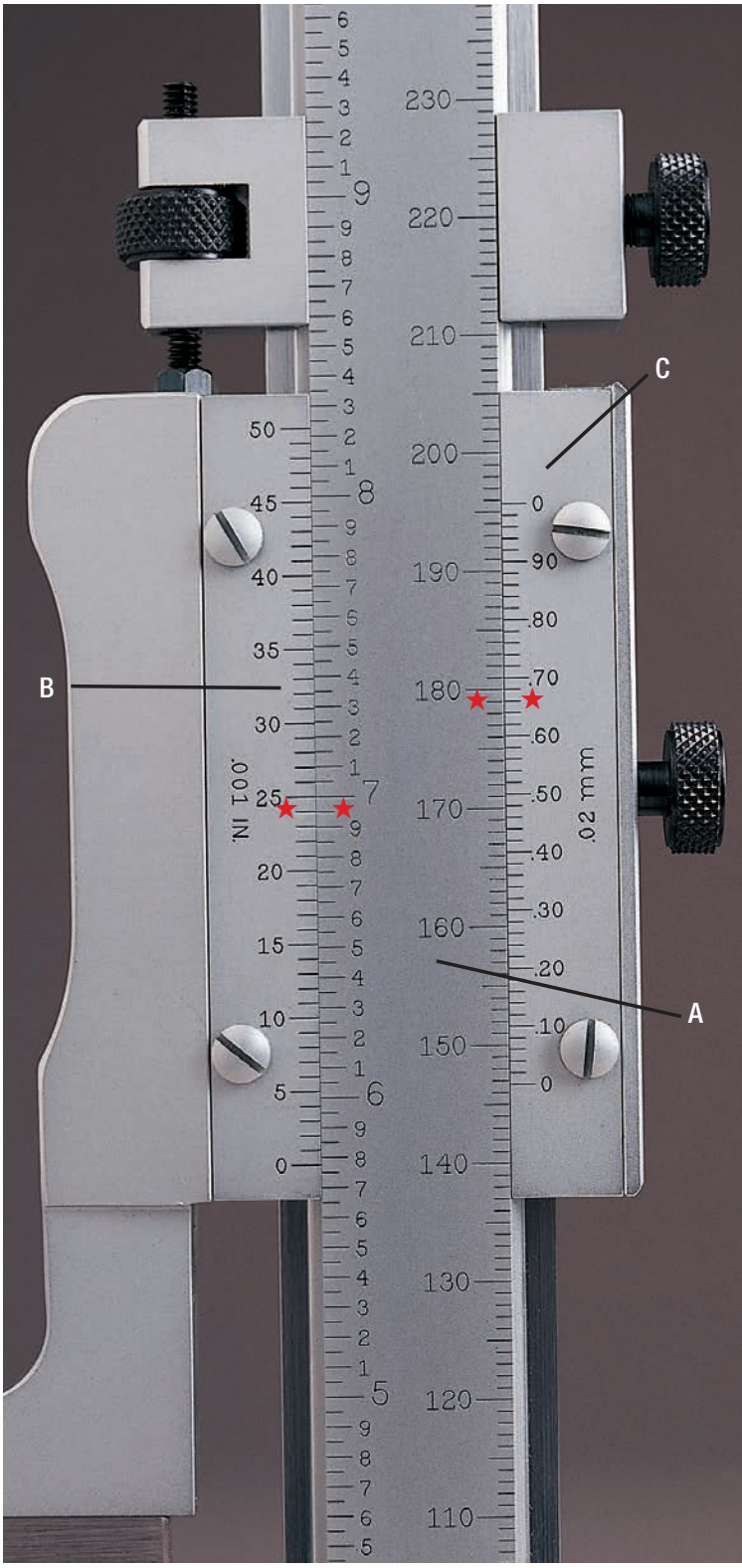
### Millimeter Reading

- Refer to the right side bar graduations and millimeter vernier plate. Each bar graduation is 1.00mm. Every tenth graduation is numbered in sequence – 10mm, 20mm, 30mm, etc. – over the full range of the bar. This provides for direct reading in millimeters.
- The vernier plate is divided into 50 parts, each representing 0.02mm. Every fifth line is numbered in sequence – 0.10mm, 0.20mm, 0.30mm … 0.80mm, 0.90mm – providing for direct reading in hundredths of a millimeter.
- To read the gage, first count how many millimeters lie between the zero line on the bar and the zero line on the vernier plate.
- Then find the graduation on the vernier plate that coincides with a line on the bar and note its value in hundredths of a millimeter. Add the vernier plate reading in hundredths of a millimeter to the number of millimeters you counted on the bar. This is your total reading.

### Example

★ In the photo, the vernier plate zero line is 146 millimeters beyond the zero line on the bar, and the 0.68mm graduation on the vernier plate coincides with a line on the bar (as indicated by stars). 0.68 millimeters is therefore added to the 146 millimeter bar reading, and the total reading is 146.68 millimeters.

## How to Read a Starrett 50-Division Vernier Height Gage Graduated in Inches and Millimeters (Direct Reading)




Open-face long Vernier with 50 widely spaced graduations for easy reading. Flush-fitting Vernier and master bar eliminates parallax.

A. Master Bar
B. Inch Vernier Plate
C. Millimeter Vernier Plate

# Vernier Height Gages

## 254, 254M Master Vernier Height Gages

**0-72"/0-900MM**

## 254EM Master Vernier Height Gages

**0-24"/0-600MM**

This Master Vernier Height Gage is an accurate, rugged and reliable tool that gives precise and dependable measurements over long ranges. It has an easy-to-read vernier, is stronger, and is offered in greater ranges than other height gages.

### Readability Features

- Long, 50-division vernier scales permits half as many bar graduations as single vernier tools. These widely spaced graduations provide easy reading to .001" or 0.02mm
- Flush fitting of the vernier scales to the main scale eliminates parallax
- Vernier scales are adjustable
- Black lines and figures against Starrett satin chrome finish make reading easy
- Scriber and base are designed for direct reading from zero (bottom of base)

### Ease-of-Handling Features

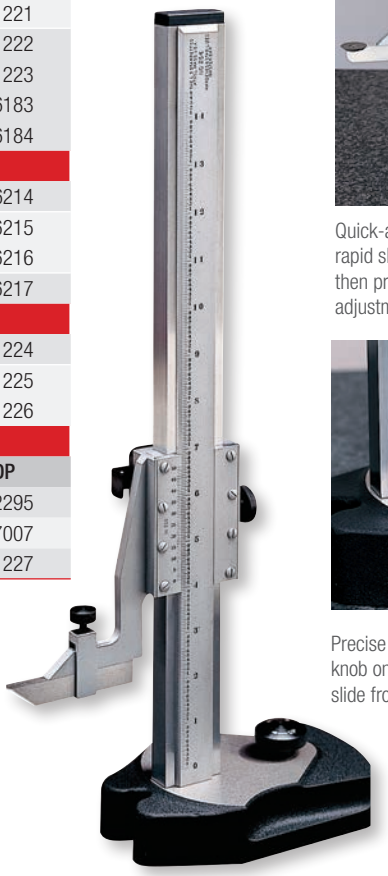
- Quick-adjust release on the slide allows for fast positioning
- Extremely fine adjustments by a knob on the base isolating the column and slide from external pressures
- Additional remote fine adjustment located on top of the bar for sizes 36" (900mm) and larger
- Special master bar design and the balanced design and weight of the base eliminates vibration
- Master bars on models up to 24" and 600mm are hardened and stabilized
- Base is hardened, ground, and lapped square with the bar and has finger grooves to provide ease of movement
- Vertical bar is positioned near the center of the base for balance and stability
- Versatile tool will scribe lines, mount dial indicators or electronic probes, and accept depth attachments
- Tool can also be used with our 359 Protractor for checking angles

| 254 Master Vernier Height Gages (.001" Graduation) | | | |
|---|---|---|---|
| **Range** | **Approximate Base Dimensions** | **Cat. No.** | **EDP** |
| 0-12" | 5-7/8" x 3-7/8" | 254Z-12 | 51219 |
| 0-18" | 7-1/2" x 4-1/2" | 254Z-18 | 51220 |
| 0-24" | | 254Z-24 | 51221 |
| 0-36" | 10" x 6-1/2" | 254Z-36 | 51222 |
| 0-48" | | 254Z-48 | 51223 |
| 0-60" | | 254Z-60 | 56183 |
| 0-72" | | 254Z-72 | 56184 |
| **254M Master Vernier Height Gages (0.02mm Graduation)** | | | |
| 0-300mm | 150mm x 95mm | 254MZ-300 | 56214 |
| 0-450mm | 190mm x 115mm | 254MZ-450 | 56215 |
| 0-600mm | | 254MZ-600 | 56216 |
| 0-900mm | 250mm x 165mm | 254MZ-900 | 56217 |
| **254EM Master Vernier Height Gages (.001"/0.02mm Graduation)** | | | |
| 0-12"/300mm | 5-7/8" x 3-7/8" | 254EMZ-12 | 51224 |
| 0-18"/450mm | 7-1/2" x 4-1/2" | 254EMZ-18 | 51225 |
| 0-24"/600mm | | 254EMZ-24 | 51226 |

| Accessories for 254, 254M and 254EM Master Vernier Height Gages | | |
|---|---|---|
| **Description** | **Part No.** | **EDP** |
| Auxilliary Straight Carbide Scriber | PT22357 | 12295 |
| Auxilliary Circular Carbide Scriber | PT28131 | 67007 |
| Depth Gage Attachment | PT05409A | 51227 |

Hardened bars on all sizes through 24" and 600mm

Furnished with Auxilliary Straight Carbide Scriber. Shown with optional Auxilliary Circular Carbide Scriber.





Quick-adjusting screw release allows rapid slide movement to desired area, then precisely position with the fine adjustment knob



Precise positioning with fine-adjustment knob on the base isolates column and slide from external pressures

# Vernier Height Gages

## 255, 255M Vernier Height Gages

**0-18"/0-300MM**

## 255EM Vernier Height Gages

**0-18"/0-450MM**

This tool is the "baby brother" of the 254 Master Vernier Height Gage. It is essentially the same tool, but a much lighter version for normal use where heavy duty applications are not practical. The 18" and 450mm models weigh 3-1/4 lb (1.5kg). No other height gage features this favorable combination of design, weight and accuracy.

### Readability Features

- Long, 50-division vernier scales that can be read to .001" or 0.02mm without a magnifying glass
- Flush-fitting of the vernier scales to the main scale eliminates parallax
- Easy-reading sharp black lines and figures against Starrett satin chrome finish background
- The scriber and the base are designed so that the gage will read directly from zero

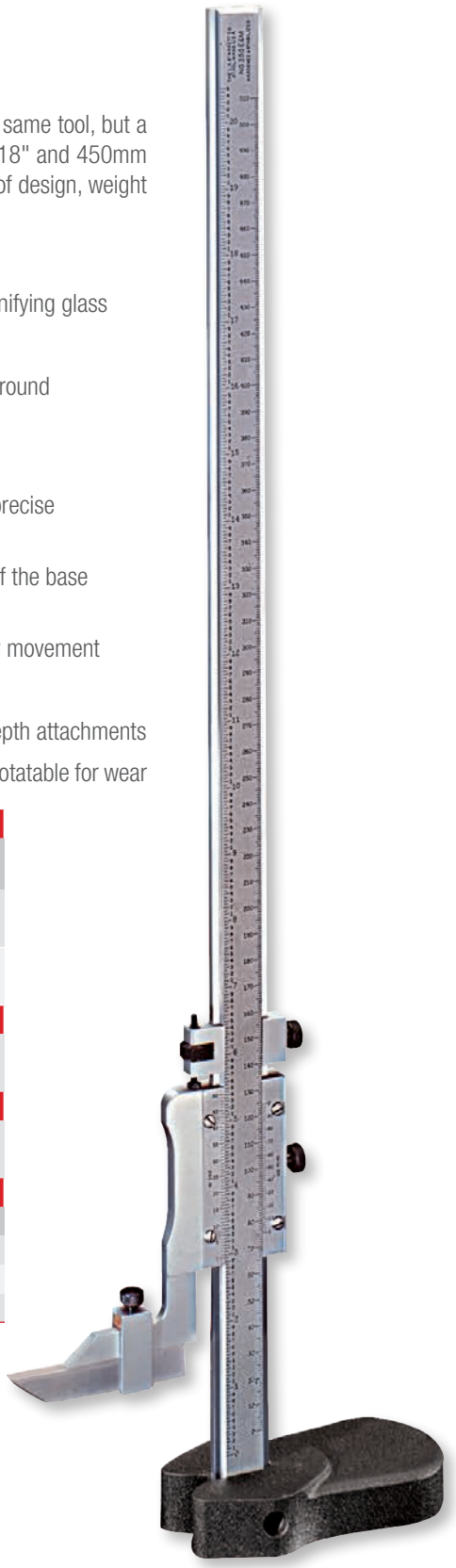
### Ease-of-Handling Features

- Slides easily for quick adjustment and has a screw type adjusting nut on the bar for precise positioning
- The design of the hardened and stabilized bar plus the balanced design and weight of the base eliminate vibration
- The base is hardened, ground, and lapped and is hand shaped for sure grip and easy movement
- The vertical bar is positioned near the center of the base for balance and stability
- Ability to scribe lines, measure with dial indicators or electronic probes and accept depth attachments
- The auxiliary scriber is a circular carbide scriber – cuts sharp, clean lines smoothly – rotatable for wear

| 255 Vernier Height Gages (.001" Graduation) | | | | | |
|---|---|---|---|---|---|
| **Range** | **Bar Approximate (Width x Thickness)** | **Base Approximate (Length x Width)** | **Description** | **Cat. No.** | **EDP** |
| 0-12" | 15/16" x 7/32" | 4-7/16" x 2-9/32" | In Case | 255Z-12 | 51229 |
| | | | Without Case | 255-12 | 51230 |
| 0-18" | 15/16" x 7/32" | 4-7/16" x 2-9/32" | In Case | 255Z-18 | 51231 |
| | | | Without Case | 255-18 | 51232 |
| **255M Vernier Height Gages (0.02mm Graduation)** | | | | | |
| 0-300mm | 24mm x 5.5mm | 113mm x 58mm | In Case | 255MZ-300 | 56218 |
| | | | Without Case | 255M-300 | 56219 |
| **255EM Vernier Height Gages ( .001"/0.02mm Graduation)** | | | | | |
| 0-18"/ 450mm | 15/16" x 7/32" (24mm x 5.5mm) | 4-7/16" x 2-9/32" (113mm x 58mm) | In Case | 255EMZ-18 | 65160 |
| | | | Without Case | 255EM-18 | 65161 |

| Accessories for 255, 255M and 255EM Vernier Height Gages | | |
|---|---|---|
| **Description** | **Part No.** | **EDP** |
| Straight Scriber | PT13791 | 71460 |
| Carbide Scriber (3/16" x 25/64" x 2-3/4") | PT27710 | 67187 |
| Depth Gage Attachment | PT08962A | 51233 |

Furnished with Straight Scriber.



# Dial Height Gages

## 3250 Dial Height Gages

### 0-6"/0-150MM

The compact 3250 Dial Height Gage is a very useful tool for machinists and inspectors. Applications include scribing lines for layout, height measurement (with or without dial test indicator), and depth measurement (with optional attachment). It is simple to use, reliable, accurate, and fits into most toolboxes.

| 3250 Height Gages | | | | |
|---|---|---|---|---|
| **Cat. No.** | **EDP** | **Range** | **Dial Grads** | **Description** |
| 3250Z-6 | 69865 | 0-6" | .001" | Dial Height Gage, English |
| 3250MZ-150 | 69861 | 0-150mm | 0.20mm | Dial Height Gage, Metric |
| PT08680A | 51383 | | | Depth Attachment |




3250-6

### Features & Specifications

- Sharp, clear dial graduations of .001" or 2mm in one revolution
- Sharp, black graduations on the satin chrome finish bar every .100" or 1mm
- Fine adjustment thumb roll for precision measurements
- Vertical bar set back from the edge for better stability
- Hardened, ground, and lapped base with finger grooves for control and ease of movement
- Base clearance allows the gage to measure full gage range of 0 - 6" or 150mm
- Dial lock screw
- Lock to hold the slide in position
- The auxiliary scriber has a rounded nose for cutting clean, sharp lines with smoothness and less pressure
- Hardened, stainless steel bar, rack, gears, scriber, and scriber carrier
- Positive spring-loaded double pinion anti-backlash control
- Includes metal case



3250-6 in case

# Digi-Chek™ Height Gages

## DHG DIGI-CHEK II Height Master

### RANGES UP TO 85" AND 2150MM

These are the world's fastest and most precise height masters, ideal for those who need the highest degree of accuracy over an extremely long vertical range.

- Can be used in the laboratory or on the shop floor
- Lower inspection costs by saving time – within 10 seconds the tool can be set into position
- The gage block stack is free-standing, so it will adapt to temperature differences in a reasonable time period
- 1" or 25mm range of adjustment
- Reverse reading block allows readings from the underside of the master gage blocks
- The large, remote digital readout can be placed in the most convenient location and adjusted for best readability
- The housing is heavy and extremely stable with hardened and lapped three-point bearings
- Standard equipment: pedestal stand for readout unit, DIGI-CHEK II plastic dust cover and wood shipping/storage case

**Optional Equipment for DIGI-CHEK II Height Master**

| Cat. No. | EDP | Description |
|---|---|---|
| HG 525.60 (Inch)<br>HG 501.3M (Millimeter) | 92579<br>91486 | Reverse Reading Blocks |
| HG 525.61 (Inch)<br>HG 501.4M (Millimeter) | 92577<br>91487 | 1" or 25mm base blocks for use with reverse reading blocks to set dial bore gages |
| CS 9133. | 92320 | Finished wood case for reverse reading and base block |

**Specifications for DIGI-CHEK II Height Master**

| Description | Inch System | Metric System |
|---|---|---|
| Tolerance (Stack)<br>Maximum:<br>Minimum: | expressed in µin<br>2.5L + 10 (in inches)<br>- 10 | expressed in µm<br>.0025L + .25 (in mm)<br>- .25 |
| Parallelism: Gage Surfaces to Base and Each Other | 15 µin | 0.4 µm |
| Resolution | 10 µin or 20 µin | 0.5 µm or 1.0 µm |
| Repeatability of Readout | ±20 µin | 0.5 µm or 1.0 µm |
| Digital Readout | 1/2" high figures | 12.5mm |
| Readout Pedestal Height | 38" | 970mm |
| Power Supply | Switchable: 115 V 60 Cycle or 220 V 50 Cycle | |
| Certificate of Calibration (Extra Cost)<br>Uncertainty of Calibration of Stack | expressed in µin<br>10 + 2.0L (in inches) | expressed in µm<br>.25 + .002L (in mm) |
| Uncertainty of Calibration of Readout | ±30 µin | ±0.75 µm |

µ = .000001 x unit of measure
The accuracy of the surface that supports the gage must be taken into account when determining the accuracy of any measurements.




**DIGI-CHEK II Height Master (1-85" Range)**

| Capacity | Cat. No. | EDP |
|---|---|---|
| 1-25" | DHG 25. | 93265 |
| 1-37" | DHG 37. | 93266 |
| 1-49" | DHG 49. | 93267 |
| 1-61" | DHG 61. | 93268 |
| 1-73" | DHG 73.* | 93269 |
| 1-85" | DHG 85.* | 93270 |
| **DIGI-CHEK II Height Master (25-2150mm Range)** | | |
| 25-625mm | DHG 625. | 93271 |
| 25-1025mm | DHG 1025. | 93272 |
| 25-1225mm | DHG 1225. | 93273 |
| 25-1550mm | DHG 1550. | 93274 |
| 25-1800mm | DHG 1800.* | 93640 |
| 25-2150mm | DHG 2150.* | 93275 |

* Setup charge extra depending on location.

**Simple, two step operation in less than 10 seconds.**

1. Set rapid positioner (A) to within .005" (0.15mm) (3 seconds).
2. Final setting (5 seconds).

# Digi-Chek™ Height Gages

## 258, 258M DIGI-CHEK Height Gages

### .100"-24.100"/2-602MM

These gages combine the accuracy of Starrett-Webber Gage Blocks with a precision micrometer head and digital readout.

| Range | Graduation Scales | Digital Readout | Micrometer Head | Gage Accuracy | Cat. No. | EDP |
|---|---|---|---|---|---|---|
| **258 DIGI-CHEK Height Gages (.100"-24.100" Range)** | | | | | | |
| .100"-12.100" | Inches | .001" | .0001" | ±.0002" | DHG12-258 | 93005 |
| .100"-18.100" | | .001" | .0001" | ±.0002" | DHG18-258 | 93006 |
| .100"-24.100" | | .001" | .0001" | ±.0002" | DHG24-258 | 93357 |
| **258M DIGI-CHEK Height Gages (2-602mm Range)** | | | | | | |
| 2mm-302mm | Millimeters | 0.01mm | 0.002mm | ±.005mm | DHG300-258 | 93007 |
| 2mm-452mm | | 0.01mm | 0.002mm | ±.005mm | DHG450-258 | 93008 |
| 2mm-602mm | | 0.01mm | 0.002mm | ±.005mm | DHG600-258 | 93358 |

Finished wood case for 12" (300mm) and 18" (450mm) also available, at additional cost.
These finished wood cases are NOT suitable for shipping. Use suggested shipping materials.
Certificate of Calibration available at additional cost.
Questions and repair regarding Digi-Chek gages should be referred to the Starrett-Webber Division, Tel.: 440-835-0001.
The accuracy of the surface that supports the gage must be taken into account when determining the accuracy of any measurements.




### Readability Features

- Satin chrome scales mounted beside the gage block column for quick reference to the nearest 1" or 25mm reading
- Digital readout reads in .001" or 0.01mm and has a range of 1" or 25mm
- Reads directly from the micrometer head to .0001" or 0.002mm. The micrometer head (our 469) has black figures on the satin chrome thimble. The graduations are staggered for easy counting.
- Both the micrometer head and digital readout are mounted on top of the gage, directly in line with the operator's vision

### Ease-of-Handling Features

- The micrometer head has a speeder knob for rapid positioning
- Both over and under heights can be checked directly from the gage blocks in a single setting. Because reference surfaces are provided on the top and bottom of each block, adjacent blocks are in the exact same plane. This eliminates the need to add or subtract block thickness.
- Readings can also be taken from either left, center, or right of the gage block column
- Parts can be checked from .100" or 2mm in height
- The gage block column design permits wringing a 1" block between two blocks in the column. This is convenient for setting and checking other gages such as inside micrometers, end measuring rods, dial bore gages, etc.

### Accuracy and Long-Life Features

- Gage is housed in a heavily flanged frame for stability and the base has three-point hardened, ground, and lapped bearing pads, making it virtually tip-proof. Gage blocks are assembled in a free-standing system that allows the blocks to conform to temperature variations independently of the frame, thereby reading the same as the workpiece.
- The highly accurate micrometer spindle is one piece, with hardened and stabilized measuring threads
- A 10" riser block is available for increased height capacity

# Height Gage Accessories

## Depth Gage Attachments for Height Gages

These attachments replace standard scribers and measure the depths of holes and slots, recesses; inside of jigs, fixtures; and over high projections.

They have adjustable rods which are held in the desired position by a knurled binding nut. The ends have a slight radius for point contact on the work.

| Depth Gage Attachments for Height Gages | | | |
|---|---|---|---|
| Rod Length | Fits Starrett Height Gage No./Size | Part No. | EDP |
| 6" (150mm) | 255 8", 12", 18", 300mm, 450mm | PT08962A | 51233 |
| 8" (200mm) | 254 12", 18", 24", 300mm, 450mm, 600mm and all Metric and English 259, 180 and 240, 3752 120 (300mm) and 240 (600mm), 755 240 (600mm) | PT05409A | 51227 |
| 6" (150mm) | 751 | PT08680A | 51383 |



Right: PT08680A
Middle, PT08962A
Left, PT05409A

## 258RRB, 258RRBM Reverse Reading Blocks for 258 Digi-Chek™ Height Gage

Used on 258 DIGI-CHEK Height Gages for the precise calibration of working gages and for setting dial bore gages. The block fits in alternate inch positions, its tongue entering the odd numbers and its groove entering the even numbers of the gage block stack.

| 258RRB and 258RRBM Reverse Reading Blocks | | |
|---|---|---|
| Description | Cat. No. | EDP |
| Fits 12", 18" and 24" Gages | HG 258.RRB | 92433 |
| Fits 300mm, 450mm and 600mm Gages | HG 258.RRBM | 92434 |

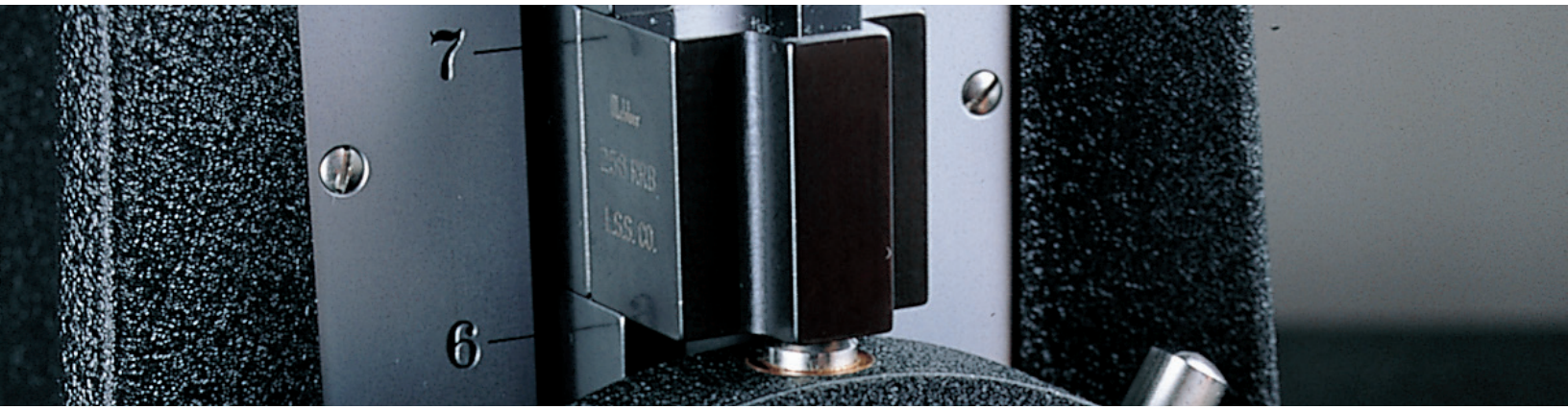




## 258R, 258MR Riser Blocks for 258 Digi-Chek™ Height Gage

Increases the range of Inch reading 258 DIGI-CHEK Height Gages by 10" and metric reading 258 DIGI-CHEKs by 250mm. Heavily flanged for rigidity and stability. Both top and base have three ground and lapped pads to match the pads on the DIGI-CHEK base. Retaining plate prevents the DIGI-CHEK from being pushed or sliding off the pads. Attractive black wrinkle finish. If desired, riser blocks can be stacked one on top of another.

| 258R Riser Blocks (10" Blocks) | | | |
|---|---|---|---|
| Accuracy | For: | Cat. No. | EDP |
| ±.000040" | 12" Gage | HG 258.R | 99865 |
| | 18" Gage | HG 258.RA | 99866 |
| **258MR Riser Blocks (250mm Blocks)** | | | |
| ±0.001mm | 300mm Gage | HG 258.MR | 99867 |
| | 450mm Gage | HG 258.MRA | 99868 |



# Height Gage Accessories

## 252 Height Transfer Gages

### 0-48"/0-1200MM

The 252 Height Transfer Gage is ideal for use with test indicators or electronic amplifiers to accurately transfer height settings from gage blocks, height gages and other standards.

**252 Height Transfer Gages**

| Range | Fine Adjustment (Approximate) | Base Size (Approximate) | Gage Rod Dimension | Cat. No. | EDP |
|---|---|---|---|---|---|
| 0-14" (350mm) | 3/8" (9.5mm) | 5-3/4" L x 3-1/2" W (145mm x 90mm) | 9" L x .375" Dia. (225mm x 9.5mm) with steps | 252Z-14 | 55890 |
| 0-24" (600mm) | | 7-1/2" L x 4-1/2" W (190mm x 115mm) | | 252Z-24 | 51216 |
| 0-48" (1200mm) | | 9" L x 6" W (225mm x 150mm) | | 252Z-48 | 51217 |

Larger sizes available on special order.
Starrett 708, 709, 711, 650 Test Indicators; 25, 81, 196, 655, 656 Dial Indicators and supplementary attachments also available.
Gage furnished with 9" (225mm) Rod and PT06784-A Gage Holding Rod in wood case.




Pictured with 717 Gage Amplifier and 715-12 lever probe.

### Accuracy and Long-Life Features

- Extreme rigidity provides the vibration-proof stability necessary to permit precise repeat readings with indicators of the highest amplification
- Extremely rigid, rectangular box-type hollow column mounted integrally on a heavy base
- Adjusting mechanism is located in the base so the column and indicator are isolated and not affected by external factors, such as heat or hand pressure

### Ease-of-Operation Features

- Hand-fitting base design for sure-grip handling and easy movement
- Bottom of the base has three ground and lapped pads for stability and smooth movement on the surface plate
- Adjustable slide, incorporating a snug for holding test indicators or electronic gage heads, has rapid vertical manual adjustment
- Thumb screw allows slide to be locked
- Knob on base allows fine vertical adjustment of the slide unit relative to the fixed column. This permits the slide with its test indicator to be quickly and precisely adjusted to the desired setting.

### Tool and Gaging Holders

- A snug on the slide provides two holes (.375" [9.5mm] and .156" [4mm]) for holding gage rods or scribers. A 9" (225mm) rod furnished with the gage is especially useful for reaching confined areas or reaching heights greater than the range of the gage.
- The rod has a major diameter of .375" (9.5mm) and stepped diameters of 1/4" (3.2mm) and 7/32" (5.5mm) at one end and 5/16" (8mm) at the opposite end
- 708 and 709 Test Indicators can be mounted on this rod using PT22428 swivel clamp. 196 Universal Back-Plunger Indicators can be mounted using Starrett snugs, Part PT18718 or PT18724 (snugs not furnished).
- PT06784-A Gage Holding Rod is included to accommodate the 715-1 Gaging Head when the Transfer Gage is used with the 717 Electronic Gage. A wire retaining clip keeps electronic gage head cables from deflecting the gage-holding rod.
- 25, 81, 655 and 656 Dial Indicators also can be used on the height gage by means of a PT06784-A Gage Rod (furnished)
- Other useful attachments (extra) are surface gage spindles (57C or 57D, 12" [300m]) and 18" [450mm]) – which are extremely useful for scribing and layout

# Height Gage Accessories

## Straight Scribers for Starrett Height Gages*

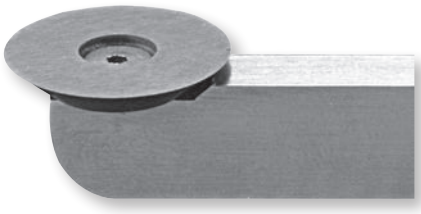
All steel scribers are hardened to approximately HRC 62 and have a rounded tip which cuts sharp, clear lines smoothly, with less pressure, on any material.



| Straight Scribers for Starrett Height Gages | | | | |
|---|---|---|---|---|
| Part No. | EDP | Point | Size | Fits Starrett Height Gage No./Size |
| PT22090 | 64507 | Hardened Tool Steel | 5/16 x 1/8 x 1-3/4" (8 x 3.2 x 45mm) | 250 and 3751 |
| PT14343 | 71511 | Hardened Tool Steel | 1/4 x 1/2 x 3" (6.4 x 12.7 x 75mm) | 254 12", 18", 24", 300mm, 450mm, 600mm 254 Metric and English 259 18" and 24" |
| PT13816 | 52367 | | 1/4 x 1/2 x 6" (6.4 x 12.7 x 150mm) | |
| PT13817 | 52368 | | 1/4 x 1/2 x 10" (6.4 x 12.7 x 250mm) | |
| PT16566 | 72288 | Hardened Tool Steel | 5/8 x 3/8 x 3-5/8" | 254 36", 48", 60",72",900mm |
| PT13791 | 71460 | Hardened Tool Steel | 3/16 x 25/64 x 2-3/4" (4.8 x 10 x 69.9mm) | 255 8", 12", 18", 300mm, 450mm |
| PT22357 | 12295 | Carbide | 1/4 x 7/16 x 3" (6.4 x 11.1 x 75mm) | 3752 |

## Circular Carbide Scribers*

This circular scriber cuts a sharper, cleaner line with less pressure than any other scriber. It resists breakage and chipping but can be rotated for wear.



| Circular Carbide Scribers | | | | |
|---|---|---|---|---|
| Part No. | EDP | Point | Size | Fits Starrett Height Gage No./Size |
| PT27724 | 67185 | Circular Carbide | 1/4 x 1/2 x 3" (6.4 x 12.7 x 75mm) | 254 12", 18", 24", 300mm, 450mm, 600mm 254 Metric and English 259 18", 24" |
| PT27708 | 67186 | | 1/4 x 1/2 x 6" (6.4 x 12.7 x 150mm) | |
| PT27710 | 67187 | Circular Carbide | 3/16 x 25/64 x 2-3/4" (4.8 x 10 x 69.9mm) | 255 8", 12", 18", 300mm, 450mm |
| PT27950 | 67015 | Circular Carbide | 1/4" (6.4mm) Diameter Shank | 2000, 2001 Altissimo |
| PT28131 | 67007 | Circular Carbide | 1/4 x 7/16 x 3" (6.4 x 11.1 x 75mm) | 3752, 752 |

*Starrett Originals

## 3259-AC Digital Height Gage Scriber Carrier Holder

NEW!

Scriber carrier for use with 3259 Height Gages to allow attachment of standard quarter inch by half inch tall accessories.



| 3259-AC Digital Height Gage Scriber Carrier Holder | | |
|---|---|---|
| Cat. No. | EDP | Description |
| 3259-AC | 69859 | Digital height gage scriber carrier holder |

## Stem-Mount Indicator Attachment for Height Gages

This attachment replaces the standard scriber and provides a way to mount dial indicators or LVTD style probes having 3/8" diameter shafts onto your height gage. By using the lower stem of the indicator as an attachment point, the indicator can be used to guarantee the amount of down pressure on the part is the same as the original set zero position.



| Stem-Mount Indicator Attachment for Height Gages | | |
|---|---|---|
| Part No. | EDP | Description |
| PT99441 | 52991 | Stem-mount indicator attachment |

## Indicator Attachment

### DOVETAIL STYLE

Replaces standard scriber. Provides means to attach dovetail equipped test indicators or electronic probes to height gages. Allows indicator to be used to ensure the down pressure on the part is the same as the original set zero position.



| Dovetail Style Indicator Attachment | | |
|---|---|---|
| Part No. | EDP | Description |
| PT99454 | 68713 | Indicator attachment, dovetail style |




# DEPTH GAGES

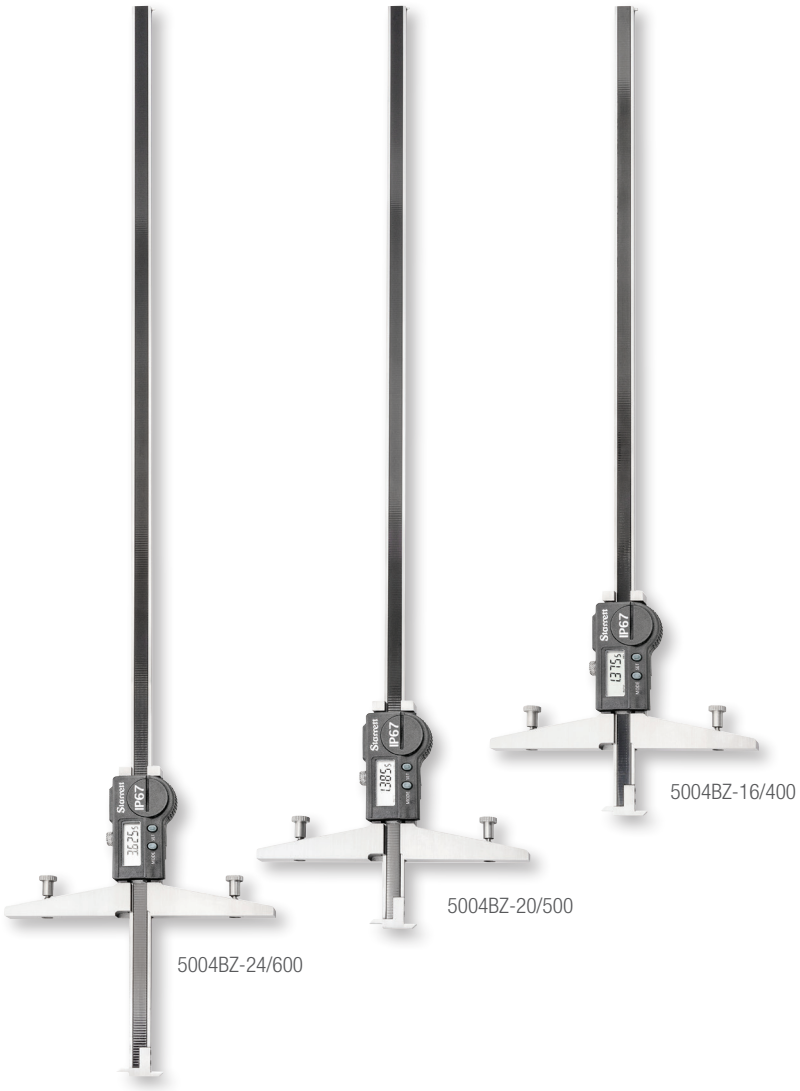
# Depth Gages

## 5004 Electronic Depth Gages

### 0-24"/0-600MM

- Ideal for large part measurement up to 24" (600mm)
- Three movable bridge attachments provide additional large part measurement capacity

| 5004 Electronic Depth Gages | | | |
|---|---|---|---|
| **Cat. No.** | **EDP** | **Description** | **Range/Size** |
| 5004BZ-16/400 | 14584 | Electronic depth gage | 0-16" (0-400mm) |
| 5004BZ-20/500 | 14585 | Electronic depth gage | 0-20" (0-500mm) |
| 5004BZ-24/600 | 14586 | Electronic depth gage | 0-24" (0-600mm) |
| **Accessories for 5004 Depth Gages** | | | |
| PT06133 | 12825 | Movable bridge attachment for use with 5004 depth gages | 16" (400mm) |
| PT06134 | 12826 | Movable bridge attachment for use with 5004 depth gages | 20" (500mm) |
| PT06135 | 12827 | Movable bridge attachment for use with 5004 depth gages | 24" (600mm) |
| PT06136 | 12828 | Offset attachment for use with 5004 depth gages | 1.024" (26mm) overall length |




### Features and Specifications

- Hardened stainless steel construction
- Coolant resistant
- Mode and Set buttons control a wide range of functions: On/Off, Absolute/Relative display, Inch/Metric display, Preset and Hold
- RS232 data transmission port
- Furnished with one CR2032 lithium battery that will provide over a year of life with normal use
- Protective wooden case
- Resolution: 0.0005"/0.01mm
- Includes offset attachment PT06136
- IP67 protection



### IP PROTECTION

An IP number is composed of two numbers, the first referring to protection against solid objects and the second against liquids.

**First number 6**: Totally protected against dust

**Second number 7**: Protection against submersion in water under standardized conditions of pressure for 30 minutes



# Depth Gages

## 3753A Electronic Depth Gages

### 0-12"/0-300MM

The 3753 is light and easy to use for depth measurements within its range.

### Readability Features

- Clear, easily-read numbers, properly sized for the tool

### Design Features for Accuracy and Long Life

- Linear accuracy: ±.001" (±0.03mm)
- Resolution: .0005" (0.01mm)
- Exclusive Starrett-designed microprocessor chip
- Hardened stainless steel body and slide for long life
- Fine adjustment thumb roll for precision measurements
- Lock to hold the slide in position
- Hardened base is 3-15/16" (99mm) long, but optional base extensions of 7" and 12" (175 and 300mm) are available. Spacing between holes is 2-3/4" (70mm).
- A hook attachment is furnished with the gage, making it possible to take readings from the edge of a workpiece to edges of slots, grooves, shoulders, and other I.D. length dimensioning. The removable hook has the screw permanently attached to prevent loss.
- One-year minimum battery life with furnished 3-volt battery, CR2032

### Action Features with Three Control Buttons

- Inch/millimeter conversion
- Zero at any position
- Manual ON/OFF plus a built in automatic OFF after 15 minutes of nonuse

| 3753A Electronic Depth Gages | | |
|---|---|---|
| **Cat. No.** | **EDP** | **Description** |
| 3753A-6/150 | 12258 | 0-6"/150mm Range, Depth Gage in Case |
| 3753A-8/200 | 12259 | 0-8"/200mm Range, Depth Gage in Case |
| 3753A-12/300 | 12260 | 0-12"/300mm Range, Depth Gage in Case |
| **Accessories for 3753A Electronic Depth Gages** | | |
| 3648-180 | 12261 | 180mm Base Extension |
| 3648-260 | 12262 | 260mm Base Extension |
| 3648-320 | 12263 | 320mm Base Extension |
| PT99492 | 65650 | Two 3-Volt Batteries, CR2032 |




3753 shown with optional 3648-180 base extension attachment



# Depth Gages

## 3753B Electronic Depth Gages

### 0-12"/0-300MM

The 3753B Electronic Depth Gage is a versatile, easy-to-use tool for measuring depth, slot width, small sections and other applications.

| 3753B Electronic Depth Gages | | |
|---|---|---|
| **Cat. No.** | **EDP** | **Description** |
| 3753B-6/150 | 12690 | 0-6"/150mm Range, Depth Gage in Case |
| 3753B-8/200 | 12692 | 0-8"/200mm Range, Depth Gage in Case |
| 3753B-12/300 | 12694 | 0-12"/300mm Range, Depth Gage in Case |
| **Accessories for 3753B Electronic Depth Gages** | | |
| 3648-180 | 12261 | 180mm Base Extension |
| 3648-260 | 12262 | 260mm Base Extension |
| 3648-320 | 12263 | 320mm Base Extension |
| PT63388 | 72517 | Computer Interface Cable to PC (USB) |
| PT99492 | 65650 | Two 3-Volt Batteries, CR2032 |
| 798SCKB | 69889 | To Computer Running Excel |
| PT63388 | 72517 | To PC Running SPC Data Collection Software |
| 798SCM | 69894 | To 7612 or 7613 |

### Features and Specifications

- Hardened, stainless steel bar for long life
- Removable hook attachment for measurements from the edge of a work piece to the inside or outside edge of slots, grooves, etc.
- Lock to hold the slide in position
- Fine adjustment thumb roll for precision measurements
- Large, easy to read LCD, .310" character height
- IP67 level of protection against coolant, water, dirt and dust
- Induction type linear encoder system
- Patented non-contact RS-232 data output
- CR2032 3-volt battery (>1 year batter life under normal use)
- Inch/mm conversion
- Zero at any position
- Automatic off after 30 minutes of nonuse without loss of position upon reactiviation
- Linear Accuracy: ±.001" (0.03mm)
- Resolution: .0005" (0.010mm)




3753B-6/150




3753B-12/300

## IP PROTECTION

An IP number is composed of two numbers, the first referring to protection against solid objects and the second against liquids.

**First number 6**: Totally protected against dust

**Second number 7**: Protection against submersion in water under standardized conditions of pressure for 30 minutes



# Depth Gages

## 450, 450M Dial Depth Gages

### 0-12"/0-300MM

These depth gages are ideal for the individual mechanic. They are light, reliable and accurate for measurements to .001" or 0.02mm and will fit into most toolboxes.

| 450 Dial Depth Gages (.001" Graduation) | | | |
|---|---|---|---|
| **Range** | **Description** | **Cat. No.** | **EDP** |
| 0-6" | 6" Gage without Case | 450-6 | 56766 |
| 0-12" | 12" Gage without Case | 450-12 | 56768 |
| **450M Dial Depth Gages (0.02mm Graduation)** | | | |
| 0-300mm | 300mm Gage without Case | 450M-300 | 64276 |
| **Accessories for 450 and 450M Dial Depth Gages** | | | |
| **Description** | | **Cat. No.** | **EDP** |
| 7"/175mm Base Extension | | PT22287 | 65861 |
| 12"/300mm Base Extension | | PT22288 | 65862 |
| 6" Case Only | | 450ZZ-6 | 56776 |
| 12" Case Only | | 450ZZ-12 | 56777 |

### Readability Features

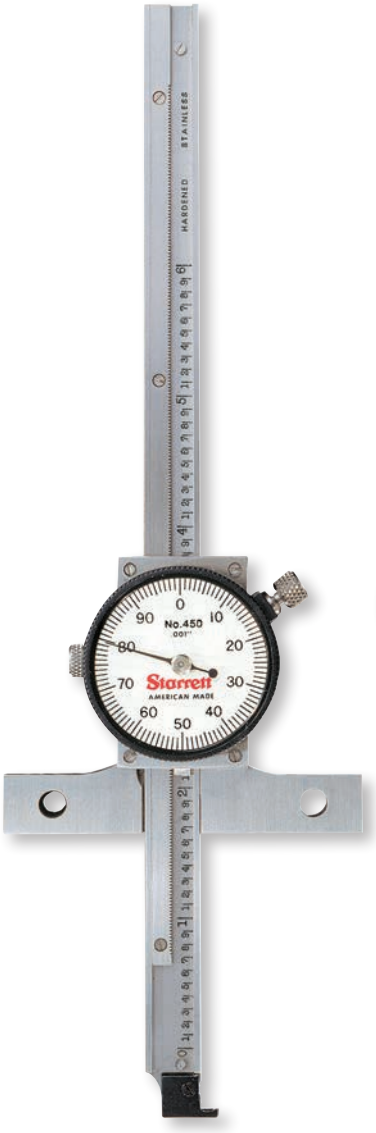
- Sharp, easy-to-read dial graduations of .001-.100" or 0.02-2mm in one revolution
- Sharp, black graduations on the satin chrome finished bar, every .100" or 1mm

### Ease-of-Handling and Versatility Features

- Lock screw for dial bezel
- Lock screw for holding the measuring rod in position
- Optional base extensions of 7" and 12" (175 and 300mm) are available to increase the base span on both models
- Removable hook attachment permits readings from the edge of a workpiece to edges of slots, shoulders, etc.

### Accuracy and Long-Life Features

- Hardened, stainless steel base, measuring bar, rack and gears
- Positive split gear anti-backlash control




Left: 6" model
Below: 12"/300mm base extension



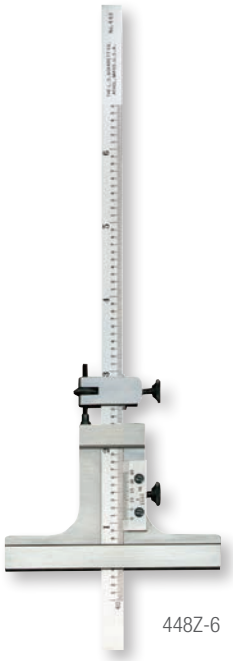
# Depth Gages

## 448, 448ME Vernier Depth Gages

### 0-12"/0-300MM

These are easy-to-use, very accurate depth gages. They are designed for measuring the depths of holes, slots, and recesses and for inspecting jig, fixtures and die work. They are also ideal for measuring from a plane surface to toolmakers' buttons for locating center distances. Readings are in .001" and 0.02mm.

- Heads are hardened, ground and lapped
- Measuring blades are hardened and ground and have accurate and sharp machine divided graduations
- All English graduations read to .001", with the bar being graduated in .025" increments
- All metric graduations read to 0.02mm, with the bar being graduated in 0.5mm increments
- Screw type adjusting nut allows for fine measuring adjustment
- Slide lock nut to hold measurement position
- Vernier plates are adjustable



448Z-6

| Range | Blades Furnished | Base Length x Width | Cat. No. | EDP |
|---|---|---|---|---|
| **Inch Reading/Graduation – .001"** | | | | |
| 0-6" | One (6") | 2-3/4 x 1/4" | 448Z-6 | 52306 |
| 0-12" | One (12") | | 448Z-12 | 52308 |
| 0-12" | Two (6" and 12") | | 448Z-612 | 52310 |
| **Inch and Millimeter Reading/Graduation – .001" and 0.02mm – Both Edges** | | | | |
| 0-6" (150mm) | One (6"/150mm) | 2-3/4 x 1/4" (70 x 6.35mm) | 448MEZ-6 | 52312 |
| 0-12" (300mm) | One (12"/300mm) | | 448MEZ-12 | 52314 |
| 0-12" (300mm) | Two (6"/150mm and 12"/300mm) | | 448MEZ-612 | 52316 |

## 237, 237M Steel Rule Depth Gages

### 0-6"/0-150MM

These very handy depth gages can be used to quickly obtain measurements in 64th of an inch or 1/2mm by simply adjusting the rule to the required depth.

- The gage consists of a nicely finished, hardened steel head and an accurate, machine divided, tempered steel rule. These rules are either our 610N (6") or our 635N (150mm) models.
- Gage can be smoothly adjusted to the required measurement and then locked into position by a knurled nut
- Base is cut out on one side, adjacent to the rule, permitting easier readings and more accurate measurements
- 6" hook rule (236HC, EDP 51077) also available, permitting easier readings from the edge of a workpiece to the edges of slots, shoulders, etc. Graduated in 32nds, 64ths.



237

| Cat. No. | EDP | Graduation | Head Length x Width |
|---|---|---|---|
| **237 Steel Rule Depth Gages (0-6" Range)** | | | |
| 237 | 51080 | 32nds, 64ths | 2-5/8 x 1/8" |
| **237M Steel Rule Depth Gages (0-150mm Range)** | | | |
| 237M | 51081 | mm, 1/2mm | 66 x 3mm |





# Depth Gages

## 236, 236H Combination Steel Rule Depth and Angle Gages

0-6"

### 236

This depth gage has an added feature permitting its use as a protractor for measuring angles. It is a simple, handy tool that is a welcome addition to any machinist's toolbox.

- The head is graduated both left and right to 30, 45, and 60 degrees. The rule can be set to any of these angles by swinging the rule until the line on the turret coincides with the desired angle.
- Head is made of hardened steel, ground, and nicely polished – 2-5/8" (66mm) long and 1/8" (3mm) wide
- One side of the base is cut out to permit easier and more accurate readings
- The center of the head is recessed so that the tool will lay flat to permit more accurate measurements
- Tempered rule has been accurately machined divided, is smoothly fitted to the head, and can be locked in position by a knurled nut.

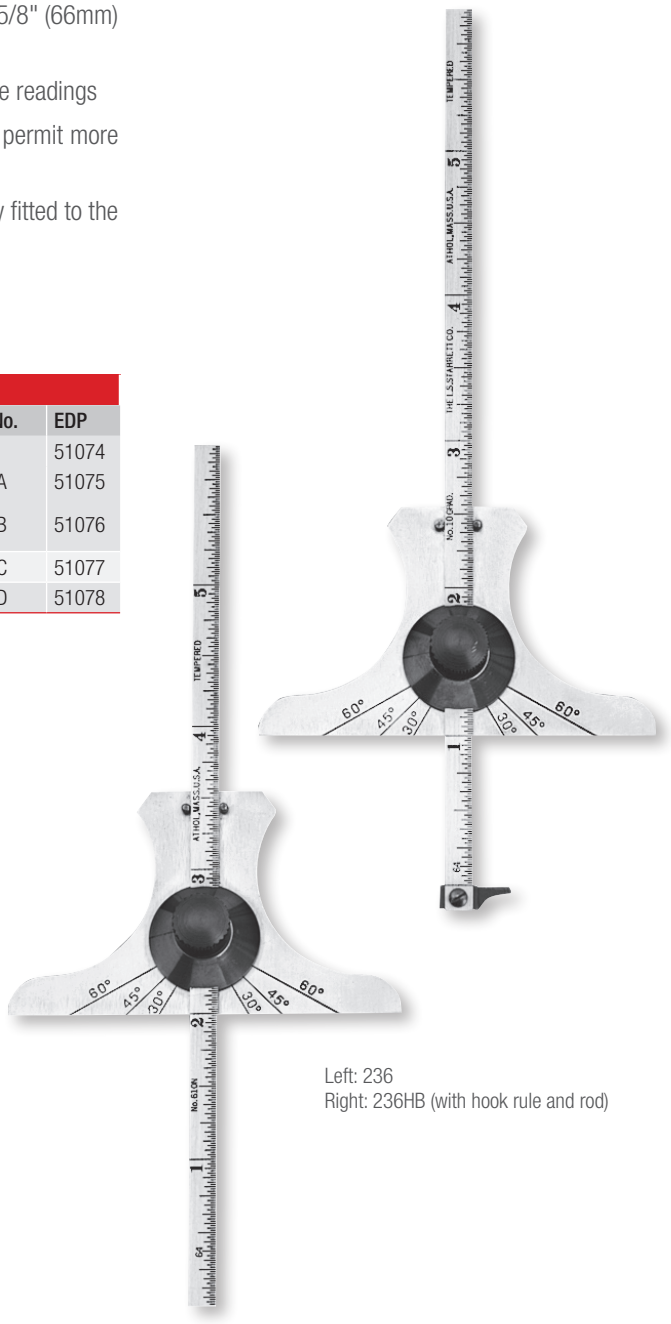
### 236H

These versatile gages can be used for calipering, as a depth gage by simply reversing the rule, as a protractor, and as a hook rule when removed from the tool.

Features are the same as the 236 except that a hook rule and an extra 6" (150mm) long rod are furnished with this gage. The rod has a 5/64" (2mm) diameter so it can measure the depth of small holes, slots, and recesses that the rule will not enter.

| 236 and 236H Combination Steel Rule Depth and Angle Gages (0-6" Range) | | | | |
|---|---|---|---|---|
| **Graduation** | **Angle Degrees** | **Description** | **Cat. No.** | **EDP** |
| 32nds, 64ths | 30, 45, 60 | 6" Combination Gage | 236 | 51074 |
| | | 6" Combination Gage with Hook Rule | 236HA | 51075 |
| | | 6" Combination Gage with Hook Rule and Rod | 236HB | 51076 |
| 32nds, 64ths | None | 6" Hook Rule Only* | 236HC | 51077 |
| None | None | 6" Rod Only | 236HD | 51078 |

Also available on request with C610N-6 satin chrome rule.
* Hook rule only for 236, 236H, 237, 493 and 493B.




Left: 236
Right: 236HB (with hook rule and rod)

# Depth Gages

## Dial Depth Gages

These depth gages are direct reading tools, referencing from their hardened and ground bases. All bases are 2-1/2" (64mm) long. They are quicker and more convenient to use than any other type of depth gage within their ranges and accuracy. Electronic Indicators can be furnished by special order.

## 640, 640M Dial Depth Gages

**0-1/2"/0-10MM**

### 640 Dial Depth Gages

The contact is slightly up into the base at rest. In action, the inspector sets the contact at zero, which is usually at the bottom of the base. Then the top button is pushed down to contact the work and the measurement is taken.




### 640R Dial Depth Gages

These gages are the same as the 640 except they have reverse movement (no push button) and can easily be used with one hand. Simply set on zero and apply the contact to the work and read the measurement.

**640 Dial Depth Gages**

| Range | Graduation | Dial Reading | In Case Cat. No. | In Case EDP |
|---|---|---|---|---|
| 0-1/2" | .0005" | 0-50 | 640JZ | 52705 |
| | | | 640RJZ | 52709 |
| 0-10mm | 0.01mm | 0-100 | 640MJZ | 55997 |
| | | | 640MRJZ | 56001 |

## 643 Dial Depth Gage

**0-.125"**

This gage has a knife-edge base and a needle point contact which has been hardened and ground. The knife-edge base has a cutout so the conical point can be precisely positioned for close work. Point is 1/2" (12.7mm) long with a 40º included angle.

In action, the inspector gently pushes the point down to read zero with the base and then pushes down to make the needle point contact the workpiece to take the measurement.




**643 Dial Depth Gages**

| Range | Graduation | Dial Reading | In Case Cat. No. | In Case EDP | Without Case Cat. No. | Without Case EDP |
|---|---|---|---|---|---|---|
| 0-.125" | .0005" | 0-25-0 | 643JZ | 52714 | 643J | 52715 |

Electronic version available from Special Order Division.



# Depth Gages

## 644, 644M Dial Depth Gages

### 0-3"/0-75MM

These gages are for longer ranges, and are accurate and simple to use. Put the contact on the work to be measured and push the gage head down until the base stops at the reference point and take your reading.

Furnished with three rounded-end contact points to cover the range. Flat end contact points are also available on special order.

The zero setting can be checked with the shortest contact in place by pushing down on a flat surface.

**644 Dial Depth Gages**

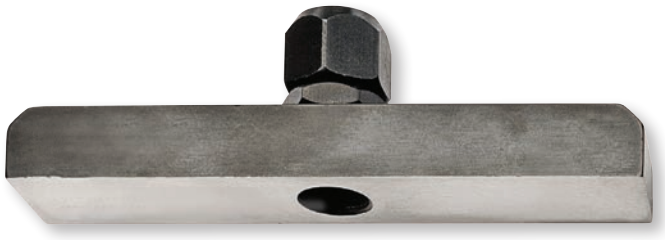
| Range | Graduation | Dial Reading | In Case | | Without Case | |
|---|---|---|---|---|---|---|
| | | | Cat. No. | EDP | Cat. No. | EDP |
| 0-3" | .001" | 0-100 | 644JZ | 52718 | 644J | 52719 |
| 0-75mm | 0.01mm | 0-100 | 644MJZ | 56027 | 644MJ | 56028 |







648 Depth Gage Bases will also accommodate the 644 Dial Depth Gage.



## 648 Depth Gage Bases

These different bases are for mounting indicators with a 3/8" (9.5mm) stem (25SC38 Stem Collet included) or an 8mm stem with optional 25MSB Split Bushing.

**648 Depth Gage Bases**

| Base Size | Cat. No. | EDP |
|---|---|---|
| 4" (100mm) | 648-4 | 65850 |
| 6" (150mm) | 648-6 | 65851 |
| 8" (200mm) | 648-8 | 65852 |

# Depth Gages

## 642, 642M Top Reading Dial Depth Gages

### 0-8.6"/0-215MM

This dial depth gage uses the back-plunger indicator to provide an upward-facing dial for easier readout. The operator selects the extension and contact point required, zeros the tool on a master and then reads any deviation of the work directly on the dial.

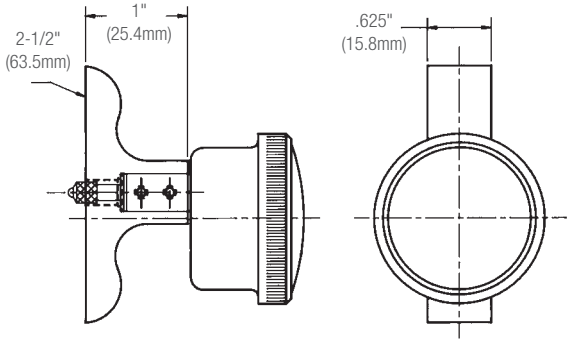
- Indicator does not have to be repositioned to get the full range available
- Choice of 2-1/2" (60mm) or 4" (100mm) base
- Two contacts and five extensions extend the range to 8.6" or 215mm
- Charts are supplied showing combinations of contacts and extensions required to achieve certain lengths

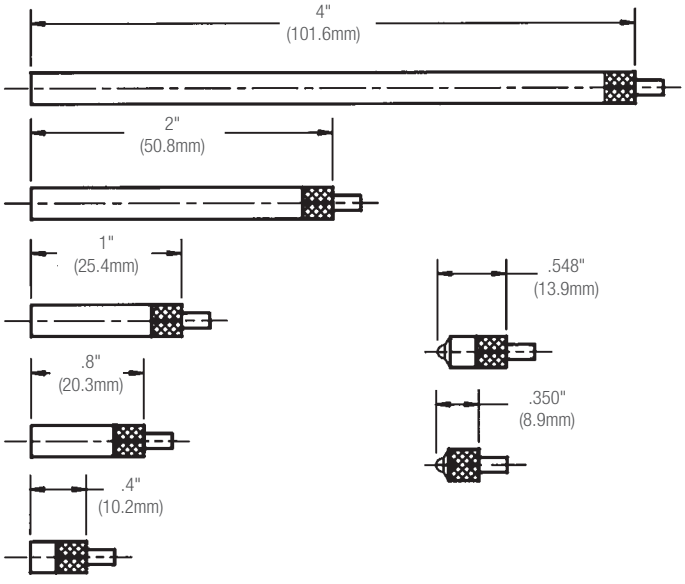


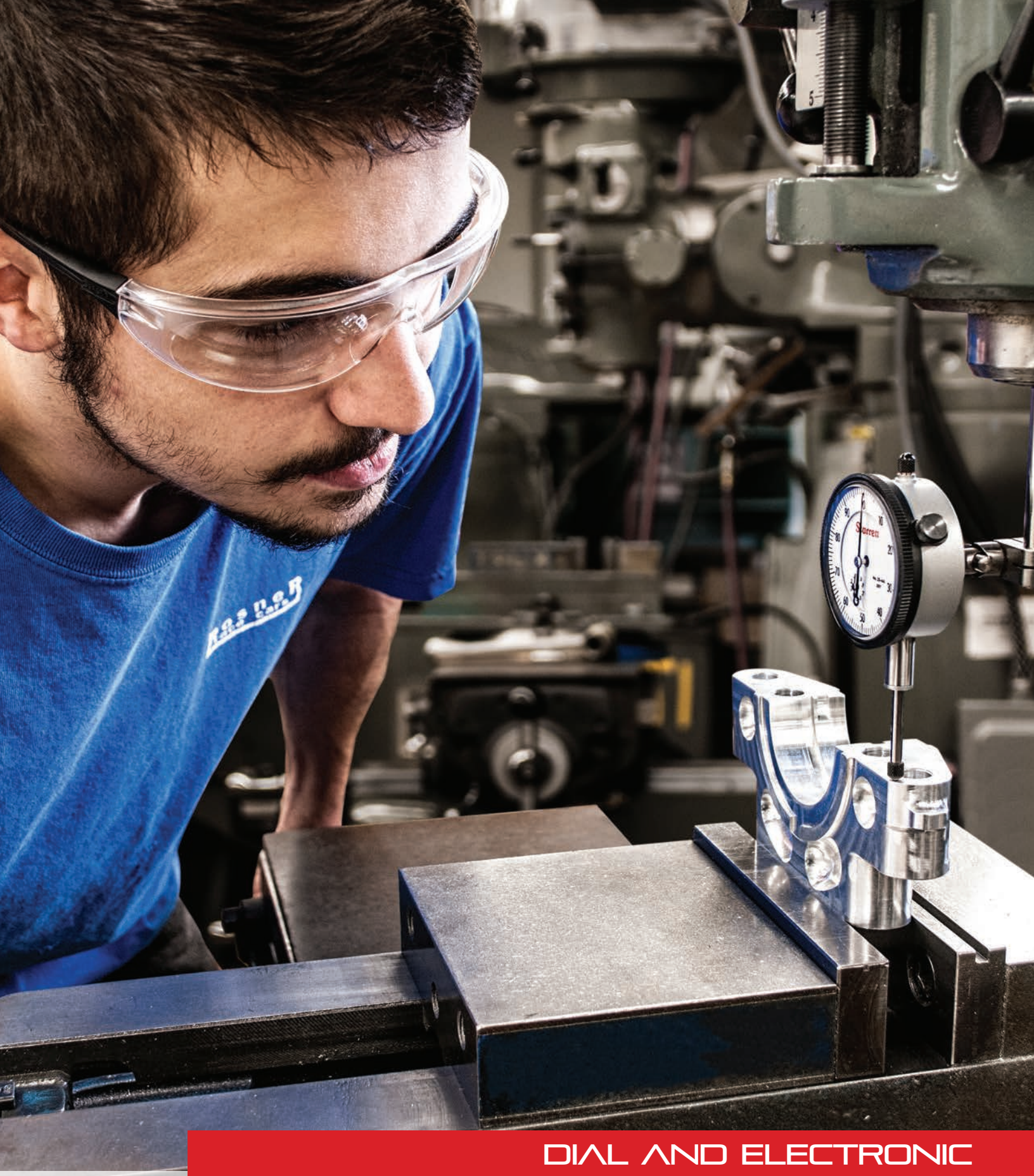
Above: 642AZ side view
Below: top view




| 642 Top Reading Dial Depth Gages | | | | | |
|---|---|---|---|---|---|
| **Range** | **Graduation** | **Dial Indicator Range** | **Approx. Base Length** | **Cat. No.** | **EDP** |
| 0-8.6" | .001" | .200" | 2-1/2" | 642Z | 65103 |
| | | | 4" | 642AZ | 65104 |
| 0-215mm | 0.01mm | 5mm | 60mm | 642MZ | 65105 |
| | | | 100mm | 642MAZ | 65106 |





# DIAL AND ELECTRONIC INDICATORS AND GAGES

# Test Indicator Snugs and Split Bushings Usage Guide

## Dove Tail Style Snugs:

PT22428: 3/32-1/4" (2.4-6.3mm) inch hole on one side and standard female dove connection on the other. For use with 708, 709 and 811 Test Indicators. Allows connection to 657AA, 657A, 657T Magnetic Base and PT017762 Holding Rod for 252 Height Stand and PT11770A Tool Post Holder or 711-49 Height Gage Attachment.

### Round Connection Sungs:

657S: 1/4" hole on both ends

PT18718: 3/32-1/4" hole on one end 5/16" on the other

PT18724: 3/32-1/4" hole on one end 3/8" on the other

657H: 3/8" inch hole on both ends

665D: 3/8" inch hole on one end .465" (11.8mm) on the other. Includes 665L (.375" bushing)

PT16846 (not shown): 3/4" inch hole on both ends

### Universal Style Snugs:

58S: 3/32-1/4" hole allows connection to 1/4", 5/16", 3/8" (6.3, 8, 9.5mm)

### Universal Drum Style Snugs:

57S: 5/16" and 3/8" (8, 9.5mm) on one end and 9/64", 5/32", 3/16", 1/4" (3.5, 4, 4.8, 6.3mm) on the opposite

**NOTE:** 3/8-1/4" bushings can be used with some of the snugs above to change 3/8"-1/4" where required (see PT00764)

### Split Bushings:

657R: outside .312" (7.9mm), inside .250" (6.3mm), length 1.000" (25.4mm)

PT00764: .375" (9.5mm) outside, inside .250" (6.3mm), length 1/2" (12.7mm)

80SB: outside .375" (9.5mm), inside .219" (5.5mm), length 1/2" (12.7mm). Used to increase the stem diameter on Starrett 80 miniature indicators to standard .375" diameter.

25MSB: outside .375" (9.5mm), inside .316" (8mm), length 1/2" (12.7mm), converts metric stemmed indicator to standard 3/8" diameter

665L: outside .465 (11.8mm), inside .375" (9.5mm), length 1-1/4" (31.5mm)

25SB: outside .500" (12.7mm), inside .375" (9.5mm), length 1/2" (12.7mm)



657H



PT22428



58S



657R



655D



657S
PT18718
PT18724



57S



665L

## Best Practices for Test Indicators and Holders

Test indicators are primarily used for testing or checking parts and for machine setups. They are a tool that is indispensable for working as a machinist or toolmaker. They are available in two types – plunger style and the lever style. Both are versatile, but the lever style is more adaptable to smaller, confined working areas.

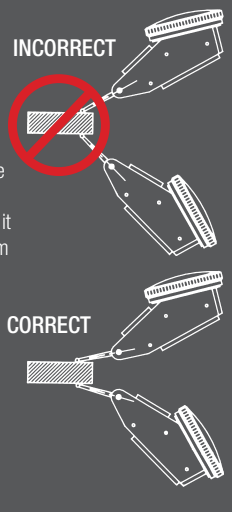
Unlike other indicators, the lever style's contact moves in an arc rather than in a straight line. This can cause a slight inaccuracy called "cosine error" if the angle of the lever to the workpiece is too steep. If, for example, a lever was set off an additional 20º, there could be an error of .0006" in a .010" range (0.012 mm in a 0.2mm range).

It is good practice, therefore, to keep your contact at or near 90º to the direction of movement.

Test indicators should always be "loaded" 1/10 to 1/4 of a turn before measuring.

Test indicators are comparative instruments that check and compare to known standards or that are used to zero-out setups.

We have a broad selection of holders shown in this section that allow you to use these indicators to the fullest. We've never seen a job that one of these holders combined with one of our test indicators could not handle.




For extreme accuracy we recommend positioning the lever contact so that it is approximately 15º from being horizontal with the workpiece

# Test Indicators

## 708, 708M, 709, 709M Dial Test Indicators with Dovetail Mounts

### .020", .060"/0.2MM, 0.8MM

These precision test indicators offer an easy to read angled head and the flexibility of three dovetail mounts. Features include:

- Large 1-3/8" (35mm) dial diameter with angled head
- Precision gear-driven design with smooth, jeweled movement
- Replaceable contact point reverses automatically, always maintaining clockwise hand rotation
- Satin chrome finish for durability
- Contacts are frictionally adjustable and replaceable
- Revolution count hand on 708B and 709B models
- Meet or exceed ISO accuracy specification




708BZ R708AZ



709BCZ

**Individual Carbide Contact Points‡**

| Fits Models | Length Inch | Length mm | Ball Diameter Inch | Ball Diameter mm | Part No. | EDP |
|---|---|---|---|---|---|---|
| .0001", .0005", 0.01mm Reading Models | 13/16" | 20mm | .040" | 1mm | PT23942 | 65255 |
| | | | .078" | 2mm | PT23914† | 64222 |
| | | | .120" | 3mm | PT23943 | 65256 |
| .0001", .0005", 0.01mm Reading Models | 1-23/64" | 34.4mm | .078" | 2mm | PT27024† | 66239 |
| .0001", .0005", 0.01mm Reading Models | 1-5/64" | 28.4mm | .078" | 2mm | PT25577† | 67294 |
| 0.002mm Reading Models Only | 5/8" | 16mm | .078" | 2mm | PT23953† | 65868 |

† PT23914, PT27024, PT25577 and PT23953 furnished as standard.
‡ Length of carbide contacts must be the same as contacts normally furnished.

**708, 709 Dial Test Indicators with dovetail mounts**

| Grad | Range | Dial Reading | Carbide Contact Point Length | Carbide Contact Point Ball Dia. | Description | Dial Color | Cat. No. | EDP | With SLC** Cat. No. | With SLC** EDP |
|---|---|---|---|---|---|---|---|---|---|---|
| .0001" | .010" | 0-5-0 | 13/16" (20mm) | .078" (2mm) | Without Attachments | White | 708AZ | 64212 | 708AZ W/SLC | 66866 |
| | | | | | | Red | R708AZ | 64603 | R708AZ W/SLC | 66867 |
| | | | | | | Black | B708AZ | 64607 | B708AZ W/SLC | 66868 |
| | | | | | With Attachments* | White | 708ACZ | 64217 | 708ACZ W/SLC | 66869 |
| | | | | | | Red | R708ACZ | 64604 | R708ACZ W/SLC | 66870 |
| | | | | | | Black | B708ACZ | 64608 | B708ACZ W/SLC | 66871 |
| .0001" | .020" | 0-5-0 | 13/16" (20mm) | .078" (2mm) | Without Attachments | White | 708BZ | 64213 | 708BZ W/SLC | 66874 |
| | | | | | With Attachments* | | 708BCZ | 64218 | 708BCZ W/SLC | 66875 |
| .0005" | .030" | 0-15-0 | 13/16" (20mm) | .078" (2mm) | Without Attachments | White | 709AZ | 64214 | | |
| | | | | | | Red | R709AZ | 64605 | | |
| | | | | | | Black | B709AZ | 64609 | | |
| | | | | | With Attachments* | White | 709ACZ | 64219 | | |
| | | | | | | Red | R709ACZ | 64606 | | |
| | | | | | | Black | B709ACZ | 64610 | | |
| .0005" | .050" | 0-25-0 | 1-23/64" (34.4mm) | .078" (2mm) | Without Attachments | White | 709ALZ | 65857 | | |
| | | | | | With Attachments* | | 709ALCZ | 65858 | | |
| .0005" | .060" | 0-15-0 | 13/16" (20mm) | .078" (2mm) | Without Attachments | White | 709BZ | 64215 | | |
| | | | | | With Attachments* | | 709BCZ | 64220 | | |
| **708M, 709M Dial Test Indicators with dovetail mounts** | | | | | | | | | | |
| 0.002mm | 0.2mm | 0-100-0 | 5/8" (16mm) | .078" (2mm) | Without Attachments | Yellow | 708MAZ | 65864 | 708MAZ W/SLC | 66872 |
| | | | | | With Attachments* | | 708MACZ | 65865 | 708MACZ W/SLC | 66873 |
| 0.01mm | 0.8mm | 0-40-0 | 13/16" (20mm) | .078" (2mm) | Without Attachments | Yellow | 709MAZ | 64216 | | |
| | | | | | With Attachments* | | 709MACZ | 64221 | | |
| 0.01mm | 1.0mm | 0-50-0 | 1-5/64" (28.4mm) | .078" (2mm) | Without Attachments | Yellow | 709MALZ | 67092 | | |
| | | | | | With Attachments* | | 709MALCZ | 67093 | | |

* Attachments include dovetail body clamp (PT22429/EDP 72441), tool post holder (PT11770A/EDP 71361), swivel post snug with dovetail indicator clamp (PT22428/EDP 72440), and snug and rod unit (Inch: PT22430/EDP 72442 or Millimeter: PT27171/EDP 66457).
** Includes redemption card for Standard Letter of Certification

# Test Indicators

## 811, 811M Dial Test Indicators with Swivel Head

### .060", 0.8MM

These are some of the most versatile and unique indicators available, the swivel head feature allows positioning to suit your line of sight from horizontal to vertical and at any angle up to 90º.

- Two positioning mounts work with dovetail test indicator accessories
- Contacts are frictionally adjustable and replaceable
- Contact point reverses, always maintaining clockwise hand rotation
- Contacts also available individually in steel, carbide, and different sizes
- Smooth, jeweled movement
- Large, 1-3/8" (35mm) dial diameter for increased readability
- Inch reading indicators are available with white, red, or black dials – metric indicators with yellow dials



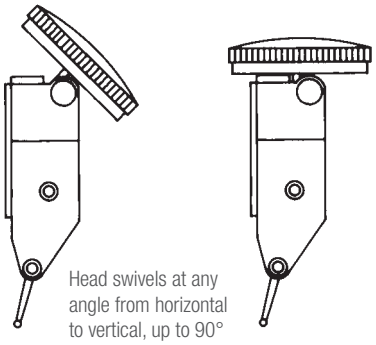
811-5PZ



R811-1PZ



B811-5PZ


Head swivels at any angle from horizontal to vertical, up to 90°



**Individual Contact Points for 811 and 811M Dial Test Indicators with Swivel Head**

| Fits 811 Models | Length Inch | Length mm | Ball Diameter Inch | Ball Diameter mm | Material | Part No. | EDP |
|---|---|---|---|---|---|---|---|
| .0005" and 0.01mm Reading Only | 5/8" | 16mm | .032" | 0.8mm | Steel | PT23062 | 72451 |
| | | | | | Carbide | PT23062X | 72452 |
| | | | .078" | 2mm | Steel | PT22315 | 72443 |
| | | | | | Carbide | PT22315X | 72453 |
| .001" Reading Only | 1-5/16" | 33mm | .032" | 0.8mm | Steel | PT23064 | 72454 |
| | | | | | Carbide | PT23064X | 72455 |
| | | | .078" | 2mm | Steel | PT23011 | 72444 |
| | | | | | Carbide | PT23011X | 72456 |

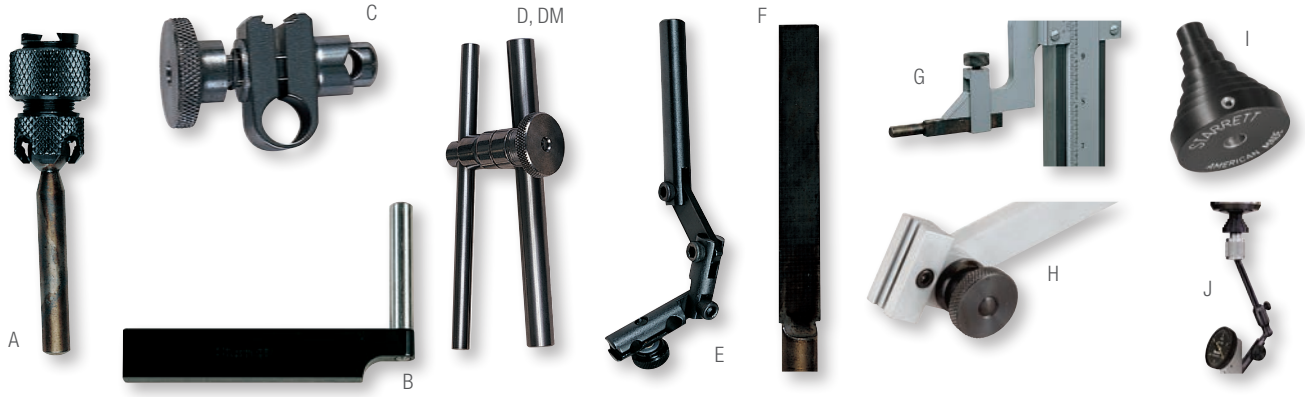
**811, Dial Test Indicators with Swivel Head**

| Graduation | Range | Dial Reading | Steel Contact Points Length Inch (mm) | Steel Contact Points Ball Dia. Inch (mm) | Description | Dial Color | Cat. No. | EDP |
|---|---|---|---|---|---|---|---|---|
| .0005" | .030" | 0-15-0 | 5/8" (16mm) | .078" (2mm) | In Case without Attachments | White | 811-5PZ | 57080 |
| | | | | | | Black | B811-5PZ | 63262 |
| | | | | | | Red | R811-5PZ | 63266 |
| | | | | | In Case with Attachments* | White | 811-5CZ | 57079 |
| | | | | | | Black | B811-5CZ | 63261 |
| | | | | | | Red | R811-5CZ | 63265 |
| .001" | .060" | 0-30-0 | 1-5/16" (33mm) | .078" (2mm) | In Case without Attachments | White | 811-1PZ | 57082 |
| | | | | | | Black | B811-1PZ | 63264 |
| | | | | | | Red | R811-1PZ | 63268 |
| | | | | | In Case with Attachments* | White | 811-1CZ | 57081 |
| | | | | | | Black | B811-1CZ | 63263 |
| | | | | | | Red | R811-1CZ | 63267 |
| **811M Dial Test Indicators with swivel head** | | | | | | | | |
| 0.01mm | 0.8mm | 0-40-0 | 5/8" (16mm) | .078" (2mm) | In Case without Attachments | Yellow | 811-MPZ | 57084 |
| | | | | | In Case with Attachments* | | 811-MCZ | 57083 |

* Attachments include dovetail body clamp (PT22429/EDP 72441), tool post holder (PT11770A/EDP 71361), swivel post snug with dovetail indicator clamp (PT22428/EDP 72440), and snug and rod unit (Inch: PT22430/EDP 72442 or Millimeter: PT27171/EDP 66457).

# Test Indicators

## Attachments for 708, 709, and 811 Test Indicators




### A. Dovetail Body Clamp

PT22429. 3/16" (4.8mm) diameter rod. For use in chucks, collets or surface gage snugs.

### B. Tool Post Holder

PT11770A. 1/4" x 1 5/16" (6.3 x 33mm) post and 1/4" x 1/2" (6.3 x 12.7mm) shank. For use in tool posts or in height gages.

### C. Swivel Post Snug with Dovetail Indicator Clamp

PT22428. Will fit over spindles and posts 3/32-1/4" (2.4-6.3mm). Can be used directly on our 252 Height Transfer Gage and our 657 Magnetic Base Holders. It is frequently used on the 1/4" (6.3mm) rod of the Snug and Rod Unit PT22430.

### D. Snug and Rod Unit

PT22430. This unit consists of a snug (PT18724) with two 4" (100mm) long rods, one a 1/4" (6.3mm) diameter, the other a 3/8" (9.5mm) diameter. It is generally used with an indicator attached to PT22428 Swivel Post Snug which slides onto the 1/4" (6.3mm) diameter rod.

The 3/8" (9.5mm) rod will fit into the 252 and 657H Gage Holders. It also has the ability to be held in chucks and adjusted to a wide range of heights and diameters.

### DM. Metric Snug and Rod Unit

PT27171. This unit consists of a snug with two 100mm (4") long rods, one having a 6mm (.236") diameter, the other an 8mm (.315") diameter.

### E. Indicator Axial Support

PT26007. This triple-hinged indicator holder is designed to mount dovetail indicators (such as our 708, 709, and 811 Indicators). By using a rod through the 3/16" (4.7mm) mounting hole, it will also accommodate test indicators such as our 711 Indicator. Overall length is approximately 5-1/4" (133mm), shank size is 3/8" (9.5mm).

### F. Height Gage Attachment

711-49. 1/8" x 5/16" (3 x 8mm) shank. This is used for 250, 750, 751 Height Gages, and 995 Planer and Shaper Gage.

### G. Height Gage Attachment

711-35. 3/16" x 3/8" (4.8 x 9.5mm) shank. This is used for 255 Height Gage.

### H. Indicator Attachment

PT99454 dovetail clamping style. Replaces standard scriber. Provides means to attach dovetail equipped test indicators or electronic probes to height gages. Allows indicator to be used to ensure that the down pressure on the part is the same as the original set zero position.

### I. and J. Collet Adaptors

PT28315 (I.)– To be used with a 3/16" (4.7mm) diameter attachment for indicators such as PT22429 dovetail body clamp and PT07104F long and short arm attachments. PT28316 (J.)– Swivel Post Collet Adaptor, for use on any dovetail test indicator.

**Attachments for 708, 709, and 811 Test Indicators**

| Photo Key | Description | Part No. | EDP |
|---|---|---|---|
| A* | Dovetail Body Clamp | PT22429 | 72441 |
| B* | Tool Post Holder | PT11770A | 71361 |
| C* | Swivel Post Snug with Clamp | PT22428 | 72440 |
| D* | Snug and Rod Unit | PT22430 | 72442 |
| DM | Metric Snug and Rod Unit | PT27171 | 66457 |
| E | Indicator Axial Support | PT26007 | 65101 |
| F | Height Gage Attachment | 711-49 | 52941 |
| G | | 711-35 | 52942 |
| H | Indicator Attachment, dovetail style | PT99454 | 68713 |
| I | Collet Adaptor | PT28315 | 68847 |
| J | | PT28316 | 68848 |

* Furnished with all sets having "C" in the catalog number

# Test Indicators

## 711, 711M Last Word® Dial Test Indicators

### .030", 0.7MM

The venerable Last Word Dial Test Indicator is among the most versatile available. Their small size and variety of attachments will handle all jobs with ease and accuracy. A very useful feature is the shaded dial – when used with a mirror, such as in a jig bore application, the operator will always know what the correct reading is.

**Other features include:**

- Ideal for precise measurements in all machining, layout, and inspection work
- Smooth, jeweled lever action
- Positive reversing switch
- Hard chrome-plated ratchet contact point
- Swiveling tubular body
- Easy reading dials, half yellow for clarity
- Variety of attachments available to suit the application.
- Indicators having "C" in the catalog number are furnished with 3 interchangeable steel contact points. All other indicators are furnished with one interchangeable steel contact point, PT07087. Carbide points available as listed.

**Individual Contact Points (Fit All 711 Models)**

| Length | | Ball Diameter | | | | |
|---|---|---|---|---|---|---|
| Inch | mm | Inch | mm | Material | Part No. | EDP |
| 5/32" | 4mm | .035" | 0.9mm | Steel | PT07137 | 70945 |
| | | .062" | 1.6mm | | PT07136 | 70944 |
| | | .120" | 3mm | | PT07087 | 70912 |
| 5/32" | 4mm | .035" | 0.9mm | Carbide | PT07137X | 52964 |
| | | .062" | 1.6mm | | PT07136X | 52965 |
| | | .120" | 3mm | | PT07087X | 52966 |

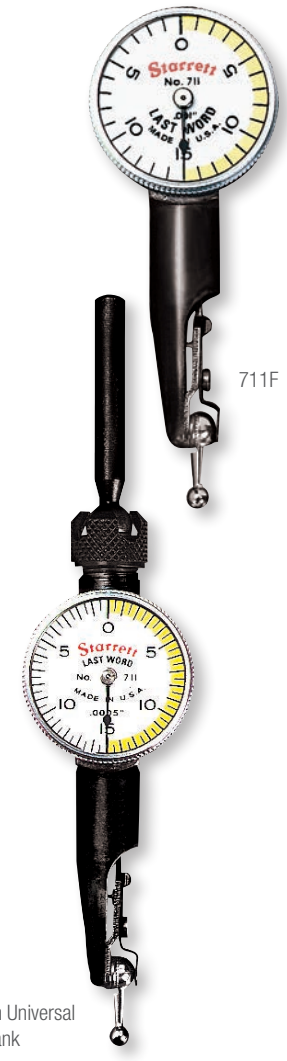
**711 Last Word® Dial Test Indicators**

| Graduation | Range | Dial Reading | Steel Contact Points Length | Steel Contact Points Ball Diameter | Description | Cat. No. | EDP |
|---|---|---|---|---|---|---|---|
| .001" | .030" | 0-15-0 | 5/32" (4mm) | One: .120" (3mm) | Indicator with Universal Shank Complete with Long and Short Arm, Body Clamp | 711FSAZ | 52925 |
| | | | | | Indicator with Gooseneck Shank | 711FSBZ | 52927 |
| | | | | | Indicator with Body Clamp Only | 711FSZ | 52929 |
| | | | | | Indicator with Universal Friction Holder with Shank | 711GPSZ | 52944 |
| | | | | Three: .035" (0.9mm) .062" (1.6mm) .120" (3mm) | Indicator Complete with All Attachments* | 711GCSZ | 52943 |
| .0005" | .030" | 0-15-0 | 5/32" (4mm) | One: .120" (3mm) | Indicator with Universal Shank Complete with Long and Short Arm, Body Clamp | 711HSAZ | 52951 |
| | | | | | Indicator with Body Clamp Only | 711HSZ | 52953 |
| | | | | | Indicator with Universal Friction Holder with Shank | 711LPSZ | 52958 |
| | | | | Three: .035" (0.9mm) .062" (1.6mm) .120" (3mm) | Indicator Complete with All Attachments* | 711LCSZ | 52957 |

**711M Last Word® Dial Test Indicators**

| | | | | | | | |
|---|---|---|---|---|---|---|---|
| 0.01mm | 0.7mm | 0-35-0 | 5/32" (4mm) | One: .120" (3mm) | Indicator with Universal Shank Complete with Long and Short Arm, Body Clamp | 711MFSAZ | 52926 |
| | | | | | Indicator with Body Clamp Only | 711MFSZ | 52930 |
| | | | | | Indicator with Universal Friction Holder with Shank | 711MGPSZ | 52946 |
| | | | | Three: .035" (0.9mm) .062" (1.6mm) .120" (3mm) | Indicator Complete with All Attachments* | 711MGCSZ | 52945 |

* Attachments include 3 contact points – body clamp – universal friction holder with shank – universal shank complete with long and short arm – double-jointed attachment – height gage attachment – surface gage attachment – coupling with 3/16" (4.8mm) hole.

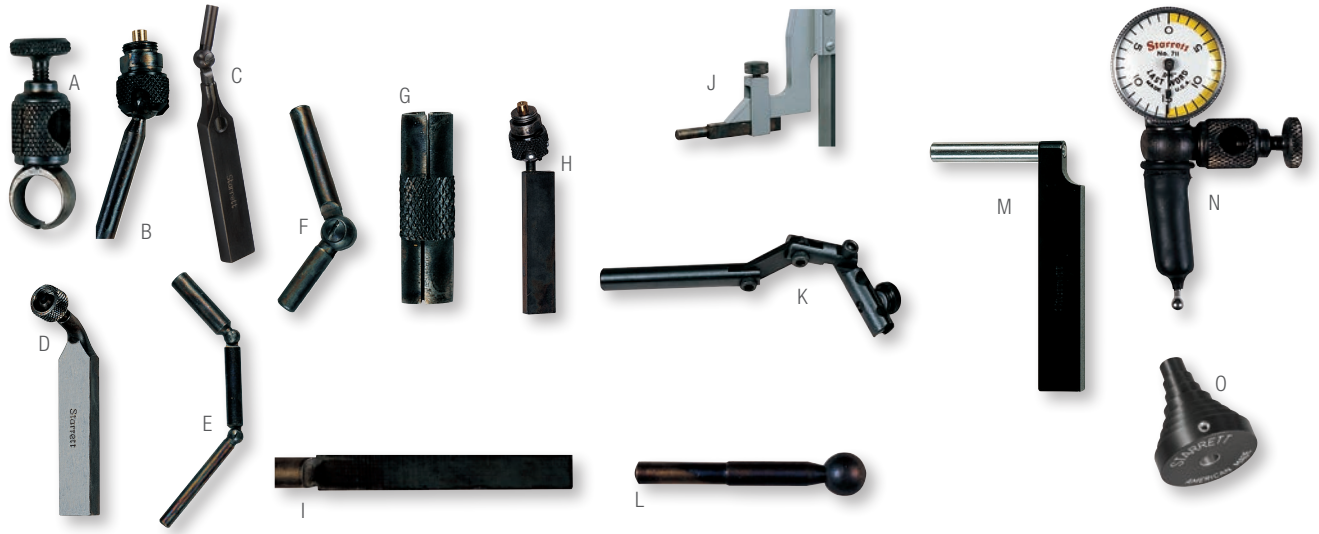



711F

711LPSZ Indicator with Universal Friction Holder and Shank

# Test Indicators

## Attachments for 711 Last Word® Dial Test Indicators




### A. Body Clamp

PT07101F Permits the indicator to be held by its body and clamped to any diameter rod from 1/8-1/4" (3-6mm). It also attaches the universal shank to the indicator with the addition of PT07104F Long and Short Arm.

### B. Universal Friction Holder

with shank 711EA – This inserts in place of the end plug at the top of the indicator body. The shank has a 3/16" (4.8mm) diameter which will fit into chucks and also into the snugs of our 57 and 257 Surface Gages.

### C. Universal Shank

PT07103A. This shank includes PT07104F (the long and short arm) to go into the body clamp. With its shank size of 1/4" x 1/2" (6.4 x 12.7mm), this can be used in a lathe tool post or for 254 Height Gage.

### D. Gooseneck Shank

PT07107A. 1/4" x 1/2" (6.4 x 12.7mm) shank can be used on tool posts and on the same height gages as the PT07103A Universal Shank. It is attached by unscrewing the body clamp and replacing it with the gooseneck shank.

### E. Double-Jointed Attachment

PT13301. This attachment has a 3/8" (9.5mm) diameter at one end and a 1/4" (6.3mm) diameter at the other end and will fit into chucks and collets, (such as in a jig borer) and hold the indicator by the body clamp, giving it greater depth and diameter range.

### F. Long and Short Arm

PT07104F. This is used with the universal shank to attach it to the body clamp. It has a 3/16" (4.8mm) diameter and arms with 13/16" and 1-3/16" (20mm and 30mm) lengths.

### G. Coupling with 3/16" (4.8mm) hole

PT05116. Coupling slips over the long and short arm PT07104F and the shank of PT13175 Universal Friction Holder to permit offset.

### H. Height Gage Attachment

PT24706 – This inserts in place of the end plug at the top of the indicator body. The 3/16" x 11/32" (4.8 x 8.7mm) shank fits 255 12", 18" and 24" Height Gages.

### I. Height Gage Attachment

711-49. 1/8" x 5/16" (3 x 8mm) shank. This is used for 250, 750, 751 Height Gages and 995 Planer and Shaper Gage.

### J. Height Gage Attachment

711-35. 3/16" x 3/8" (4.8 x 9.5mm) shank. This is used for 255 Height Gage.

### K. Indicator Axial Support

PT26007. This triple-hinged indicator holder is designed to mount dovetail indicators (such as our 708, 709, and 811 indicators). By using a rod through the 3/16" (4.7mm) mounting hole, it will also accommodate test indicators such as our 711 indicators. Overall length is approximately 5 1/4" (133mm), shank size is 3/8" (9.5mm).

### L. Surface Gage Attachment

PT05119. Fits in place of the ball shank of the 711EA Attachment. Allows 711G and L Indicators to be used on holders with smaller clamp hole.

### M. Tool Post Holder

PT11770A. 1/4" x 1 5/16" (6.3 x 33mm) post and 1/4" x 1/2" (6.3 x 12.7mm) shank. For use in tool posts or in height gages

### N. Rubber Dust Guard

PT09764. Protects the indicators' working parts by sealing out dust, powder, and other foreign matter under adverse gaging conditions.

### O. Collet Adaptor

PT28315. To be used with a 3/16" (4.7mm) diameter attachment for indicators such as PT22429 dovetail body clamp and PT07104F long and short arm attachments.

**Attachments for 711 Last Word Dial Test Indicators**

| Photo Key | Description | Part No. | EDP |
|---|---|---|---|
| A* | Body Clamp | PT07101F | 70924 |
| B* | Universal Friction Holder with Shank | 711EA | 52924 |
| C* | Universal Shank Complete with Long and Short Arm | PT07103A | 52939 |
| D | Gooseneck Shank | PT07107A | 52937 |
| E* | Double-Jointed Attachment | PT13301 | 71441 |
| F* | Long and Short Arm | PT07104F | 70929 |
| G* | Coupling with 3/16" (4.8mm) Hole | PT05116 | 70556 |
| H* | Height Gage Attachment | PT24706 | 65064 |
| I | | 711-49 | 52941 |
| J | | 711-35 | 52942 |
| K | Indicator Axial Support | PT26007 | 65101 |
| L* | Surface Gage Attachment | PT05119 | 70557 |
| M | Tool Post Holder | PT11770A | 71361 |
| N | Rubber Dust Guard | PT09764 | 71290 |
| O | Collet Adaptor | PT28315 | 68847 |

* Furnished with all sets having "C" in the catalog number

# Test Indicators

## 3808, 3809, 3908 and 3909 Dial Test Indicators

These dial test indicators are offered with choices of dial size, range and include accessories.

All 3808 and 3809 models have 1-1/4" (32mm) dial faces while 3908 and 3909 models offer a larger 1-9/16" (40mm) dial face.

**3808, 3809, 3908 and 3909 Inch Reading Indicators**

| Grad | Range | Dial Reading | Dial Diameter | Description | Cat. No. | EDP |
|---|---|---|---|---|---|---|
| .0001" | .008" | 0-4-0 | 1-1/4" | Indicator, two dovetail clamps, case* | 3808A | 12331 |
| | | | | Indicator with accessories, case** | 3808AC | 12303 |
| | | | 1-9/16" | Indicator, two dovetail clamps, case* | 3908A | 12488 |
| | | | | Indicator with accessories, case** | 3908AC | 12636 |
| .0005" | .030" | 0-15-0 | 1-1/4" | Indicator, two dovetail clamps, case* | 3809A | 12333 |
| | | | | Indicator with accessories, case** | 3809AC | 12305 |
| | | | 1-9/16" | Indicator, two dovetail clamps, case* | 3909A | 12527 |
| | | | | Indicator with accessories, case** | 3909AC | 12669 |

* Indicator, .156" contact point, 3/8" and 5/32" dovetail clamps & case

** Indicator, .078" and .156" contact points, 3/8" and 5/32" dovetail clamps, .156" swivel post holder, tool post holder, contact wrench and case

**3808, 3809, 3908 & 3909 Metric Reading Indicators**

| Grad | Range | Dial Reading | Dial Diameter | Description | Cat. No. | EDP |
|---|---|---|---|---|---|---|
| 0.002mm | 0.2mm | 0-100-0 | 32mm | Indicator, two dovetail clamps, case* | 3808MA | 12332 |
| | | | | Indicator with accessories, case** | 3808MAC | 12304 |
| | | | 40mm | Indicator, two dovetail clamps, case* | 3908MA | 12520 |
| | | | | Indicator with accessories, case** | 3908MAC | 12656 |
| 0.01mm | 0.8mm | 0-40-0 | 32mm | Indicator, two dovetail clamps, case* | 3809MA | 12334 |
| | | | | Indicator with accessories, case** | 3809MAC | 12307 |
| | | | 40mm | Indicator, two dovetail clamps, case* | 3909MA | 12563 |
| | | | | Indicator with accessories, case** | 3909MAC | 12673 |

* Indicator, 4mm contact point, 9.5mm and 4mm dovetail clamps and case

** Indicator, 2mm and 4mm contact points, 9.5mm and 4mm dovetail clamps, 4mm swivel post holder, tool post holder, contact wrench and case

Each inch reading and metric reading 3808, 3809, 3908 and 3909 is offered with a choice of two Graduation/Range/Reading configurations. Features include:

- Precision gear-driven design with smooth, jeweled movement
- Frictionally adjustable contact point reverses automatically, always maintaining clockwise hand rotation
- Meets or exceeds ANSI/ASME accuracy specifications
- High contrast, easy-to-read dials with white background for inch and yellow for metric




3909A




3909MA

# Back Plunger Indicators

## 650, 651 Back-Plunger Dial Indicators

.200"

These workhorse back plunger indicators feature AGD (American Gage Design) stem holding fixtures and the great variety of AGD contact points. These very versatile indicators have the following features:

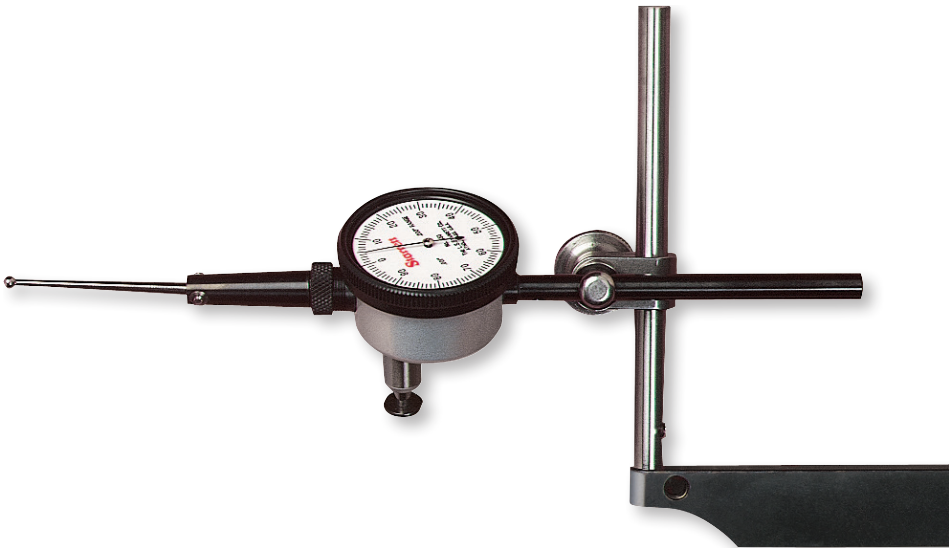
- 650 Indicators have a 3" (75mm) deep hole attachment that connects directly with the main spindle for positive action. Attachment is convenient to use when checking internal dimensions of a workpiece. When not needed, the attachment can be easily removed and the hole capped.
- 651 Indicators are identical to the 650 indicators except they cannot accept the deep hole attachment
- Both models have large 1-11/16" (43mm) diameter bezels with easy-to-read dial numbers and graduations
- Smooth and accurate operation due to their sturdy, basic design
- Hardened, stainless steel AGD stem .375" (9.5mm) diameter
- Shank dimension 1/4" (6.3mm) diameter, 3-3/16" (80mm) long
- With their .375" (9.5mm) AGD stem diameter, the 650 and 651 can be used with our 670 Hole Attachment and our 671 Universal Attachment
- Adjustable dials to set zero at any point opposite the hand
- Inch reading dials have white faces and millimeter reading dials are yellow
- Three different styles of contact points are furnished with each indicator




| 650, 651 Back Plunger Dial Indicators | | | | With Deep Hole Attachment | | Without Deep Hole Attachment | |
|---|---|---|---|---|---|---|---|
| Graduation | Range | Dial Reading | Description | Cat. No. | EDP | Cat. No. | EDP |
| .001" | .200" | 0-100 | Indicator with 3 Contact Points, 3 Attachments*, in Case | 650A1Z | 64475 | 651A1Z | 64483 |
| | | | Indicator with 3 Contact Points Only | 650B1 | 64477 | 651B1 | 64485 |
| .001" | .200" | 0-50-0 | Indicator with 3 Contact Points, 3 Attachments*, in Case | 650A5Z | 64474 | 651A5Z | 64484 |
| | | | Indicator with 3 Contact Points Only | 650B5 | 64476 | 651B5 | 64486 |
| **650, 651 Back Plunger Dial Indicators** | | | | **With Deep Hole Attachment** | | **Without Deep Hole Attachment** | |
| 0.01mm | 5mm | 0-100 Yellow Dial Face | Indicator with 3 Contact Points, 3 Attachments*, in Case | 650MA1Z | 65261 | 651MA1Z | 65263 |
| | | | Indicator with 3 Contact Points Only | 650MB1 | 65262 | 651MB1 | 65264 |

* Attachments include clamp, tool post holder and snug (PT18718).

| Individual Contact Points Only | | |
|---|---|---|
| Photo | Part No. | EDP |
|  | PT01761 | 75263 |
|  | PT06632-5 | 70793 |
|  | PT06632-6 | 70794 |



# Back Plunger Indicators

## 196, 196M Universal Back Plunger Dial Indicators

### .200", 5MM

Our 196 Indicator is one of the most versatile indicators available … and it is the "granddaddy" of them all. Over the years this tool has been improved by methods and materials, but the basic design is unchanged. The design has withstood the test of time and beaten all challengers because it is:

- Accurate and reliable
- Simple to operate
- Rugged, with few moving parts
- Smooth in operation

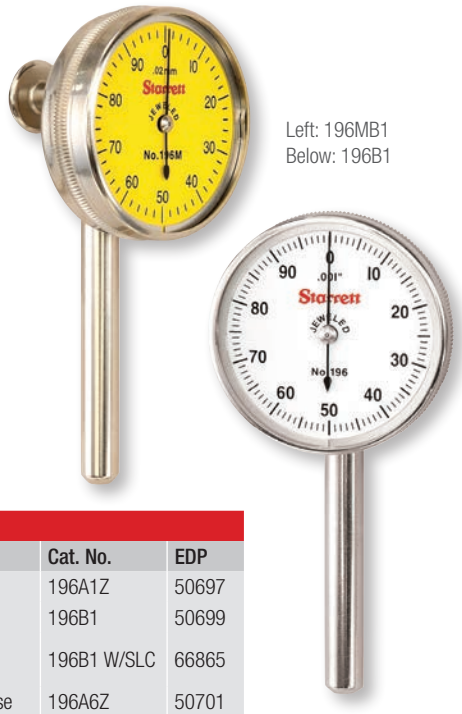
While there is a need for indicators with finer graduations, such as our 708 Indicators, this indicator with graduations to .001" and 0.02mm will handle by far the majority of jobs. Shank diameter is 1/4" (6.3mm). Antimagnetic models are also available: (inch reading) 196A6Z and 196B6.

For full use, the operator first chooses the proper contact from the three hardened contact points that come with each model. Then the contact should be brought against the work with enough pressure to give the hand one full turn. Set the hand at zero by rotating the dial with the knurled bezel. This provides one full rotation of the hand both to the right and left of zero, showing a rise or drop in the work and the amount of that variation.

| Contact Points and Adaptors Only for 196 and 196M Universal Back Plunger Dial Indicators | | |
|---|---|---|
| **Description** | **Catalog/Part No.** | **EDP** |
| Adaptor** | 196R | 50711 |
| Adaptor (Metric Threads) | 196MR | 67457 |
| Hardened Steel Contact Point | PT05471 | 70617 |
| | PT05472 | 70618 |
| | PT05473 | 70619 |

** For Contact Points with #4-48 Thread, see AGD Contact Listings.




Left: 196MB1
Below: 196B1

| 196 Universal Back Plunger Dial Indicators (1/4" Shank Diameter) | | | | | |
|---|---|---|---|---|---|
| **Graduation** | **Range** | **Dial Reading** | **Description** | **Cat. No.** | **EDP** |
| .001" | .200" | 0-100 | Indicator with 3 Contact Points, Adaptor, 4 Attachments* in Case | 196A1Z | 50697 |
| | | | Indicator with 3 Contact Points and Adaptor Only | 196B1 | 50699 |
| | | | Indicator with 3 Contact Points, Adaptor, and Standard Letter of Certification† | 196B1 W/SLC | 66865 |
| | | | Antimagnetic Indicator with 3 Contact Points, 4 Attachments* in Case | 196A6Z | 50701 |
| | | | Antimagnetic Indicator with 3 Contact Points Only | 196B6 | 50702 |
| .001" | .200" | 0-50-0 | Indicator with 3 Contact Points, Adaptor, 4 Attachments* in Case | 196A5Z | 50714 |
| | | | Indicator with 3 Contact Points and Adaptor Only | 196B5 | 50717 |
| **196M Universal Back Plunger Dial Indicators (6.3mm Shank Diameter)** | | | | | |
| 0.02mm | 5mm | 0-100 Yellow Dial Face | Indicator with 3 Contact Points, Adaptor, 4 Attachments* in Case | 196MA1Z | 65251 |
| | | | Indicator with 3 Contact Points and Adaptor Only | 196MB1 | 65252 |
| | | 0-50-0 Yellow Dial Face | Indicator with 3 Contact Points, Adaptor 196R, 4 Attachments* in Case | 196MA5Z | 65253 |
| | | | Indicator with 3 Contact Points and Adaptor Only | 196MB5 | 65254 |

* Attachments include clamp, tool post holder, snug and hole attachment.
† Includes redemption card for Standard Letter of Certification (SLC).

# Back Plunger Indicators

## Attachments for 650, 651, 196 and 196M Back Plunger Dial Indicators and Universal Dial Indicators

### A. Clamp

PT99437 With a 1-5/16" (33mm) flat or round capacity – 5/16" (8mm) post (PT03709-1/2) used with PT18718 Snug.

### B. Tool Post Holder

PT99438 3/8" x 3/4" x 6" (9.5 x 19 x 150mm) with upright spindle (PT03820-0) 5/16" dia. x 4-1/2" length (8 x 114mm). Use with PT18718 Snug.

### C. Snug Complete

PT18718. Post hole has a 5/16" diameter† and 3/32-1/4" holding capacity. Can be used on our 252 Height Transfer Gage, 57 and 257A and B Surface Gages, on 657A Magnetic Base and Swivel Post Assembly.

### D. Snug Complete

PT18724. Post hole has a 3/8" diameter (9.5mm) and 3/32-1/4" (2.4-6.3mm) holding capacity. Can be used with our 57 and 257C and D Surface Gages or 657AA Magnetic Base with upright post.

### E. Universal Snug

57S With spindle hole diameters 5/16", 3/8" (8, 9.5mm) and gripping hole diameters 9/64", 5/32", 3/16", 1/4" (3.5, 4, 4.8, 6.3mm).

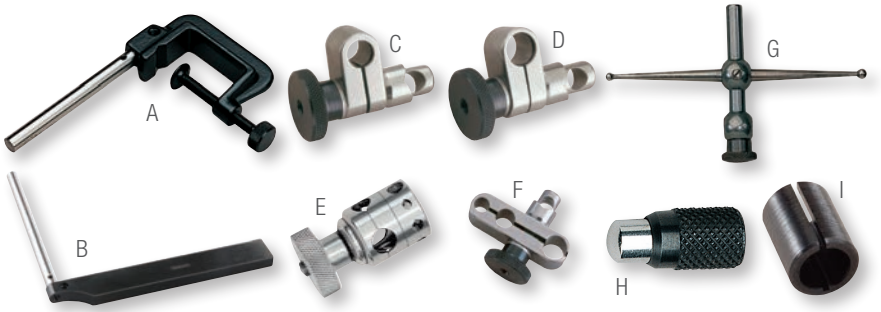
### F. Universal Snug

58S. With spindle hole diameters 1/4", 5/16", 3/8" (6.3, 8, 9.5mm). Gripping hole diameters range from 3/32-1/4" used on holders with smaller clamp hole.

| Attachments for 650, 651, 196 and 196M Back Plunger Dial Indicators and Universal Dial Indicators | | | |
|---|---|---|---|
| Photo Key | Description | Cat./Part No. | EDP |
| A* | Clamp | PT99437 | 64492 |
| B* | Tool Post Holder | PT99438 | 64493 |
| C* | Snug Complete | PT18718 | 50709 |
| D | Snug Complete - 1/4" and 3/8" Holes | PT18724 | 50710 |
| E | Universal Snug | 57S | 50296 |
| F | | 58S | 56613 |
| G* | Hole Attachment for 196 and 196M Only | 196F | 50706 |
| H | Shock Absorbing Anvil for 196 and 196M Only | PT08726A | 66052 |
| I | Split Bushing for 196 and 196M Only | PT00764 | 68850 |

* Attachments marked with an asterisk (*) are furnished with all sets having "A" in the catalog number.

† For snug with 8mm post hole diameter and 2.4-6.3mm holding capacity, order PT27171, EDP 66457.



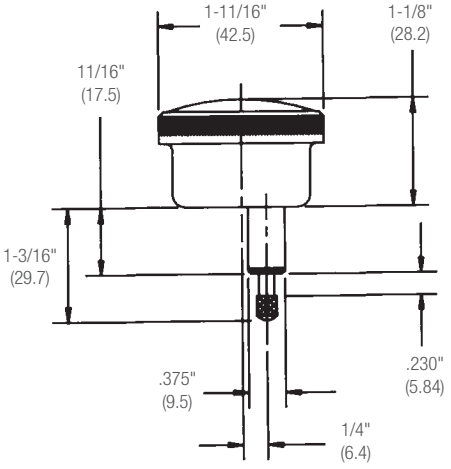

## 641, 641M Back Plunger Dial Indicators

### .200"/5MM

These indicators have the same design as the 650, but without the shank and deep hole attachments. They are useful for positioning in unconventional fixtures and mountings. The spindle is perpendicular to the dial face for optimum dial readability.

- Continuous reading dials with revolution counters
- Uses standard AGD contacts

| 641 Back-Plunger Dial Indicators | | | | |
|---|---|---|---|---|
| Range | Graduation | Dial Reading | Cat. No. | EDP |
| .200" | .001" | 0-100 | 641 | 65107 |
| **641M Back-Plunger Dial Indicators** | | | | |
| 5mm | 0.01mm | 0-100 | 641M | 65108 |




## Attachments for 196 and 196M Only

### G. Hole Attachment

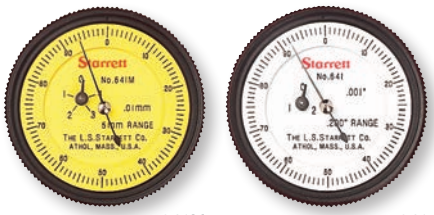
196F. allows indicator be used over obstructions and inside holes to a depth of approximately 1-5/8" (40mm).

### H. Shock Absorbing Anvil

PT08726A.

### I. Split Bushing

PT00764. Allows attachment of 196 Indicator to 660 Magnetic Base.




641M 641

# Dial Indicators

## Mechanical Dial Indicators and Attachments

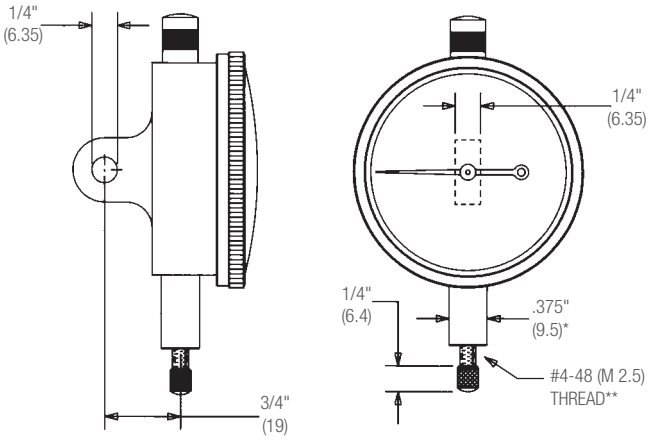
### Electronic Indicators/Indicator Holders

Accurate, rugged, versatile, convenient to use and inexpensive – for these reasons and more, mechanical dial indicators with bottom plungers are the measurement workhorses of industrial production.

Electronic indicators have an unmatched ability for the accurate recording of a great amount of measurement data which is used in a variety of Statistical Process Control (SPC) operations.

The first part of this section shows our complete line of mechanical/analog dial indicators – over 180 models to give you the widest selection in the industry. Our comparison guide, following these introduction pages, has all the significant specifications to help you make your selection.

## Comparing AGD Design Specifications with Others




* There are two major differences between American Gage Design and other specifications. The first is the stem diameter. AGD specifies .375" (9.5mm) and some other standards specify an 8mm (.315") diameter. International specifications allow for either one and we can furnish both diameters. The .375" (9.5mm) diameter provides a little more protection for the rack when clamped on the stem – 8mm stems are available on any model, please specify when ordering.
** The other difference is the contact thread. AGD specifies a #4-48 thread. Other standards specify a metric thread, #M2.5.

### Application Specification Factors

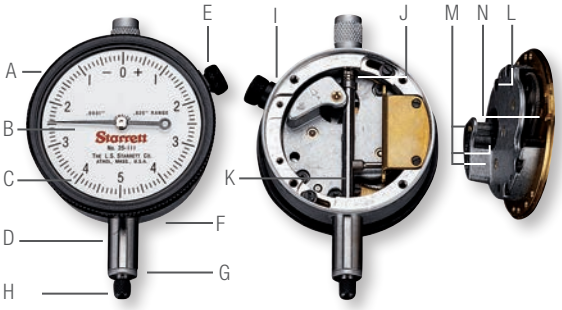
1. Regular analog styles with indicating hands are more readable than digital styles when the measurements are being visually monitored by an operator.
2. Select the dial size that gives you the readability you need. We offer five regular dial sizes which will fit most applications that have both space limitations and readability requirements.
3. Choose the accuracy and readout you need – don't select a .0001" (or 0.001mm) readout if .001" (or 0.01mm) will do your job.
4. Electronic styles are best when the measurement data needs to be collected, printed out or stored for future use.
5. Consider any special features you may need – inch or millimeter reading, special shockless movement, antimagnetic, long range, long stem, special backs, special contacts, special holders, etc. If you don't see what you need, please contact our Special Order Department. Even though we have a broad line of indicators to tackle most jobs, we also do a lot of special design, catering to the specific needs of our customers – challenge us!
6. Starrett indicators are made to American Gage Design Specifications (AGD). These specifications were developed in 1945 at the request of the U.S. Commerce Department through the National Bureau of Standards – now the National Institute of Standards and Technology (NIST). These specifications provide the dimensions to allow interchangeability between indicators of different manufacturers in fixturing. As you will see, these dimensions pertain to sizes for space consideration and for holding. Other countries have made their own design specifications which we can also furnish. However, the AGD design is probably more widely used, simply because it was the first standard created.
7. Basically, all dial indicators used worldwide fall into the following size ranges which relate to bezel diameters. Size 0 is a smaller dial indicator, having its own dimensions. Sizes 1 through 4 are AGD sizes. These sizes and the AGD dimensions are essentially the same for all manufacturers, except as noted.
8. Accuracy – All indicators should be "loaded" 1/8-1/4 of a turn before testing or measuring. Starrett dial indicators meet or exceed all known performance specifications. Most accuracies are specified plus or minus one graduation over the full range. This basically means a 2-1/2 turn range. Longer ranges have slightly wider tolerances. Starrett indicators are at least that accurate, but we are better than that in the final critical measuring zone of "10 o'clock to 2 o'clock" from zero.

   AGD specifies 2-1/3 turn indicators to cover any particular range. The reason for this is that in an effort to get the most out of the indicator, the operator "loads" it to about 1-1/3 turns and sets zero on his master. The indicator will now show the accurate deviation for a full revolution, plus or minus.

# Dial Indicators

## Design Features

- Rugged and simple unit construction with a "universally fitting" design as shown
- One gear unit assembly fits AGD Group 2 (our 25 Indicators), AGD Group 3 (our 655 Indicators) and AGD Group 4 (our 656 Indicators)
- The gear unit is constructed of a massive single bridge and plate assembly with a hardened stainless steel gear train
- All gear trains are fully jeweled for sensitivity, smoothness and life. (We do provide 1/2" and 1" range models with plain bronze bearings)
- The case is light but sturdy, with a hardened, precision stainless steel rack that rides in bronze bushings. Size Groups 0 and 1 indicators are of similar construction but smaller in size.
- Hardened stainless steel bottom stems can be held in fixtures without cramping rack action
- Easy readability with the best, balanced style of graduation and number combination. (Too thick and accuracy suffers; too thin and readability suffers)
- Balanced and tapered hands are easy to follow
- Special non-shock mechanism (can be furnished on most styles) is ideal for when an indicator may be subjected to repeated and excessive shocks




**A.** Sharp bezel serrations for positive grip
**B.** Non-reflecting white eggshell finish on dial (millimeter models have yellow dials)
**C.** Unbreakable crystal
**D.** Hardened stainless steel stem
**E.** Positive-acting clamp locks bezel in position
**F.** No-glare satin finish on case
**G.** .375" mounting diameter (all AGD models)
**H.** Interchangeable contact point
**I.** Four screw holes for 90º rotation of back
**J.** Direct acting compression spring eliminates side friction
**K.** Hardened stainless steel rack and spindle
**L.** Massive bridge for rigid bearing support
**M.** Replaceable low friction jewel bearings
**N.** Hardened stainless steel gears and pinions

## Dials, Accessories and Options

**Balanced or Continuous Dials** – Starrett AGD indicators are furnished with a balanced dial (plus on right). A continuous dial (reading clockwise) may also be ordered.

**Plus and Minus Graduations** – Plus and minus readout – black figures read clockwise, red figures read counterclockwise, or colors reversed – are available on some 81 Dial Indicators.

**Revolution Counters** – All AGD indicators with 2-1/2 revolutions can be furnished with double dial and count hand at a slight additional cost. Intermediate and long-range indicators have revolution counters







Far Left: Dial with Plus and Minus Graduations
Left: Dial with Special Trademark Imprint

**Special Dials** – Starrett dial indicators can be furnished with any standard dial marked with your company name or trademark. No charge when the indicators are purchased in lots of 25 or more. For quantities under 25, there is an additional charge. Prices are available on request.

**Antimagnetic Mechanism** – An antimagnetic mechanism can be furnished on most 81, 25, 655, 656, 196B6 Dial Indicators. This mechanism is desirable when the indicator is used near a magnetic chuck or a similar magnetic field which would disturb its operation. See individual listings for availability.

**Attachments and Accessories** – A variety of attachments and accessories are provided for mounting dial indicators on machine tools, inspection equipment and special fixtures, including:

- Backs
- Contact Points
- Dust Guard
- Hole Attachments
- Special Non-shock mechanism
- Spindle Travel Controls
- Stem and Back Mounting Accessories
- Tolerance and Maximum Reading Hands



Gear Unit + Case Assembly = Complete Indicator

# Dial Indicators

## 80 Miniature Dial Indicators and Accessories

### ANSI GROUP 0
### RANGES UP TO .100"
### 1-1/4" BEZEL, 7/32" STEM

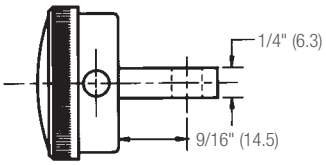
Similar in design to AGD dial indicators, these miniatures are built for gaging dimensions in tight places. Equipped with high precision, low friction movements, they are made in four models, all with frictionally adjustable bezels for quick, positive zero setting. No-glare, white eggshell finish dials. Black bezel, silver finish on case. Furnished with balanced dial, jeweled bearings and lug-on-center back.

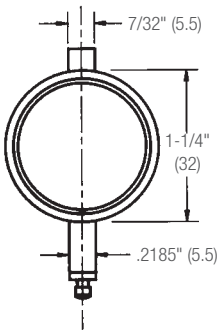
80SB split bushing available .219" to 3/8".

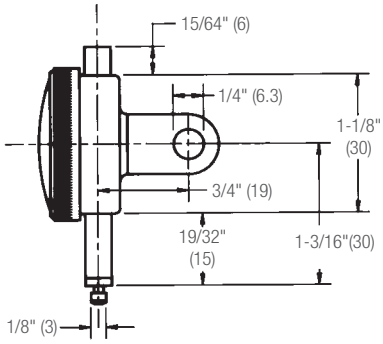
**80 Miniature Dial Indicators**

| Graduation | Range One Rev. | Total | Dial Reading | Cat. No. | EDP |
|---|---|---|---|---|---|
| .0001" | .004" | .010" | 0-2-0 | 80-114J | 55891 |
| | .010" | .025" | 0-5-0 | 80-111J | 67714 |
| .0005" | .020" | .050" | 0-10-0 | 80-134J | 55892 |
| .001" | .040" | .100" | 0-20-0 | 80-144J | 55893 |

Dimensions with lug-on-center back




Free drafting template available for this size.
Write The L. S. Starrett Co. at:
121 Crescent Street
Athol, MA 01331.




80-114J



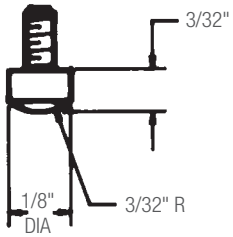

80-134J



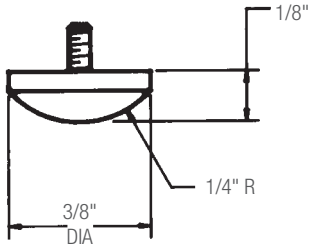

80-144J

## Contact Points

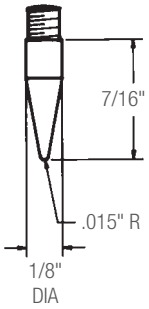
The regular contact point is furnished standard on all 80 Dial Indicators. Button, cone and flat contact points are available individually, as listed. All have #0-80 thread.



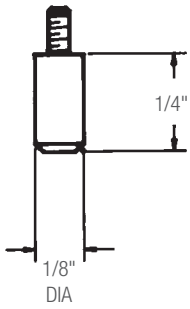

**PT25044 Regular Contact Point**
(Standard on all 80 Dial Indicators)




**PT25159 Button Contact Point**




**PT25161 Cone Contact Point**



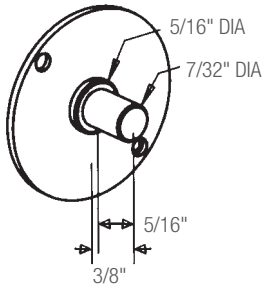

**PT25160 Flat Contact Point**



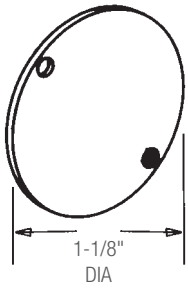

80-111J

## Backs

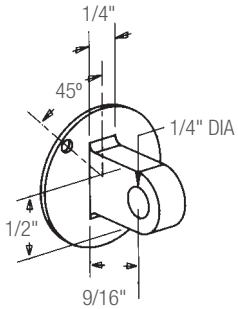
The lug-on-center back is furnished standard on all 80 Dial Indicators.



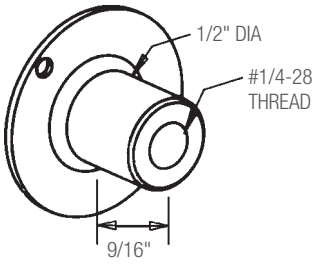

**PT25158 Post-Type Lug Back**



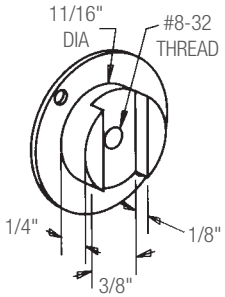

**PT25079 Flat Back**




**PT25053 Lug-on-Center Back**
(Standard on all 80 Dial Indicators)




**PT25071 Screw-Type Lug Back**




**PT25157 Adjustable Bracket Back**

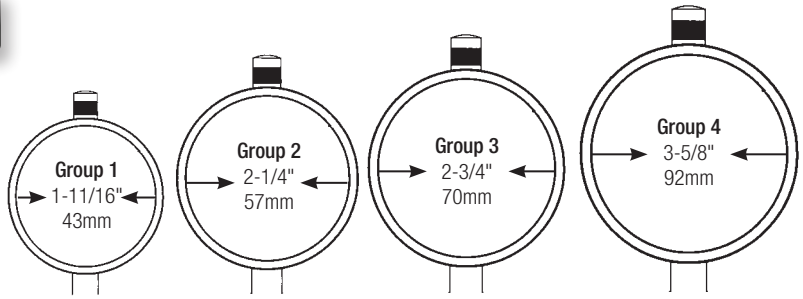
**NOTE:** Contact points and backs can be ordered individually. Order by part number/EDP number.

| Description | Part No. | EDP |
|---|---|---|
| Regular Contact Point | PT25044 | 72023 |
| Button Contact Point | PT25159 | 72024 |
| Cone Contact Point | PT25161 | 72025 |
| Flat Contact Point | PT25160 | 72026 |
| Flat Back | PT25079 | 72028 |
| Screw-Type Lug Back | PT25071 | 72030 |
| Lug-on Center Back | PT25053 | 72027 |
| Adjustable Bracket Back | PT25157 | 72029 |
| Post-Type Lug Back | PT25158 | 72031 |

# Dial Indicators

## 81, 25, 655 and 656 AGD Dial Indicators

This comparison table is an aid to help you find the indicator with the specific graduations and ranges you are looking for. Refer to the following pages for the exact catalog number and EDP number.




**81, 25, 655 and 656 AGD Dial Indicators (White Dials Furnished Standard)**

| Graduation | Range One Rev. | Range Total | Dial Reading | Group 1 81 Indictators | Group 2 25 Indicators | Group 3 655 Indicators | Group 4 656 Indicators |
|---|---|---|---|---|---|---|---|
| .00005" | .006" | .015" | 0-3-0<br>0-6 | | 25-109<br>25-209 | | 656-109<br>656-209 |
| .0001" | .006" | .015" | 0-3-0 | | 25-116 | | |
| .0001" | .008" | .020" | 0-4-0<br>0-8 | | 25-118<br>25-218 | 655-118 | 656-118 |
| .0001" | .010" | .025" | 0-5-0<br>0-10 | 81-111<br>81-211 | 25-111<br>25-211 | 655-111<br>655-211 | 656-111<br>656-211 |
| .0001" | .010" | .025" | +0.10<br>–0.10<br>–0.10<br>+0.10 | 81-111-624*<br><br>81-111-630* | | | |
| .0001" | .010" | .200" | 0-5-0<br>0-10 | | 25-511*<br>25-611* | 655-511*<br>655-611* | 656-511*<br>656-611* |
| .0001" | .020" | .400" | 0-10-0<br>0-20 | | | | 656-517*<br>656-617* |
| .00025" | .010" | .025" | 0-5-0<br>0-10 | 81-124<br>81-224 | 25-124<br>25-224 | 655-124<br>655-224 | 656-124<br>656-224 |
| .00025" | .020" | .050" | 0-10-0<br>0-20 | 81-128<br>81-228 | 25-128<br>25-228 | 655-128<br>655-228 | 656-128<br>656-228 |
| .00025" | .030" | .075" | 0-15-0<br>0-30 | | | 655-129<br>655-229 | 656-129<br>656-229 |
| .0005" | .020" | .050" | 0-10-0<br>0-20 | 81-134<br>81-234 | 25-134<br>25-234 | 655-134<br>655-234 | 656-134<br>656-234 |
| .0005" | .030" | .075" | 0-15-0<br>0-30 | 81-136<br>81-236 | 25-136<br>25-236 | 655-136<br>655-236 | 656-136<br>656-236 |
| .0005" | .030" | .075" | +0.30<br>–0.30<br>–0.30<br>+0.30 | 81-136-622*<br><br>81-136-623* | | | |
| .0005" | .040" | .100" | 0-20-0<br>0-40 | 81-138<br>81-238 | 25-138<br>25-238 | 655-138<br>655-238 | 656-138<br>656-238 |
| .0005" | .050" | .125" | 0-25-0<br>0-50 | 81-131<br>81-231 | 25-131<br>25-231 | 655-131<br>655-231 | 656-131<br>656-231 |
| .0005" | .050" | .500"<br>1.000" | 0-50<br>0-50 | | 25-431*†<br>25-631*† | | |

* With revolution counter on dial
† With top lift mechanism

**AGD Design Specifications: Bezel Diameters**

| Design | Size Group | Minimum Diameter Inch | Minimum Diameter mm | Maximum Diameter Inch | Maximum Diameter mm |
|---|---|---|---|---|---|
| AGD | 0 | 1" | 25mm | 1-3/8" | 35mm |
| | 1 | 1-3/8" | 35mm | 2" | 50mm |
| | 2 | 2" | 50mm | 2-3/8" | 60mm |
| | 3 | 2-3/8" | 60mm | 3" | 75mm |
| | 4 | 3" | 76mm | 3-3/4" | 95mm |

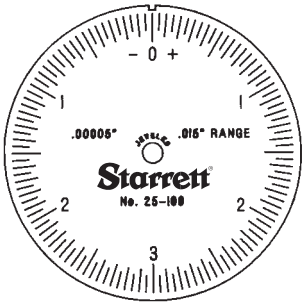
| 81, 25, 655 and 656 AGD Dial Indicators (White Dials Furnished Standard) | | | | | | | |
|---|---|---|---|---|---|---|---|
| Graduation | Range One Rev. | Total | Dial Reading | Group 1 81 Indicators | Group 2 25 Indicators | Group 3 655 Indicators | Group 4 656 Indicators |
| .001" | .020" | .050" | 0-10-0<br>0-20 | 81-142<br>81-242 | 25-142<br>25-242 | 655-142<br>655-242 | 656-142<br>656-242 |
| .001" | .030" | .075" | 0-15-0<br>0-30 | 81-143<br>81-243 | 25-143<br>25-243 | 655-143<br>655-243 | 656-143<br>656-243 |
| .001" | .030" | .075" | +0.30, –0.30<br>–0.30, +0.30 | 81-143-628*<br>81-143-629* | | | |
| .001" | .040" | .100" | 0-20-0<br>0-40 | 81-144<br>81-244 | 25-144<br>25-244 | 655-144<br>655-244 | 656-144<br>656-244 |
| .001" | .050" | .125" | 0-25-0<br>0-50 | 81-145<br>81-245 | 25-145<br>25-245 | 655-145<br>655-245 | 656-145<br>656-245 |
| .001" | .100" | .250" | 0-50-0<br>0-100 | 81-141<br>81-241 | 25-141<br>25-241 | 655-141<br>655-241 | 656-141<br>656-241 |
| .001" | .100" | .500" | 0-50-0<br>0-100 | | 25-341/5*†<br>25-441/5*† | 655-341/5*<br>655-441/5* | 656-341/5*<br>656-441/5* |
| .001" | .100" | 1.000" | 0-50-0<br>0-100 | | 25-341*†<br>25-441*† | 655-341*†<br>655-441*† | 656-341*†<br>656-441*† |
| .001" | .100" | 2.000"<br>3.000"<br>4.000"<br>5.000"<br>6.000"<br>7.000"<br>8.000"<br>9.000"<br>10.000"<br>11.000"<br>12.000" | 0-100 | | 25-2041*<br>25-3041*<br>25-4041*<br>25-5041* | 655-2041*<br>655-3041*<br>655-4041*<br>655-5041* | 656-2041*<br>656-3041*<br>656-4041*<br>656-5041*<br>656-6041*<br>656-7041*<br>656-8041*<br>656-9041*<br>656-10041*<br>656-11041*<br>656-12041* |
| **81, 25, 655 and 656 AGD Dial Indicators (Yellow Dials Furnished Standard)** | | | | | | | |
| 0.001mm | 0.1mm | 0.25mm | 0-50-0<br>0-100 | | 25-151*<br>25-251* | | |
| 0.002mm | 0.2mm | 0.5mm | 0-10-0<br>0-20 | 81-161<br>81-261 | 25-161<br>25-261 | 655-161<br>655-261 | 656-161<br>656-261 |
| 0.01mm | 1mm | 2.5mm | 0-50-0<br>0-100 | 81-181<br>81-281 | 25-181<br>25-281 | 655-181<br>655-281 | 656-181<br>656-281 |
| 0.01mm | 1mm | 10mm | 0-50-0<br>0-100 | | 25-381*†<br>25-481* | | |
| 0.01mm | 1mm | 25mm | 0-50-0<br>0-100 | | 25-781*†<br>25-881*† | 655-881*† | 656-881*† |
| 0.01mm | 1mm | 50mm | 0-100 | | 25-2081* | 655-2081* | |
| 0.01mm | 1mm | 75mm | 0-100 | | 25-3081* | 655-3081* | |
| 0.01mm | 1mm | 100mm | 0-100 | | 25-4081* | 655-4081* | |
| 0.01mm | 1mm | 125mm | 0-100 | | 25-5081* | 655-5081* | |

* With revolution counter on dial
† With top lift mechanism

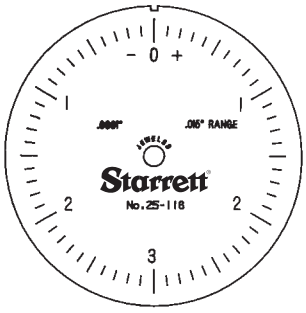
# Dial Indicators

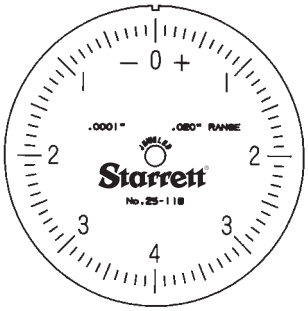
## Starrett Dial Numbering and Line Styles for Dial Indicators

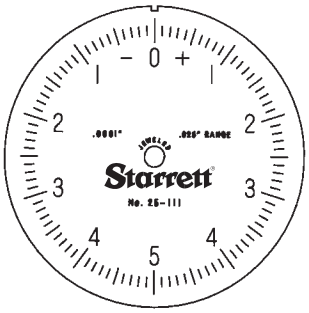
These next four pages include all Starrett dial styles. (Actual size not shown.) Refer to the graduation, then range, and catalog number below the dial and then see the following pages for the specific dial reading and other indicator information. Most of the dials shown have balanced styles. Continuous dials have the same graduations, but have consecutive numbers instead. For most indicators, the first number after the base catalog number signifies dial style. The number "1" signifies balanced dials (example: 25-109) and number "2" signifies continuous dials (example: 25-209).



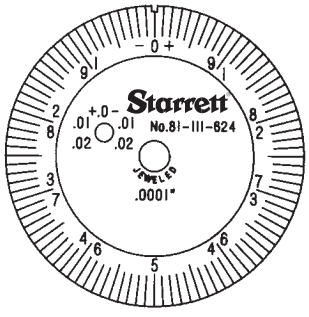

| .00005" Graduation | |
|---|---|
| Total Range | .015" |
| Cat. No. | 25-109<br>656-109 |

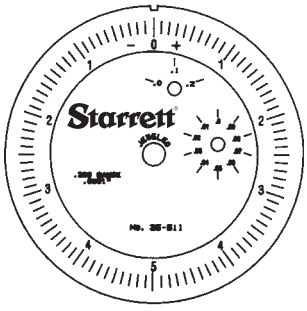


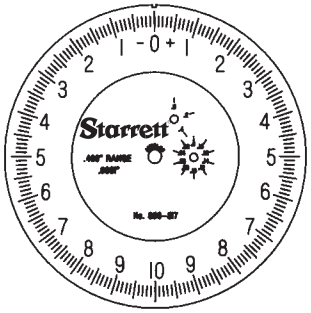



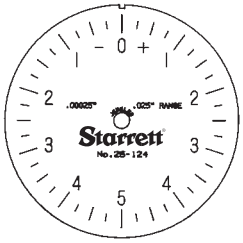

| .0001" Graduation | | | |
|---|---|---|---|
| Total Range | .015" | .020" | .025" |
| Cat. No. | 25-116 | 25-118<br>655-118<br>656-118 | 25-111<br>80-111<br>81-111<br>655-111<br>656-111 |

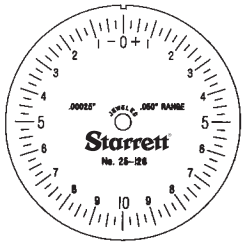


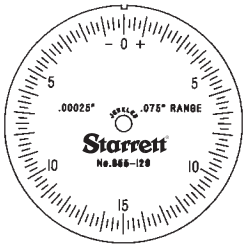



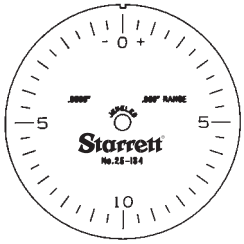

| .0001" Graduation | | | |
|---|---|---|---|
| Total Range | .025" | .200" | .400" |
| Cat. No. | 81-111-624<br>(with double row figures) | 25-511<br>655-511<br>656-511 | 656-517 |

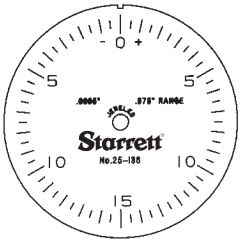


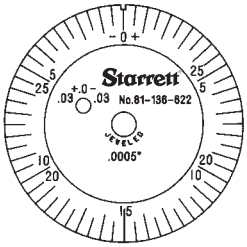



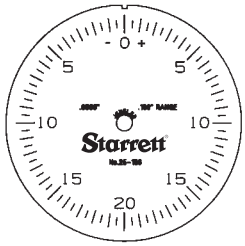




| .00025" Graduation | | | |
|---|---|---|---|
| **Total Range** | **.025"** | **.050"** | **.075"** |
| **Cat. No.** | 81-124 | 81-128 | 655-129 |
| | 25-124 | 25-128 | 656-129 |
| | 655-124 | 655-128 | |
| | 656-124 | 656-128 | |

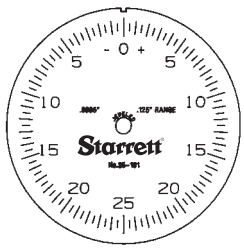


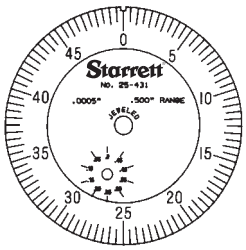



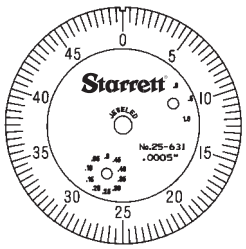




| .0005" Graduation | | | | |
|---|---|---|---|---|
| **Total Range** | **.050"** | **.075"** | **.075"** | **.100"** |
| **Cat. No.** | 81-134 | 81-136 | 81-136-622 (with double row figures) | 81-138 |
| | 25-134 | 25-136 | | 25-138 |
| | 655-134 | 655-136 | | 655-138 |
| | 656-134 | 656-136 | | 656-138 |



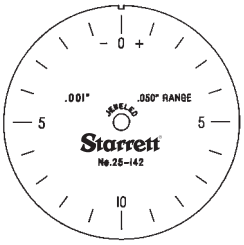



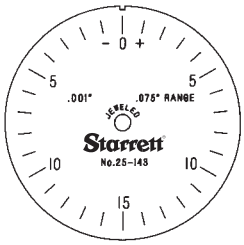



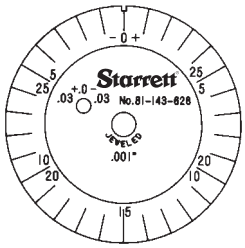

| .0005" Graduation | | | |
|---|---|---|---|
| **Total Range** | **.125"** | **.500"** | **1.000"** |
| **Cat. No.** | 81-131 | 25-431 | 25-631 |
| | 25-131 | | |
| | 655-131 | | |
| | 656-131 | | |

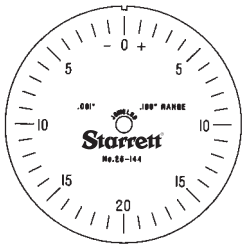
# Dial Indicators

## Starrett Dial Numbering and Line Styles for Dial Indicators



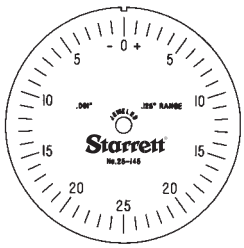



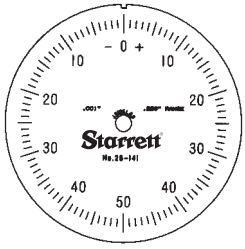



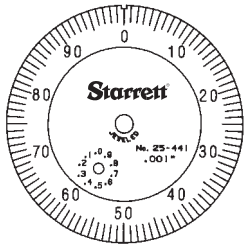




| .001" Graduation | | | | |
|---|---|---|---|---|
| **Total Range** | **.050"** | **.075"** | **.075"** | **.100"** |
| **Cat. No.** | 81-142<br>*25-142<br>*655-142<br>*656-142 | 81-143<br>25-143<br>655-143<br>656-143 | 81-143-628<br>(with double row figures) | 81-144<br>*25-144<br>*655-144<br>*656-144 |

* Also on long range models.

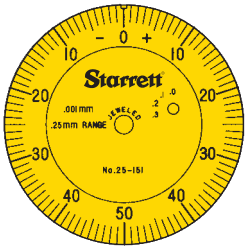


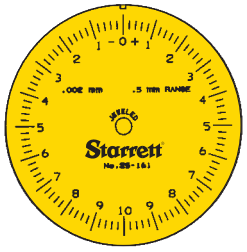




| .001" Graduation | | | |
|---|---|---|---|
| **Total Range** | **.125"** | **.250"** | **.500", 1.000"** |
| **Cat. No.** | 81-145<br>*25-145<br>*655-145<br>*656-145 | 81-141<br>*25-141<br>*655-141<br>*656-141 | 25-441, 25-441/5<br>655-441, 655-441/5<br>656-441, 656-441/5 |

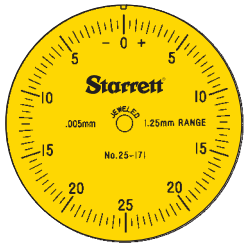
* Also on long range models.



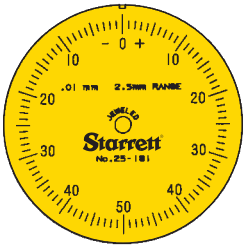

| 0.001mm Graduation | |
|---|---|
| Total Range | .25mm |
| Cat. No. | 25-151 |

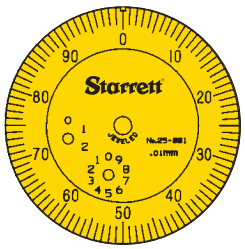


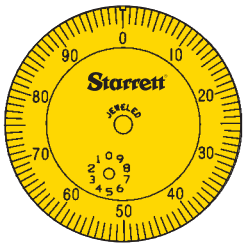

| 0.002mm Graduation | |
|---|---|
| Total Range | 0.5mm |
| Cat. No. | No.81-161 |
| | 25-161 |
| | 655-161 |
| | 656-161 |




| 0.005mm Graduation | |
|---|---|
| Total Range | 1.25mm |
| Cat. No. | 25-171 |




| 0.01mm Graduation | | | | |
|---|---|---|---|---|
| Total Range | 2.5mm | 25mm | 10mm | 50, 75, 100, 125mm |
| Cat. No. | 81-181 | 25-881 | 25-381 | 25-2081 |
| | 25-181 | 655-881 | | 25-3081 |
| | 655-181 | 656-881 | | 25-4081 |
| | 656-181 | | | 25-5081 |

# Dial Indicators

## 81 Dial Indicators

### AGD GROUP 1
### RANGES UP TO .250" AND 2.5MM

These Indicators have a shockless, hardened steel gear train and jewel bearings. They are furnished with a lug-on-center back. Antimagnetic and special non-shock mechanisms are options available for all models. For more information on these and other attachments, accessories and contact points, refer to the end of the AGD Dial Indicator listings. For dial styles, see previous pages.

If lift lever is desired, indicator must be ordered with case stem cap.

**81 Dial Indicators**

| Graduation | Range One Rev. | Range Total | Dial Reading | Cat. No. | EDP |
|---|---|---|---|---|---|
| .0001" | .010" | .025" | 0-5-0 | 81-111J | 53378 |
| | | | 0-10 | 81-211J | 53414 |
| .00025" | .010" | .025" | 0-5-0 | 81-124J | 53384 |
| | | | 0-10 | 81-224J | 53416 |
| .00025" | .020" | .050" | 0-10-0 | 81-128J | 53386 |
| | | | 0-20 | 81-228J | 53418 |
| .0005" | .020" | .050" | 0-10-0 | 81-134J | 53390 |
| | | | 0-20 | 81-234J | 53422 |
| .0005" | .030" | .075" | 0-15-0 | 81-136J | 53392 |
| | | | 0-30 | 81-236J | 53424 |
| .0005" | .040" | .100" | 0-20-0 | 81-138J | 53398 |
| | | | 0-40 | 81-238J | 53426 |
| .0005" | .050" | .125" | 0-25-0 | 81-131J | 53388 |
| | | | 0-50 | 81-231J | 53420 |
| .001" | .020" | .050" | 0-10-0 | 81-142J | 53402 |
| | | | 0-20 | 81-242J | 53430 |
| .001" | .030" | .075" | 0-15-0 | 81-143J | 53404 |
| | | | 0-30 | 81-243J | 53432 |
| .001" | .040" | .100" | 0-20-0 | 81-144J | 53408 |
| | | | 0-40 | 81-244J | 53434 |
| .001" | .050" | .125" | 0-25-0 | 81-145J | 53410 |
| | | | 0-50 | 81-245J | 53436 |
| .001" | .100" | .250" | 0-50-0 | 81-141J | 53400 |
| | | | 0-100 | 81-241J | 53428 |




81-141J

**81 Dial Indicators**

| Graduation | Range One Rev. | Range Total | Dial Reading | Stem Dia. | Cat. No. | EDP |
|---|---|---|---|---|---|---|
| 0.002mm | 0.2mm | 0.5mm | 0-10-0 | .375" (8mm) | 81-161J | 56043 |
| | | | | | 81-161J-8 | 64643 |
| 0.002mm | 0.2mm | 0.5mm | 0-20 | .375" (8mm) | 81-261J | 56045 |
| | | | | | 81-261J-8 | 64644 |
| 0.01mm | 1.0mm | 2.5mm | 0-50-0 | .375" (8mm) | 81-181J | 53412 |
| | | | | | 81-181J-8 | 64645 |
| 0.01mm | 1.0mm | 2.5mm | 0-100 | .375" (8mm) | 81-281J | 53438 |
| | | | | | 81-281J-8 | 64646 |




81-161J

# Dial Indicators

## 81 Dial Indicators with Double Row Figures

### AGD GROUP 1
### RANGES UP TO .075"

These indicators have the exact same features as our 81 Dial Indicators on the previous page, except the dials have double-row figures, as illustrated, and they cannot be specified with a special non-shock mechanism.

If lift lever is desired, indicator must be ordered with case stem cap.

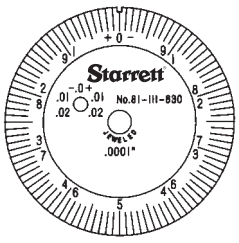
**81 Dial Indicators with double row figures**

| Graduation | Dial Reading | Figures Direction | Color | Range One Rev. | Range Total | Cat. No. | EDP |
|---|---|---|---|---|---|---|---|
| .0001" | +0-10 | Clockwise | Black | .010" | .025" | 81-111-624J | 53380 |
| | –0-10 | Counter-clockwise | Red | | | | |
| | +0-10 | Counter-clockwise | Black | | | 81-111-630J | 53382 |
| | –0-10 | Clockwise | Red | | | | |
| .0005" | +0-30 | Clockwise | Black | .030" | .075" | 81-136-622J | 53394 |
| | –0-30 | Counter-clockwise | Red | | | | |
| | +0-30 | Counter-clockwise | Black | | | 81-136-623J | 53396 |
| | –0-30 | Clockwise | Red | | | | |
| .001" | +0-30 | Clockwise | Black | .030" | .075" | 81-143-628J | 53406 |
| | –0-30 | Counter-clockwise | Red | | | | |
| | +0-30 | Counter-clockwise | Black | | | 81-143-629J | 66666 |
| | –0-30 | Clockwise | Red | | | | |

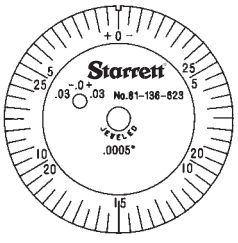
Other models with double-row figures can be furnished by request.



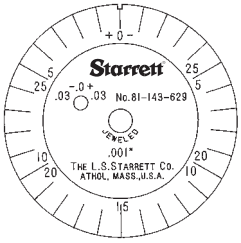

81-111-624J



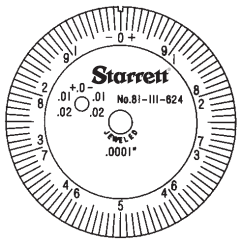

81-111-630J



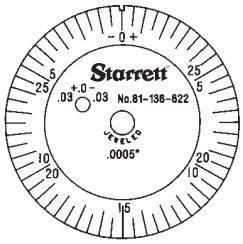

81-136-623J



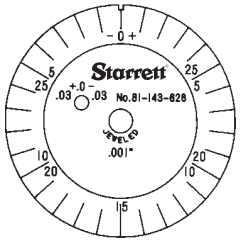

81-143-629J



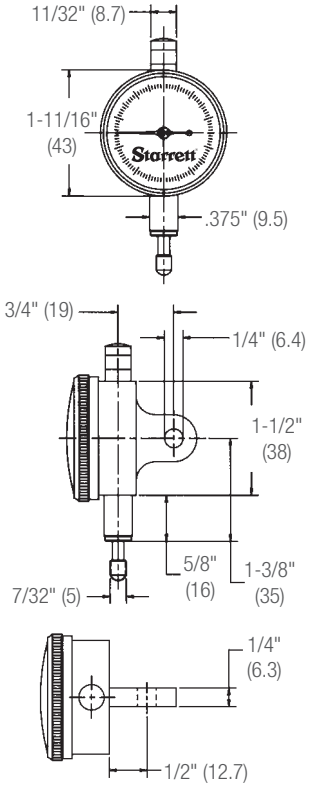

81-111-624J




81-136-622J




81-143-628J




Free drafting template available for this size.
Write The L. S. Starrett Co. at:
121 Crescent Street
Athol, MA 01331.

# Dial Indicators

## 25 Dial Indicators

### AGD GROUP 2
### RANGES UP TO 1" AND 25MM

These indicators have a shockless, hardened steel gear train and jewel bearings, except where noted. They are furnished with a lug-on-center back. Antimagnetic mechanism is optional for all models. Special non-shock mechanism is available for all models except 25-109, 25-209 and 25-116. For more information on these and other attachments, accessories and contact points, refer to the end of the AGD Dial Indicator listings. For dial styles, see previous pages.

If lift lever is desired, indicator must be ordered with case stem cap.



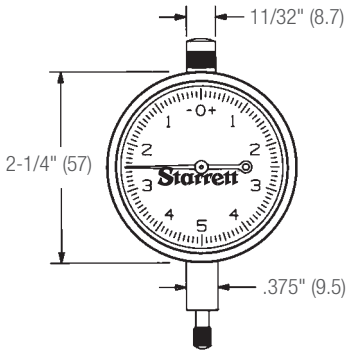

25-111J

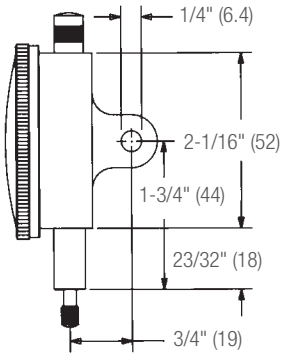


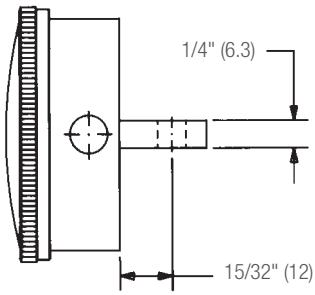

25-161J

**25 Dial Indicators with Jewel Bearings**

| Graduation | Range One Rev. | Range Total | Dial Reading | Stem Dia. | Cat. No. | EDP |
|---|---|---|---|---|---|---|
| 0.001mm | 0.1mm | 0.25mm | 0-50-0 | .375" (8mm) | 25-151J | 67644 |
| | | | | | 25-151J-8 | 68646 |
| | | | 0-100 | .375" (8mm) | 25-251J | 68118 |
| | | | | | 25-251J-8 | 68647 |
| 0.002mm | 0.2mm | 0.5mm | 0-10-0 | .375" (8mm) | 25-161J | 53250 |
| | | | | | 25-161J-8 | 64651 |
| | | | 0-20 | .375" (8mm) | 25-261J | 53281 |
| | | | | | 25-261J-8 | 64652 |
| 0.005mm | 0.5mm | 1.25mm | 0-25-0 | .375" | 25-171J | 68643 |
| 0.01mm | 1.0mm | 2.5mm | 0-50-0 | .375" (8mm) | 25-181J | 53252 |
| | | | | | 25-181J-8 | 64653 |
| | | | 0-100 | .375" (8mm) | 25-281J | 53283 |
| | | | | | 25-281J-8 | 64654 |
| 0.01mm | 1.0mm | 10mm | 0-50-0 | .375" (8mm) | 25-381J | 53289 |
| | | | | | 25-381J-8 | 64655 |
| | | | 0-100 | .375" (8mm) | 25-481J | 53297 |
| | | | | | 25-481J-8 | 64656 |
| 0.01mm | 1.0mm | 25mm | 0-50-0 | .375" (8mm) | 25-781J | 53305 |
| | | | | | 25-781J-8 | 64657 |
| | | | 0-100 | .375" (8mm) | 25-881J | 53307 |
| | | | | | 25-881J-8 | 64658 |




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Write The L. S. Starrett Co. at:
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Athol, MA 01331.

25-441J
with top lift




656-129J
case stem cap design required
for use with lift lever
see page 170



# Dial Indicators

| 25 Dial Indicators with Jewel Bearings | | | | | |
|---|---|---|---|---|---|
| Graduation | Range One Rev. | Total | Dial Reading | Cat. No. | EDP |
| .00005" | .006" | .015" | 0-3-0 | 25-109J | 53222 |
| | | | 0-6 | 25-209J | 53254 |
| .0001" | .006" | .015" | 0-3-0 | 25-116J | 53225 |
| .0001" | .008" | .020" | 0-4-0 | 25-118J | 53226 |
| | | | 0-8 | 25-218J | 53257 |
| .0001" | .010" | .025" | 0-5-0 | 25-111J | 53223 |
| | | | 0-10 | 25-211J | 53255 |
| .0001" | .010" | .200" | 0-5-0 | 25-511J | 53299 |
| | | | 0-10 | 25-611J | 53301 |
| .00025" | .010" | .025" | 0-5-0 | 25-124J | 53228 |
| | | | 0-10 | 25-224J | 53259 |
| .00025" | .020" | .050" | 0-10-0 | 25-128J | 53230 |
| | | | 0-20 | 25-228J | 53261 |
| .0005" | .020" | .050" | 0-10-0 | 25-134J | 53234 |
| | | | 0-20 | 25-234J | 53265 |
| .0005" | .030 | .075" | 0-15-0 | 25-136J | 53236 |
| | | | 0-30 | 25-236J | 53267 |
| .0005" | .040" | .100" | 0-20-0 | 25-138J | 53238 |
| | | | 0-40 | 25-238J | 53269 |
| .0005" | .050" | .125" | 0-25-0 | 25-131J | 53232 |
| .0005" | .050" | .125" | 0-50 | 25-231J | 53263 |
| | | .500" | | 25-431J | 53292 |
| | | 1.000" | | 25-631J | 53304 |
| .001" | .020" | .050" | 0-10-0 | 25-142J | 53242 |
| | | | 0-20 | 25-242J | 53273 |
| .001" | .030" | .075" | 0-15-0 | 25-143J | 53244 |
| | | | 0-30 | 25-243J | 53275 |
| .001" | .040" | .100" | 0-20-0 | 25-144J | 53246 |
| | | | 0-40 | 25-244J | 53277 |
| .001" | .050" | .125" | 0-25-0 | 25-145J | 53248 |
| | | | 0-50 | 25-245J | 53279 |
| .001" | .100" | .250" | 0-50-0 | 25-141J | 53240 |
| | | | 0-100 | 25-241J | 53271 |
| .001" | .100" | .500" | 0-50-0 | 25-341/5J | 53285 |
| .001" | .100" | .500" | 0-100 | 25-441/5J | 53293 |
| | | | | 25-441/5J W/SLC* | 66864 |
| .001" | .100" | 1.000" | 0-50-0 | 25-341J | 53287 |
| .001" | .100" | 1.000" | 0-100 | 25-441J | 53295 |
| | | | | 25-441/J W/SLC* | 66863 |
| **25 Dial Indicators Inch Reading Models with Plain Bearings** | | | | | |
| .001" | .100" | .500" | 0-50-0 | 25-341/5P | 53286 |
| | | | 0-100 | 25-441/5P | 53294 |
| .001" | .100" | 1.000" | 0-50-0 | 25-341P | 53288 |
| | | | 0-100 | 25-441P | 53296 |

* Includes redemption card for Standard Letter of Certification.

## 253 Dial Indicator Sets

### INCH AND MILLIMETER READING

These sets provide in one handy, compact kit three 25 Dial Indicators to handle most gaging jobs at a minimum cost. Sets are ideal for tool and die shops, machine shops and toolrooms having occasional work where a heavy investment in dial indicators would not be practical. The indicators are furnished with jewel bearings.

| 253 Dial Indicator Sets | | |
|---|---|---|
| Description | Cat. No. | EDP |
| Set of 3 Inch Reading Dial Indicators: 25-111J, 25-131J and 25-441J | S253Z | 51218 |
| Set of 3 Millimeter Reading Dial Indicators: 25-161J, 25-181J and 25-881J | S253MZ | 56283 |

Sets furnished in attractive, protective case.



# Dial Indicators

## 655 Dial Indicators

### AGD GROUP 3
### RANGES UP TO 1" AND 25MM

These indicators have a shockless, hardened steel gear train and jewel bearings. They are furnished with a lug-on-center back. Antimagnetic and special non-shock mechanisms are options available for all models. For more information on these and other attachments, accessories and contact points, refer to the end of the AGD Dial Indicator listings. For dial styles, see previous pages.

If lift lever is desired, indicator must be ordered with case stem cap.

**655 Dial Indicators**

| Graduation | Range One Rev. | Total | Dial Reading | Stem Dia. | Cat. No. | EDP |
|---|---|---|---|---|---|---|
| 0.002mm | 0.2mm | 0.5mm | 0-10-0 | .375" (8mm) | 655-161J<br>655-161J-8 | 53533<br>64659 |
| 0.002mm | 0.2mm | 0.5mm | 0-20 | .375" (8mm) | 655-261J<br>655-261J-8 | 53603<br>64660 |
| 0.01mm | 1.0mm | 2.5mm | 0-50-0 | .375" (8mm) | 655-181J<br>655-181J-8 | 53535<br>64661 |
| 0.01mm | 1.0mm | 2.5mm | 0-100 | .375" (8mm) | 655-281J<br>655-281J-8 | 53605<br>64868 |
| 0.01mm | 1.0mm | 25mm | 0-100 | .375" (8mm) | 655-881J<br>655-881J-8 | 56229<br>64869 |

**655 Dial Indicators**

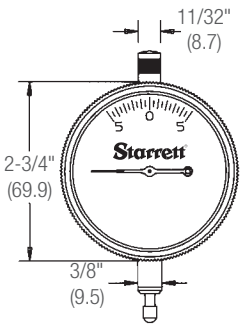
| Graduation | Range One Rev. | Total | Dial Reading | Cat. No. | EDP |
|---|---|---|---|---|---|
| .0001" | .008" | .020" | 0-4-0 | 655-118J | 53507 |
| .0001" | .010" | .025" | 0-5-0 | 655-111J | 53505 |
| | | | 0-10 | 655-211J | 53537 |
| .0001" | .010" | .200" | 0-5-0 | 655-511J | 53615 |
| | | | 0-10 | 655-611J | 53617 |
| .00025" | .010" | .025" | 0-5-0 | 655-124J | 53509 |
| | | | 0-10 | 655-224J | 53539 |
| .00025" | .020" | .050" | 0-10-0 | 655-128J | 53511 |
| | | | 0-20 | 655-228J | 53541 |
| .00025" | .030" | .075" | 0-15-0 | 655-129J | 53513 |
| | | | 0-30 | 655-229J | 53543 |
| .0005" | .020" | .050" | 0-10-0 | 655-134J | 53517 |
| | | | 0-20 | 655-234J | 53587 |
| .0005" | .030" | .075" | 0-15-0 | 655-136J | 53519 |
| | | | 0-30 | 655-236J | 53589 |
| .0005" | .040" | .100" | 0-20-0 | 655-138J | 53521 |
| | | | 0-40 | 655-238J | 53591 |
| .0005" | .050" | .125" | 0-25-0 | 655-131J | 53515 |
| | | | 0-50 | 655-231J | 53585 |
| .001" | .020" | .050" | 0-10-0 | 655-142J | 53525 |
| | | | 0-20 | 655-242J | 53595 |
| .001" | .030" | .075" | 0-15-0 | 655-143J | 53527 |
| | | | 0-30 | 655-243J | 53597 |
| .001" | .040" | .100" | 0-20-0 | 655-144J | 53529 |
| | | | 0-40 | 655-244J | 53599 |
| .001" | .050" | .125" | 0-25-0 | 655-145J | 53531 |
| | | | 0-50 | 655-245J | 53601 |
| .001" | .100" | .250" | 0-50-0 | 655-141J | 53523 |
| | | | 0-100 | 655-241J | 53593 |
| .001" | .100" | .500" | 0-50-0 | 655-341/5J | 53607 |
| | | | 0-100 | 655-441/5J | 53611 |
| .001" | .100" | 1.000" | 0-50-0 | 655-341J | 53609 |
| | | | 0-100 | 655-441J | 53613 |

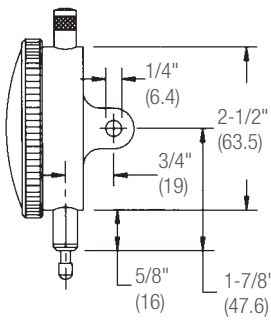


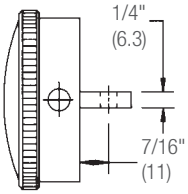

655-161J-8




655-111J







655-131J
with top lift




655-341J
with stem cap

# Dial Indicators

## 656 Dial Indicators

### AGD GROUP 4
### RANGES UP TO 1" AND 25MM

These indicators have a shockless, hardened steel gear train and jewel bearings. They are furnished with a lug-on-center back. Antimagnetic mechanism is optional for all models. Special non-shock mechanism is available for all models except 656-109 and 656-209. For more information on these and other attachments, accessories and contact points, refer to the end of the AGD Dial Indicator listings. For dial styles, see previous pages.

If lift lever is desired, indicator must be ordered with case stem cap.

**656 Dial Indicators**

| Graduation | Range One Rev. | Total | Dial Reading | Stem Dia. | Cat. No. | EDP |
|---|---|---|---|---|---|---|
| 0.002mm | 0.2mm | 0.5mm | 0-10-0 | .375" (8mm) | 656-161J | 53690 |
| | | | | | 656-161J-8 | 64870 |
| 0.002mm | 0.2mm | 0.5mm | 0-20 | .375" (8mm) | 656-261J | 53779 |
| | | | | | 656-261J-8 | 64871 |
| 0.01mm | 1.0mm | 2.5mm | 0-50-0 | .375" (8mm) | 656-181J | 53692 |
| | | | | | 656-181J-8 | 64872 |
| 0.01mm | 1.0mm | 2.5mm | 0-100 | .375" (8mm) | 656-281J | 53781 |
| | | | | | 656-281J-8 | 64873 |
| 0.01mm | 1.0mm | 25mm | 0-100 | .375" (8mm) | 656-881J | 56234 |
| | | | | | 656-881J-8 | 64874 |

**656 Dial Indicators**

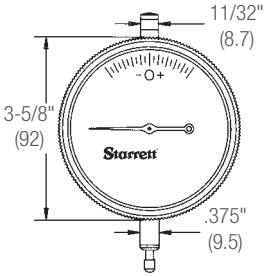
| Graduation | Range One Rev. | Total | Dial Reading | Cat. No. | EDP |
|---|---|---|---|---|---|
| .00005" | .006" | .015" | 0-3-0 | 656-109J | 53661 |
| | | | 0-6 | 656-209J | 53694 |
| .0001" | .008" | .020" | 0-4-0 | 656-118J | 53664 |
| .0001" | .010" | .025" | 0-5-0 | 656-111J | 53662 |
| | | | 0-10 | 656-211J | 53695 |
| .0001" | .010" | .200" | 0-5-0 | 656-511J | 53791 |
| | | | 0-10 | 656-611J | 53795 |
| .0001" | .020" | .400" | 0-10-0 | 656-517J | 53793 |
| | | | 0-20 | 656-617J | 53797 |
| .00025" | .010" | .025" | 0-5-0 | 656-124J | 53666 |
| | | | 0-10 | 656-224J | 53697 |
| .00025" | .020" | .050" | 0-10-0 | 656-128J | 53668 |
| | | | 0-20 | 656-228J | 53699 |
| .00025" | .030" | .075" | 0-15-0 | 656-129J | 53670 |
| | | | 0-30 | 656-229J | 53701 |
| .0005" | .020" | .050" | 0-10-0 | 656-134J | 53674 |
| | | | 0-20 | 656-234J | 53705 |
| .0005" | .030" | .075" | 0-15-0 | 656-136J | 53676 |
| | | | 0-30 | 656-236J | 53707 |
| .0005" | .040" | .100" | 0-20-0 | 656-138J | 53678 |
| | | | 0-40 | 656-238J | 53709 |
| .0005" | .050" | .125" | 0-25-0 | 656-131J | 53672 |
| | | | 0-50 | 656-231J | 53703 |
| .001" | .020" | .050" | 0-10-0 | 656-142J | 53682 |
| | | | 0-20 | 656-242J | 53713 |
| .001" | .030" | .075" | 0-15-0 | 656-143J | 53684 |
| | | | 0-30 | 656-243J | 53715 |
| .001" | .040" | .100" | 0-20-0 | 656-144J | 53686 |
| | | | 0-40 | 656-244J | 53717 |
| .001" | .050" | .125" | 0-25-0 | 656-145J | 53688 |
| | | | 0-50 | 656-245J | 53719 |
| .001" | .100" | .250" | 0-50-0 | 656-141J | 53680 |
| | | | 0-100 | 656-241J | 53711 |
| .001" | .100" | .500" | 0-50-0 | 656-341/5J | 53783 |
| | | | 0-100 | 656-441/5J | 53787 |
| .001" | .100" | 1.000" | 0-50-0 | 656-341J | 53785 |
| | | | 0-100 | 656-441J | 53789 |

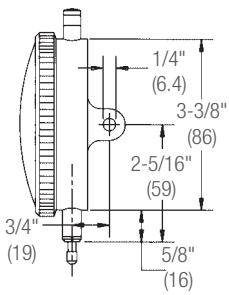


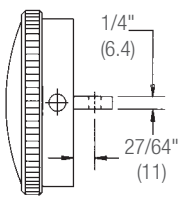

656-161J-8




656-111J




Free drafting template available for this size.
Write The L. S. Starrett Co. at:
121 Crescent Street
Athol, MA 01331.

656-441J
with top lift




656-129J
stem cap required for
use with lift lever
see page 170



# Dial Indicators

## 25, 655, 656 Dial Indicators with Long Range

### 2-5" RANGES

These indicators have a shockless, hardened steel gear train and are furnished with jewel bearings and lug-on-center backs unless otherwise ordered.

- Conforms to AGD specifications except for range
- Stem cap supplied as standard – top lift available when specified
- Furnished with continuous reading double dial with direct reading count hands

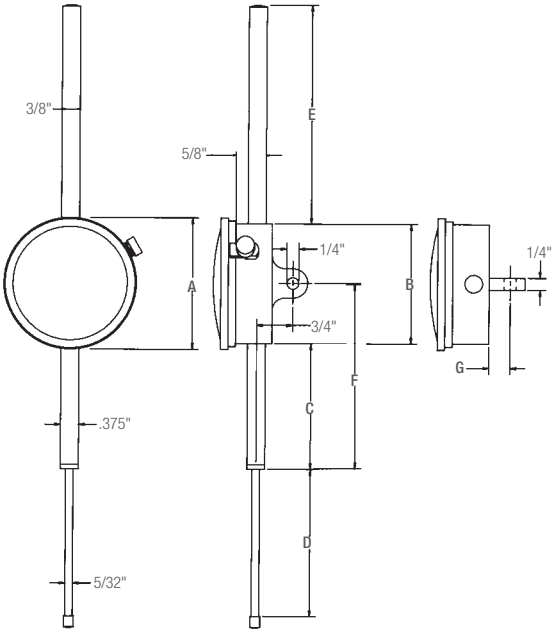
**25, 655, 656 Dial Indicators with Long Range**

| Graduation | Range | Dial Reading | Revs. of Hand | AGD Group | Bezel Diameter | Cat. No. | EDP |
|---|---|---|---|---|---|---|---|
| .001" | 2.000" | 0-100 | 20 | 2 | 2-1/4" | 25-2041J | 53309 |
| | | | | 3 | 2-3/4" | 655-2041J | 53619 |
| | | | | 4 | 3-5/8" | 656-2041J | 53799 |
| .001" | 3.000" | 0-100 | 30 | 2 | 2-1/4" | 25-3041J | 53310 |
| | | | | 3 | 2-3/4" | 655-3041J | 53620 |
| | | | | 4 | 3-5/8" | 656-3041J | 53800 |
| .001" | 4.000" | 0-100 | 40 | 2 | 2-1/4" | 25-4041J | 53311 |
| | | | | 3 | 2-3/4" | 655-4041J | 53621 |
| | | | | 4 | 3-5/8" | 656-4041J | 53801 |
| .001" | 5.000" | 0-100 | 50 | 2 | 2-1/4" | 25-5041J | 53312 |
| | | | | 3 | 2-3/4" | 655-5041J | 53622 |
| | | | | 4 | 3-5/8" | 656-5041J | 53802 |

Not available with special non-shock mechanism. For other attachments, accessories and contact points, refer to the end of the AGD Dial Indicator listings.

**Approximate Dimensions**

| Cat. No. | A | B | C | D | E | F | G |
|---|---|---|---|---|---|---|---|
| 25-2041J | 2-1/4" | 2-1/16" | 1-13/16" | 2-1/16" | 3-3/32" | 2-7/8" | 15/32" |
| 655-2041J | 2-3/4" | 2-1/2" | 1-5/8t" | 2-1/16" | 3-3/32" | 2-7/8" | 7/16" |
| 656-2041J | 3-5/8" | 3-3/8" | 1-1/4" | 2-1/16" | 3-3/32" | 3" | 27/64" |
| 25-3041J | 2-1/4" | 2-1/16" | 2-13/16" | 3-1/16" | 4-9/16" | 3-7/8" | 15/32" |
| 655-3041J | 2-3/4" | 2-1/2" | 2-5/8" | 3-1/16" | 4-9/16" | 3-7/8" | 7/16" |
| 656-3041J | 3-5/8" | 3-3/8" | 2-1/4" | 3-1/16" | 4-9/16" | 4" | 27/64" |
| 25-4041J | 2-1/4" | 2-1/16" | 3-13/16" | 4-1/16" | 6" | 4-7/8" | 15/32" |
| 655-4041J | 2-3/4" | 2-1/2" | 3-5/8" | 4-1/16" | 6" | 4-7/8" | 7/16" |
| 656-4041J | 3-5/8" | 3-3/8" | 3-1/4" | 4-1/16" | 6" | 5" | 27/64" |
| 25-5041J | 2-1/4" | 2-1/16" | 4-13/16" | 5-1/16" | 7-1/4" | 5-7/8" | 15/32" |
| 655-5041J | 2-3/4" | 2-1/2" | 4-5/8" | 5-1/16" | 7-1/4" | 5-7/8" | 7/16" |
| 656-5041J | 3-5/8" | 3-3/8" | 4-1/4" | 5-1/16" | 7-1/4" | 6" | 27/64" |







25-2041J

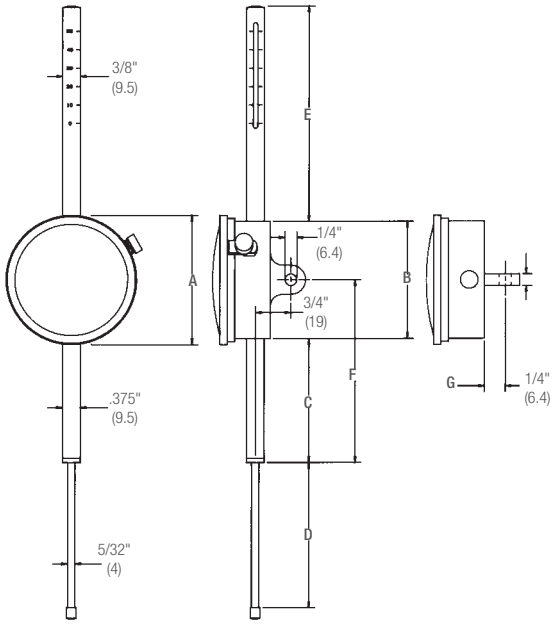
# Dial Indicators

## 25, 655 Metric Dial Indicators with Long Range

### 50-125MM RANGES

These indicators have a shockless, hardened steel gear train and are furnished with jewel bearings and lug-on-center backs unless otherwise ordered.

- Conforms to AGD specifications except for range
- Furnished with continuous reading double dial
- Direct readout accomplished by (1) graduated top tube which indicates each 10mm of spindle travel, (2) revolution counter which indicates each 1mm full turn of the indicator hand, and (3) indicator hand which shows each 0.01mm of spindle movement




**25, 655 Metric Dial Indicators with Long Range**

| Graduation | AGD Group | Stem Diameter | Range | Dial Reading | Revs. of Hand | Cat. No. | EDP |
|---|---|---|---|---|---|---|---|
| 0.01mm | 2 | .375" (9.5mm) | 50mm | 0-100 | 50 | 25-2081J | 56225 |
| | 3 | | | | | 655-2081J | 56230 |
| 0.01mm | 2 | .375" (9.5mm) | 75mm | 0-100 | 75 | 25-3081J | 56226 |
| | 3 | | | | | 655-3081J | 56231 |
| 0.01mm | 2 | .375" (9.5mm) | 100mm | 0-100 | 100 | 25-4081J | 56227 |
| | 3 | | | | | 655-4081J | 56232 |
| 0.01mm | 2 | .375" (9.5mm) | 125mm | 0-100 | 125 | 25-5081J | 56228 |
| | 3 | | | | | 655-5081J | 56233 |

Not available with special non-shock mechanism. For contact points, attachments and accessories, refer to the end of the AGD Dial Indicator listings.

**Approximate Dimensions Inch and Millimeter**

| Cat. No. | A | B | C | D | E | F | G |
|---|---|---|---|---|---|---|---|
| 25-2081J | 2-1/4" (57mm) | 2-1/16" (52mm) | 1-13/16" (46mm) | 2-1/16" (52mm) | 3-3/32" (79mm) | 2-7/8" (73mm) | 15/32" (12mm) |
| 655-2081J | 2-3/4" (70mm) | 2-1/2" (63.5mm) | 1-5/8" (41mm) | 2-1/16" (52mm) | 3-3/32" (79mm) | 2-7/8" (73mm) | 7/16" (11mm) |
| 25-3081J | 2-1/4" (57mm) | 2-1/16" (52mm) | 2-13/16" (71mm) | 3-1/16" (78mm) | 4-9/16" (116mm) | 3-7/8" (98mm) | 15/32" (12mm) |
| 655-3081J | 2-3/4" (70mm) | 2-1/2" (63.5mm) | 2-5/8" (67mm) | 3-1/16" (78mm) | 4-9/16" (116mm) | 3-7/8" (98mm) | 7/16" (11mm) |
| 25-4081J | 2-1/4" (57mm) | 2-1/16" (52mm) | 3-13/16" (81mm) | 4-1/16" (103mm) | 5-61/64" (151mm) | 4-7/8" (124mm) | 15/32" (12mm) |
| 655-4081J | 2-3/4" (70mm) | 2-1/2" (63.5mm) | 3-5/8" (92mm) | 4-1/16" (103mm) | 5-61/64" (151mm) | 4-7/8" (124mm) | 7/16" (11mm) |
| 25-5081J | 2-1/4" (57mm) | 2-1/16" (52mm) | 4-13/16" (122mm) | 5-1/16" (129mm) | 7-1/4" (184mm) | 5-7/8" (149mm) | 15/32" (12mm) |
| 655-5081J | 2-3/4" (70mm) | 2-1/2" (63.5mm) | 4-5/8" (117.5mm) | 5-1/16" (129mm) | 7-1/4" (184mm) | 5-7/8" (149mm) | 7/16" (11mm) |




655-2081J

# Dial Indicators

## 656 Dial Indicators with Extra Long Range

### AGD GROUP 4
### 6-12" RANGES

These indicators have a shockless, hardened steel gear train and are furnished with jewel bearings and lug-on-center backs unless otherwise ordered.

- Use anywhere a long reach is needed – positioning of stops, measuring travel of slides and cam throws, and use in deep slots or holes
- Conforms to AGD specifications except for range, stems and contact point
- Top stem graduated in 1" increments, called out by red colored pointer
- Furnished with continuous reading double dial with direct reading count hand

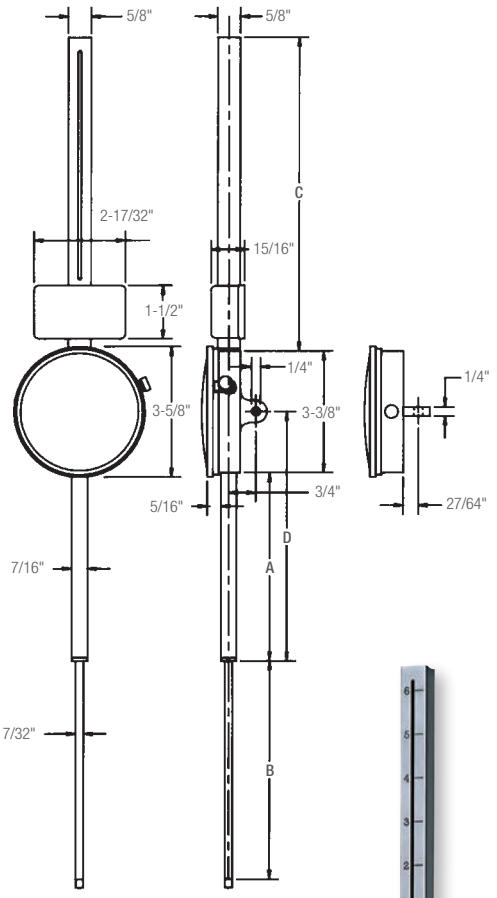
**656 Dial Indicators with Extra-Long Range**

| Graduation | AGD Group | Dial Diameter | Range | Dial Reading | Revs. of Hand | Cat. No. | EDP |
|---|---|---|---|---|---|---|---|
| | | | 6.000" | | 60 | 656-6041J | 53803 |
| | | | 7.000" | | 70 | 656-7041J | 53804 |
| | | | 8.000" | | 80 | 656-8041J | 53805 |
| .001" | 4 | 3-5/8" | 9.000" | 0-100 | 90 | 656-9041J | 53806 |
| | | | 10.000" | | 100 | 656-10041J | 53807 |
| | | | 11.000" | | 110 | 656-11041J | 53808 |
| | | | 12.000" | | 120 | 656-12041J | 53809 |

Not available with special non-shock mechanism. For contact points, attachments and accessories, refer to the end of the AGD Dial Indicator Section

**Dimensions**

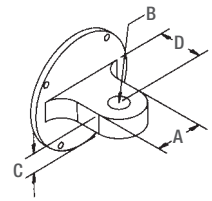
| Cat. No. | A | B | C | D |
|---|---|---|---|---|
| 656-6041J | 5-1/4" | 6-1/16" | 8-3/4" | 6-15/16" |
| 656-7041J | 6-1/4" | 7-1/16" | 9-3/4" | 7-15/16" |
| 656-8041J | 7-1/4" | 8-1/16" | 10-3/4" | 8-15/16" |
| 656-9041J | 8-1/4" | 9-1/16" | 11-3/4" | 9-15/16" |
| 656-10041J | 9-1/4" | 10-1/16" | 12-3/4" | 10-15/16" |
| 656-11041J | 10-1/4" | 11-1/16" | 13-3/4" | 11-15/16" |
| 656-12041J | 11-1/4" | 12-1/16" | 14-3/4" | 12-15/16" |



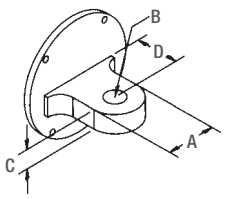



656-6041J

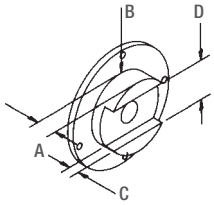
# Indicator Backs



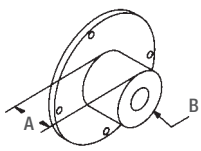
Lug-On-Center



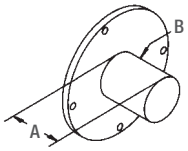
Lug-Off-Center



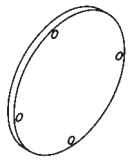
Adjustable Bracket



Screw-Type Lug



Post-Type Lug


Flat

## AGD Dial Indicator Backs

| Type | Fits Starrett Indicator Models | Part No. | EDP | Dimensions A Inch | A mm | B Inch | B mm | C Inch | C mm | D Inch | D mm |
|---|---|---|---|---|---|---|---|---|---|---|---|
| *Lug-On-Center | 81 | PT06836-1 | 70856 | 5/8" | 16mm | 1/4" | 6.3mm | 1/4" | 6.3mm | 1/2" | 12.7mm |
| | 25, 2600 | PT07206-1 | 70960 | | | | | | | 15/32" | 12mm |
| | 655 | PT06966-1 | 70888 | | | | | | | 7/16" | 11mm |
| | 656 | PT07317-1 | 70980 | | | | | | | 27/64" | 10.7mm |
| **Lug-Off-Center | 81 | PT06836 | 70855 | 5/8" | 16mm | 1/4" | 6.3mm | 1/4" | 6.3mm | 1/2" | 12.7mm |
| | 25, 2600 | PT06608-1 | 70770 | | | | | | | 15/32" | 12mm |
| | 655 | PT06966A | 71996 | | | | | | | 7/16" | 11mm |
| | 656 | PT07317A | 71997 | | | | | | | 27/64" | 10.7mm |
| †Adjustable Bracket (#1/4-20 Thread) | 81 | PT06836M | 70859 | 1/4" | 6.3mm | 7/8" | 22mm | 1/8" | 3mm | 1/2" | 12.7mm |
| | 25, 2600 | PT06608M | 70776 | | | | | | | | |
| | 655 | PT06878M | 70874 | | | 1-1/4" | 32 mm | | | | |
| | 656 | PT06903M | 70882 | | | | | | | | |
| †Screw-Type Lug (#1/4-20 Thread) | 81 | PT24074 | 72482 | 1/2" | 12.7mm | 5/8" | 16mm | | | | |
| | 25, 2600 | PT24076 | 72483 | | | | | | | | |
| | 655 | PT24078 | 72484 | | | | | | | | |
| | 656 | PT24080 | 72485 | | | | | | | | |
| †Screw-Type Lug (#3/8-24 Thread) | 81 | PT06836S | 72223 | 1/2" | 12.7mm | 5/8" | 16mm | | | | |
| | 25, 2600 | PT06608E | 70772 | | | | | | | | |
| | 655 | PT06878E | 72224 | | | | | | | | |
| | 656 | PT06903E | 72225 | | | | | | | | |
| †Screw-Type Lug (#1/4-28 Thread) | 81 | PT24073 | 72486 | 1/2" | 12.7mm | 5/8" | 16mm | | | | |
| | 25, 2600 | PT24075 | 72487 | | | | | | | | |
| | 655 | PT24077 | 72488 | | | | | | | | |
| | 656 | PT24079 | 72489 | | | | | | | | |
| †Post-Type Lug | 81 | PT06836F | 70857 | 1-1/4" | 32mm | 1/2" | 12.7mm | | | | |
| | 25, 2600 | PT06608F | 70773 | | | | | | | | |
| | 655 | PT06878F | 71992 | | | | | | | | |
| | 656 | PT06903F | 71994 | | | | | | | | |
| **Flat | 81 | PT06836J | 70858 | | | | | | | | |
| | 25, 2600 | PT06608J | 70774 | | | | | | | | |
| | 655 | PT06878J | 70873 | | | | | | | | |
| | 656 | PT06903J | 71995 | | | | | | | | |
| Flat (Plastic) | 81 | PT24921 | 67295 | | | | | | | | |
| | 25, 2600 | PT26160 | 67405 | | | | | | | | |

* Regularly furnished on all listed indicators at no extra charge.

** When specified, available on all listed indicators at no extra charge.

† When specified, available at extra charge on all listed indicators. Backs for special requirements are also available; priced on application.

# Dial Indicators

## 647 and 647M Dial Comparator Indicators

The 647 Dial Comparator Indicators offer a high degree of security and precision. They are based on a solid and well thought-out construction taking into account the latest technology. They are manufactured by the most up-to-date methods.

### Features and Specifications

| 647 and 647M Dial Comparator Indicators | | | | |
|---|---|---|---|---|
| **Cat. No.** | **EDP** | **Range** | **Graduation** | **Dial Reading** |
| 647 | 00001 | .004" | .00005" | 20-0-20 |
| 647M | 00002 | 0.1mm | 0.001mm | 50-0-50 |
| **647 and 647M Dial Comparator Indicator Accessories** | | | | |
| **Part No.** | **EDP** | **Description** | | |
| PT15052 | 00537 | Lug-on-center back | | |
| PT15053 | 00538 | Lift cable | | |

- Effective non-shock mechanism
- Pinions and shafts of the movement are jeweled
- After removal of the safety cap and adjustment screw on top of the case allows simple and safe zero setting of the instrument over the total measuring range
- A safety cap prevents unintentional turning of the fine adjustment screws
- Stem and spindle are made of hardened stainless steel
- The measuring spindles are very sensitive on account of their accurate guides
- Additional overtravel assists with the insertion of work pieces into the measuring device
- The clear scale is shadow free
- The red tolerance markers are easy to recognize and to set
- Furnish with flat back




647

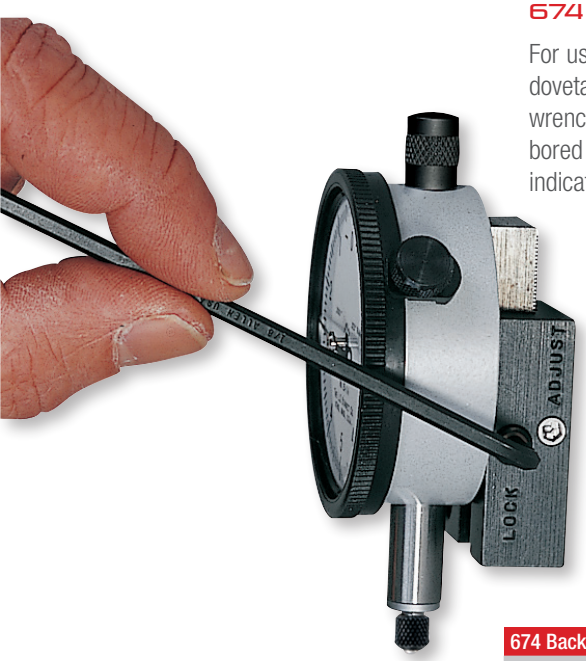



647M

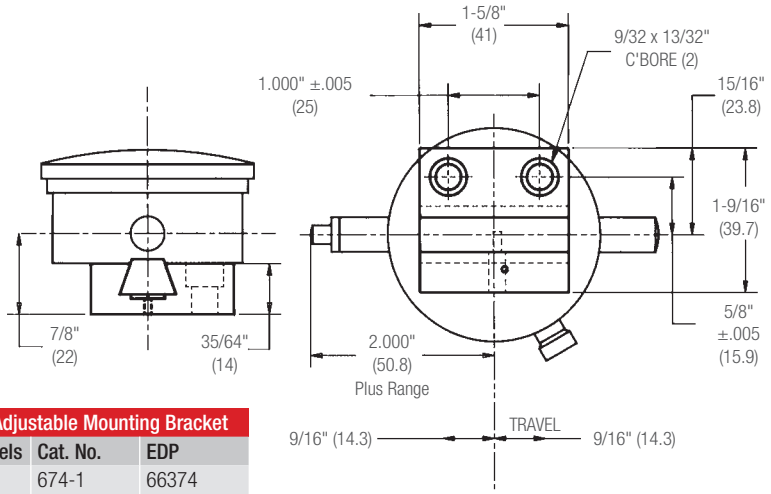
# INDICATOR BACKS

## SPECIAL INDICATOR BACKS

### 674 BACKS WITH ADJUSTABLE MOUNTING BRACKET




For use with gages and gaging fixtures where an adjustable indicator mounting is required. A dovetail with rack and pinion adjustment provides 1-1/8" (28mm) indicator travel. A 1/8" hex wrench is used to adjust and lock the indicator in final position. The bracket has two counter-bored mounting holes (for 1/4" socket head screws), and the back has four screw holes so the indicator back can be rotated.



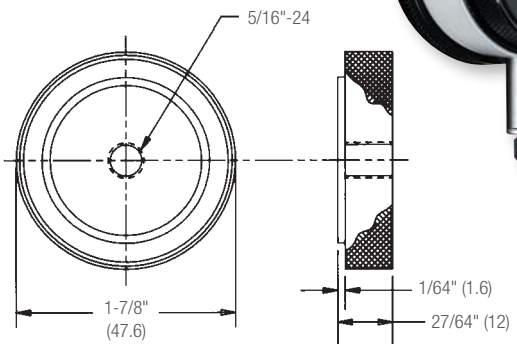

| 674 Backs with Adjustable Mounting Bracket | | |
|---|---|---|
| **Fits Starrett Models** | **Cat. No.** | **EDP** |
| 81 | 674-1 | 66374 |
| 25, 2600, 2900 | 674-2 | 52892 |
| 655 | 674-3 | 52893 |
| 656 | 674-4 | 52894 |

### 676 MAGNETIC BACKS

These magnetic backs provide a quick and easy means of attaching any Starrett AGD indicator to flat, ferrous metal surfaces. A real time-saver for machine, jig and fixture set up. Requires no clamps, rods or snugs. A special 5/16"-24 threaded stud back is provided to replace the standard lug back. The powerful, permanent magnet is then attached to the threaded stud. Anti-magnetic indicators are not required.

| 676 Magnetic Backs | | |
|---|---|---|
| **Fits Starrett Models** | **Cat. No.** | **EDP** |
| 81 | 676-1 | 56647 |
| 25, 2600, 2900 | 676-2 | 56648 |
| 655 | 676-3 | 56649 |
| 656 | 676-4 | 56650 |



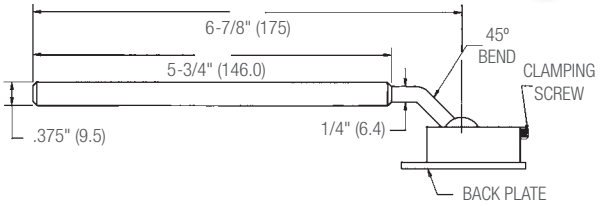



### 672 UNIVERSAL BACKS

Featuring a universal ball joint attached to the end of a gooseneck shank, these attachments make it possible to position an AGD indicator at any desired setting. The indicator can be rotated 360º and angularly up to 90º and locked in the desired position by tightening a single knurled nut. Straight shank is 3/8" (9.5mm) in diameter.

| 672 Universal Backs | | |
|---|---|---|
| **Fits Starrett Models** | **Cat. No.** | **EDP** |
| 25, 2600, 2900 | 672-2 | 52887 |
| 655 | 672-3 | 52888 |
| 656 | 672-4 | 52889 |





# Indicator Accessories

## AGD Indicator Attachments and Accessories

### 670 Indicator Hole Attachment

These hole attachments make it possible to measure the inside of holes and other surfaces that cannot be reached with the regular indicator spindle. Both attachments have a .375" (9.5mm) diameter hole to fit all indicators made to AGD standards and can be securely clamped to the indicator stem. The ball end on the swivel arm which contacts the work is 1/8" (3mm) in diameter.

| 670 Indicator Hole Attachment | | | | | |
|---|---|---|---|---|---|
| Range (Approx.) | | For Hole Depths to: | | | |
| Inch | mm | Inch | mm | Cat. No. | EDP |
| 3/8" | 9.5mm | 13/16" | 20mm | 670A | 52884 |
| 9/16" | 14mm | 1-11/16" | 42mm | 670B | 52724 |



670A

### 671 Universal Attachment

This Universal Attachment is for use with indicators having standard AGD .375" (9.5mm) stem diameters. It clamps on the indicator stem and its movement is transmitted through the contact point to the indicator. Furnished with two interchangeable arms, one straight for measuring internal surfaces and one angular for measuring at right angles to the indicator spindle.

| 671 Universal Attachment | | |
|---|---|---|
| Range (Approx.) | Cat. No. | EDP |
| 1/8" (3mm) | 671 | 52886 |




671

### Special Non-Shock Mechanism

Starrett dial indicators have hardened, stainless steel gears, pinions and racks for maximum resistance to shock. Where the rack is subject to repeated, severe and/or excessive mechanical shocks, many Starrett AGD dial indicators may be ordered with a special non-shock mechanism. Based on a positive-loaded, split gear assembly, this simple device protects indicator accuracy, prolongs life, and reduces service costs.

When ordering, specify "N/S" after the dial indicator catalog number.

The following indicators are not available with non-shock mechanism: 25-109, 25-209, 2600 and 2700 Indicators; 656-109, 656-209 and all other indicators with 2" (50mm) range and above.




25-111J
with Special Non-Shock Mechanism



# Indicator Accessories

## AGD Indicator Contact Points and Accessories

Any of the contact points listed here can also be used with the 650 and 651 Indicators and with the 196 Indicators by using the 196R Adapter.

### Extra-Length Regular-Style Contact Points with round or flat ends

**1/4-4"/6-100MM**

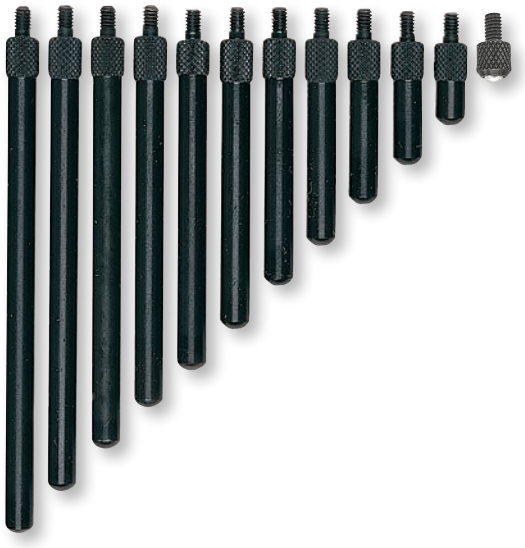
All Starrett AGD indicators are regularly furnished with 1/4" (6.4mm) length interchangeable contact points. Available in standard lengths to 4" (100mm). Diameter is 13/64" (5mm), with a #4-48 screw thread. Made from high grade steel, hardened and ground. Other lengths are also available priced on application. Available with round or flat ends as listed.

### Regular-Style Carbide Contact Points with round or flat end

Two round points are available in standard lengths. 1/4" (6.3mm), PT08399-X (EDP 66053) – or – 1/2" (13mm), PT06677-X (EDP 66054). One flat point is available in standard length; 1/4" (6.3mm), PT10453-X (EDP 66068). Interchangeable points have a #4-48 screw thread. Longer lengths can be easily obtained by adding contact point extensions (see next page). Other sizes also available by request.

**Extra-Length Contact Points, Regular Style**

| Length | | Rounded End | | Flat End | |
|---|---|---|---|---|---|
| Inch | mm | Part No. | EDP | Part No. | EDP |
| 1/4" | 6.4mm | PT07215<br>PT01761 | 70965<br>75263 | PT10453 | 72048 |
| 1/2" | 13mm | PT06677 | 70823 | PT09560 | 71260 |
| 3/4" | 19mm | PT06677A | 70824 | PT09560A | 71261 |
| 1" | 25mm | PT06677B | 70825 | PT09560B | 71262 |
| 1-1/4" | 32mm | PT06677C | 70826 | PT09560C | 71263 |
| 1-1/2" | 38mm | PT06677D | 70827 | PT09560D | 71264 |
| 1-3/4" | 44mm | PT06677E | 70828 | PT09560E | 71265 |
| 2" | 50mm | PT06677F | 70829 | PT09560F | 71266 |
| 2-1/4" | 57mm | PT06677G | 70830 | PT09560G | 71267 |
| 2-1/2" | 63mm | PT06677H | 70831 | PT09560H | 71268 |
| 2-3/4" | 70mm | PT06677J | 70832 | PT09560J | 71269 |
| 3" | 75mm | PT06677K | 70833 | PT09560K | 71270 |
| 4" | 100mm | PT10459 | 71327 | | |



### 28 Shock Absorbing Anvil

Anvil replaces the regular contact point on any AGD indicator, protecting its movement against mechanical shock. Any sudden impact telescopes the anvil into the body of the unit against an internal spring. Acts as a solid contact point when the indicator is used normally. Furnished with #4-48 AGD standard screw thread.

**Shock Absorbing Anvil**

| Cat. No. | EDP |
|---|---|
| 28 | 50199 |

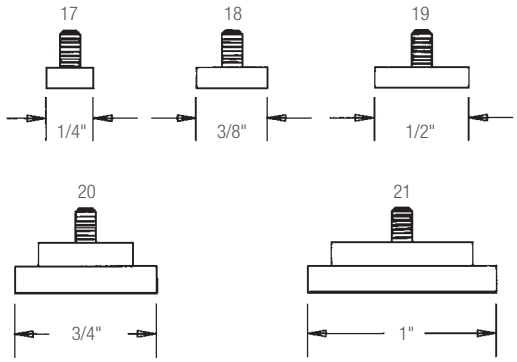


### Flat-End Steel Points

The flat-end contact points have hardened steel contact surfaces, ground flat and lapped. They are furnished with a #4-48 screw thread for use on any AGD Indicator.

**Flat-End Steel Points**

| Diameter | | | | |
|---|---|---|---|---|
| Inch | mm | Style No. | Part No. | EDP |
| 1/4" | 6.4 | 17 | PT06632-17 | 70804 |
| 3/8" | 9.5 | 18 | PT06632-18 | 70805 |
| 1/2" | 12.7 | 19 | PT06632-19 | 70806 |
| 3/4" | 19 | 20 | PT06632-20 | 70808 |
| 1" | 25 | 21 | PT06632-21 | 70807 |



# Indicator Accessories

## AGD Indicator Special Contact Points and Accessories

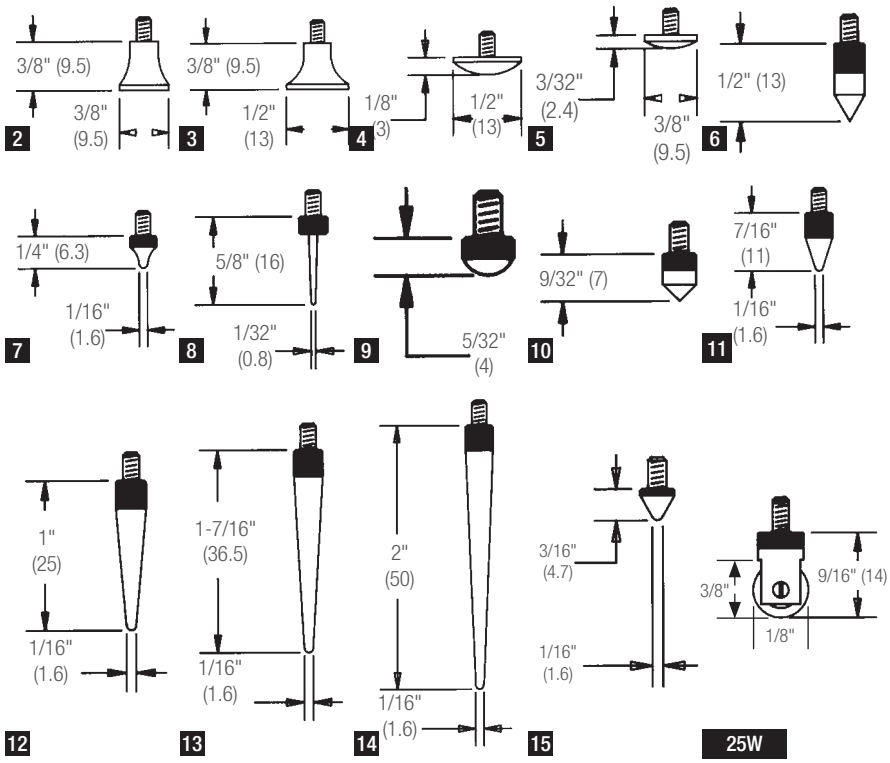
### Special Form Contact Points

Starrett Special Contact Points are furnished in fourteen shapes. Knurled diameter is approximately 13/64" (5mm). All have #4-48 screw thread and can be used on any AGD indicator. Other special shapes are available on special order.

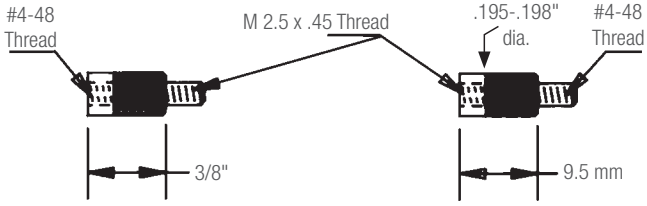
Carbide, sapphire, diamond or teflon-coated contact points are also available by request.

### 25W Roller Contact Point

This contact has a small, hardened roller 3/8" (9.5mm) in diameter for continuous gaging of moving material where the material movement is at a slow speed. Contact has #4-48 screw thread and substitutes for the regular contact point provided on Starrett and other AGD indicators. Furnished with a knurled check nut for positioning the contact on the indicator spindle. See drawing (right).



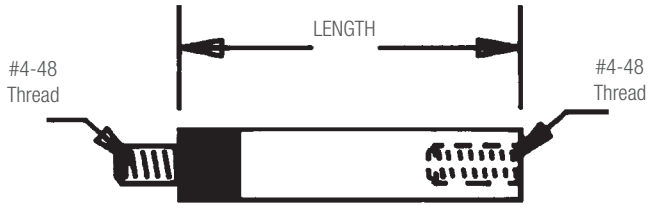

## AGD Contact Adaptors




From Metric Racks to Inch Contacts
PT24728

From Inch Racks to Metric Contacts
PT24729

## AGD Contact Point Extensions




| AGD Contact Point Extensions | | |
|---|---|---|
| Length | Part No. | EDP |
| 1/2" | PT21697-1/2 | 64632 |
| 1" | PT21697-1 | 64633 |
| 2" | PT21697-2 | 64634 |
| 3" | PT21697-3 | 64635 |
| 4" | PT21697-4 | 64636 |

## 25R Contact Point Set

14 points with #4-48 screw thread to fit AGD indicators: a regular 1/4" (6.3mm) long point; 9 special form points; a 28 Shock Absorbing Anvil; and 3 extra long points 1/2", 3/4" and 1" (13, 19, 25mm) long. High grade steel, hardened and ground. All points are mounted on a convenient aluminum ring for safe keeping and easy selection.

| Contact Points | | |
|---|---|---|
| Style No. | Part No. | EDP |
| 2 | PT06632-2 | 70790 |
| 3 | PT06632-3 | 70791 |
| 4 | PT06632-4 | 70792 |
| 5 | PT06632-5 | 70793 |
| 6 | PT06632-6 | 70794 |
| 7 | PT06632-7 | 70795 |
| 8 | PT06632-8 | 70796 |
| 9 | PT06632-9 | 70797 |
| 10 | PT06632-10 | 70798 |
| 11 | PT06632-11 | 70799 |
| 12 | PT06632-12 | 70800 |
| 13 | PT06632-13 | 70801 |
| 14 | PT06632-14 | 70802 |
| 15 | PT06632-15 | 70803 |
| | 25W | 53916 |
| | 25R | 50153 |
| | PT24728 | 64963 |
| | PT24729 | 64964 |



# Indicator Accessories

## AGD Indicator Accessories

### 25SC Split Collets

**ENGLISH AND METRIC THREADS**

For mounting AGD Indicators with 3/8" (9.5 mm) or 8 mm stems in gaging and work location fixtures, these collets simplify fixture mounting. Screw the collet into the fixture or into our 648 Depth Gage Base, insert the indicator into the collet and tighten it in place with the hexagonal nut. Internal collet fingers grip the stem with equal pressure to eliminate spindle binding. Made of steel with black finish. Overall length of collet and threads is 1".




| 25SC Split Collets English Thread | | | | |
|---|---|---|---|---|
| **Thread Size** | **Thread Length** | **Hole for Indicator Stem** | **Cat. No.** | **EDP** |
| 3/8-24NF | 9/32" (7mm) | .375" (9.5mm) Diameter to 1/2" (12.7mm) Depth; 1/4" (6.3mm) Diameter through Hole | 25SC14 | 50155 |
| 1/2-20NF | | .375" (9.5mm) Dia. through Hole | 25SC38 | 50156 |
| 1/2-32UN | | .375" (9.5mm) Dia. through Hole | 25SC38B | 55995 |
| **25SC Split Collets Metric Thread** | | | | |
| M12 x 1.75 | 7mm | 8mm Diameter through Hole | 25SC8M | 64885 |


Split Bushing Attachment

### Split Bushings

Split bushings fit over the indicator stem to increase the overall diameter for mounting in fixtures.

| Split Bushings for 80 Miniature Dial Indicators | | | | |
|---|---|---|---|---|
| | **Diameter** | | | |
| **Length** | **Inside** | **Outside** | **Cat. No.** | **EDP** |
| 1/2" | .219" | .375" | 80SB | 56008 |
| **Split Bushings for AGD English Indicators** | | | | |
| 1/2" | .375" | .500" | 25SB | 50154 |
| **Split Bushings for AGD Metric Indicators** | | | | |
| 12.7mm | 8mm | 9.5mm | 25MSB | 56007 |

### Threaded Stems

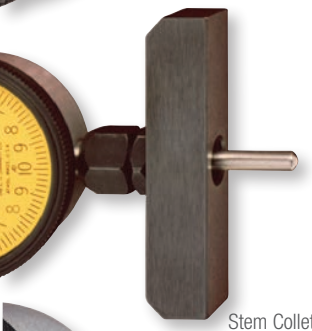
Threaded stems on Starrett indicators with a .375" (9.5mm diameter stem up to 1" (25mm) range (except long stem models) are available at additional cost. A threaded stem is often desirable for attaching the indicator to machine tools or fixtures. A 3/8-24 thread is furnished unless otherwise specified.


Threaded Stem Attachment

### 648 Depth Gage Bases with Stem Collet

Bases are for mounting AGD indicators to measure depths. Indicators with .375" (9.5mm) stems will fit the stem collet furnished with the base (25SC38). Indicators with 8mm stems need the split bushing 25MSB to adapt to the stem collet. Longer contacts or extensions may be required.

| 648 Depth Gage Bases with Stem Collet | | |
|---|---|---|
| **Base Size** | **Cat. No.** | **EDP** |
| 4" (100mm) | 648-4 | 65850 |
| 6" (150mm) | 648-6 | 65851 |
| 8" (200mm) | 648-8 | 65852 |


Stem Collet

### 25LC Range Limit Cap

The Range Limit Cap replaces the stem cap furnished on most 81, 25, 2600, 655 and 656 AGD Indicators, preventing the possible error of a complete revolution. It can be adjusted to limit an indicator's measuring range any amount up to 3/8" (9.5mm).

| 25LC Range Limit Cap | |
|---|---|
| **Part No.** | **EDP** |
| 25LC | 50152 |


Range Limit Cap

### Long Stem Dial Indicators

Starrett 81, 25, 2600, 655 and 656 Indicators through the 1" (25mm) range can be furnished with long stems up to 12" (300mm). These are especially useful for gaging in deep holes or where obstructions prevent the use of regular indicators. Specify stem length from outside case diameter when ordering.

Long stems not available on 80 Miniature Dial Indicators.



# Indicator Accessories




Top Lift

## AGD Indicator Accessories

### Top Lift

A knurled grip allows the spindle to be manually lifted and returned by spring action to contact the work. Furnished in place of the stem cap on .500", 1.000", 10mm and 25mm range indicators. No extra charge on AGD Indicators up to 1" (25mm) range; over 1" (25mm) range, priced on request. To order, specify "with Top Lift" after the indicator catalog number.

**NOTE**: Will not fit on 2700 Indicators.

### Rubber Dust Guard

Protects the rack of AGD Indicators from foreign matter under adverse gaging conditions. Made in lengths to fit 81, 25, 2600, 655 and 656 Indicators up to 1" (25mm) range.

| Rubber Dust Guard | | |
|---|---|---|
| **Indicator Range** | **Part No.** | **EDP** |
| .400", .500", 1.000" (10mm, 12.7mm, 25mm) | PT09545 | 71256 |
| Ranges under .400" (10mm) | PT09763 | 71289 |

### AGD Dial Indicator Tolerance Hands

Starrett dial indicators may be ordered with crystal-mounted or bezel-mounted tolerance hands for visually checking limits of a given dimension.

Crystal-mounted hands, both colored red, are positioned under the crystal and are individually adjustable through 360º by turning concentric knurled knobs on the outside of the crystal. Available for all 81, 25, 655 and 656 AGD Dial Indicators.

Bezel-mounted hands, both colored red, rotate inside the bezel. They are mounted outside the crystal and are independently adjustable through 360º. Available for 81 and 25 AGD Indicators only.

Snap-on bezel-mounted hands, two hands colored red, are easily mounted on the outside of the bezel and are adjustable through 360º. Available for 25 AGD Indicators only. Order PT99513 (EDP 66038).



Indicators with snap-on bezel-mounted hands (left), crystal-mounted hands (above), and bezel-mounted hands (right).

### Maximum Hand

This red-colored hand records the maximum position reached by the indicator hand within a single revolution. Mounted under the crystal, it has a small nib at its point. The indicator hand contacts the nib, advancing the maximum hand which remains in position when the indicator hand returns to its at-rest position. To reset the maximum hand, turn the knurled knob mounted outside the crystal.

To order Tolerance or Maximum Hands, specify the indicator catalog number followed by the type of hand desired.



Maximum Hand in at-rest position with indicator hand (left), and in recording position (right).

### Lever Control

Handy attachment mounts in place of stem cap and is interchangeable on most Starrett 81, 25, 2600, 655 and 656 AGD Indicators up to 1" or 25mm range. Pressing down lever lifts spindle; releasing it lets spindle contact the work. Easy to install in the left or right hand position using a screwdriver and an open end wrench. If ordered on a new indicator, specify left or right hand position. (Furnished at left unless otherwise ordered.)

**NOTE**: Fits only indicators with a case stem cap.

| Lever Control | |
|---|---|
| **Part No.** | **EDP** |
| PT99356 | 72088 |



# Indicator Testers

## 716, 716M Indicator Testers

### 0-1"/0-25MM

With direct reading capability to .0001" or 0.002mm, these gages provide a rapid means for calibrating both AGD and dial test indicators for linearity and repeatability through ranges up to 1" or 25mm. This tester design is unlike others because it can be swung to any position between vertical and horizontal by loosening a large hand knob which fastens the gage assembly to the base.

In addition, the micrometer head can be turned on its axis and its scale positioned to suit the operator's convenience by loosening a single set screw. Tensioned locking screws prevent tipping of both the gage assembly and the indicator holding clamp during set-up and adjustment.

The micrometer head is our 469 super-precision head with reverse reading capability. When testing a 2600 or 2700 Electronic Indicator, a .000050" graduated head is advisable, available on special order.

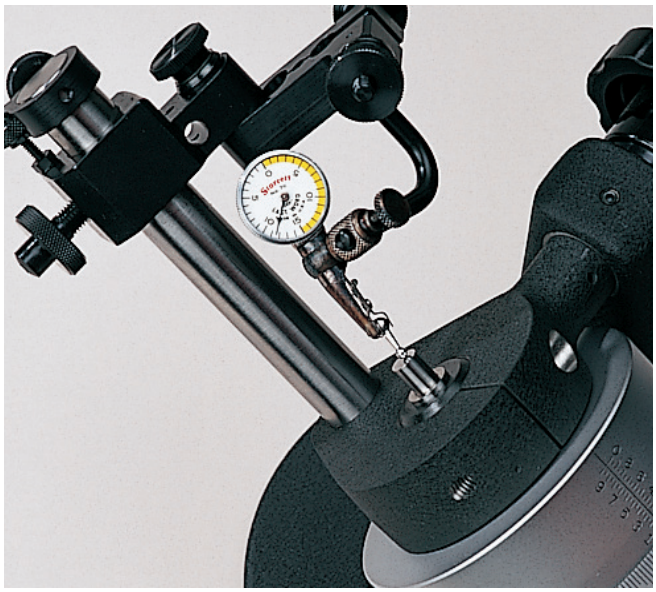
An indicator mounting attachment holds dovetail mount indicators, AGD indicators with 3/8" (9.5mm) stems and indicators with a holder that has a 3/16" (4.7mm) shank. Unit also has a fine adjustment to zero the indicator.



716MX

| 716 Indicator Tester (0-1" Range) | | | |
|---|---|---|---|
| **Micrometer Head Graduation*** | **Description** | **Cat. No.** | **EDP** |
| .0001" | Tester with carbide faced spindle, indicator mounting and offset attachment | 716X | 67228 |
| **716M Indicator Tester (0-25mm Range)** | | | |
| 0.002mm | Tester with carbide faced spindle, indicator mounting and offset attachment | 716MX | 67229 |
| **Accessory for 716, 716M Indicator Testers** | | | |
| **Description** | | **Cat. No.** | **EDP** |
| Indicator mounting attachment only | | PT26009 | 65102 |

*Available on special order with resolution to .000050" or 0.001mm.


Dial test indicator held in place by an offset attachment



Checking AGD dial indicator

# Electronic Indicators

## 2900 Electronic Indicators

### RANGES UP TO .5"/1" AND 12MM/25MM
### AGD GROUP 2

The 2900 Electronic Indicators are available in a choice of configurations to meet a range of requirements. Innovative True Absolute Sensor Technology minimizes the chance of data loss for exceptional reliability. Built with IP67 protection and renowned Starrett quality, they maintain their reliability in hostile shop environments.

| 2900 Electronic Indicators - Inch/Metric .375" Stem: #4-48 UNF Thread | | | | | | | |
|---|---|---|---|---|---|---|---|
| Range | | Resolution | | Accuracy | | | |
| in | mm | in | mm | in | mm | Cat. No. | EDP |
| .5" | 12mm | .00005" | 0.001mm | ±.00012" | ±0.003mm | 2900-1 | 09980 |
| .5" | 12mm | .0001" | 0.001mm | ±.00012" | ±0.003mm | 2900-2 | 09981 |
| 1" | 25mm | .0005" | 0.01mm | ±0.001" | ±0.03mm | 2900-3-1 | 09963 |
| .5" | 12mm | .0005"/.0001"/.00005" | 0.01mm/0.001mm | ±0.001" | ±0.03mm | 2900-4 | 09983 |
| 1" | 25mm | .0005" | 0.01mm | ±0.001" | ±0.03mm | 2900-5-1 | 09967 |
| .5" | 12mm | .0005"/.0001"/.00005" | 0.01mm/0.001mm | ±.00012" | ±0.003mm | 2900-6 | 09985 |
| **2900 Electronic Indicators - Inch/Metric 8mm Stem: M2.5 x 0.45 Thread** | | | | | | | |
| .5" | 12mm | .00005" | 0.001mm | ±.00012" | ±0.003mm | 2900-1ME | 09975 |
| 1" | 25mm | .0005" | 0.01mm | ±0.001" | ±0.03mm | 2900-3ME-25 | 09975 |
| .5" | 12mm | .0005"/.0001"/.00005" | 0.01mm/0.001mm | ±.00012" | ±0.003mm | 2900-4ME | 09976 |
| 1" | 25mm | .0005" | 0.01mm | ±0.001 | ±0.03mm | 2900-5ME-25 | 09978 |
| .5 | 12mm | .0005"/.0001"/.00005" | 0.01mm/0.001mm | ±0.00012" | ±0.003mm | 2900-6ME | 09979 |
| **2900 Electronic Indicators - Metric Only 8mm Stem: M2.5 x 0.45 Thread** | | | | | | | |
| | 12mm | | 0.001mm | | ±0.003mm | 2900-1M | 09986 |
| | 25mm | | 0.01mm | | ±0.03mm | 2900-3M-25 | 09964 |
| | 12mm | | 0.01mm/0.001mm | | ±0.003mm | 2900-4M | 09988 |
| | 25mm | | 0.01mm | | ±0.03mm | 2900-5M-25 | 09968 |
| | 12mm | | 0.01mm/0.001mm | | ±0.003mm | 2900-6M | 09990 |

| 2900 Electronic Indicators - Accessories | | | |
|---|---|---|---|
| Cat. No. | EDP | Spindle Thread | Description |
| PT99543 | 00004 | 4-48 | Top lift lever for 2900 Electronic Indicators (English) |
| PT99556 | 73065 | M2.5X | Top lift lever for 2900 Electronic Indicators (metric) |

### Features

- Intuitive design and layout – easy to learn and use
- Positive, tactile-feel button activation
- Long battery life
- CE compliant
- Data output on all models
- Choice of Basic, Standard and Advanced feature levels
- One micron resolution available
- Selectable resolution models available
- Fixed ratio measurement systems available
- Metric-only versions available
- Compatible with 25 Indicator backs
- IP67 compliant




### IP Protection

An IP number is composed of two numbers, the first referring to protection against solid objects and the second against liquids.

**First number 6**: Totally protected against dust

**Second number 7**: Protection against submersion in water under standardized conditions of pressure for 30 minutes

IP67

# Electronic Indicators

## 2700 Wisdom® Electronic Indicators

The 2700 Wisdom Electronic Indicator is one of the most versatile of the electronic indicators. All indicators feature a glass scale design with an unsurpassed accuracy of ± two resolutions when measuring from a known standard. All have rugged, sealed enclosures as well.

### Features

- 8 resolutions and 4 measuring ranges available
- Plus or minus travel direction
- Zero the tool at any position of the spindle
- Rotating bezel
- Auto Off after 10 minutes of non-use
- Three power sources - operate by battery, A/C adaptor or through data port
- Output jack allows data transmission

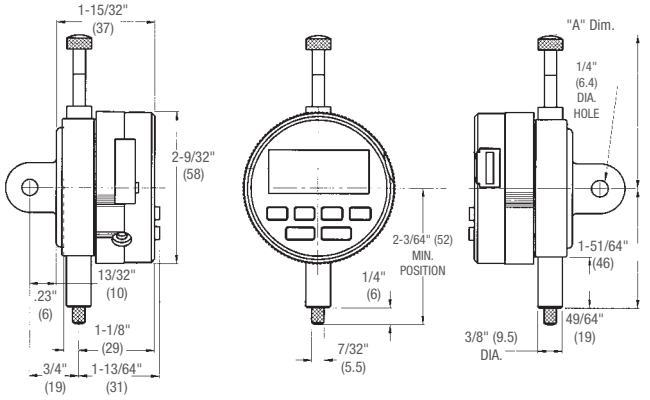



F2720AD

F2730IQ

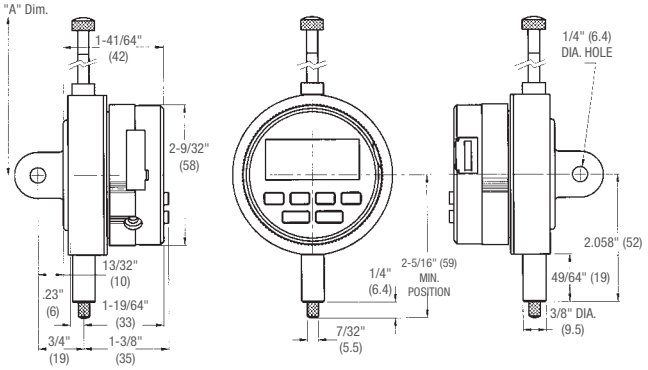
| 2700 Wisdom Electronic Indicators - Inch/Metric .375" Stem: #4-48 UNF Thread | | | | | | | |
|---|---|---|---|---|---|---|---|
| Range | | Resolution | | Accuracy | | | |
| in | mm | in | mm | in | mm | Cat. No. | EDP |
| 1" | 25mm | .001"/.0005"/.0001"/.00005" | 0.02mm/0.01mm/0.002mm/0.001mm | ±.0001" | ±0.002mm | F2730IQ | 49509 |
| 1" | 25mm | .001"/.0005"/.0001" | 0.02mm/0.01mm/0.002mm/0.001mm | ±.0002" | ±0.004mm | F2730-1IQ | 49516 |
| 2" | 50mm | .001"/.0005"/.0001" | 0.02mm/0.01mm/0.002mm | ±.0002" | ±0.004mm | F2740IQ | 49510 |
| 4" | 100mm | .001"/.0005"/.0001" | 0.02mm/0.01mm/0.002mm | ±.0002" | ±0.004mm | F2750IQ | 49511 |
| 0.6" | 15mm | .001"/.0005"/.0001"/.00005" | 0.02mm/0.01mm/0.002mm/0.001mm | ±.0001" | ±0.002mm | F2720AD | 49500 |
| 0.6" | 15mm | .001"/.0005"/.0001" | 0.02mm/0.01mm/0.002mm | ±.0002" | ±0.004mm | F2720-1AD | 00043 |
| 1" | 25mm | .001"/.0005"/.0001"/.00005" | 0.02mm/0.01mm/0.002mm/0.001mm | ±.0001" | ±0.002mm | F2730AD | 49501 |
| 1" | 25mm | .001"/.0005"/.0001" | 0.02mm/0.01mm/0.002mm | ±.0002" | ±0.004mm | F2730-1AD | 00045 |
| 2" | 50mm | .001"/.0005"/.0001" | 0.02mm/0.01mm/0.002mm | ±.0002" | ±0.004mm | F2740AD | 49502 |
| 4" | 100mm | .001"/.0005"/.0001" | 0.02mm/0.01mm/0.002mm | ±.0002" | ±0.004mm | F2750AD | 49503 |
| **2700 Wisdom Electronic Indicators - Inch/Metric 8mm Stem: M2.5 x 0.45 Thread** | | | | | | | |
| 1" | 25mm | .001"/.0005"/.0001"/.00005" | 0.02mm/0.01mm/0.002mm/0.001mm | ±.0001" | ±0.002mm | F2730IQM | 49513 |
| 1" | 25mm | .001"/.0005"/.0001" | 0.02mm/0.01mm/0.002mm | ±.0002" | ±0.004mm | F2730-1IQM | 09992 |
| 2" | 50mm | .001"/.0005"/.0001" | 0.02mm/0.01mm/0.002mm/0.001mm | ±.0002" | ±0.004mm | F2740IQM | 49514 |
| 4" | 100mm | .001"/.0005"/.0001" | 0.02mm/0.01mm/0.002mm | ±.0002" | ±0.004mm | F2750IQM | 49515 |
| 0.6" | 15mm | .001"/.0005"/.0001"/.00005" | 0.02mm/0.01mm/0.002mm/0.001mm | ±.0001" | ±0.002mm | F2720ADM | 49504 |
| 0.6" | 15mm | .001"/.0005"/.0001" | 0.02mm/0.01mm/0.002mm | ±.0002" | ±0.004mm | F2720-1ADM | 09993 |
| 1" | 25mm | .001"/.0005"/.0001"/.00005" | 0.02mm/0.01mm/0.002mm/0.001mm) | ±.0001" | ±0.002mm | F2730ADM | 49505 |
| 1" | 25mm | .001"/.0005"/.0001" | 0.02mm/0.01mm/0.002mm | ±.0002" | ±0.004mm | F2730-1ADM | 09994 |
| 2" | 50mm | .001"/.0005"/.0001" | 0.02mm/0.01mm/0.002mm | ±.0002" | ±0.004mm | F2740ADM | 49506 |
| 4" | 100mm | .001"/.0005"/.0001" | 0.02mm/0.01mm/0.002mm | ±.0002" | ±0.004mm | F2750ADM | 49507 |

# Electronic Indicators



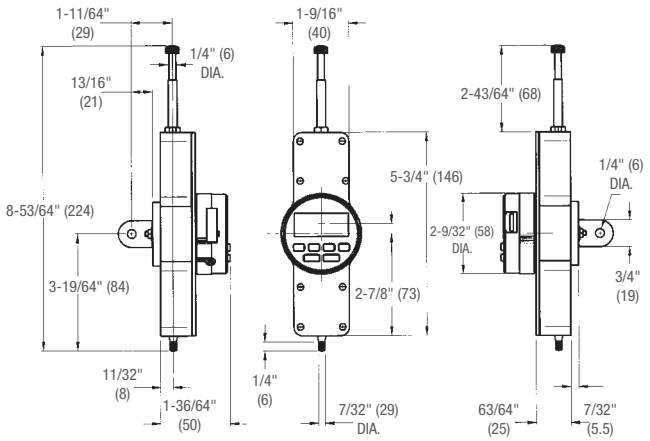

## .250"/6mm and .600"/15mm Models

| Travel | | "A" Dimension | |
|---|---|---|---|
| Inch | mm | Inch | mm |
| .600" | 15mm | 2-13/32" | 61mm |
| .250" | 6.4mm | 2-1/16" | 52mm |



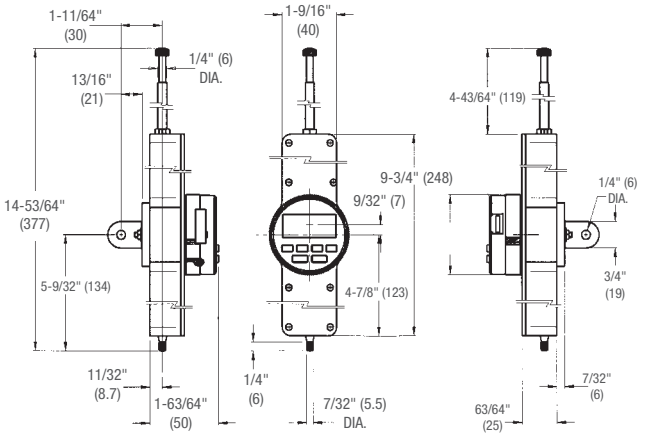

## 1"/25mm Models

| Travel | | "A" Dimension | |
|---|---|---|---|
| Inch | mm | Inch | mm |
| 1" | 25.4mm | 2-7/8" | 73mm |




## 2"/50 mm Models

| Accessories, Power Source, Cables | | |
|---|---|---|
| Description | Part No. | EDP |
| A/C Adaptor, 110-Volt | PT26413 | 65880 |
| Replacement Zinc Air Batteries, 4-Pack | PT26404 | 65884 |
| Replacement Battery, 1-Pack (req. 2) | PT61120 | 65446 |
| Cable to Module PT61490, to Connect to 772 Data Collectors and 761 Multiplexers | PT61489 | 65904 |
| Cable for Wisdom Indicator to Wisdom Remote Display | PT26415 | 65882 |
| USB Cable to RS232 (PC/Compatible) | PT26441 | 65893 |
| 7612 Data Multiplexer Gage Interface | 2700SCM | 69896 |




## 4"/100mm Models

| Backs/Lever* | | |
|---|---|---|
| Description | Part No. | EDP |
| Flat Back | PT26406 | 65886 |
| Offset Lug Back | PT26407 | 65887 |
| Adjustable Lug Back | PT26411 | 65891 |
| Adjustable Back | PT26408 | 65888 |
| Post-Type Back | PT26409 | 65889 |
| Screw Bracket Back | PT26410 | 65890 |
| Adjustable Mounting Bracket Back | PT26848 | 66293 |
| Lifting Lever | PT26405 | 65885 |

* Other backs, styles and accessories also available by request. To order contact points individually, see previous pages.

# Electronic Indicators

## Wisdom® Remote Displays and Probes

These displays with probes will make absolute, incremental and/or comparative measurements and implement all the features of Wisdom Indicators. System is suitable for any stand-alone gaging application.

- Remote display is a rugged enclosure with a 5/8" (16mm) high, easy-to-view LCD readout
- Box Dimensions: 6-1/4" across x 7" deep x 3-1/4" high
- Power sources include 110V 50/60hz, or battery operated (without backlight)
- Probe has 6' cable as standard
- Inch probes use #4/48 indicator contacts
- Probe and display can be separated by a distance of up to 18 ' (5.4m) with use of extension cable
- Cable is hard wired to the probe and has a jack for convenient connection to the remote display box
- Readout box can be elevated for desired viewing




R2760 with Wisdom Remote Display and probe.

**Remote Display Probes**

| Range | | Resolution | | In/mm | | mm Only | |
|---|---|---|---|---|---|---|---|
| Inch | mm | Inch | mm | Cat. No. | EDP | Cat. No. | EDP |
| .250" | 6 | .00005" | 0.001 | P2711-0 | 65870 | | |
| | | .0001" | 0.002 | P2711-1 | 65871 | | |
| .600" | 15 | .00005" | 0.001 | P2721-0 | 65872 | | |
| | | .0001" | 0.002 | P2721-1 | 65873 | P2721-1M | 67146 |
| 1.0" | 25 | .00005" | 0.001 | P2731-0 | 65874 | | |
| | | .0001" | 0.002 | P2731-1 | 65875 | | |
| 2.0" | 50 | .0001" | 0.002 | P2741-1 | 65978 | P2741-1M | 67143 |
| 4.0" | 100 | .0001" | 0.002 | P2751-1 | 65979 | | |

**Extension Cables**

| Description | Part No. | EDP |
|---|---|---|
| 6' Extension Cable | PT05679 | 68752 |
| SmartCable with USB 2.0 for 2700 Micrometer | 2700SCKB | 69891 |
| USB style 6' cable to PC for programs already incorporating a terminal program with send button for the Wisdom IQ/AD | PT60644 | 72589 |
| USB style to PC creates a virtual comm.; Port has no send button requires command from PC to acquire reading for Wisdom IQ/AD | PT60646 | 72592 |
| 6' long cable to remote reader for the Wisdom IQ/AD | PT60645 | 72591 |

**Backs/Lever***

| Description | Part No. | EDP |
|---|---|---|
| Flat Back | PT26406 | 65886 |
| Offset Lug Back | PT26407 | 65887 |
| Adjustable Lug Back | PT26411 | 65891 |
| Adjustable Back | PT26408 | 65888 |
| Post-Type Back | PT26409 | 65889 |
| Screw Bracket Back | PT26410 | 65890 |
| Adjustable Mounting Bracket Back | PT26848 | 66293 |
| Lifting Lever | PT26405 | 65885 |

* Other backs, styles and accessories also available by request. To order contact points individually, see previous pages.

**NOTE**: Probe and display resolutions must be the same for accurate readings.

**Wisdom Remote Displays**

| Resolution | | | In/mm | | mm Only | |
|---|---|---|---|---|---|---|
| Inch | mm | Power | Cat. No. | EDP | Cat. No. | EDP |
| .00005" | 0.001 | 110 Volt | R2762-0 | 65878 | R2762-0M | 66514 |
| | | Battery | R2763-0 | 65879 | R2763-0M | 67149 |
| .0001" | 0.002 | 110 Volt | R2760-1 | 65876 | R2760-1M | 67147 |
| | | Battery | R2761-1 | 65877 | R2761-1M | 67148 |




R2760-1

R2761-1




P2741-1

P2721-0

# Electronic Indicators

## 3600 Electronic Indicators

### AGD GROUP 2
### RANGES UP TO .500" AND 12.7MM

The 3600 Electronic Indicators have simple, powerful, easy-to-use functions, all at an attractive price. Versions are available for inch/metric and metric only.

| Inch/mm | | | | | |
|---|---|---|---|---|---|
| Range | | Resolution | | | |
| Inch | mm | Inch | mm | Cat. No. | EDP |
| .500 | 12.7 | .0005 | 0.01 | 3600-5 | 68813 |
| **Metric-Only** | | | | | |
| | 12.7 | | 0.01 | 3600M-5 | 68918 |
| **Accessory** | | | | | |
| Description | | | | Cat. No. | EDP |
| SR44 Battery | | | | PT61918 | 67169 |




### Features

- Large, easy-to-read LCD
- Range: .500" or 12.7mm
- Resolution: .0005" or .01mm
- Power On/Off button
- Reverse travel (± control indicates direction)
- Zero setting at any position
- Long battery life
- 3/8" diameter stem for inch/mm model (8mm on metric-only model)
- 4-48 spindle thread on inch/mm model (M2.5 X .45 thread on metric-only model)
- Lug-on-center back with additional flat back
- Dust cap
- Plastic storage case with clear cover

# Indicator Holders

## 657 Indicator Holders

Base has three precision ground, magnetic contact surfaces. Grips horizontally, vertically or upside down. V-step holds base to round surfaces. Extra #1/4-20 tapped hole in one side of base (not shown) for mounting post.

Available with or without Starrett AGD Dial Indicators: inch reading 25-131J (graduation .0005", dial reading 0-25-0, range .125") or millimeter reading 25-181J (graduation 0.01mm, dial reading 0-50-0, range 2.5mm). Other indicators can be furnished on request.

**657 Base Holder Assembly and Individual Components**

| Photo Key | Description | Cat. No. | EDP |
|---|---|---|---|
| | Magnetic Base, Upright Post Assembly Including Post, Swivel Post Snug and Gage Holding Rod | 657D | 52749 |
| A | Magnetic Base Only | 657P | 52757 |
| B | Upright Base Post Only | 657G | 52753 |
| C | Swivel Post Snug Only | 657H | 52785 |
| D | Gage Holding Rod with Clamp Mechanism | PT06784-A | 52755 |
| E | Universal Snug with 5/16" and 3/8" Hole Dia. | 57S | 50296 |
| F | Universal Snug with 1/4", 5/16" and 3/8" Hole Dia. | 58S | 56613 |

**Sets Including Magnetic Base, Upright Post Assembly and AGD Dial Indicators**

| | w/Finished Wood Case | | Without Case | |
|---|---|---|---|---|
| Description | Cat. No. | EDP | Cat. No. | EDP |
| Base and Upright Post Assembly with Inch Reading Indicator 25-131J | 657EZ | 52751 | 657E | 52750 |
| Base and Upright Post Assembly with Millimeter Reading Indicator 25-181J | 657MEZ | 56358 | 657ME | 56357 |

A. 657P Magnetic Base. 1-15/16" x 1-5/8" x 1-7/8" (50 x 40 x 48mm) deep. Push button on/off switch for one-hand operation.

B. 657G Upright Base Post. 3/8" (9.5mm) diameter x 7-7/16" (190mm) length overall.

C. 657H Swivel Post Snug. Allows universal indicator adjustment – up-and-down, any vertical angle, for a complete 360°. Two 3/8" (9.5mm) holes.

D. PT06784-A Gage Holding Rod. 3/8" x 9-1/2" (9.5 x 240mm) with clamping mechanism for gripping the indicator lug back (see photo below).

E. F. 57S and 58S Universal Snugs. Adapt various scribers and indicator shanks to rods and posts.



# Indicator Holders

## 657AA Magnetic Base Indicator Holder

For use with all Starrett Test, Back-Plunger, AGD, Dial and Miniature-Dial Indicators. Also accommodates similar indicators of other manufacturers.

A. 657P Magnetic Base. 1-15/16 x 1-5/8 x 1-7/8" (50 x 40 x 48mm). Push-button on/off switch for one-hand operation. Base has three precision ground magnetic contact points. Grips horizontally, vertically, and upside down. V-step holds base to arbors, shafts, etc. Base has extra 1/4-20 tapped hole on one side for mounting post. Black wrinkle finish on non-working surfaces.

B. 657G Upright Base Post. 3/8" (9.5mm) diameter x 7-7/16" (190mm) length overall. 57S and 58S Universal Snugs may also be used.

C. 657S Snug. Two 1/4" (6.3mm) diameter holes. Adapts 196, 650, and 651 Dial Indicators and 657Y Indicator Attachment to 657X Rod.

D. 657X Rod. 1/4" (6.3mm) diameter x 6" (150mm) long. Accommodates Starrett 708, 709, 811 and 711F Dial Test Indicators and 657S Sleeve.

E. 657Y Indicator Attachment. 1/4" (6.3mm) O.D. one end, other end threaded and fits lug backs of all AGD indicators (81, 25, 655, 656) and 80 Miniature Indicators.

F. PT18724 Snug. 3/8" (9.5mm) diameter post hole. 1/4" (6.3mm) diameter gripping hole accommodates 657X Rod.



657Y with lug-on-center back




657AA with 196B1 Universal Dial Indicator




| 657AA Magnetic Base Indicator Holder - Individual Components | | | |
|---|---|---|---|
| **Photo Key** | **Description** | **Cat. No.** | **EDP** |
| A | Magnetic Base Only | 657P | 52757 |
| B | 7-7/16" Upright Base Post Only | 657G | 52753 |
| C | Snug with Two 1/4" (6.3 mm) Holes | 657S | 52759 |
| D | Rod | 657X | 52764 |
| E | Indicator Attachment | 657Y | 52765 |
| F | Snug Complete – 1/4" and 3/8" Holes | PT18724 | 50710 |

| 657AA Magnetic Base Indicator Holder - Complete Set | | |
|---|---|---|
| **Description** | **Cat. No.** | **EDP** |
| Magnetic Base with All Attachments – A, B, C, D, E, F | 657AA | 52743 |
| Base and Post Assembly with 650B1 Indicator, 657S Snug, and 3 Contact Points | 657-650Z | 65259 |




657AA with 711FS Last Word® Dial Test Indicator

# Indicator Holders

## 657A Magnetic Base Indicator Holder with Swivel Post Assembly

The swivel post assembly on these holders provides universal adjustment in both horizontal and vertical planes. Available with inch or millimeter Dial Test or Back-Plunger Indicators, they save time in shop set-up and other inspection jobs.

For use with all Test, Back-Plunger, AGD, Dial and Miniature-Dial Indicators. Also accommodates similar indicators of other manufacturers.

Powerful, permanent magnetic base holds firmly to steel or iron surfaces – horizontally, vertically, upside-down. Push-button turns magnetic force on or off for quick, one-hand set-up and take-down. V-step adapts base to horizontal or vertical arbors and chucks. There is an extra 1/4-20 NC tapped hole in side of base for indicator mounting post. Three precision ground magnetic contact surfaces (plus V-step). Black wrinkle finish on non-working surfaces.

### Magnetic Base Assembly Features:

A. 657P Magnetic Base is 1-15/16" x 1-5/8" x 1-7/8" (50 x 40 x 48mm) deep.

B. Swivel Cap Slot permits 90º post travel to horizontal position.

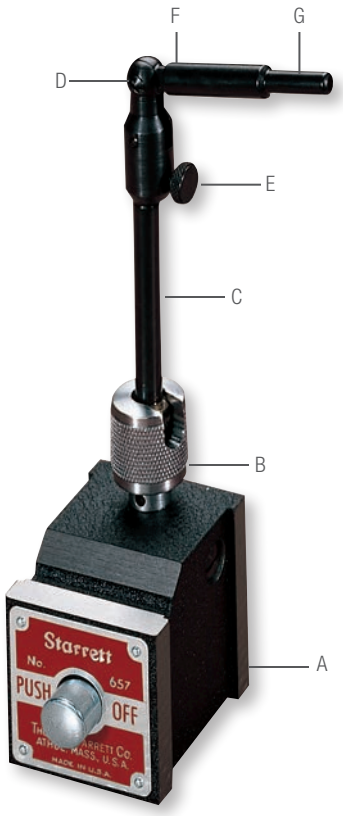
C. Post rotates 360º.

D. 657F Indicator Swivel Post Assembly is 6-1/2" (165mm) high (less threaded end). Assembly consists of items B, C, E, F, G.

E. Fine-Adjusting Screw. Turn to zero set indicator.

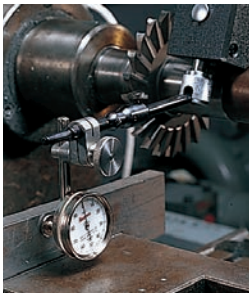
F. Upper arm is 2" (50mm) long with a 5/16" (8mm) diameter and swings more than 180º; friction joint holds it in position.

G. 7/32" (5.5mm) diameter step, 1/2" (13mm) long.

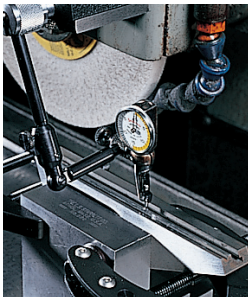



| 657A Magnetic Base Indicator Holder - Individual Components | | |
|---|---|---|
| **Description** | **Cat. No.** | **EDP** |
| Magnetic Base with Swivel Post Assembly | 657A | 52744 |
| Magnetic Base Only | 657P | 52757 |
| Swivel Post Assembly Only | 657F | 52752 |

| 657 Magnetic Base Indicator Holder Sets | | | | |
|---|---|---|---|---|
| | w/Finished Wood Case | | Without Case | |
| **Description** | **Cat.** | **EDP** | **Cat. No.** | **EDP** |
| Base and Post Assembly with 711FSAZ Last Word® Indicator and PT07101F Body Clamp | 657BZ | 52746 | 657B | 52745 |
| Base and Post Assembly with 196B1 Indicator, PT18718 Snug, 3 Contact Points, and Contact Point Adaptor | 657CZ | 52748 | 657C | 52747 |
| Base and Post Assembly with 709AZ Indicator and PT22428 Swivel Post Snug | 657-709Z | 65257 | | |
| Base and Post Assembly with 811-1Z Indicator and PT22428 Swivel Post Snug | 657-811Z | 65258 | | |
| **657 Magnetic Base Indicator Holder Sets** | | | | |
| Base and Post Assembly with 711MFSZ Indicator with PT07101F Body Clamp | 657MBZ | 56354 | 657MB | 56353 |
| Base and Post Assembly with 196MB1 Indicator, PT18718 Snug, 3 Contact Points, Contact Point Adaptor | 657MCZ | 56356 | 657MC | 56355 |



657A with 196B1 Universal Dial Indicator setting up workpiece on milling machine.



657A with 711LS Last Word Dial Test Indicator setting up workpiece on surface grinder.

## 657 Sets

These sets have been put together for your ordering convenience, but you can mix and match other Starrett test or back-plunger indicators and attachments with the 657A Magnetic Base and Swivel Post Assembly to suit your needs.



657C



657B

# Indicator Holders

## 657T Flex-O-Post Indicator Holders with Magnetic Base

For use with all Starrett Test, Back-Plunger, AGD, Dial, and Miniature Dial Indicators. Also accommodates similar indicators of other manufacturers. The flexible post is an assembly of short tubular steel sections and precision ball joints, linked by an internal steel cable. It can be adjusted to any position and locked by turning a lever near the magnetic base. This makes it possible to use indicators in awkward places that are hard to reach with conventional holding devices.

Assembled to the magnetic base, the post has a vertical reach of approximately 15" (380mm) and a horizontal reach of approximately 10" (250mm). The indicator snug on the end of the post can be rotated through 360º and locked in any position.

The base has three precision ground magnetic contact surfaces. Grips horizontally, vertically or upside down. V-step holds base to arbors, shafts, chucks.

The 657W Attachment allows fine adjustments to be made, operated by turning the fine-adjusting thumb screw (with post locked in rigid position) to zero, then set the indicator.

A. Gage Rod. 3/8" x 3" (9.5mm x 75mm) has 5/16, 1/4 and 7/32" (8, 6.3, and 5.5mm) steps. Holds 708, 709, 711 and 811 Dial Test Indicators by body clamp. See attachment specifications for the appropriate indicator body clamp on previous pages.

B. Adjusting Take-up Sleeve with locking nut for maintaining proper degree of post rigidity.

C. Post Snug has 3/8" (9.5mm) hole (which will also grip AGD dial indicators by the stem).

D. Flex-O-Post 3657U.

E. Locking Lever tightens internal steel cable to make post rigid and lock it in position.

F. Magnetic Base 657P has push-button on/off switch.

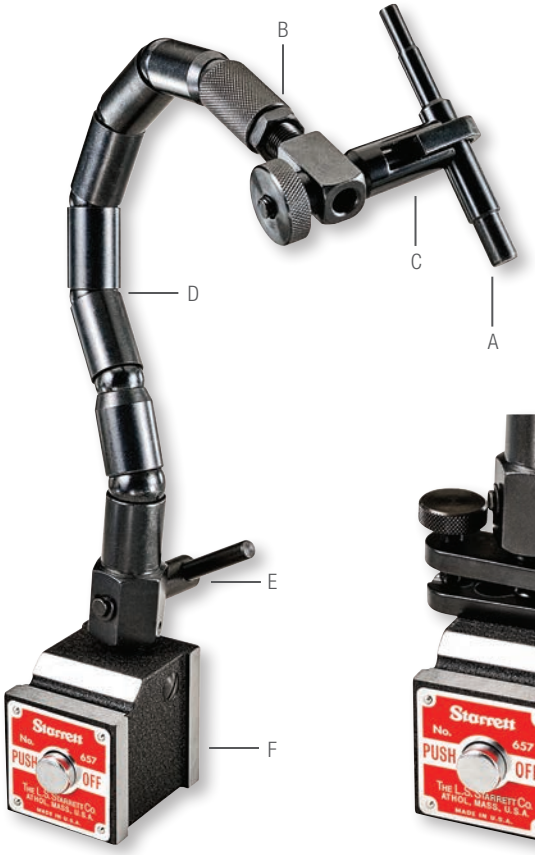
| 657T Flex-O-Post Indicator Holders with magnetic base - Individual Components | | | |
|---|---|---|---|
| **Photo Key** | **Description** | **Cat. No.** | **EDP** |
| F | Magnetic Base Only | 657P | 52757 |
| (A, B, C, D, E) | Flex-O-Post with Locking Lever and Snug Only | 3657U | 12695 |
| G | Fine-Adjustment Attachment | 657W | 52763 |
| A | Indicator Holding Rod | PT17850 | 72400 |
| **657T Flex-O-Post Indicator Holders with magnetic base - Complete Assemblies** | | | |
| **Description** | | **Cat. No.** | **EDP** |
| Magnetic Base with Flex-O-Post Assembly | | 657T | 52760 |
| Magnetic Base with Flex-O-Post Assembly and Fine-Adjustment Attachment | | 657TW | 52761 |




651B1 Indicator gripped directly to its stem via the post snug.



196B1 Indicator via a 657S Snug.







657W Fine-Adjustment Attachment

# Indicator Holders

## 657-1, 657-2 Magnetic Base Universal Indicator Holder

### WITH TRIPLE JOINTED ARM AND FINE ADJUSTMENT

This versatile indicator holder has three pivots available for positioning the indicator where needed. All pivots are controlled by one tightening knob. It will hold:

- Any indicator with a 3/8" (9.5mm) stem (such as our 25, 650 and 651 Indicators)
- Any indicator with a standard dovetail mount (such as our 708, 709, and 811 Indicators)
- Any indicator with a 1/4" (6.3mm) shank (such as our 196 Indicator)
- Any indicator with a 3/16" (4.7mm) shank (such as our 708, 709, 811 and 711 Indicators)
- Any indicator with a body clamp (such as our 711 Indicators)
- The working area is within a hemisphere having a radius of approximately 12" (300mm)
- The very sensitive fine-adjustment is located on the magnetic base to eliminate indicator deflection when it is being adjusted
- The 657-3 Universal Indicator Holder Arm Assembly can also be used on the 659P Base using the 659 Thread Adaptor, PT18318

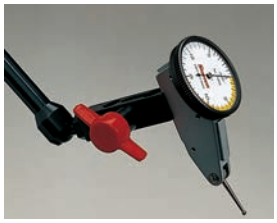
| 657-1 and 657-2 Magnetic Base Universal Indicator Holders - Individual Components | | | |
|---|---|---|---|
| **Photo Key** | **Description** | **Cat. No.** | **EDP** |
| A | Universal Indicator Holder Arm Assembly Only | 657-3 | 64438 |
| B | Fine-Adjustment Attachment | 657W | 52763 |
| C | Indicator Holding Rod | PT17850 | 72400 |
| D | Magnetic Base Only | 657P | 52757 |
| E | Snug with Two 1/4" (6.3 mm) Holes | 657S | 52759 |

| 657-1 and 657-2 Magnetic Base Universal Indicator Holders - Complete Assemblies | | |
|---|---|---|
| **Description** | **Cat. No.** | **EDP** |
| Universal Indicator Holder, 657W Fine-Adjustment, 657P Magnetic Base, PT17850 Indicator Holding Rod, and 657S Snug | 657-1 | 64436 |
| Universal Indicator Holder with 657 Magnetic Base | 657-2 | 64437 |






657-1 with 196B1 Universal Dial Indicator



709A Dial Test Indicator with dovetail mount

## 660 Magnetic Base Indicator Holder

### WITH TRIPLE JOINTED ARM

The compact and versatile 660 Magnetic Base Indicator Holder has three adjustable pivots controlled by a single knob for fast, easy indicator positioning.

- Small but powerful magnetic base with 70lb (320N) holding force
- Positive On/Off switch
- Base Dimensions: 1-3/16" x 1-9/16" x 1-3/8" (30mm x 40mm x 35mm)
- Horizontal and vertical mounting positions
- Will hold any indicator with a 3/8" (9.5mm) stem or standard dovetail mount
- Articulating arm with powerful central locking knob, provides full 360º horizontal positioning and over 180º vertical positioning
- Maximum Horizontal Reach: 4.750" (120mm); Maximum Vertical Reach: 7.500" (190mm)
- Very sensitive fine-adjustment thumb screw

| 660 Magnetic Base Indicator Holder | | |
|---|---|---|
| **Description** | **Cat. No.** | **EDP** |
| Base Indicator Holder | 660 | 68621 |



660 shown with Dial Indicator

# Indicator Holders

## 661 Mini Magnetic Indicator Holder

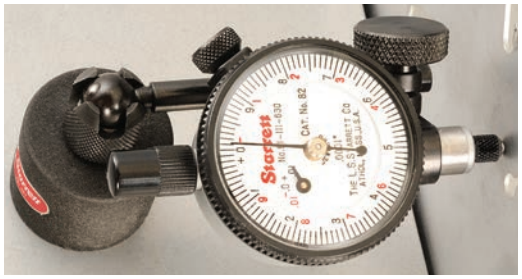
The Mini Magnetic Tool Holder is a simple, versatile, effective and economical tool for a variety of indicator holding tasks. It has no levers or switches – simply place the holder on the measuring surface, attach the indicator and position as required.

### Features and Specifications

- 30 lb (133 N) of holding force
- Base Diameter: 1.180" (30mm)
- Base Height: 1" (25.4mm)
- Overall Height 4.173" (106mm)
- Holds indicators with 3/8" stems or standard dovetail mounts
- Fits over spindles and posts with diameter of 1/4" (6.3mm), such as the 196 Dial Indicator
- Includes an 8mm adapter for indicators with metric (8mm) stems

| 661 Mini Magnetic Indicator Holder | | |
|---|---|---|
| **Description** | **Cat. No.** | **EDP** |
| Indicator Holder | 661 | 68620 |





## 659 Heavy-Duty Magnetic Base Indicator Holder

### WITH ROTARY ON/OFF SWITCH. FURNISHED WITH OR WITHOUT STARRETT AGD DIAL INDICATORS

This holder has a powerful magnetic base that attaches to flat surfaces or on round work up to 5" (125mm) in diameter by a form-ground involute vee for accurate seating. It has approximately twice the holding power of our 657 Magnetic Base and has a rotary on/off switch.

A post snug with two 3/4" (19mm) gripping holes positions the dial indicator at any height and at any vertical angle and allows for 360º rotation of the gage rod. After locking the gage in place, the final indicator setting is made by an independent fine adjustment at the back end of the gage rod.

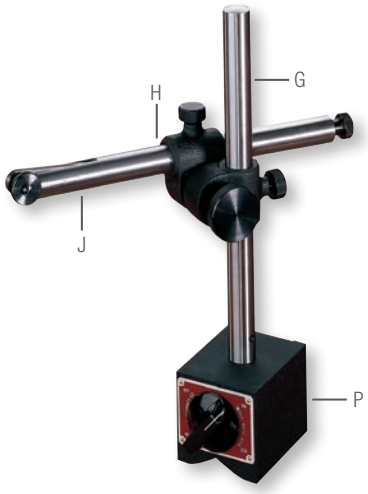
A second tapped hole (3/8"-24) in one side of the base is for mounting the post horizontally or adding another post for multiple inspection work. The base is furnished with a threaded adaptor, making it possible to use the 657 Magnetic Base post and attachments. Base and snug have a black wrinkle finish with precision ground contact surfaces.

Available with or without Starrett AGD Dial Indicators: inch reading 25-131J (.0005" graduation) or millimeter reading 25-181J (0.01mm graduation). Other mechanical AGD indicators are available on request. Electronic indicators, 2600 and 2700, are also available on request.

Both the upright post and the gage rod are approximately 9 3/8" (238mm) long and 3/4" (19mm) in diameter.

| Base Holder Assembly and Individual Components | | | |
|---|---|---|---|
| **Photo Key** | **Description** | **Cat. No.** | **EDP** |
| | Magnetic Base, Upright Post Assembly Including Post, Snug, Gage Rod with Clamp and Fine Adjust, and Thread Adaptor, without Case | 659A | 56687 |
| | Complete Assembly (Above) in Case | 659AZ | 55947 |
| P | Magnetic Base, Including Thread Adaptor | 659P | 55949 |
| G | Upright Base Post Only | 659G | 56688 |
| H | Swivel Post Snug Only with Two 3/4" (19mm) Gripping Holes | PT16846 | 71597 |
| J | Gage Holding Rod Only, Including Clamp Mechanism and Fine-Adjustment | PT08903 | 72032 |
| | Thread Adaptor Only | PT18318 | 72040 |
| **Sets, Including Magnetic Base, Upright Post Assembly and AGD Dial Indicators** | | | |
| **Description** | | **Cat. No.** | **EDP** |
| Base and Upright Post Assembly with Inch Reading Indicator 25-131J in Case | | 659BZ | 55948 |
| Base and Upright Post Assembly with Millimeter Reading Indicator 25-181J in Case | | 659MBZ | 64892 |



# Indicator Holders

## Common Test and Back Plunger Indicator Applications

A. Models with tool post holders, generally used for lathe work.

B. Indicators may be used on our 665 Inspection Holder.

B, C. Some indicator holders have flexible joints for holding in different places.

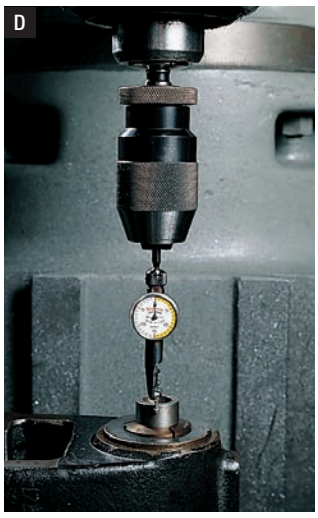
C, D. Indicators with straight stems or shanks can be held in snugs or in chucks and collets.










## References for Other Test Indicator Holding Methods

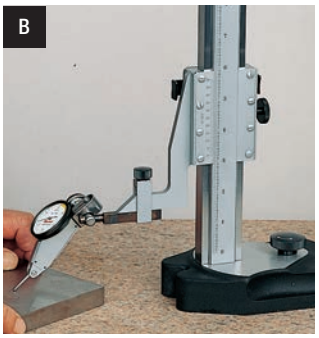
In addition to the magnetic base indicator holders on the preceding pages, we also offer the following:

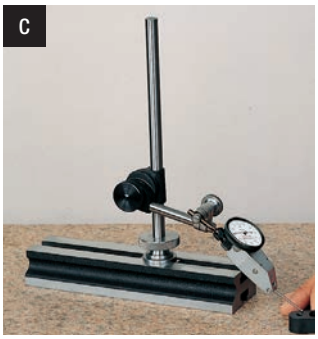
A. For very precise measurements such as comparing a part to a gage block set, we have our 252 Height Transfer Gage with our DIGI-CHEK® Height Gages

B. Any of our great variety of height gages - 250, 254, 255, and 3752 - can be used for comparing and for actual vertical measurements

C. Our 57 or 257 Surface Gages. These are for comparison and the truing-up of surfaces



# Indicator Holders

## 665 Inspection Holder and Dial Indicators

This is the most versatile dial indicator holder with an extremely stable base **(A)** that is 8-1/2" (215mm) long x 2-1/4" (57mm) wide at the bottom. It can inspect workpieces on the top surface of the ground base or within a working area defined by the 8" (200mm) upright base post **(B)** and the 9-1/2" (238mm) long gage-holding rod **(C)**. The base post can be conveniently located anywhere along the 8-1/2" (215mm) T-slot in the base.

This tool can be held in a vise or by a bolt in a machine T-slot coming up through one of the two 3/8" (9.5mm) holes in the base and fastening down on the top surface.

### D. Swivel Post Snug 665D

Snug has a .375" (9.5mm) hole for the gage holding rod and a .465" (11.8mm) hole for the upright post. Also comes with the 665L Reducing Bushing (J) that can reduce the .465" (11.8mm) hole to 3/8" (9.5mm).

| Individual Components | | | |
|---|---|---|---|
| **Key** | **Description** | **Cat. No.** | **EDP** |
| A | Base Only | 665A | 52783 |
| B | Upright Base Post .464" x 8" (11.8 x 200mm) with Clamp Mechanism | 665B | 52784 |
| C | Gage Holding Rod 3/8" x 9-1/2" (9.5 x 240mm) with Clamp Mechanism | PT06784-A | 52755 |
| D | Swivel Post Snug with .465" and 3/8" (11.8 and 9.5mm) holes with 665L Reducing Bushing | 665D | 52754 |
| G | Clamp with .464" x 5-3/4" (11.8 x 146mm) Post | 665G | 52792 |
| | Clamp with 1/4" (6.3mm) Diameter Post | 665G-1/4 | 52793 |
| | Clamp with 5/16" (7.9mm) Diameter Post | 665G-5/16 | 52794 |
| | Clamp with 3/8" (9.5mm) Diameter Post | 665G-3/8 | 52795 |
| H | Tool Post Holder Approximately 1" x 7/16" (25 x 11mm) | 665H | 52790 |
| I | Offset Arm 3/8" (9.5mm) Diameter 3" and 5 1/2" (75 and 140mm) Arms | 665G-1 | 52789 |
| J | Reducing Bushing Only (for Swivel Post Snug) .465" (11.8mm) O.D. .375" (9.5mm) I.D. | 665L | 52756 |
| **Inspection Sets with AGD Dial Indicators** | | | |
| **Description** | | **Cat. No.** | **EDP** |
| Complete with Components and 25-131J Inch Reading Indicator in Case | | 665JZ | 56275 |
| Complete with Components and 25-181J Millimeter Reading Indicator in Case | | 665MJZ | 56276 |




665JZ with 25-131J Indicator

Three very useful inspection combinations can be made by removing the complete swivel post snug and gage holding rod as follows:

### G. Clamp 665G

Take the clamp and put the clamp post into the snug and lock it. Now this combination can be used to clamp the gage holding rod and the indicator into hard-to-reach places for inspecting jigs, fixtures, lining up work on centers and machine tables.

The clamp has a 3" (75mm) capacity and a post with an approximately 5-3/4" (145mm) length. The clamp post is .464" (11.8mm) diameter that fits into the regular swivel post snug 665D.

Three other clamp post diameter options available – 665G-3/8 is a 3/8" (9.5mm) diameter clamp post that can be used in the regular swivel post snug 665D with the addition of the 665L reducing bushing. The 665G-5/16 (7.9mm) and 665G-1/4 (6.3mm) can be used with other snugs to hold an indicator.

### H. Tool Post Holder 665H

Put one end of the offset arm into the swivel post snug 665D (with the 665L reducing bushing in it). Then put this rectangular tool post holder 665H onto the other arm. This combination now allows for a good, tight setup in lathe tool posts and other machine setups.

### I. Offset Arm 665G-1

Another very popular measuring combination is to put the reducing bushing (which is furnished) into the snug and then put one leg of the offset arm into it. Now the tool can be used in a 3/8" (9.5mm) chuck or collet to sweep a large area.

# Indicator Holders

## 675 Dial Comparators with Granite Base

Extremely rugged and universally adjustable to any position, these gages are well suited for inspection, layout, checking and lineup operations anywhere in the shop. All settings are individually made without disturbing others.

These versatile stands allow the indicator to be positioned at any height within the capacity of the upright base post – 360º both horizontally and vertically.

The indicator can also be moved lengthwise within the capacity of the 3/4" x 9-7/8" (19 x 250mm) horizontal gage-holding rod.

A special feature of this tool is the sensitive, fine-adjustment at the end of the gage rod. The fine-adjustment range is approximately 1/4" (6.3mm).

A 1/4" (6.3mm) steel indicator contact point is provided, but contact points in other lengths and materials are also available – see previous accessory pages.

This holder has a Starrett Grade-A Crystal Pink® Granite base that is 8" x 12" x 2" (200 x 300 x 50mm), and is finished to an overall tolerance of .0001" (0.0025mm).

**NOTE:** Not recommended for electronic indicators 2" and above.

**675 Complete Units**

| Dial Indicator Specifications | | | | With Granite Base | |
|---|---|---|---|---|---|
| Graduation | Dial Reading | Range | Indicator No. | Cat. No. | EDP |
| .0005" | 0-25-0 | .125" | 25-131J | 675GJ | 55964 |
| 0.01mm | 0-50-0 | 2.5mm | 25-181J | 675GMJ | 56129 |

**Individual Components**

| Description | Cat. No. | EDP |
|---|---|---|
| Granite Base, Upright Base Post and Gage Holding Rod, Including Clamp Mechanism and Fine-Adjustment | 675G | 66051 |
| Gage Holding Rod Only, Including Clamp Mechanism and Fine-Adjustment | PT08903 | 72032 |
| Swivel Post Snug Only with Two 3/4" (19mm) Gripping Holes | PT16846 | 71597 |

Available with special non-shock mechanism or without indicator. Any Starrett AGD Dial or Electronic Indicator can be interchanged with indicators listed. Please specify when ordering.



## 653 Dial Comparators

### WITH CAST IRON BASE, INCH AND MM READING

## 653G Dial Comparators

### WITH GRANITE BASE, INCH AND MM READING

These bench-type comparator gages are ruggedly built for in-process and final inspection work.

The dial indicator can be adjusted vertically and locked in any position. A sliding ring with locking screw below the beam permits swinging the indicator to either side. The ring also acts as a safety device, preventing the beam from accidentally dropping. There is a fine adjustment on the beam for final indicator setting.

The hand lifting lever on the indicator raises the spindle and releases it to contact the work. Left hand lever furnished unless otherwise specified.

Both gages have a maximum vertical capacity of 9-1/4" (235mm) and a throat depth of 5" (125mm) and a vertical indicator fine adjustment of up to 1/2" (12.7mm). Post diameter is 1-1/2".

**653 Dial Comparator** has a precision ground cast iron base measuring approximately 8" x 9" (200 x 225mm).

**653G Dial Comparator** has a Starrett Grade A, Crystal Pink® Granite base, measuring 8" x 12" x 2" (200 x 300 x 50mm). Base is finished to an overall tolerance of .0001" (0.0025mm).

**NOTE:** Recommended for electronic indicators 2" and above.

**653 Complete Units**

| Dial Indicator Specifications | | | | With Cast Iron Base | | With Granite Base | |
|---|---|---|---|---|---|---|---|
| Graduation | Dial Reading | Range | Indicator No. | Cat. No. | EDP | Cat. No. | EDP |
| .001" | 0-50-0 | .250" | 655-141J | 653J | 52737 | 653GJ | 55966 |
| 0.01mm | | 2.5mm | 655-181J | 653MJ | 56146 | 653GMJ | 56127 |

**Individual Components**

| Description | Cat. No. | EDP |
|---|---|---|
| Comparator with Cast Iron Base, without Indicator | 653 | 55917 |
| Comparator with Granite Base, without Indicator | 653G | 56646 |

Available with special non-shock mechanism or without indicator. Any Starrett AGD Dial or Electronic Indicator can be interchanged with indicators listed. Please specify accordingly.



# Special Function Indicators

## Chamfer Gages

**FOR INTERNAL CHAMFERS:**
**683 CHAMFER GAGE 0-90º**
**684 CHAMFER GAGE 90-127º**

**FOR EXTERNAL CHAMFERS:**
**685 CHAMFER GAGE 0-90º**
**686 CHAMFER GAGE 90-127º**

These gages directly measure the diameter of chamfered holes. No setting master is necessary. When the three-blade plunger is pressed against a flat surface, the gage should read the set number stamped on the back of the indicator. In case of wear, the gage may be adjusted to read the proper number.

All ground surfaces are of hardened tool steel. Indicators are AGD design.

Internal gages will measure the largest diameter of any chamfer that has an included angle within the range of angles printed on the dial face of the gage.

External gages will measure the smallest diameter of any chamfer within the range of angles printed on the dial face of the gage.

| 683 Inch Reading Internal Gages | | | | | 684 Millimeter Reading Internal Gages with Yellow Dials | | | | |
|---|---|---|---|---|---|---|---|---|---|
| | 0-90º Angle | | 90-127º Angle | | | 0-90º Angle | | 90-127º Angle | |
| Range | Cat. No. | EDP | Cat. No. | EDP | Range | Cat. No. | EDP | Cat. No. | EDP |
| 0-3/8" | 683-1Z | 63684 | 684-1Z | 63688 | 0-9.5mm | 683M-1Z | 64989 | 684M-1Z | 64993 |
| 0-1/2" | 683-2Z | 63685 | 684-2Z | 63689 | 0-12.7mm | 683M-2Z | 64990 | 684M-2Z | 64994 |
| 0-1" | 683-3Z | 63686 | 684-3Z | 63690 | 0-25mm | 683M-3Z | 64991 | 684M-3Z | 64995 |
| 1-2" | 683-4Z | 63687 | 684-4Z | 63691 | 25-50mm | 683M-4Z | 64992 | 684M-4Z | 64996 |
| **685 Inch Reading External Gages** | | | | | **686 Millimeter Reading External Gages with Yellow Dials** | | | | |
| 1/8-1/2" | 685-1Z | 63692 | 686-1Z | 63695 | 3.2-12.7mm | 685M-1Z | 64997 | 686M-1Z | 65000 |
| 3/16-1" | 685-2Z | 63693 | 686-2Z | 63696 | 4.7-25mm | 685M-2Z | 64998 | 686M-2Z | 65001 |
| 1-2" | 685-3Z | 63694 | 686-3Z | 63697 | 25-50mm | 685M-3Z | 64999 | 686M-3Z | 65002 |

Also available with electronic indicators. Please specify.
Gages furnished in deluxe padded case.



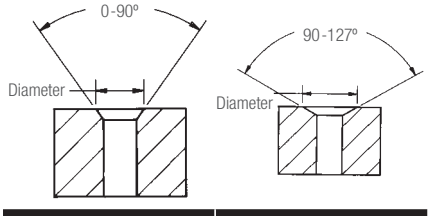

684-2Z Chamfer Gage with F2710-3 Electronic Indicator on 695 Check Stand

## Special Function Dial Gages

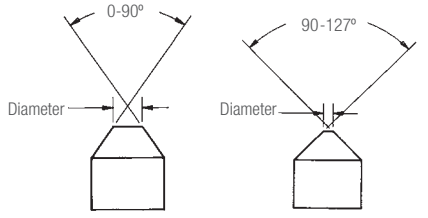
This section includes special function dial gages that we list as regular items. Gages are also available with electronic indicators on request, where noted.

- Chamfer Gages
- Countersink Gages
- Hole Gages
- Bore Gages – See Bore Gage Section
- Direct-Reading Thickness Gages
- Snap Gages
- Groove Gages
- Caliper Gages
- Depth Gages
- Out-of-roundness Gages
- Inside Dial Gages
- Automotive Gages
- Crankshaft Distortion Gages
- Cylinder Gages
- Disc Brake Gages
- Large Diameter Gages

In addition, we have made many other special function gages to suit a wide variety of our customers' specific requirements. If you have a special application, we invite you to submit your drawings and specifications to our Special Order Department at 121 Crescent Street, Athol, MA 01331, USA. We will be happy to provide a prompt quotation.




683 (Internal) | 684 (Internal)




685 (External) | 686 (External)

# Special Function Indicators

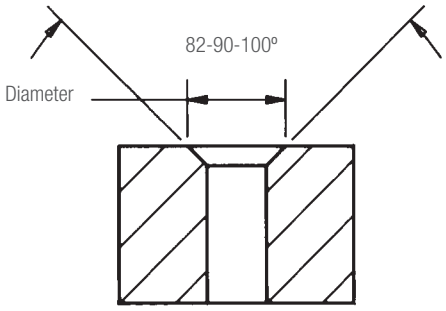
## Countersink Gages

### 687 COUNTERSINK GAGE 82º
### 688 COUNTERSINK GAGE 90º
### 689 COUNTERSINK GAGE 100º

Starrett Countersink Gages are offered in three different angles so that the gage sets on the angular side of the countersink, as opposed to a chamfer gage which sets on the top edge of the chamfer.

This gage directly reads the large diameter of the countersink in .002" or 0.05 mm increments. A set master ring is furnished with each gage for calibration and setting. Press the button on top of the indicator to firmly depress the gage head into the countersink. When the gage is removed, the indicator reading is held in place until the reset button is activated.

All ground surfaces are of hardened tool steel. Indicators are AGD design.




687, 688, 689

| Inch Reading Countersink Gages | | | | | | |
|---|---|---|---|---|---|---|
| | 82º Angle | | 90º Angle | | 100º Angle | |
| Range | Cat. No. | EDP | Cat. No. | EDP | Cat. No. | EDP |
| .020-.170" | 687-1Z | 63698 | 688-1Z | 63702 | 689-1Z | 63706 |
| .160-.360" | 687-2Z | 63699 | 688-2Z | 63703 | 689-2Z | 63707 |
| .360-.560" | 687-3Z | 63700 | 688-3Z | 63704 | 689-3Z | 63708 |
| .560-.780" | 687-4Z | 63701 | 688-4Z | 63705 | 689-4Z | 63709 |
| **Millimeter Reading Countersink Gages with Yellow Dials** | | | | | | |
| 0.5-4.3mm | 687M-1Z | 65003 | 688M-1Z | 65007 | 689M-1Z | 65011 |
| 4-9mm | 687M-2Z | 65004 | 688M-2Z | 65008 | 689M-2Z | 65012 |
| 9-14.2mm | 687M-3Z | 65005 | 688M-3Z | 65009 | 689M-3Z | 65013 |
| 14.2-19.8mm | 687M-4Z | 65006 | 688M-4Z | 65010 | 689M-4Z | 65014 |
| **Check Gage Stand for Chamfer, Countersink and Hole Gages** | | | | | | |
| Description | | | | | Cat. No. | EDP |
| 8-3/16" H x 6" W x 4" D (212 x 150 x 100mm)<br>Hold Downs - 5" (125mm) on Center – 1/4" (6.3mm) Holes | | | | | 695 | 63875 |

Also available with electronic indicators. Please specify.



687



688



689




Shown with optional 695 electronic indicator stand.

# Special Function Indicators

## Hole Gages

### 690 HOLE GAGE
### .010-.330"

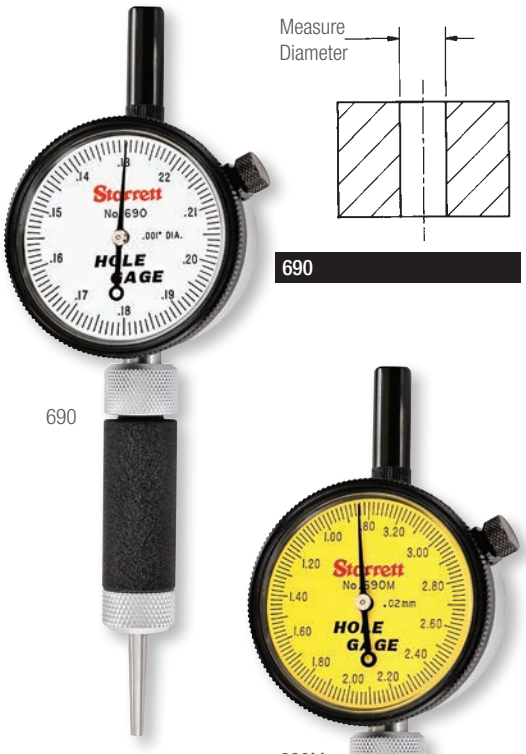
### 690M HOLE GAGE
### 0.25-8.35MM

These hole gages will check hole diameters to .001" and 0.02mm. They are fast, accurate, easy to read and have a balanced design for easy one- hand operation.

The gage can be pressed down on a flat surface and checked so the size should read the same as the set number stamped on the back of the indicator. It can also be checked and set with an optional "setting master".

All ground surfaces are of hardened tool steel. Indicators are AGD design.

Holes that need to be accurately checked must have no chamfers or countersinks.




| Inch Reading Hole Gages | | | | |
|---|---|---|---|---|
| | Gages | | Set Masters (Optional) | |
| Range | Cat. No. | EDP | Part No. | EDP |
| .010-.040" | 690-1Z | 63710 | PT23710-1 | 63879 |
| .030-.130" | 690-2Z | 63711 | PT23710-2 | 63880 |
| .130-.230" | 690-3Z | 63712 | PT23710-3 | 63881 |
| .230-.330" | 690-4Z | 63713 | PT23710-4 | 63882 |
| **Millimeter Reading Hole Gages with Yellow Dials** | | | | |
| .25-1.00mm | 690M-1Z | 63714 | PT23710-5 | 63883 |
| .75-3.30mm | 690M-2Z | 63715 | PT23710-6 | 63884 |
| 3.30-5.85mm | 690M-3Z | 63716 | PT23710-7 | 63885 |
| 5.85-8.35mm | 690M-4Z | 63717 | PT23710-8 | 63886 |
| **Check Gage Stand for Chamfer, Countersink and Hole Gages** | | | | |
| Description | | | Cat. No. | EDP |
| 8-3/16" H x 6" W x 4" D (212 x 150 x 100mm) Hold Downs - 5" (125mm) on Center – 1/4" (6.3mm) Holes | | | 695 | 63875 |

Also available with electronic indicators. Please specify.

## 170 Dial Sheet Gages

### .150"

Measures the thickness of sheet materials like paper, cardboard, leather, plastics and metals. Raise the movable contact, insert the work, remove thumb, and spring pressure holds the work parallel with the contacts. Thickness is registered on the dial. By turning the knurled bezel, the dial may be moved to bring the hand to zero.

- Contact edges are radiused to prevent work from being marred or deflected
- The flat contact area measures 5/16" in diameter
- Black finish
- 1-1/8" throat depth
- Furnished in deluxe padded case



| 170 Dial Sheet Gages, Inch Reading | | | | |
|---|---|---|---|---|
| Range | Graduation | Dial Reading | Cat. No. | EDP |
| .150" | .001" | 0-100 | 170Z | 50647 |

# Special Function Indicators

## 649 Spindle Squares™

The 649 Spindle Square offers accuracy, convenience and significant time saving with the common shop task of tramming the head of a vertical milling machine. This must be done regularly to ensure squarness and perpendicularity between the spindle and work surface.

The spindle square is easier to use and more precise than the traditional method of tramming with a dial test indicator.

### Using the Spindle Square

After setting the spindle square indicators to "0" on a surface plate, place the Spindle Square into the collet of the milling machine and bring the head down to the table until both indicator needles have rotated approximately one full rotation.

The needles do not need to point in the same direction. Identical numerical readings, not the needle positions, indicate squareness.

To tram the milling machine, adjust the machine per normal procedures until both indicators read the same numerical value. After setting the X-axis, repeat the same procedure with the Y-axis.

### Features and Specifications

- Fully assembled with two AGD Group 2 dial indicators
- Patented design
- Solid steel body construction with durable black oxide finish
- Ground gaging surface
- Approximately 4lbs with custom case
- 3/8" inch shank diameter
- 4" (100mm) between contact points
- Approximately 6-3/4" (172mm) wide and 5" (140mm) from the top of shank to the end of the contact points

| 649 Spindle Square | | | | |
|---|---|---|---|---|
| **Range** | **Graduation** | **Dial Reading** | **Cat. No.** | **EDP** |
| .250" | .001" | 0-50-0 | 649-1 | 52080 |
| .125" | .0005" | 0-25-0 | 649-5 | 52081 |
| 2.5mm | 0.01mm | 0-50-0 | 649-1M | 52082 |




649-1





# Special Function Indicators

## 765A Electronic Snap Gage

### 0-1/2"/0-12.7MM

High quality, economical gage that is ideal for inspectors, purchasing agents, sales people and other who need to quickly measure materials up to 1/2" or 12.7mm thick.

- Balanced, compact design
- Simple, logical control buttons
- Easy-to-read LCD
- Single, long-life battery with easy access
- Light-weight aluminum frame
- Inch/millimeter conversion
- Zero at any position
- Manual ON/OFF, AUTO OFF
- Furnished in fitted plastic case




| 765A* Electronic Snap Gage | | | | |
|---|---|---|---|---|
| **Range** | **Linear Accuracy** | **Resolution** | **Cat. No.** | **EDP** |
| 0-1/2" (0-12.7mm) | ±.0010" (±0.02mm) | .0005" (0.01mm) | 765A | 67659 |
| Two Replacement Batteries, CR2032 | | | PT99492 | 65650 |

* No output available on the 765A.




## 1010, 1010M Dial Indicator Pocket Gages

### .375"/9MM

Handy pocket gage is approximately the size of a thin pocket watch. Ideal for inspectors, purchasing agents and sales people to check the size of materials up to 3/8" or 9mm thick. The gage fits naturally in the curve between the thumb and index finger. A slight pull on the serrated top plate raises the spindle.

- Throat depth ranges from 1/2" (12.7mm) down to 5/16" (8mm)
- Models are available with flat or rounded contacts as listed
- The diameter of both the flat or round contacts are 1/4" (6.3mm)
- Gage has a small count hand for recording each revolution of large hand
- Chrome plated case, unbreakable crystal dial cover
- Furnished in attractive, protective case




| 1010 Dial Indicator Pocket Gages, Inch Reading | | | | | |
|---|---|---|---|---|---|
| **Range** | **Graduation** | **Dial Reading** | **Contacts** | **Cat. No.** | **EDP** |
| .375" | .001" | 0-100 | Flat | 1010Z | 53114 |
| | .0005" | 0-50 | | 1010EZ | 53115 |
| .275" | .001" | 0-100 | Round | 1010RZ | 56067 |
| **1010M Dial Indicator Pocket Gages, Millimeter Reading** | | | | | |
| 9mm | 0.01mm | 0-100 | Flat | 1010MZ | 53116 |

# Special Function Indicators

## 1015, 1015M Portable Dial Thickness Gages

### 0-1"/0-25MM

After inserting work between the measuring contacts, releasing the lever will cause the spindle to contact the work, giving an accurate size reading because measuring pressure is independent of the user. Indicators have jewel bearings and continuous dials. Models with balanced dials, other graduations and ranges are also available on special order. Electronic indicators can also be furnished. Throat depths include 2-1/2", 4", and 6". The contact edges are radiused to prevent the work from being marred or deflected. The flat contact area measures 1/4" (6.3mm) in diameter and is 1/8" (0.125mm) thick. Special contact sizes and shapes are available by request.




| Throat Depth | Range | Graduation | Dial Reading | Dial Indicator Model No. | Without Case Cat. No. | Without Case EDP | Case Only Cat. No. | Case Only EDP |
|---|---|---|---|---|---|---|---|---|
| **1015 Portable Dial Thickness Gages, Inch Reading** | | | | | | | | |
| 2-1/2" | 1/2" | .0005" | 0-50 | 1015A-431J | 1015A | 53119 | 1015AZZ | 55407 |
| | 1" | .001" | 0-100 | 1015B-441J | 1015B | 53121 | 1015BZZ | 55408 |
| 4" | 1/2" | .0005" | 0-50 | 1015A-431J | 1015A-4 | 67646 | | |
| | 1" | .001" | 0-100 | 1015B-441J | 1015B-4 | 67649 | | |
| 6" | 1/2" | .0005" | 0-50 | 1015A-431J | 1015A-6 | 67652 | | |
| | 1" | .001" | 0-100 | 1015B-441J | 1015B-6 | 67655 | | |
| **1015M Portable Dial Thickness Gages, Millimeter Reading** | | | | | | | | |
| 63mm | 10mm | 0.01mm | 0-100 | 1015MA-481J | 1015MA | 56131 | 1015AZZ | 55407 |
| | 25mm | | | 1015MB-881J | 1015MB | 56133 | 1015BZZ | 55408 |
| 100mm | 10mm | 0.01mm | 0-100 | 1015MA-481J | 1015MA-100 | 67647 | | |
| | 25mm | | | 1015MB-881J | 1015MB-100 | 67650 | | |
| 150mm | 10mm | 0.01mm | 0-100 | 1015MA-481J | 1015MA-150 | 67653 | | |
| | 25mm | | | 1015MB-881J | 1015MB-150 | 67656 | | |

# Special Function Indicators

## 1150 Dial Indicator Snap Gages

### 0-8"

These compact gages have rigid aluminum alloy frames protected from hand heat by insulating handles. They are used to gage outside diameters to an accuracy of .0001".

Dimensional variations are transmitted to the dial indicator through a linear friction-free transfer mechanism totally enclosed for protection against side thrust, foreign matter and coolants. Flat gaging contacts simplify measurement close to shoulders. The top sensitive contact may be reversed to present a spherical face to the work. An adjustable backstop simplifies centering the work.

The contacts and backstop are 5/16" diameter hardened tool steel, precision ground and lapped flat. The contacts are individually adjustable to a maximum 2" range and are locked in position by tightening parallel-lock clamps to maintain parallelism of faces. Both contacts are also keyed to maintain orientation of faces regardless of adjustment.

Plus or minus tolerances are read directly from the indicator since the dial face has a double row of graduations reading in opposite directions from zero, with "minus" graduations in red and "plus" in black. The indicator can be rotated 360º and locked in position to read from any angle, and a fine-adjusting screw provides for zero setting the hand. A guard protects the dial indicator when the gage is laid down.

A bench stand is available to convert the gage to a bench comparator. T1150 Dial Indicator Snap Gages also available with indicators other than those listed, a 717 Gage Amplifier and gaging head in place of the indicator, carbide faces on the contacts, special contact and backstop shapes and sizes, variable gaging pressure control, disc setting and other special masters, and larger ranges.

| 1150 Dial Indicator Snap Gages, Inch Reading | | | | | | |
|---|---|---|---|---|---|---|
| | Dial Indicator | | | | Without Stand | |
| Range | Graduation | Dial Reading | Range | Model No. | Cat. No. | EDP |
| 0-2" | .0001" | + 10 – 10 | .040" | 81-111-1150 | 1150Z-2 | 53168 |
| 2-4" | | | | | 1150Z-4 | 53169 |
| 4-6" | | | | | 1150Z-6 | 53170 |
| 6-8" | | | | | 1150Z-8 | 53171 |
| **Accessory for 1150 Dial Indicator Snap Gages** | | | | | | |
| **Description** | | | | | **Cat. No.** | **EDP** |
| Bench Stand Only | | | | | 1150 | 53172 |

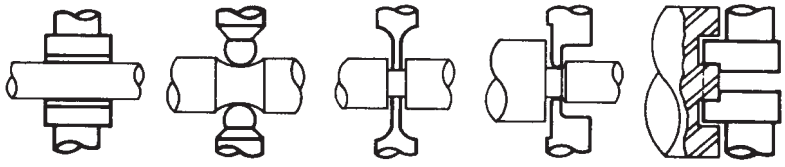
Gages furnished in case.



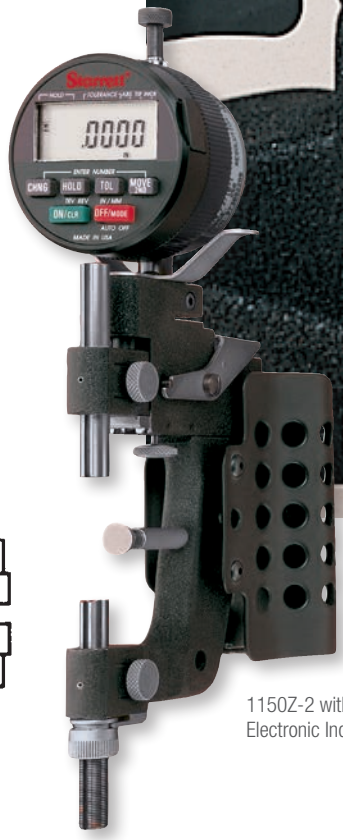

1150Z-2 mounted on 1150 Bench Stand

### Special Contacts

Some of the many interchangeable anvil configurations designed to suit special applications.



Wide Face up to 9/16" Square | Ball or Roll | Blade Type | Offset | Offset for Face Groove



1150Z-2 with F2710-1 Electronic Indicator

# Special Function Indicators

## 1175, 1175M Dial Indicator Groove Gages

### .375-6"/9.5-150MM

This lightweight gage is used for in-process or bench inspection of oil grooves, snap ring retainer grooves, "O" ring seat retainer grooves and similar internal recesses. It is also useful for checking bore dimensions and testing for taper, bell-mouth and out-of-roundness.

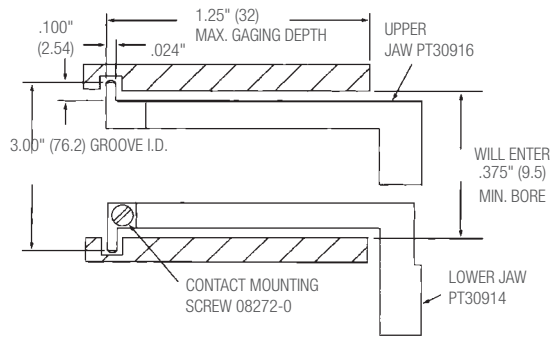
The movable, sensitive gaging contact has a 1/2" (12.7mm) retractable range and transfers the measurement through a linear, friction-free transfer mechanism to the dial indicator. The lower reference jaw is fixed and supports the entire weight of the gage and the operator's hands, thus preventing incorrect gaging pressure and false readings.

The reference jaw can be mounted in two positions on the range adjusting bar. The bar itself is also adjustable for greater or lesser range. A fine adjustment screw and a lock are also provided.

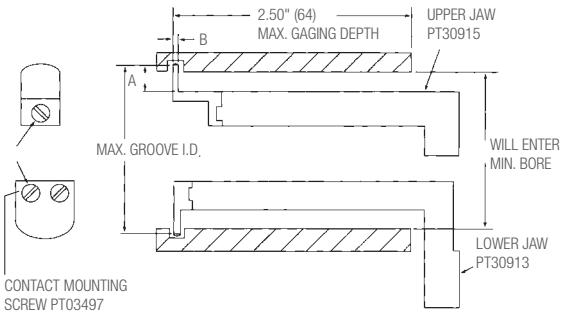
#### Features:

- Supplied with two sets of jaws, both readily interchangeable
- Three sets of contacts are furnished (Styles 1-10, 2-10, 2-20) that can be attached to the ends of the jaws without replacing the entire jaw. Contacts have flush ends so that grooves at the bottom of blind holes can be gaged. The contacts are hardened steel with a hard chrome finish for long life.
- Gage can be set with gage blocks or other methods such as micrometers, vernier calipers and ring gages
- Furnished with storage case

Special jaws for 4" and 6" (100mm and 150mm) gaging depths, a diameter range extension bar from 6-12" (150-300mm), dial indicators graduated in .001", or any special modification of gaging contacts and jaws, are also available by request through our Special Order Department.




STYLE 1-10




STYLES 2-10, 2-20

**1175 and 1175M Dial Indicator Groove Gages**

| Range | Dial Indicator Model No. | Graduation | Reading | Range | Cat. No. | EDP |
|---|---|---|---|---|---|---|
| .375-6" | 81-136-1175 | .0005" | ±30 | .060" | 1175Z | 53173 |
| 9.5-150mm | 81-181-1175 | 0.01mm | ±100 | 2.5mm | 1175MZ | 65032 |

**1175 Dial Indicator Groove Gage Contact Sets**

| Contact Set | Part No. Upper | Part No. Lower | Will Enter Minimum Bore Inch | Will Enter Minimum Bore mm | Maximum Groove I.D. Inch | Maximum Groove I.D. mm | Minimum-A Groove Depth Inch | Minimum-A Groove Depth mm | Minimum-B Groove Width Inch | Minimum-B Groove Width mm |
|---|---|---|---|---|---|---|---|---|---|---|
| Style 1-10 | PT30917 | PT30917 | .375" | 9.5 | 3.00" | 75 | .100" | 2.5 | .024" | 0.6 |
| Style 2-10 | PT30918 | PT30919 | .690" | 17.5 | 5.00" | 125 | .140" | 3.6 | .034" | 0.8 |
| Style 2-20 | PT30920 | PT30921 | 1.00" | 25 | 6.00" | 150 | .265" | 6.7 | .051" | 1.3 |

## 1017 Outside Dial Caliper Gages

### 0-2"/0-50MM

These gages are designed for use in measuring castings, forgings and sheet metal work. Large clearances have been provided to reach over part configurations for easy measurement of small sections. The convenient retraction lever allows for one-hand operation and good gage control.

The dial indicator has a direct reading count hand. The contacts are cylindrical carbide for long wear life.



**1017 Outside Dial Caliper Gages**

| Range | Graduation | Throat Depth | Cat. No. | EDP |
|---|---|---|---|---|
| 0-2" | .001" | 4" | 1017-4 | 65091 |
| | | 8" | 1017-8 | 64959 |
| 0-50mm | 0.02mm | 100mm | 1017M-100 | 64179 |
| | | 200mm | 1017M-200 | 64180 |

# Special Function Indicators

## 1019, 1019M Internal Dial Caliper Gages

### .400-1.4"/10-35MM

These indicating gages are ideal for obtaining fast, comparative I.D. measurements, especially in hard-to-reach locations. The user depresses the button on the indicator housing and releases, allowing the arms to make contact with the work.

- Makes convenient, accurate I.D. measurements
- Spring loaded design provides constant pressure and positive contact for reliable measurements
- Can be set with a micrometer or ring gage
- 3-1/4" arm length for ample reach
- Rotatable bezel for zero setting and bezel lock
- Jewel bearings
- .040" (1.016mm) dia. carbide ball measuring contacts

**1019 and 1019M Internal Dial Caliper Gages**

| Range | Description | Cat. No. | EDP |
|---|---|---|---|
| .400-1.4" | .001" with Revolution Counter | 1019-1 | 66559 |
| 10-35mm | 0.025mm with Revolution Counter | 1019M-25 | 67120 |




## 697, 697M Inside Dial Gages

### 2-3/8–18"/61–458MM

These gages are used between two walls to check parallelism and also to take comparative measurements of internal diameters. There are ten rods and one extension furnished. The rods are marked to designate the approximate overall length of the gage. All measuring contacts are rounded. Tool can be set with a micrometer.

The indicator bezel is rotated to adjust the dial in relation to the hand and has a non-breakable crystal. The movement of the dial indicator is approximately 5/32" (4mm). Rods of different lengths can also be furnished on request.

**697 and 697M Inside Dial Gages**

| Range | Graduation | Dial Reading | One Revolution | Cat. No. | EDP |
|---|---|---|---|---|---|
| 2-3/8–18" | .001" | 0-20-0 | .040" | 697Z | 52907 |
| 61-458mm | 0.02mm | 0-50-0 | 1.0mm | 697MZ | 52908 |



697Z

# Special Function Indicators

## 668 Shaft Alignment Clamp Sets

The 668 Shaft Alignment Clamp is designed for fast, precise alignment of motors, pumps, compressors, etc. This system is capable of addressing radial and angular misalignment problems and can be set up within minutes.

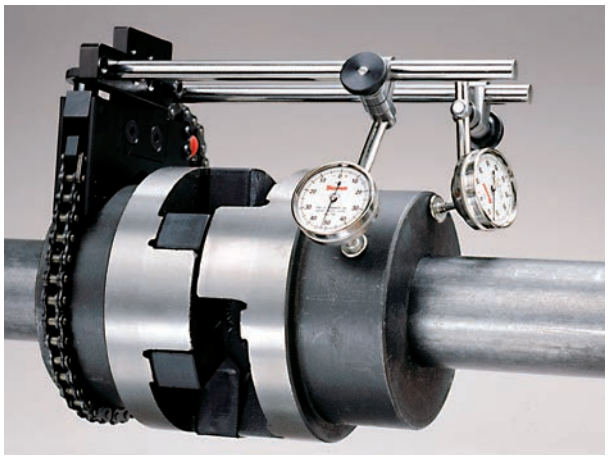
| 668 Shaft Alignment Clamp Sets | | |
|---|---|---|
| **Description** | **Cat. No.** | **EDP** |
| 1 each: Chain Clamp, Extension Plate, Posts (5", 7-7/16", 9"), without Case | S668A | 67150 |
| 2 each: Chain Clamp, Extension Plate, Posts (5", 7-7/16", 9"), with Fitted Case | S668BZ | 67151 |
| 2 each: Chain Clamp, 196B5 Indicator, PT18724 Snug, Extension Plate, Posts (5", 7-7/16", 9"), with Fitted Case | S668CZ | 67152 |
| 2 each: Chain Clamp, 81-141J Indicator, 657Y Indicator Attachment, PT18724 Snug, Extension Plate, Posts (5", 7-7/16", 9"), with Fitted Case | S668DZ | 67153 |
| Extra Length Chain: 24" #35 ANSI Chain with Link | 27984-0 | - |




### Features

- Lightweight clamp design made of black anodized aluminum
- Rigid 3/8" diameter stainless steel indicator posts provided in three lengths (5", 7-7/16", and 9")
- Extension plate allows for added radial clearance
- Heavy-duty roller chain can accommodate up to a 7-1/2" diameter shaft
- Sets are available with either two 196B5 or 81-141J Indicators
- Excess roller chain can be secured to the side of the chain clamp
- A second shaft alignment clamp can be mounted across from the first clamp to act as a vertical "target" for face alignment

| 668 Shaft Alignment Clamp | | | |
|---|---|---|---|
| **Photo Key** | **Individual Components** | **Cat. No.** | **EDP** |
| A | Chain Clamp Only | 668 | 67155 |
| B | Extension Plate Screw, Washer | PT99529 | 67454 |
| C | 5" Post | PT27981 | 67302 |
| D | 7-7/16" Post | 657G | 52753 |
| E | 9" Post | PT27982 | 67303 |
| F | Snug Complete | PT18724 | 50710 |
| G | Indicator Attachment | 657Y | 52765 |



# Special Function Indicators



## 696, 696M Crankshaft Distortion Dial/Strain Gage

**2-3/8–18"/61–458MM**

Ideal gage for checking bearing alignment or shaft deflection without dismantling the engine. Also useful as a strain gage on engine frames. This inside measuring gage checks the distortion of crankshaft webs and bears a direct relation to existing misalignment or excessive bearing wear. Used on all diesel engine shafts and center crankshafts on any type of engine or compressor, the gage can also be applied as a strain gage on engine frames while the engine is operating. A comparison of readings taken at top and bottom positions indicates any misalignment of cylinder and frame which results in local over-stress and eventual cracking of the frame neck.

With a special spring tension in the dial indicator, the gage is self-sustaining in any position without sacrificing necessary rigidity, leaving the operator's hands free. Hardened and ground to a sharp point, conical contact points have an approximate 60º included angle, and will stay in place on 45º surfaces.

**696 and 696M Crankshaft Distortion Dial/Strain Gages**

| Range | Dial Indicator Graduation | Dial Reading | Range One Rev. | Description | Cat. No. | EDP |
|---|---|---|---|---|---|---|
| 2-3/8–18" | .001" | 0-20-0 | .040" | Strain Gage with Balancing Attachment | 696Z | 52901 |
| 61-458mm | 0.02mm | 0-50-0 | 1mm | Millimeter Strain Gage with Balancing Attachment | 696MZ | 52902 |
| Balancing Attachment Only | | | | | 696B | 52903 |

Gage furnished with 10 rods, sharp points and balancing attachment in attractive, protective case.

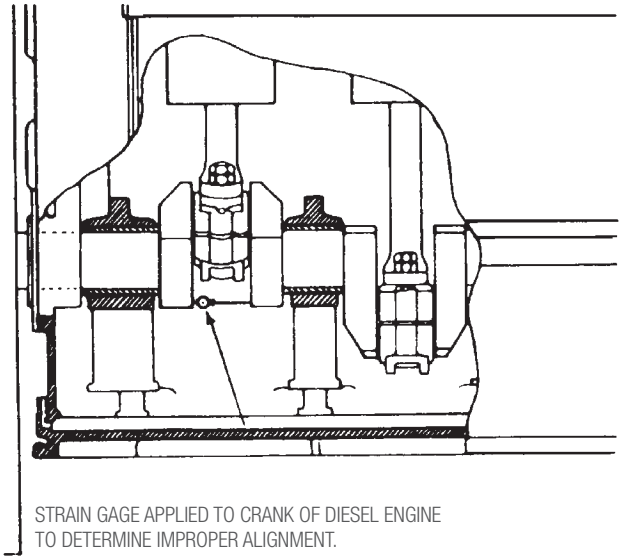
**696B Balancing Attachment** is furnished with the gage. For certain applications, like turning the crank under test with the gage in place, the attachment can be adjusted to maintain the face of the indicator upward or in desired position. To install on a strain gage in use, remove the knurled clamping nut, then the doweled plate or end strap at either end by the screw. The unit is then positioned over the hubs on two sides of the indicator head. A spring plunger provides the friction that holds the balance in proper relation to position. The parts are nickel plated.



696B Balancing Attachment

The dial indicator movement is approximately 5/32" (4mm) and with rods and extension, provides a range from 2 3/8-18" or 61-458mm. There are 10 rods and one extension furnished. Rods are marked to designate the approximate overall length of the gage. Indicator has a movable bezel to adjust the dial in relation to the hand and a non-breakable crystal.

Designed in collaboration with Hartford Steam Boiler Inspection and Insurance Company. It was known as the Hartford Steam Boiler Engine Strain Gage and is used by their inspectors to check the distortion of engine shafts and frames.



STRAIN GAGE APPLIED TO CRANK OF DIESEL ENGINE TO DETERMINE IMPROPER ALIGNMENT.

Fig. 1

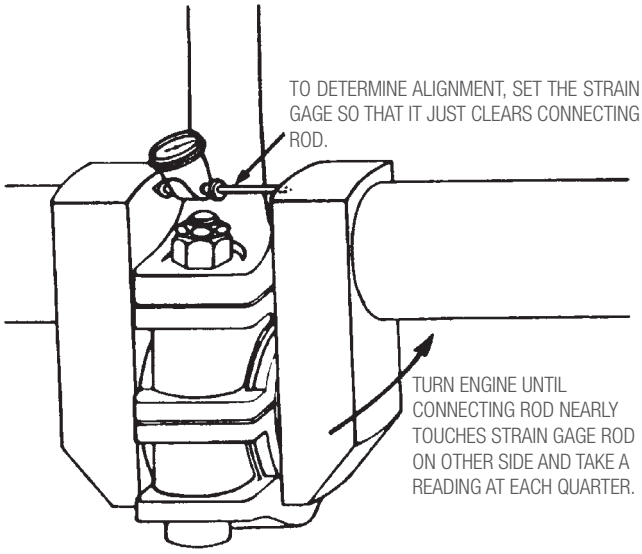
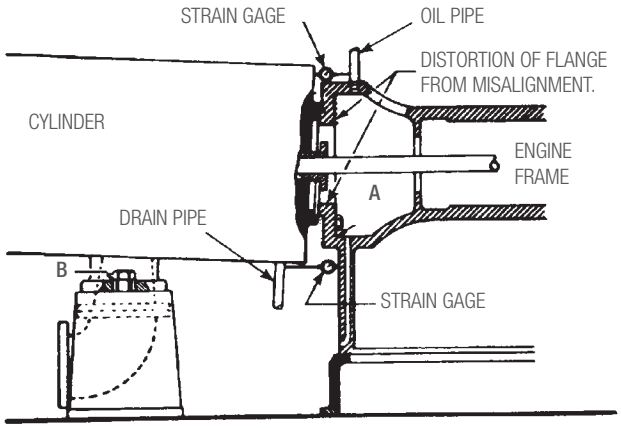
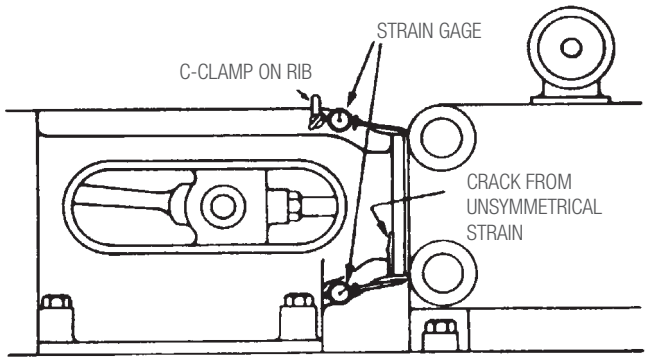



Fig. 2




MISALIGNMENT OF CYLINDER AND ENGINE FRAME (SHOWN EXAGGERATED FOR PURPOSES OF ILLUSTRATION).

Fig. 3




STRAIN GAGE APPLIED TO ENGINE FRAME (WHILE OPERATING), DIFFERENCE BETWEEN TOP AND BOTTOM READINGS OF THE STRAIN GAGE INDICATES IMPROPER ALIGNMENT, CAUSING CRACKS.

Fig. 4

# Special Function Indicators

## 452 Cylinder Gages

**2-1/2–9"**

These convenient, easy-to-use gages are used to determine taper and out-of-roundness of bores, offering a quick and accurate way to show your customer whether new rings or reconditioning is necessary.

The ranges are achieved by the use of two measuring contact rods. The gage is easily and accurately set to a micrometer.

### Features:

- Dial is graduated to show plus or minus
- Bezel may be rotated for zero setting
- Sled is hardened and ground for long, accurate life and has two long-line contacts in constant alignment with the cylinder wall. These reference points are spring loaded, making the gage self-centering and non-collapsible.
- The locking screw (stem protruding above the dial) clamps the contact points in position for measurement with a micrometer
- The handle can be locked in any perpendicular or angular position and may also be transformed by a slight turn into a toggle joint with a wide sweep
- Extra handles may be ordered to make a long extension

| 452 Cylinder Gages | | | | | |
|---|---|---|---|---|---|
| **Range** | **Graduation** | **Dial Reading** | **One Rev.** | **Cat. No.** | **EDP** |
| 2-1/2–6" | .001" | 0-100 | .100" | 452B | 52339 |
| 2-1/2–9" | | | | 452B-9 | 52341 |
| **Accessories** | | | | | |
| **Description** | | **Length** | | **Cat. No.** | **EDP** |
| Handle Extension for 452B and 452B-9 | | 8-5/8" | | PT06722 | 72275 |

Height from contact points to top of handle is 10" (250mm).



# Special Function Indicators





## Dial Indicator Diameter Gages

These gages measure both outside and inside diameters by comparing dimensions to gage blocks or an adjustable setting master. Each gage consists of a strong rectangular box beam with a sensitive gaging contact at one end and a reference gaging contact at the other.

- All of the diameter gages have these features:
- The sensitive contact transfers dimensions to the dial indicator through a linear friction-free mechanism
- There are two gage feet at the reference end of the gage and one foot at the sensitive end of the gage to set the gage on the work and align the contacts
- Gage depth is set by adjusting the gage feet up or down
- A lever-actuated reverse mechanism loads the gage for either inside or outside diameter measurements
- The gage contacts are easily changed to I.D. or O.D. gaging by turning them end for end
- Unless otherwise specified, the dial indicator sent with the gage reads in .0005" increments with a total range of ±.030". The dial has a double row of graduations reading in opposite directions – minus in red and plus in black

On the following pages we list our standard line but to suit other needs we also can furnish the following:

1. Any length that is required
2. Any dial indicator with inch or millimeter reading
3. 717 Electronic Gage Amplifier and Gaging Head in place of the indicator
4. Electronic indicators can also be furnished on any of these gages except the 1102
5. Special contact shapes
6. Gaging contacts with more depth

# Indicator Diameter Gages




## 1102, 1102M Dial Indicator Diameter Gages

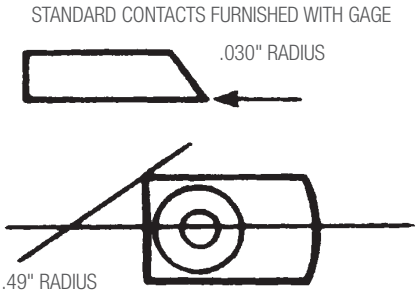
### 1-12"/25-300MM

This is a light, easy-to-handle gage that is a workhorse in its range. Approximate weight is 1lb, 12oz. (0.8kg). The gaging depth can be set within a range of 0-1" (0-25mm) by adjusting the rest foot. Dial indicators are the 81-136-623 Inch Reading (.0005") or 81-181-623 Millimeter Reading (0.01mm) models.

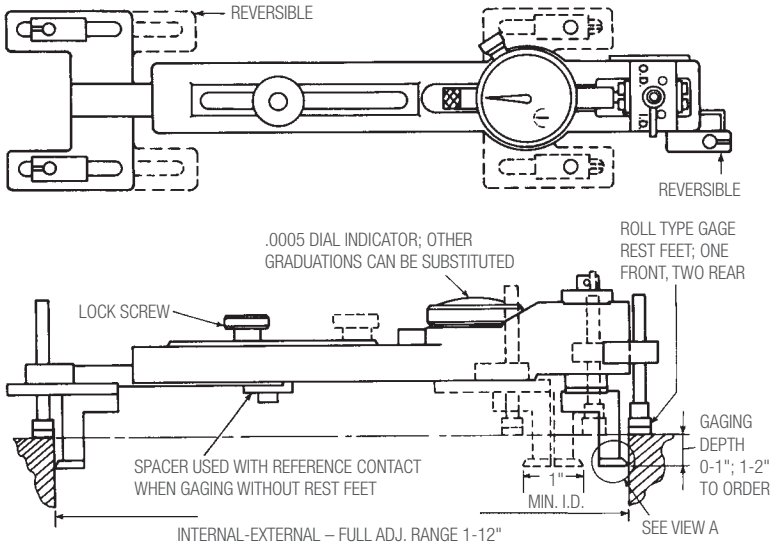
The gage should be checked against our 1127 Master for a precise reference standard during production gaging (See the following pages). Also available on request with .0001" or 0.002mm graduations.

| 1102 and 1102M Dial Indicator Diameter Gages | | | |
|---|---|---|---|
| **Length Range** | **Height Adjustment** | **Cat. No.** | **EDP** |
| 1-12" (.0005" Indicator) | 0-1" | 1102 | 56134 |
| 1-12" (.0001" Indicator) | 0-1" | 1102-1 | 69004 |
| 25-300mm | 0-25mm | 1102M | 65020 |
| **Case for 1102 and 1102M Dial Indicator Diameter Gages** | | | |
| **Description** | | **Cat. No.** | **EDP** |
| Storage Case to Hold Both Gage and 1127 Master | | 1102ZZ | 56136 |

| 1102 and 1102M Dial Indicator Diameter Gages | |
|---|---|
| **Photo Key** | **Description** |
| A | Range Lock Screw |
| B | I.D.-O.D. Preload Reversing Mechanism Lever |
| C | Rest Foot |
| D | Reference Contact |
| E | Sensitive Contact |

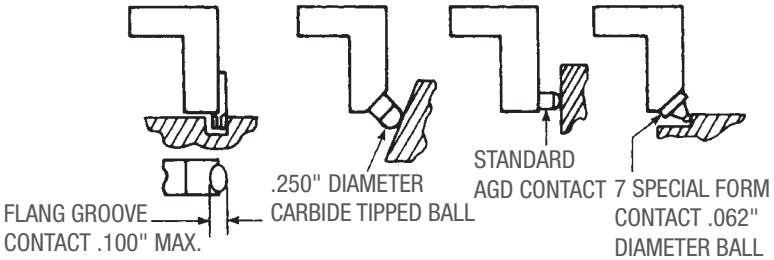



View A

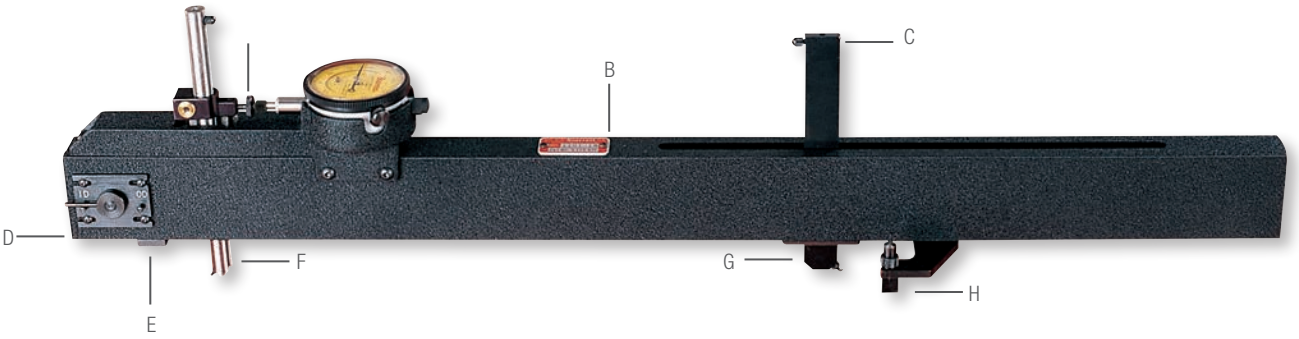



1102

## SPECIAL CONTACTS DESIGNED TO ORDER



# Indicator Diameter Gages



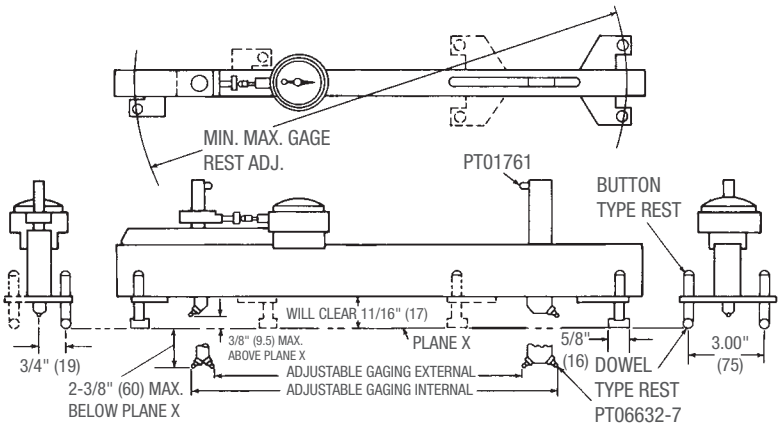

## 1101, 1101M Dial Indicator Diameter Gages

### 12-60"/300-1500MM

These gages allow for measurement beyond the size range of our 1102 models. Each gage adjusts a full 6" or 150mm. The contact carriers are vertically adjustable to handle various work depth. Special contacts are available.

This tool has dowel (line) contacts at one end of the gage feet, and a button (point) contact gage at the other end of the feet. These can be reversed as needed and the gaging depth can be set within a range of 2-3/4" or 70mm.

This gage should be checked against our 1126 Master for a precise reference standard during production gaging (See the following pages).



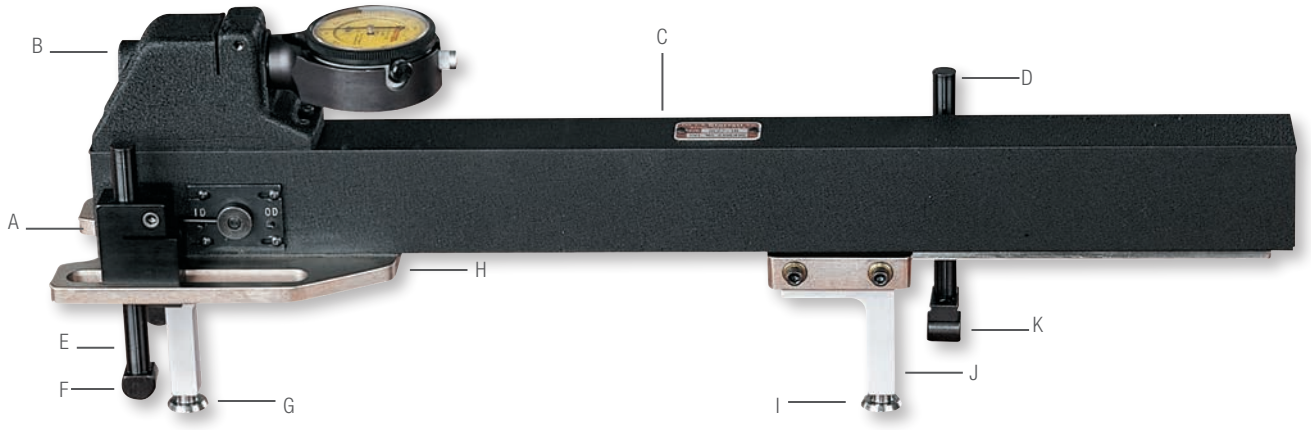

| 1101 and 1101M Dial Indicator Diameter Gages | |
|---|---|
| **Photo Key** | **Description** |
| A | Dial Indicator Fine-Adjusting Screw |
| B | Beam – Rectangular Box Section |
| C | Contact for Added Applications |
| D | I.D.-O.D. Preload Reversing Mechanism Lever |
| E | Combination Dowel/Button Rest Feet |
| F | Sensitive Contact |
| G | Reference Contact |
| H | Mounting Plate with Combination Dowel and Button Rest Feet |

**1101 and 1101M Dial Indicator Diameter Gages**

| Length | | Inch Reading .0005" Graduations | | Millimeter Reading .01mm Graduations | | Inch Reading .0001" Graduations | | Millimeter Reading .002mm Graduations | |
|---|---|---|---|---|---|---|---|---|---|
| **Inch** | **mm** | **Cat. No.** | **EDP** | **Cat. No.** | **EDP** | **Cat. No.** | **EDP** | **Cat. No.** | **EDP** |
| 12-18" | 300-450mm | 1101-18 | 53144 | 1101M-450 | 65015 | 1101-18-1 | 69005 | 1101M-450-2 | 69021 |
| 18-24" | 450-600mm | 1101-24 | 53146 | 1101M-600 | 65016 | 1101-24-1 | 69006 | 1101M-600-2 | 69022 |
| 24-30" | 600-750mm | 1101-30 | 53148 | 1101M-750 | 65017 | 1101-30-1 | 69007 | 1101M-750-2 | 69023 |
| 30-36" | 750-900mm | 1101-36 | 53150 | 1101M-900 | 65018 | 1101-36-1 | 69008 | 1101M-900-2 | 69024 |
| 36-42" | 900-1050mm | 1101-42 | 53152 | 1101M-1050 | 65019 | 1101-42-1 | 69009 | 1101M-1050-2 | 69025 |
| 42-48" | 1050-1200mm | 1101-48 | 53154 | 1101M-1200 | 65021 | 1101-48-1 | 69010 | 1101M-1200-2 | 69026 |
| 48-54" | 1200-1350mm | 1101-54 | 53156 | 1101M-1350 | 65022 | 1101-54-1 | 69011 | 1101M-1350-2 | 69027 |
| 54-60" | 1350-1500mm | 1101-60 | 53158 | 1101M-1500 | 65023 | 1101-60-1 | 69012 | 1101M-1500-2 | 69028 |
| **Gaging Contact Range:** | | ±.050" | | ±1.3mm | | ±.050" | | ±1.3mm | |

Sent without case unless otherwise ordered. To order case, specify the Catalog and "ZZ" (For example: 1101ZZ-18).

# Indicator Diameter Gages



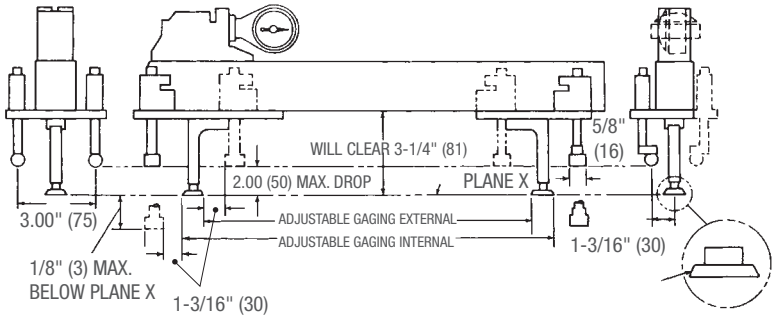

## 1100, 1100M Heavy-Duty Dial Indicator Diameter Gages

### 12-60"/300-1500MM

These gages combine heavy-duty construction features with adaptability for a wide range of internal and external measurements. The adjustable dowel rest legs ride on slotted mounting plates for horizontal adjustment. Each of the legs are vertically adjustable to obtain the proper rest position on the work and correct alignment on the gaging contacts. 2" or 50 mm range is the vertical adjustment.

The gaging contacts are radiused but may be modified by request to suit special gaging conditions.

The indicator and its housing can be rotated through to 360º so that the indicator may be read at the most convenient angle. The gage should be checked against our 1126 Master for a precise reference standard during production gaging (See the following pages).




| 1100 and 1100M Heavy-Duty Dial Indicator Diameter Gages | |
|---|---|
| **Photo Key** | **Description** |
| A | I.D.-O.D. Preload Reversing Mechanism Lever |
| B | Tamper Proof Dial Indicator Fine-Adjust Screw |
| C | Beam – Rectangular Box Section |
| D, E | Adjustable Dowel Rest Leg |
| F, K | Dowel Rest |
| G | Sensitive Contact |
| H | Slotted Rest Leg Mounting Plate |
| I | Reference Contact |
| J | Reference Contact Carrier |

**1100 and 1100M Heavy-Duty Dial Indicator Diameter Gages**

| Length | | Inch Reading .0005" Graduations | | Millimeter Reading .01mm Graduations | | Inch Reading .0001" Graduations | | Millimeter Reading .002mm Graduations | |
|---|---|---|---|---|---|---|---|---|---|
| **Inch** | **mm** | **Cat. No.** | **EDP** | **Cat. No.** | **EDP** | **Cat. No.** | **EDP** | **Cat. No.** | **EDP** |
| 12-18" | 300-450mm | 1100-18 | 53128 | 1100M-450 | 65024 | 1100-18-1 | 69013 | 1100M-450-2 | 69029 |
| 18-24" | 450-600mm | 1100-24 | 53130 | 1100M-600 | 65025 | 1100-24-1 | 69014 | 1100M-600-2 | 69030 |
| 24-30" | 600-750mm | 1100-30 | 53132 | 1100M-750 | 65026 | 1100-30-1 | 69015 | 1100M-750-2 | 69031 |
| 30-36" | 750-900mm | 1100-36 | 53134 | 1100M-900 | 65027 | 1100-36-1 | 69016 | 1100M-900-2 | 69032 |
| 36-42" | 900-1050mm | 1100-42 | 53136 | 1100M-1050 | 65028 | 1100-42-1 | 69017 | 1100M-1050-2 | 69033 |
| 42-48" | 1050-1200mm | 1100-48 | 53138 | 1100M-1200 | 65029 | 1100-48-1 | 69018 | 1100M-1200-2 | 69034 |
| 48-54" | 1200-1350mm | 1100-54 | 53140 | 1100M-1350 | 65030 | 1100-54-1 | 69019 | 1100M-1350-2 | 69035 |
| 54-60" | 1350-1500mm | 1100-60 | 53142 | 1100M-1500 | 65031 | 1100-60-1 | 69020 | 1100M-1500-2 | 69036 |
| **Gaging Contact Range:** | | ±.050" | | ±1.3mm | | ±.050" | | ±1.3mm | |

Sent without case unless otherwise ordered. To order case, specify the Catalog and "ZZ" (For example: 1101ZZ-18).

# Indicator Diameter Gages

## Setting Masters For Dial Indicator Diameter Gages

These setting masters are used to check and reset diameter gages under production gaging conditions. Each master consists of a rigid box beam with reference and sensitive heads which are individually adjustable along dovetail ways.

A platen on each head locates the diameter gage from its feet. The position of the gage contacts is matched by the anvils on the masters which are vertically adjustable. The reference head anvil has a fine adjustment for final settings, plus a restrictor to help position the gage in the master.

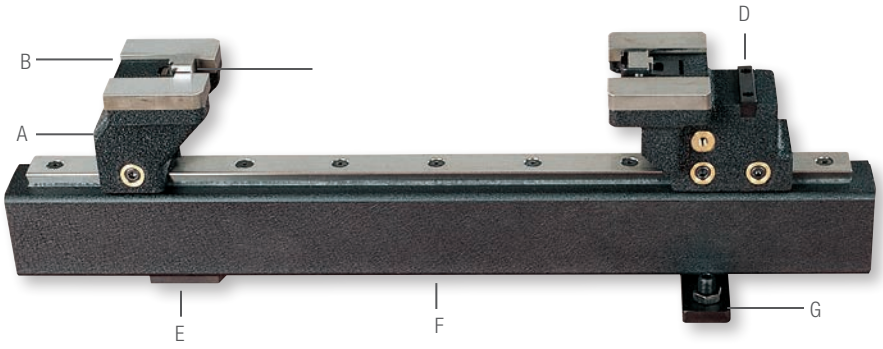
Both heads can be reversed for I.D. or O.D. settings. Each master has a fixed single point rest and two leveling screws which provide a three-point suspension. All contact and working surfaces are hardened and ground.

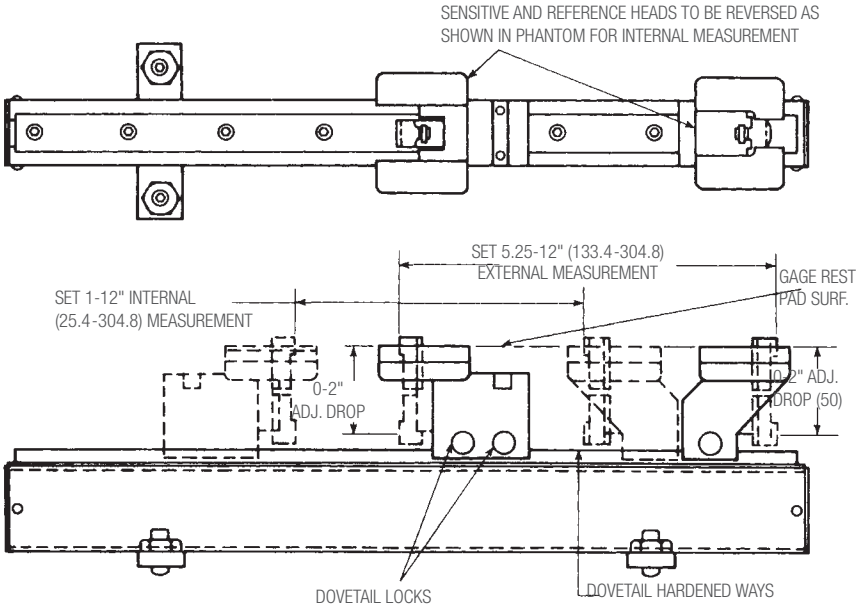
The setting procedure is as follows: set the diameter gage precisely to gage blocks or height gages. Then, using the diameter gage, set the master which can then be used as a precise reference standard for the diameter gage during production gaging.

## 1127 Internal-External Adjustable Setting Master for Starrett 1102 Diameter Gages

**EDP 56135**

This set master is used with our 1102 Diameter Gages. The internal adjustment range is 1–12" (25-300mm) and external adjustment is 5-1/4–12" (133-300mm). Storage case is available to hold both the gage and master (Catalog 1102ZZ, EDP 56136).




| 1127 Internal-External Adjustable Setting Master for Starrett 1102 Diameter Gages | |
|---|---|
| **Photo Key** | **Description** |
| A | Sensitive Head |
| B | Hardened Rest Platen |
| C | Anvil |
| D | Reference Head |
| E | Fixed Single Point Button Rest |
| F | Beam – Rectangular Box Section |
| G | Leveling Screws (2) |

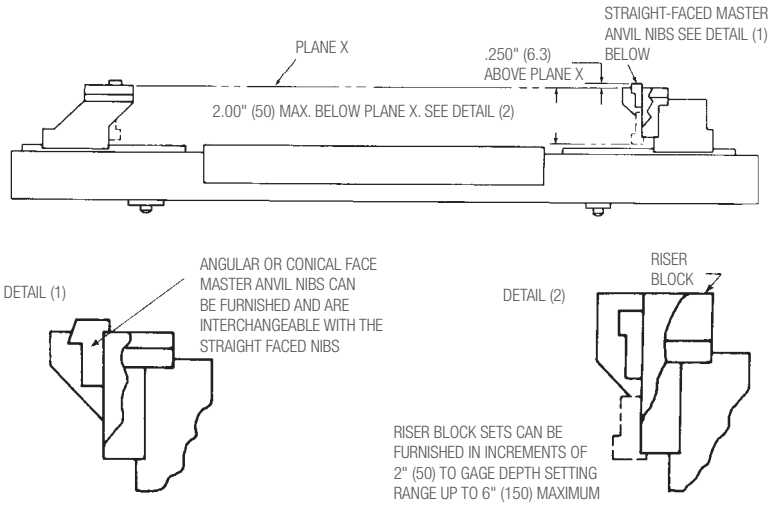
# Indicator Diameter Gages




## 1126 Internal-External Adjustable Setting Masters for Starrett 1100 and 1101 Diameter Gages

**12-60"/300-1500MM**

These set masters are used to check and reset Starrett 1100 and 1101 Diameter Gages under production gaging conditions. The range is from 12-60" or 300-1500mm.




ANGULAR OR CONICAL NIBS AND RISER BLOCKS QUOTED UPON REQUEST

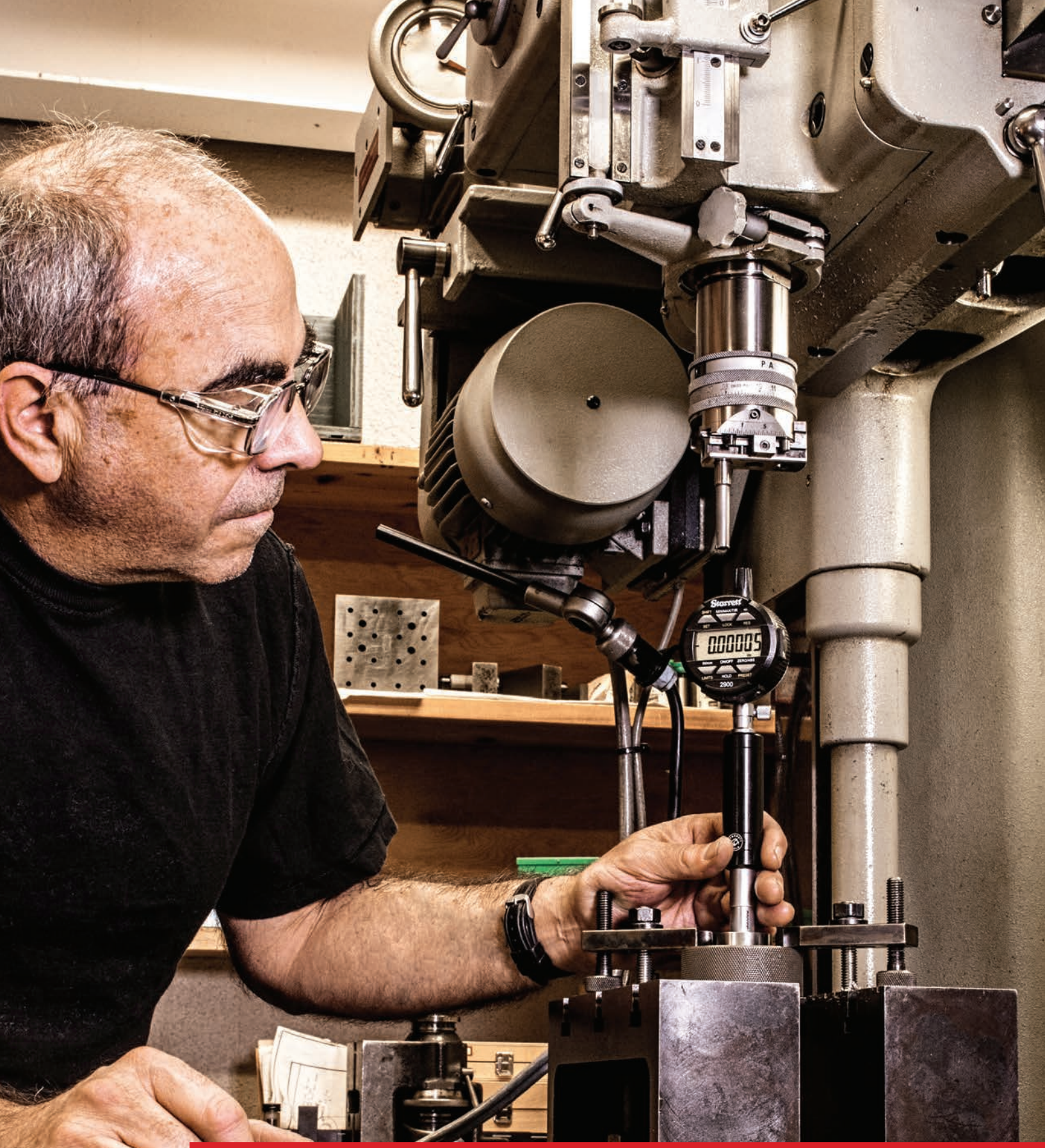
| 1126 Internal-External Adjustable Setting Masters for Starrett 1100 and 1101 Diameter Gages | |
|---|---|
| **Photo Key** | **Description** |
| A | Sensitive Head |
| B | Hardened Rest Platen |
| C | Anvil |
| D | Reference Head |
| E | Leveling Screws (2) |
| F | Beam – Rectangular Box Section |
| G | Fixed Single Point Button Rest |

| 1126 Internal-External Adjustable Setting Masters for Starrett 1100 and 1101 Diameter Gages | | | | | | | | Case Only |
|---|---|---|---|---|---|---|---|---|
| Length Range | | For Use With Diameter Gage Nos. | | | | | | |
| Inch | mm | Inch | mm | Inch | mm | Cat. No. | EDP | Cat. No. |
| 12-18" | 300-450mm | 1100-18 | 1100M-450 | 1101-18 | 1101M-450 | 1126-18 | 53160 | 1126ZZ-18 |
| 18-24" | 450-600mm | 1100-24 | 1100M-600 | 1101-24 | 1101M-600 | 1126-24 | 53161 | 1126ZZ-24 |
| 24-30" | 600-750mm | 1100-30 | 1100M-750 | 1101-30 | 1101M-750 | 1126-30 | 53162 | 1126ZZ-30 |
| 30-36" | 750-900mm | 1100-36 | 1100M-900 | 1101-36 | 1101M-900 | 1126-36 | 53163 | 1126ZZ-36 |
| 36-42" | 900-1050mm | 1100-42 | 1100M-1050 | 1101-42 | 1101M-1050 | 1126-42 | 53164 | 1126ZZ-42 |
| 42-48" | 1050-1200mm | 1100-48 | 1100M-1200 | 1101-48 | 1101M-1200 | 1126-48 | 53165 | 1126ZZ-48 |
| 48-54" | 1200-1350mm | 1100-54 | 1100M-1350 | 1101-54 | 1101M-1350 | 1126-54 | 53166 | 1126ZZ-54 |
| 54-60" | 1350-1500mm | 1100-60 | 1100M-1500 | 1101-60 | 1101M-1500 | 1126-60 | 53167 | 1126ZZ-60 |

Setting masters for larger diameters are also available by request – priced on the application.

In addition to the products detailed in this section, we have made many other special function gages to suit a wide variety of our costomers' specific requirements.

If you have a special application, we invite you to submit your drawings and specifications to our Special Order Department at 121 Crescent Street, Athol, MA 01331, USA. We will be happy to provide a prompt quotation.




# BORE GAGES

# Electronic Bore Gages

## 781XT AccuBore® Electronic Bore Gages with Output

**.080"-8"/2-200MM**

AccuBore is a high-quality, trigger-activated, three-point contact bore gaging system with extended range. Its convenient single-hand operation provides speed and control. Simply squeeze the trigger, insert the gage into the bore and release the trigger for an instant reading from the large, easy-to-read digital display.

What makes AccuBore superior to other gages are features like the mechanically-driven parallel anvils which extend simultaneously, establishing a more true alignment to the axis of the bore. This provides consistent pressure, resulting in more accurate readings than models with spring-driven contacts which are subject to pressure variations.

Speed and convenience are further enhanced by the repositionable AccuBore indicator, which may be swiveled and rotated for left, right hand or even vertical viewing. The gage also features a set of "Go/No-Go" lights above the readout display that quickly indicate whether a bore measurement is within a preset tolerance window.

### Features

- Single-hand operation with right- and left-hand viewing flexibility
- Large, easy-to-read display
- Enhanced wear life with carbide-faced contacts – available from 1/2" to 8"
- Convenient "Go/No-Go" tolerance indicator lights
- True alignment with mechanically-driven parallel anvils
- Resolution .00005" (0.001mm)
- Accuracy of up to .00015" (.004mm)
- Push button inch/metric conversion
- Preset and preset recall
- Hold, max/min and zeroing capabilities
- Blind bore measurement is standard for .50" (12.7mm) and above
- Specialized heads available for thread, groove and other non-standard measurements on request
- Output capability for Statistical Process Control (SPC) analysis. Download data directly to a PC by an RS232 connection (Direct to PC cable available on request).




781XTZ-138

## Bore Gage Measuring Tips

Whether to use a two-point or three-point contact measuring tool is usually a matter of preference, but there are some differences.

A two-point contact rod-type inside micrometer is usually lighter, easier to handle, and more versatile over long ranges from approximately 6-107" (150-2700mm).

Any two-point contact micrometer, regardless of range, can probe a hole better to find the geometry of that hole than a three-point contact.

Most three-point contact tools have setting rings to ensure accuracy. If you desire very close tolerance work with two-point contact inside micrometers, it is recommended that they be set to a ring gage or to an outside micrometer.

A three-point contact micrometer has an advantage in that it can be seated in position more quickly than a two-point contact tool.

Usually these tools can also be read to a finer accuracy. The three-point tool will tell the maximum true diameter that can enter the hole a little faster than a two-point contact tool.

Micrometer heads used in these tools are accurate to ±.0001" or 0.002mm, but overall accuracy on tools that add rods is dependent on good practice and technique.

To ensure accuracy, these practices should be followed:

- Always make sure that there are no specks of dirt between the clamping surfaces of the rods and micrometer heads
- Tighten all rods uniformly, not too tightly, not too loosely, but a fairly firm assembly
- Assembling long sections should be done vertically or, with support, horizontally
- Because temperature can affect long rods used in these tools, they should be assembled in the same environment in which they will be used




Output jack enables collection of measurement data for SPC analysis






AccuBore XT's indicator can be rotated, allowing easy reading from either the right or left hand, or when accessing difficult to reach holes




Sets include gage, contacts, setting rings, instructions, certificate of calibration and a 3v lithium battery in a protective carrying case

| 781XT AccuBore Electronic Bore Gages with output – 2-Point Contact (.080-.250" (2-6mm) Range) | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|
| Range | | Accuracy | | Approx Meas. Depth | | Ring Diameter | | | |
| Inch | mm | Inch | mm | Inches | mm | Inches | mm | Cat. No. | EDP |
| .080-.100 | 2-2.5 | .00015 | .004 | 3/8 | 9 | .100 | 2.54 | 781XTZ-100 | 68159 |
| .100-.120 | 2.5-3 | | | | | | | 781XTZ-120 | 68160 |
| .120-.160 | 3-4 | .00015 | .004 | 1/2 | 12 | .160 | 4.06 | 781XTZ-160 | 68161 |
| .160-.200 | 4-5 | .00015 | .004 | 3/4 | 18 | .200 | 5.08 | 781XTZ-200 | 68162 |
| .200-.250 | 5-6 | | | | | | | 781XTZ-250 | 68163 |
| 781XT AccuBore Electronic Bore Gages with output – 3-Point Contact (1/4-8" (6-200mm) Range) – Fixed Anvils | | | | | | | | | |
| 1/4-5/16 | 6-8 | .00015 | .004 | 2-1/4 | 58 | .3125 | 7.94 | 781XTZ-312 | 68164 |
| 5/16-3/8 | 8-10 | | | | | | | 781XTZ-375 | 68165 |
| 3/8-1/2 | 10-12.5 | | | | | .500 | 12.7 | 781XTZ-500 | 68166 |
| 1/2-5/8 | 12.5-16 | .00015 | .004 | 2-3/8 | 62 | .500 | 12.7 | 781XTZ-625 | 68167 |
| 5/8-3/4 | 16-20 | | | | | .750 | 19.05 | 781XTZ-750 | 68168 |
| 3/4-1 | 20-25 | .00015 | .004 | 2-5/8 | 66 | .750 | 19.05 | 781XTZ-1 | 68651 |
| 1-1-3/8 | 25-35 | | | | | 1.375 | 34.93 | 781XTZ-138 | 67685 |
| 1-3/8-2 | 35-50 | .00015 | .004 | 3-1/16 | 80 | 1.375 | 34.93 | 781XTZ-2 | 67686 |
| 2-2-5/8 | 50-65 | .0002 | .005 | 3-1/16 | 80 | 2.625 | 65.68 | 781XTZ-258 | 67687 |
| 2-5/8-3-1/4 | 65-80 | | | | | 3.250 | 82.55 | 781XTZ-314 | 67688 |
| 3-1/4-4 | 80-100 | .0002 | .005 | 3-3/8 | 85 | 3.250 | 82.55 | 781XTZ-4 | 67689 |
| 4-5 | 100-125 | .00025 | .006 | 4 | 100 | 5.0 | 127.00 | 781XTZ-5 | 67690 |
| 5-6 | 125-150 | | | | | | | 781XTZ-6 | 67691 |
| 6-7 | 150-175 | .0003 | .007 | 4 | 100 | 7.0 | 177.80 | 781XTZ-7 | 67692 |
| 7-8 | 175-200 | | | | | | | 781XTZ-8 | 67693 |

| Pistol Grip Gage Only With Indicator* | | | |
|---|---|---|---|
| Range | | | |
| Inch | mm | Cat. No. | EDP |
| .080-.250" | 2-6mm | 781XTP-250 | 68705 |
| 1/4-3/4" | 6-20mm | 781XTP-750 | 68706 |
| 3/4-4" | 20-100mm | 781XTP-4 | 68707 |
| 4-12" | 100-300mm | 781XTP-12** | 68708 |

Larger sizes available on special order.
Gages are also available with dial indicators on special order.
* Does not include heads, rings, etc.
** Heads above 8" available on special order.

# Electronic Bore Gages

## 781XT AccuBore® Electronic Bore Gages

See specifications on previous pages

| 781XT AccuBore Electronic Bore Gage Set – 2-Point Contact (.080-.250" [2-6 mm] Range) | | | | | |
|---|---|---|---|---|---|
| Range | | | | | |
| Inch | mm | Number of Heads | Number of Rings | Cat. No. | EDP |
| .080-.250 | 2-6 | 5 | 3 | S781XTBZ | 68169 |
| **781XT AccuBore Electronic Bore Gage Sets – 3-Point Contact (.250-8" [6-200mm] Range – Fixed Anvils)** | | | | | |
| .250-.375 | 6-10 | 2 | 1 | S781XTCZ | 68170 |
| .250-.750 | 6-20 | 5 | 3 | S781XTHZ | 68658 |
| .375-.750 | 10-20 | 3 | 2 | S781XTDZ | 68171 |
| .750-2.00 | 20-50 | 3 | 3 | S781XTEZ | 67694 |
| .750-4.00 | 20-100 | 6 | 4 | S781XTJZ | 67697 |
| 2.00-4.00 | 50-100 | 3 | 2 | S781XTFZ | 67695 |
| 4.00-6.00 | 100-150 | 2 | 1 | S781XTKZ | 67698 |
| 4.00-8.00 | 100-200 | 4 | 4 | S781XTGZ | 67696 |
| 6.00-8.00 | 150-200 | 2 | 1 | S781XTLZ | 67699 |

| Accessories for 781XT AccuBore Electronic Bore Gages | | |
|---|---|---|
| Description | Part No. | EDP |
| Cable Link to 772 Data Collector, 761 Multiplexer | PT61340 | 65648 |
| Starrett Module #4 for 772 Data Collector, 761 Multiplexer | PT61285 | 65647 |
| Two 3-volt Batteries, No. CR2032 | PT99492 | 65650 |

Larger sizes available on special order.
Gages are also available with dial indicators on special order.




S780XTKZ

| Extensions for 781XT AccuBore Electronic Bore Gages | | | | | | |
|---|---|---|---|---|---|---|
| | | Ext. Size | | | Model Size | |
| Cat. No. | EDP | Inches | mm | Fits Models | Inches | mm |
| 78/782F | 65484 | 2.5 | 63 | 78XT/780XT/781XT/782XT - 250-375mm | 1/4-5/16 | 6-8 |
| 78/782G | 65485 | 3 | 75 | 78XT/780XT/781XT/782XT - 375-500mm | 3/8-1/2 | 10-12.5 |
| 78/782H | 65486 | 4 | 100 | 78XT/780XT/781XT/782XT - 625-750mm | 1/2-3/4 | 12.5-20 |
| 78/782J | 65487 | 6 | 150 | 78XT/780XT/781XT/782XT - 1 thru 2" | 3/4-2 | 20-50 |
| 78/782K | 65488 | 6 | 150 | 78XT/780XT/781XT/782XT - 2 thru 12" | 2-12 | 50-300 |




Extensions from 2-1/2 - 6" can be added to the 781XT, enabling internal measurements in deep hole bores

# Electronic Bore Gages

## 780XT Electronic Internal Micrometers with IP65 Protection (with output)

### .080-12"/2-300MM

780XT Electronic Internal Micrometers provide IP65 level of protection against coolant, water, dirt and dust in hostile shop environments. In addition, they offer extended travel, reducing the need to exchange anvils.

The ground contact points seat the internal micrometer faster and more accurately than the spherical contacts found on other gages. These rugged and accurate internal micrometers are available individually or in sets from .080" (2mm) to 12" (300mm).




### Features

- Wide measurement range without changing anvils
- IP65 level of protection against coolant, water, dirt and dust
- Resolution to .00005" (0.001mm)
- Large high-contrast LCD digital readout is easy to read and reduces error
- RS232 output
- Carbide measuring faces on sizes above 1/2" (12.5mm) diameter
- Extensions available for deep holes
- Includes instant inch/millimeter conversion and preset + and - functions
- Precision ratchet stop provides correct contact pressure for accurate readings
- Each micrometer bore gage with head comes with a wooden case, complete with setting ring, contacts, adjusting wrench, spare battery, and instructions

**780XT Electronic Internal Micrometers, 2-Point Contact (.080-.250" (2-6mm) Range)**

| Range | | Accuracy | | Approx. Meas. Depth | | Ring Diameter | | | |
|---|---|---|---|---|---|---|---|---|---|
| Inch | mm | Inch | mm | Inch | mm | Inch | mm | Cat. No. | EDP |
| .080-.100" | 2-2.5mm | .00015" | .004mm | 3/8" | 9mm | .100" | 2.54mm | 780XTZ-100 | 12015 |
| .100-.120" | 2.5-3mm | | | | | | | 780XTZ-120 | 12016 |
| .120-.160" | 3-4mm | | | 15/32" | 12mm | .160" | 4.06mm | 780XTZ-160 | 12017 |
| .160-.200" | 4-5mm | | | 3/4" | 18mm | .160" | 4.06mm | 780XTZ-200 | 12019 |
| .200-.250" | 5-6mm | | | | | .200" | 5.08mm | 780XTZ-250 | 12020 |
| **780XT Electronic Internal Micrometers, 3-Point Contact (1/4-12" (6-300mm) Range), Fixed Anvils** | | | | | | | | | |
| 1/4 – 5/16" | 6-8mm | .00015" | .004mm | 2-1/4" | 58mm | .3125" | 7.94mm | 780XTZ-312 | 12021 |
| 5/16 – 3/8" | 8-10mm | | | | | | | 780XTZ-375 | 12022 |
| 3/8 – 1/2" | 10-12.5mm | | | | | .500" | 12.7mm | 780XTZ-500 | 12024 |
| 1/2 – 5/8" | 12.5-16mm | | | 2-3/8" | 62mm | .500" | 12.7mm | 780XTZ-625 | 12025 |
| 5/8 – 3/4" | 16-20mm | | | | | .750" | 19.05mm | 780XTZ-750 | 12026 |
| 3/4 – 1" | 20-25mm | | | 2-5/8" | 66mm | .750" | 19.05mm | 780XTZ-1 | 12027 |
| 1 – 1-3/8" | 25-35mm | | | | | 1.375" | 34.93mm | 780XTZ-138 | 12028 |
| 1-3/8 – 2" | 35-50mm | | | 3-1/16" | 80mm | | | 780XTZ-2 | 12029 |
| 2 – 2-5/8" | 50-65mm | .00020" | .005mm | 3-1/16" | 80mm | 2.625" | 65.68mm | 780XTZ-258 | 12030 |
| 2-5/8–3-1/4" | 65-80mm | | | | | | | 780XTZ-314 | 12032 |
| 3-1/4 – 4" | 80-100mm | .00020" | .005mm | 4" | 100mm | 3.250" | 82.55mm | 780XTZ-4 | 12033 |
| 4 – 5" | 100-125mm | .00025" | .006mm | 4-1/2" | 115mm | 5.0" | 127.00mm | 780XTZ-5 | 12034 |
| 5 – 6" | 125-150mm | | | | | | | 780XTZ-6 | 12035 |
| 6 – 7" | 150-175mm | .00030" | .007mm | 4-1/2" | 115mm | 7.0" | 177.80mm | 780XTZ-7 | 12036 |
| 7 – 8" | 175-200mm | | | | | | | 780XTZ-8 | 12037 |
| 8 – 9" | 200-225mm | .00030" | .007mm | 4-5/8" | 118mm | 9.0" | 228.60mm | 780XTZ-9 | 12038 |
| 9 – 10" | 225-250mm | | | | | | | 780XTZ-10 | 12039 |
| 10 – 11" | 250-275mm | .00035" | .009mm | 4-5/8" | 118mm | 11.0" | 279.40mm | 780XTZ-11 | 12040 |
| 11 – 12" | 275-300mm | | | | | | | 780XTZ-12 | 12041 |

**Accessories for 780XT Electronic Internal Micrometers**

| Description | Part No. | EDP |
|---|---|---|
| Cable Link to PC | PT28318 | 12181 |
| Two 3-volt Batteries, CR2032 | PT99492 | 65650 |

See next page for sets.

### IP PROTECTION

An IP number is composed of two numbers, the first referring to protection against solid objects and the second against liquids.

**First number 6**: Totally protected against dust

**Second number 5**: Protected against low pressure jets of water from all directions - limited ingress permitted



# Electronic Bore Gages

## 780XT Electronic Internal Micrometers with IP65 Protection (with output)

See specifications on previous page

| 780XT Electronic Internal Micrometer Sets, 2-Point Contact (.080-.250" [2-6mm] Range) | | | | | |
|---|---|---|---|---|---|
| Range | | | | | |
| Inch | mm | No. of Heads | No. of Rings | Cat. No. | EDP |
| .080-.250 | 2-6 | | | S780XTBZ | 12043 |
| **780XT Electronic Internal Micrometer Sets, 3-Point Contact (1/4-8" [6-200mm] Range), Fixed anvils** | | | | | |
| 1/4-3/8 | 6-10 | 2 | 1 | S780XTCZ | 12044 |
| 3/8-3/4 | 10-20 | 3 | 2 | S780XTDZ | 12045 |
| 3/4-2 | 20-50 | 3 | 2 | S780XTEZ | 12046 |
| 2-4 | 50-100 | 3 | 2 | S780XTFZ | 12047 |
| 4-6 | 100-150 | 2 | 1 | S780XTKZ | 12049 |
| 4-8 | 100-200 | 4 | 2 | S780XTGZ | 12048 |
| 6-8 | 150-200 | 2 | 1 | S780XTLZ | 12050 |

## Internal Extensions for 78, 780, 781 Internal Micrometers

Extensions from 2-1/2 - 6" can be added to both the 780XT and 78XT, enabling internal measurements in deep hole bores (Multiple extensions can also be used).

| Internal Extensions | | | | | | |
|---|---|---|---|---|---|---|
| Ext. Size | | | Model Size | | | |
| Inch | mm | Fits Models | Inch | mm | Cat. No. | EDP |
| 2.5 | 63 | 78XT/780XT/781XT–312-375 | 1/4-3/8 | 6-10 | 78/782F | 65484 |
| 3 | 75 | 78XT/780XT/781XT–375-500 | 3/8-1/2 | 10-12.5 | 78/782G | 65485 |
| 4 | 100 | 78XT/780XT/781XT–625-750 | 1/2-3/4 | 12.5-20 | 78/782H | 65486 |
| 6 | 150 | 78XT/780XT/781XT–1 thru 2 | 3/4-2 | 20-50 | 78/782J | 65487 |
| 6 | 150 | 78XT/780XT/781XT–2 thru 12 | 2-12 | 50-300 | 78/782K | 65488 |





# Vernier Bore Gages

## 78XT Bore Gages

### .080-12"/1-300MM

The 78XT Bore Gages feature extended travel, reducing the need to exchange anvils. The ground contact points seat the internal micrometer faster and more accurately than the spherical contacts found in other gages. These rugged and accurate internal micrometers are available individually or in economical sets from .080-12" (2-300mm).

| Range Inch | Accuracy Inch | Approximate Measuring Depth Inch | Setting Ring Diameter Inch | Cat. No. | EDP |
|---|---|---|---|---|---|
| **78XT Bore Gages, 2-Point Contact (.080-.250" Range)** | | | | | |
| .080-.100 | .00010 | 3/8 | .100 | 78XTZ-100 | 68124 |
| .100-.120 | | | | 78XTZ-120 | 68125 |
| .120-.160 | .00010 | 15/32 | .160 | 78XTZ-160 | 68126 |
| .160-.200 | .00010 | 3/4 | .160 | 78XTZ-200 | 68127 |
| .200-.250 | | | .200 | 78XTZ-250 | 68128 |
| **78XT Bore Gages, 3-Point Contact (1/4-12" Range)** | | | | | |
| 1/4-5/16 | .00015 | 2-1/4 | .3125 | 78XTZ-312 | 68129 |
| 5/16-3/8 | | | .3125 | 78XTZ-375 | 68130 |
| 3/8-1/2 | | | .500 | 78XTZ-500 | 68131 |
| 1/2-5/8 | .00015 | 2-7/16 | .500 | 78XTZ-625 | 68132 |
| 5/8-3/4 | | | .750 | 78XTZ-750 | 68133 |
| 3/4-1 | .00015 | 2-5/8 | .750 | 78XTZ-1 | 68134 |
| 1-1-3/8 | | | 1.375 | 78XTZ-138 | 67674 |
| 1-3/8-2 | .00015 | 3-1/16 | 1.375 | 78XTZ-2 | 67675 |
| 2-2-5/8 | .00020 | 3-1/16 | 2.625 | 78XTZ-258 | 67676 |
| 2-5/8-3-1/4 | | | | 78XTZ-314 | 67677 |
| 3-1/4-4 | .00020 | 4 | 3.250 | 78XTZ-4 | 67678 |
| 4-5 | .00025 | 4 | 5.0 | 78XTZ-5 | 67679 |
| 5-6 | .00025 | 4-1/2 | 5.0 | 78XTZ-6 | 67680 |
| 6-7 | .00030 | 4-1/2 | 7.0 | 78XTZ-7 | 67681 |
| 7- 8 | | | 7.0 | 78XTZ-8 | 67682 |
| 8-9 | | | 9.0 | 78XTZ-9 | 67857 |
| 9-10 | .00030 | 4-5/8 | 9.0 | 78XTZ-10 | 67858 |
| 10-11 | .00035 | 4-5/8 | 11.0 | 78XTZ-11 | 67859 |
| 11-12 | | | | 78XTZ-12 | 67860 |

| Range | No. of Heads | No. of Rings | Cat. No. | EDP |
|---|---|---|---|---|
| **78XT Sets, 2-Point Contact (.250" Range)** | | | | |
| .120-.250" | 3 | 2 | S78XTBZ | 68152 |
| **78XT Sets, 3-Point Contact (1/4-4" Range)** | | | | |
| 1/4-3/8" | 2 | 1 | S78XTCZ | 68153 |
| 3/8-3/4" | 3 | 2 | S78XTDZ | 68154 |
| 3/4-2" | 3 | 2 | S78XTEZ | 67683 |
| 2-4" | 3 | 2 | S78XTFZ | 67684 |




78XTZ-138 Measuring a bore

### Features

- Wide measurement range without changing anvils
- Resolution from .0001" (0.0025mm) on the 2-point contact toolsup to 1/4" (6mm) and .00025" (0.005mm) on the 3-point contact tools ranging from 1/4"-12" (6mm - 300mm)
- Tungsten carbide measuring faces on all 3-point heads above 1/2" (12.5mm)
- Ratchet stop ensures consistent measurements
- Self-centering contacts for true readings
- Blind bore measuring capability above 1/2" (12.5mm) diameter
- Extensions available up to 6" (150mm) for deep hole measuring
- Setting rings included
- Depth stop/collar also available for .080"-.250" (1-6mm) range
- Each micrometer bore gage is furnished in a case, complete with setting ring, contacts, wrenches, and instructions



# Electronic Bore Gages

## 78MXT Bore Gages

See specifications on previous page

| 78MXT Bore Gages, 2-Point Contact (1-6mm Range) | | | | | |
|---|---|---|---|---|---|
| Range (mm) | Accuracy (mm) | Approximate Measuring Depth (mm) | Setting Ring Dia (mm) | Cat. No. | EDP |
| 1-1.15mm | 0.003mm | 6mm | 1mm | 78MXTZ-1.15 | 68135 |
| 1.15-1.3mm | | 6mm | 1.3mm | 78MXTZ-1.3 | 68136 |
| 1.3-1.5mm | | 6mm | 1.3mm | 78MXTZ-1.5 | 68137 |
| 1.5-1.75mm | | 8mm | 1.75mm | 78MXTZ-1.75 | 68138 |
| 1.75-2mm | | 8mm | 1.75mm | 78MXTZ-2 | 68139 |
| 2-2.5mm | 0.004mm | 9mm | 2.5mm | 78MXTZ-2.5 | 68140 |
| 2.5-3mm | | 9mm | 2.5mm | 78MXTZ-3 | 68141 |
| 3-4mm | | 12mm | 4mm | 78MXTZ-4 | 68142 |
| 4-5mm | | 18mm | 4mm | 78MXTZ-5 | 68143 |
| 5-6mm | | 18mm | 5mm | 78MXTZ-6 | 68144 |
| **78MXT Bore Gages, 3-Point Contact (6-300mm Range)** | | | | | |
| 6-8mm | 0.004mm | 58mm | 8mm | 78MXTZ-8 | 68145 |
| 8-10mm | | 58mm | 8mm | 78MXTZ-10 | 68146 |
| 10-12.5mm | | 58mm | 12.5mm | 78MXTZ-12.5 | 68147 |
| 12.5-16mm | | 62mm | 12.5mm | 78MXTZ-16 | 68148 |
| 16-20mm | | 62mm | 20mm | 78MXTZ-20 | 68149 |
| 20-25mm | | 66mm | 20mm | 78MXTZ-25 | 68150 |
| 25-35mm | | 66mm | 35mm | 78MXTZ-35 | 67861 |
| 35-50mm | | 80mm | 35mm | 78MXTZ-50 | 67862 |
| 50-65mm | 0.005mm | 80mm | 65mm | 78MXTZ-65 | 67863 |
| 65-80mm | | 80mm | 65mm | 78MXTZ-80 | 68650 |
| 80-100mm | | 100mm | 80mm | 78MXTZ-100 | 67864 |
| 100-125mm | 0.006mm | 115mm | 125mm | 78MXTZ-125 | 67865 |
| 125-150mm | | | | 78MXTZ-150 | 67866 |
| 150-175mm | 0.007mm | 115mm | 175mm | 78MXTZ-175 | 67867 |
| 175-200mm | | | | 78MXTZ-200 | 67868 |
| 200-225mm | 0.008mm | 118mm | 225mm | 78MXTZ-225 | 67869 |
| 225-250mm | | | | 78MXTZ-250 | 67870 |
| 250-275mm | 0.009mm | 118mm | 275mm | 78MXTZ-275 | 67871 |
| 275-300mm | | | | 78MXTZ-300 | 67872 |

| 78MXT Sets, 2-Point Contact (2-6mm Range) | | | | |
|---|---|---|---|---|
| Range | No. of Heads | No. of Rings | Cat. No. | EDP |
| 2-3 mm | 2 | 1 | S78MXTAZ | 68155 |
| 3-6 mm | 3 | 2 | S78MXTBZ | 68156 |
| **78XT Sets, 3-Point Contact (6-100mm Range)** | | | | |
| 6-10mm | 2 | 1 | S78MXTCZ | 68157 |
| 10-20mm | 3 | 2 | S78MXTDZ | 68158 |
| 20-50mm | 3 | 2 | S78MXTEZ | 67873 |
| 50-100mm | 3 | 2 | S78MXTFZ | 67874 |




780MXTZ-150 in case




78MXTZ-100

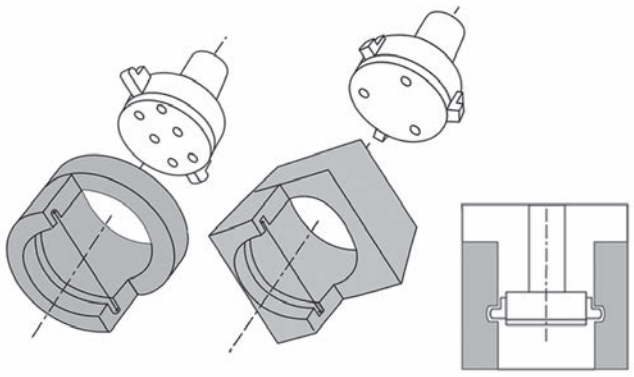
# Bore Gage Heads

## Special Bore Gage Measuring Heads

We offer several configurations of special purpose measuring heads for 780, and 781 Bore Gages, available by special order. Some, but not all, of these will also work with the 78 Bore Gages.

### Groove Measuring Heads

- **Groove.** Available as a 2-point system for ovality measurement.
- Various 2-point anvil forms available with diameters from .080-12" (2-300mm).
- **Grooves.** Available as a 3-point system
- Various 3-point anvil forms available for diameters from .250-12" (6-300mm).



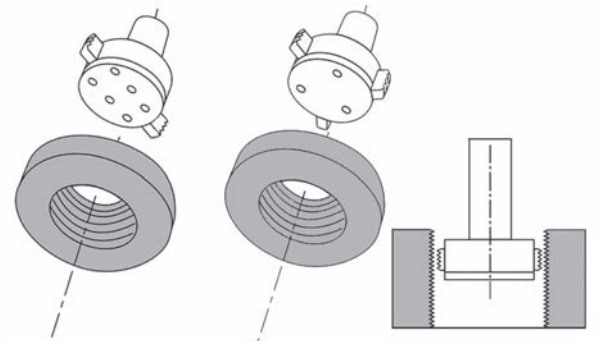



2-point and 3-point heads are available with various anvils to measure specialized internal grooves

### Thread Measuring Heads

Thread Measuring Heads are available as two point system from 8 to 5/16" (M4-8mm) and three point system from 3/8"-12" (9.5-300mm). Most forms available including UNC, UNF, UNJ, UNS, Buttress, Acme, Multi-start, LH and RH.

- **Thread.** Thread forms available as a 3-point system.
- **Internal.** To measure effective (functional) diameter, pitch diameter.
- Available as two point system from 8 to 5/16" (M4-8mm) Available as three point system from 3/8"-12" (9.5-300mm).
- Most forms available including UNC, UNF, UNJ, UNS, Buttress, Acme, Multi-start, LH and RH.

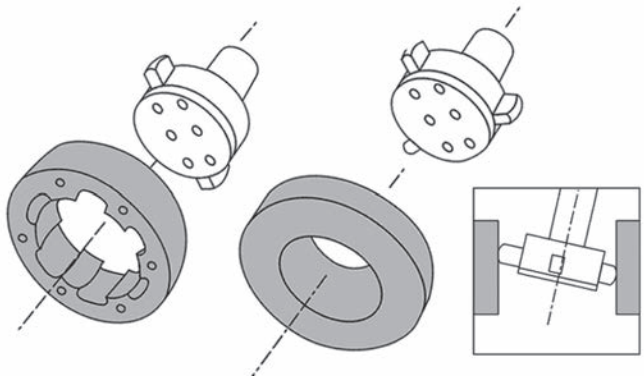





2-point and 3-point heads are available with various anvils to measure specialized internal grooves

### Spherical Radius Measuring Heads

- **Spherical Radius.** Available as 2-point to measure ovality or with 3-point contact.
- Available with diameters from .236-3.93" (6-100mm).
- **3-Point Spherical.** Available in .118-12" (3-300mm) range.
- Gives good repeatability even when somewhat out of line with bore center.






2-point and 3-point spherical radius heads heads are available

# Dial Bore Gages

## 3089 Dial Bore Gages

The 3089 Dial Bore Gages offer precision, a full compliment of features and excellent value.

| 3089 Dial Bore Gages | | | | | | |
|---|---|---|---|---|---|---|
| **Measuring Range** | **Probe Depth** | **Contacts** | **Spacers** | **Extension** | **Cat. No.** | **EDP** |
| 0.7-1.5" | 6" | 10 | 2 | – | 3089Z-131-715J | 12456 |
| 1.4-2.4" | 6" | 6 | 4 | – | 3089Z-131-1424J | 12457 |
| 2-6" | 6" | 11 | 4 | (1x) 2" | 3089Z-131-26J | 12458 |

| 3089 Dial Bore Gage Set | | | |
|---|---|---|---|
| **Range** | **Set Includes** | **Cat. No.** | **EDP** |
| 0.7-6" | 3089Z-131-715J, 3089Z-131-1424J, 3089Z-131-26J | S3089Z-131-6J | 13016 |

### Features

- Ergonomic design with non-slip insulating grip
- Carbide contacts for extended wear
- 2-point contact
- All anvils laser marked for easy selection
- Gage chart for quick and easy anvil selection
- Includes sturdy aluminum case with cutouts for gage and all accessories
- Resolution: .0005"









# Dial Bore Gages

## 82, 82M Dial Bore Gages

### .107-1.565"/2.7-39.75MM

Dial bore gages are available in convenient sets or with individual probes and dial indicators. Each set consists of a dial indicator, a body and actuating rod, two adjusting wrenches and the probes as specified below.

The head may be ordered separately (includes dial indicator, body, and two adjusting wrenches). Individual probes can also be ordered as listed. All probes are furnished with an actuating rod. These gages are also available with electronic indicators by special order.

Measurements are taken by comparison so some type of set master should be used as a reference standard. We recommend setting as close to the hole being measured as possible, and this can be easily done with gage blocks or with a micrometer. We can also furnish master setting rings by request.

- The split-ball contact is self-centering and the two-point contact makes the gage useful for detecting hole geometry problems like taper, bell-mouth and out-of-roundness
- Reads to .0001" and 0.002mm
- Useful for controlling approach to tolerance without removing the workpiece from a machine
- Interchangeable probes are hard chrome plated and polished
- Sets furnished in attractive, protective case.

| A Sets Individual Probes Only for 82 and 82M Bore Gages | | | |
|---|---|---|---|
| Range Inch | mm | Cat. No. | EDP |
| .107-.140 | 2.7-3.55 | 82A2 | 66015 |
| .139-.172 | 3.55-4.35 | 82A3 | 66016 |
| .171-.203 | 4.35-5.15 | 82A4 | 66017 |
| .202-.234 | 5.15-5.95 | 82A5 | 66018 |
| .233-.266 | 5.9-6.76 | 82A6 | 66019 |
| **B Sets Individual Probes Only for 82 and 82M Bore Gages** | | | |
| .217-.281 | 5.5-7.15 | 82B2 | 66020 |
| .279-.344 | 7.1-8.75 | 82B3 | 66021 |
| .342-.405 | 8.7-10.3 | 82B4 | 66022 |
| .403-.469 | 10.25-11.9 | 82B5 | 66023 |
| .467-.532 | 11.9-13.5 | 82B6 | 66024 |
| .530-.594 | 13.5-15.1 | 82B7 | 66025 |
| **C Sets Individual Probes Only for 82 and 82M Bore Gages** | | | |
| .560-.690 | 14.2-17.5 | 82C2 | 66028 |
| .685-.815 | 17.4-20.7 | 82C3 | 66029 |
| .810-.940 | 20.6-23.9 | 82C4 | 66030 |
| .935-1.065 | 23.75-27.05 | 82C5 | 66031 |
| 1.060-1.190 | 26.9-30.2 | 82C6 | 66032 |
| 1.185-1.315 | 30.1- 33.4 | 82C7 | 66033 |
| 1.310-1.440 | 33.3-36.6 | 82C8 | 66034 |
| 1.435-1.565 | 36.5-39.75 | 82C9 | 66035 |

All probes come complete with actuating rod.




| 82 Dial Bore Gages | | | | | | | | |
|---|---|---|---|---|---|---|---|---|
| | | | | | Complete Sets | | Heads | |
| Total Range | No. of Probes | Range Each Probe | Max. Bore Depth | Graduation | Cat. No. | EDP | Cat. No. | EDP |
| .107-.266" | 5 | .107-.140"; .139-.172"; .171-.203"; .202-.234"; .233-.266" | 13/16" | .0001" | 82AZ | 55791 | 82AB1 | 66013 |
| .217-.594" | 6 | .217-.281"; .279-.344"; .342-.405" .403-.469"; .467-.532"; .530-.594" | 1-1/2" 1-3/4" | .0001" | 82BZ | 55792 | 82AB1 | 66013 |
| .560-1.565" | 8 | .560-.690"; .685-.815"; .810-.940" .935-1.065"; 1.060-1.190"; 1.185-1.315"; 1.310-1.440"; 1.435-1.565" | 2-1/2" 5"* | .0001" | 82CZ | 55793 | 82C1 | 66026 |
| **82M Dial Bore Gages** | | | | | | | | |
| 2.7-6.76mm | 5 | 2.7-3.55mm; 3.55-4.35mm; 4.35-5.15mm; 5.15-5.95mm; 5.95-6.76mm | 20.6mm | 0.002 mm | 82MAZ | 66010 | 82MAB1 | 66014 |
| 5.5-15.1mm | 6 | 5.5-7.15mm; 7.1-8.75mm; 8.7-10.3mm 10.25-11.9mm; 11.9-13.5mm; 13.5-15.1mm | 38mm 44mm | 0.002 mm | 82MBZ | 66011 | 82MAB1 | 66014 |
| 14.2-39.75mm | 8 | 14.2-17.5mm; 17.4-20.7mm; 20.6-23.9mm 23.75-27.05mm; 26.9-30.2mm; 30.1-33.4mm; 33.3-36.6mm; 36.5-39.75mm | 63mm 125mm* | 0.002 mm | 82MCZ | 66012 | 82MC1 | 66027 |

* Includes insertion of gage body into bore.

# Dial Bore Gages

## 84A, 84MA Dial Bore Gages

### 1-1/2 – 12-1/8"/38-308MM

These bore gages allow for bore measurements beyond the size range of our 82 Bore Gage.

They are comparison gages and should be set with a master ring gage, gage blocks with parallel jaws, outside micrometers or vernier calipers. Ring gages are available by request, quoted by application. Good practice is to set the gage to zero, as near to the desired dimension as possible.

Gages are well balanced, easy to use and have the following features:

- Can be easily held to inspect bores and hole sizes without removing the workpiece
- An adjustable range screw and two centralizing plungers provide accurate, three-point contact for tool alignment in larger bores
- All contacts and centralized plungers are hardened tool steel for wear and spring-loaded for sensitivity
- The housing and knurled handle are aluminum for light weight and good balance
- Dial indicators have jewel bearings for sensitivity
- Bore depths are also available up to 12" (300mm) in 1" (25mm) increments on special order
- Furnished in finished wood case
- Available with longer reach lengths, carbide contacts or electronic indicators with output capability from our special order division



84AZ-111-5

84MAZ-161-6

| 84A Dial Bore Gages (1-1/2 - 12-1/2" Range) | | | | | | | |
|---|---|---|---|---|---|---|---|
| **Total Range with Extension** | **Ext.** | **Range Each Extension (inches)** | **Max. Bore Depth** | **Plunger Travel** | **Indicator Grad.** | **Cat. No.** | **EDP** |
| 1-1/2-3" | 12 | 1.500-1.625", 1.625-1.750", 1.750-1.875", 1.875-2.000", 2.000-2.125", 2.125-2.250", 2.250-2.375", 2.375-2.500", 2.500-2.625", 2.625-2.750", 2.750-2.875", 2.875-3.000" | 3" | .020" | .0001"<br>.0005" | 84AZ-111-4J<br>84AZ-134-4J | 00026<br>00030 |
| 3-5-1/16" | 11 | 3.000-3.187", 3.187-3.375", 3.375-3.562", 3.562-3.750", 3.750-3.937", 3.937-4.125", 4.150-4.312", 4.312-4.500", 4.500-4.687", 4.687-4.875", 4.875-5.062" | 6" | .030" | .0001"<br>.0005" | 84AZ-111-5J<br>84AZ-134-5J | 00027<br>00031 |
| 5-8" | 4 | 5.000-5.750", 5.750-6.500", 6.500-7.250", 7.250-8.000" | 6" | .030" | .0001"<br>.0005" | 84AZ-111-6J<br>84AZ-134-6J | 00028<br>00032 |
| 8-12-1/2" | 3 | 8.000-9.500", 9.500-11.000", 11.000-12.500" | 7" | .030" | .0001"<br>.0005" | 84AZ-111-7J<br>84AZ-134-7J | 00029<br>00033 |
| **84MA Dial Bore Gages (38.1 - 317.5mm Range)** | | | | | | | |
| **Total Range with Extension** | **Ext.** | **Range Each Extension (mm)** | **Max. Bore Depth** | **Plunger Travel** | **Indicator Grad.** | **Catalog No.** | **EDP** |
| 3.175-76.2mm | 12 | 38.1-41.28mm, 41.28-44.45mm, 44.45-47.62mm, 47.62-50.8mm, 50.8 -53.98mm, 53.98-57.15mm, 57.15-60.32mm, 60.32-63.5mm, 63.5-66.68mm, 66.68-69.85mm, 69.85-73.02mm, 73.02-76.2mm | 75mm | 0.51mm | 0.002 mm<br>0.01 mm | 84MAZ-161-4J<br>84MAZ-181-4J | 00034<br>00038 |
| 76.2-128.58mm | 11 | 76.2-80.96mm, 80.96-85.72mm, 85.72-90.49mm, 90.49-95.25mm, 95.25-100.01mm, 100.01-104.78mm, 104.78-109.54mm, 109.54-114.3mm, 114.3-119.06mm, 119.06-123.82mm, 123.82-128.58mm | 150mm | 0.76mm | 0.002 mm<br>0.01 mm | 84MAZ-161-5J<br>84MAZ-181-5J | 00035<br>00039 |
| 127-203.2mm | 4 | 127-146.05mm, 146.05-165.1mm, 165.1-184.15mm, 184.15-203.2mm | 150mm | 0.76mm | 0.002 mm<br>0.01 mm | 84MAZ-161-6J<br>84MAZ-181-6J | 00036<br>00040 |
| 203.2-317.5mm | 3 | 203.2 - 241.3mm, 241.3 - 279.4mm, 279.4 - 317.5mm | 175mm | 0.76mm | 0.002 mm<br>0.01 mm | 84MAZ-161-7J<br>84MAZ-181-7J | 00037<br>00041 |

# Bore Gage Systems

NEW!



## AccuPlug™ Bore Gages

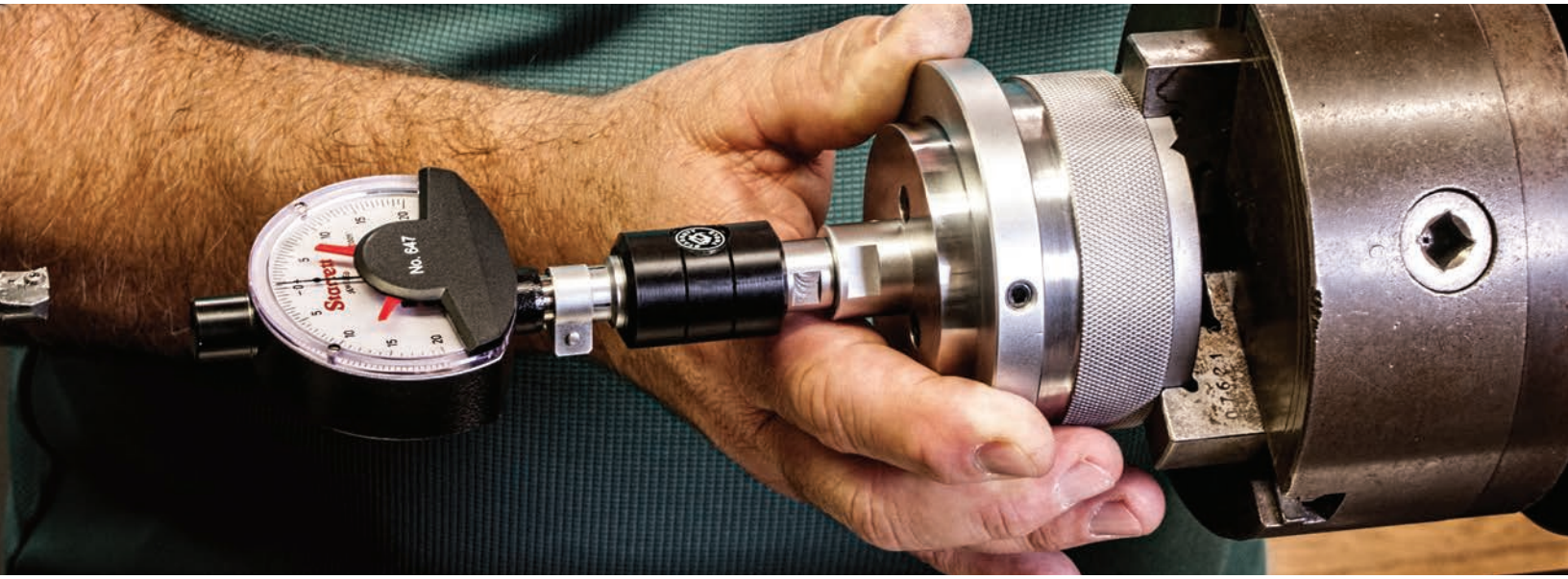
The AccuPlug consists of interchangeable indicators, handles, plugs, extensions and depth stops for a custom bore gage built specifically for your application needs.

The robust, easy to use AccuPlug range is designed to give the operator greater speed of use, unmatched measuring accuracy and superb repeatability, especially in harsh shop-floor environments. Advanced hand held ergonomics allied to an ingenious mechanical/electronic system render AccuPlug the easiest to operate Starrett bore gaging system to date. The flexible nature of the AccuPlug range means that they can be supplied fitted with easy to read electronic indicators (ideal for automatic data collection) or conventional analogue indicators.




### Features

- Ranges from 0.2362 - 11.0236" (6 - 280mm)
- Tough, robust construction
- Easy-to-use
- High accuracy dedicated plug-gages
- Flexible, modular
- Hand-held measurement
- Cost-effective
- High visibility display
- Protective indicator shroud (with some indicators)
- All setting rings supplied as standard with UKAS calibration certificates
- Repeatability: ≤1µm
- Setting by means of a setting ring
- Quick and reliable measurement
- 2 - point measurement as standard
- Blind bore available
- Depth-stops available
- Extensions available for deeper bores
- Guide chamfer for easy entry into bore
- High durability, long-life plugs and contacts
- Easy to clean
- Plug body coatings: Hard-chrome (standard), T.i.N, Plain steel
- Measuring contacts: Tungsten carbide (standard), hard-chrome, ruby, ceramic



# Bore Gage Systems

## AccuPlug™ Bore Gages







| AccuPlug | | | |
|---|---|---|---|
| **Regular Bore*** | | | |
| **in** | **mm** | **Thread** | **Cat. No.** |
| 0.2362-0.7874 | 6-20 | M6 x 0.75 | 802P-001 |
| 0.5906-0.9843 | 15-25 | M10 x 1 | 802P-002 |
| 0.9843-1.3780 | 25-35 | M10 x 1 | 802P-003 |
| 1.3780-1.7717 | 35-45 | M10 x 1 | 802P-004 |
| 1.7717-2.3622 | 45-60 | M10 x 1 | 802P-005 |
| 2.3622-3.1496 | 60-80 | M10 x 1 | 802P-006 |
| 3.1496-3.9370 | 80-100 | M10 x 1 | 802P-007 |
| 3.9370-4.9213 | 100-125 | M10 x 1 | 802P-008 |
| 4.9213-5.9055 | 125-150 | M10 x 1 | 802P-009 |
| 5.9055-6.8898 | 150-175 | M10 x 1 | 802P-010 |
| 6.8898-7.8740 | 175-200 | M10 x 1 | 802P-011 |
| 7.8740-8.8583 | 200-225 | M10 x 1 | 802P-012 |
| 8.8583-9.8425 | 225-250 | M10 x 1 | 802P-013 |
| 9.8425-11.0236 | 250-280 | M10 x 1 | 802P-014 |
| **Blind Bore*** | | | |
| **in** | **mm** | **Thread** | **Cat. No.** |
| 0.2362-0.7874 | 6-20 | M6 x 0.75 | 802BB-001 |
| 0.5906-0.9843 | 15-25 | M10 x 1 | 802BB-002 |
| 0.9843-1.3780 | 25-35 | M10 x 1 | 802BB-003 |
| 1.3780-1.7717 | 35-45 | M10 x 1 | 802BB-004 |
| 1.7717-2.3622 | 45-60 | M10 x 1 | 802BB-005 |
| 2.3622-3.1496 | 60-80 | M10 x 1 | 802BB-006 |
| 3.1496-3.9370 | 80-100 | M10 x 1 | 802BB-007 |
| 3.9370-4.9213 | 100-125 | M10 x 1 | 802BB-008 |
| 4.9213-5.9055 | 125-150 | M10 x 1 | 802BB-009 |

*See Technical Specifications for plug ranges.

| Indicators | | |
|---|---|---|
| **Description** | **Cat No.** | **EDP** |
| 0.00005"/.001mm Electronic Indicator, Full Function, 3/8" Stem | 2900-4 | 09983 |
| 0.001mm Electronic Indicator, Full Functions, 8mm Stem | 2900-4M | 09988 |
| 0.00005"/.001mm Electronic Indicator, Full Function with TIR Runout and Hold Function, 3/8" Stem, Analog Digital Display | F2720AD | 49500 |
| 0.00005"/.001mm Electronic Indicator, Full Function with TIR Runout and Hold Function, 8mm Stem, Analog Digital Display | F2720ADM | 49504 |
| 0.00005" Mechanical Indicator with 3/8" Stem | 647 | 00001 |
| 0.001mm Mechanical Indicator with 8mm Stem | 647M | 00002 |
| **Mini Electronic Indicator** | **M 10 Thread** | **M 6 Thread** |
| With Shroud and M10 Holder Short 8mm Stem | 802H10MI-001 | 802H6MI-001 |
| With Shroud and M10 Holder Long 8mm Stem | 802H10MI-002 | 802H6MI-002 |







**Setting Rings**

| Diameter Range | | |
|---|---|---|
| in | mm | Cat. No. |
| 0.2362-0.3937 | 6-10 | 802RX-001 |
| 0.3937-0.7874 | 10-20 | 802RX-002 |
| 0.7874-0.9843 | 20-25 | 802RX-003 |
| 0.9843-1.1811 | 25-30 | 802RX-004 |
| 1.1811-1.5748 | 30-40 | 802RX-005 |
| 1.5748-1.9685 | 40-50 | 802RX-006 |
| 1.9685-2.3622 | 50-60 | 802RX-007 |
| 2.3622-2.7559 | 60-70 | 802RX-008 |
| 2.7559-3.1496 | 70-80 | 802RX-009 |
| 3.1496-3.5433 | 80-90 | 802RX-010 |
| 3.5433-3.9370 | 90-100 | 802RX-011 |
| 3.9370-4.5276 | 100-115 | 802RX-012 |
| 4.5276-5.1181 | 115-130 | 802RX-013 |
| 5.1181-5.7087 | 130-145 | 802RX-014 |
| 5.7087-6.2992 | 145-160 | 802RX-015 |
| 6.2992-6.6929 | 160-170 | 802RX-016 |
| 6.6929-7.0866 | 170-180 | 802RX-017 |
| 7.0866-7.4803 | 180-190 | 802RX-018 |
| 7.4803-7.8740 | 190-200 | 802RX-019 |
| 7.8740-8.2677 | 200-210 | 802RX-020 |
| 8.2677-8.6614 | 210-220 | 802RX-021 |
| 8.6614-9.0551 | 220-230 | 802RX-022 |
| 9.0551-9.4488 | 230-240 | 802RX-023 |
| 9.4488-9.8425 | 240-250 | 802RX-024 |
| 9.8425-10.2362 | 250-260 | 802RX-025 |
| 10.2362-10.6299 | 260-270 | 802RX-026 |
| 10.6299-11.0236 | 270-280 | 802RX-027 |

**Depth Stop**

| Diameter Range | | |
|---|---|---|
| in | mm | Cat. No. |
| 2.3622-0.3347 | 6-8.5 | 802DS-001 |
| 0.3347-0.5118 | 8.5-13 | 802DS-002 |
| 0.5118-0.6890 | 13-17.5 | 802DS-003 |
| 0.6890-0.9843 | 17.5-25 | 802DS-004 |
| 0.9843-1.2795 | 25-32.5 | 802DS-005 |
| 1.2795-1.5748 | 32.5-40 | 802DS-006 |
| 1.5748-1.8701 | 40-47.5 | 802DS-007 |
| 1.8701-2.1654 | 47.5-55 | 802DS-008 |
| 2.1654-2.4606 | 55-62.5 | 802DS-009 |
| 2.4606-2.7559 | 62.5-70 | 802DS-010 |
| 2.7559-3.0512 | 70-77.5 | 802DS-011 |
| 3.0512-3.3465 | 77.5-85 | 802DS-012 |
| 3.3465-3.6417 | 85-92.5 | 802DS-013 |
| 3.6417-3.9370 | 92.5-100 | 802DS-014 |



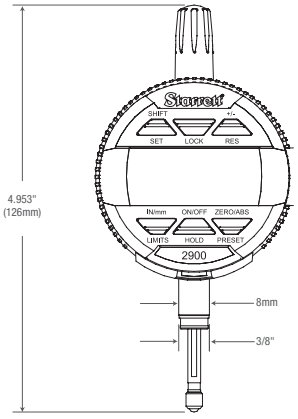
**Accessories**

| M 6 Thread | | M 10 Thread | |
|---|---|---|---|
| Description | Cat No. | Description | Cat No. |
| M6 Holder Short 3/8" Stem | 802H6-001 | M10 Holder Short 3/8" Stem | 802H10-001 |
| M6 Holder Long 3/8" Stem | 802H6-002 | M10 Holder Long 3/8" Stem | 802H10-002 |
| M6 Holder Short 8mm Stem | 802H6-003 | M10 Holder Short 8mm Stem | 802H10-003 |
| M6 Holder Long 8mm Stem | 802H6-004 | M10 Holder Long 8mm Stem | 802H10-004 |
| M6 100mm Extension | 802E6-001 | M10 100mm Extension | 802E10-001 |

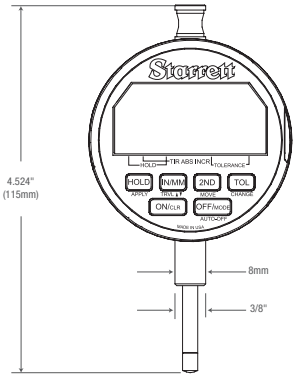
# Bore Gage Systems

## AccuPlug™ Bore Gaging Technical Specifications

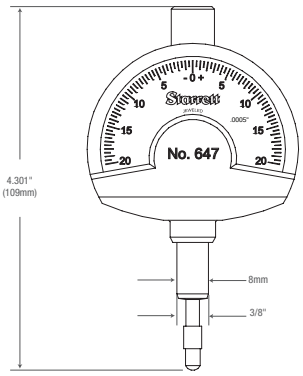
### Indicator Units 8mm and 3/8"




2900-4 and 2900-4M

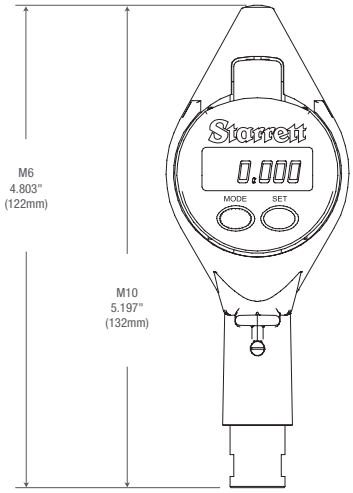



F2720AD and F2720ADM



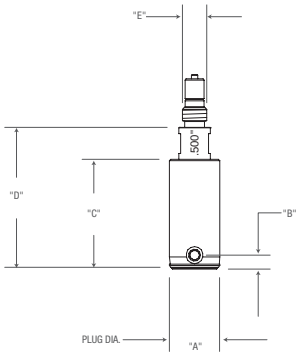

647 and 647M

### Mini Indicator Units

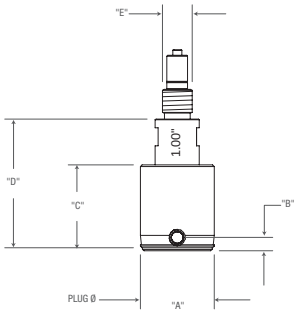



Mini Indicator with Shroud,
Short Handle, M6 and M10

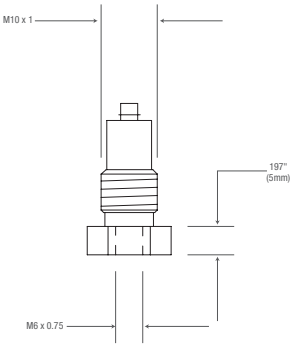
### ACCUPLUGS



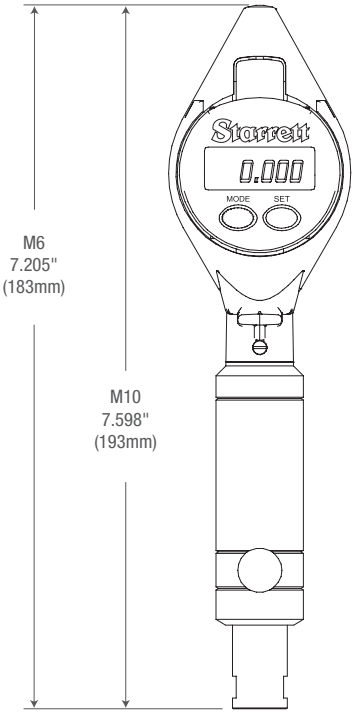

M6 AccuPlug




M10 AccuPlug

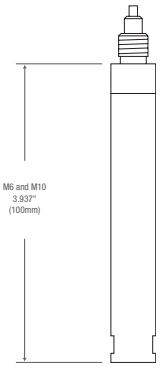



M6 to M10 Adapter

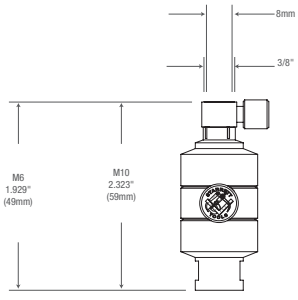



Mini Indicator wtih Shroud,
Long Handle, M6 and M10

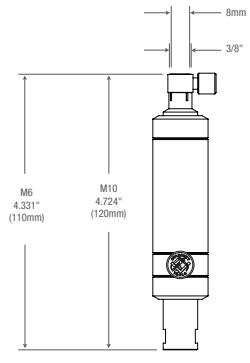
### ACCessories




100mm Extension
M6 and M10




Short Holder M6 and M10
with 8mm or 3/8" Stem




Long Holder M6 and M10
with 8mm or 3/8" Stem

**AccuPlug Dimension Specifications**

| Plug Diameter "A" | | Range | | "B" | | "C" | | "D" | | "E" |
|---|---|---|---|---|---|---|---|---|---|---|
| in | mm | in | mm | in | mm | in | mm | in | mm | |
| 0.2362-0.7874 | 6-20 | .006 | 0.15 | .138 | 3.5 | 1.063 | 27 | 1.378 | 35 | M6 x 0.75 |
| 0.5906-1.7717 | 15-45 | .008 | 0.20 | .177 | 4.5 | 1.102 | 28 | 1.713 | 43.5 | M10 x 1 |
| 1.7717- 2.756 | 45-70 | .008 | 0.20 | .217 | 5.5 | 1.102 | 28 | 1.732 | 44 | M10 x 1 |
| 2.756-11.0236 | 70-280 | .008 | 0.20 | .217" | 5.5 | 1.378 | 35 | 1.732 | 44 | M10 x 1 |




# TOOL SETS

# Basic Electronic Tool Sets

## S766A

### WITHOUT OUTPUT

Basic starter sets for electronic measuring include slide calipers and 1"/25mm micrometers. Two sets without output are offered: S766AZ for English units and S766MAZ for metric. Both sets include an attractive, protective case.



S766AZ



S766BZ

## S766B

### WITH OUTPUT AND IP PROTECTION

Basic starter sets for electronic measuring with output capability for SPC, and IP protection against dirt, dust, water and coolant.

They include the 798B-6/150 Slide Calipers with IP65 protection and output, and the 795XFL-1 or 795MEXFL-25 1"/25mm micrometers with IP67 protection and output.

Two sets are offered – sets S766BZ and S766MBZ. Both sets include an attractive, protective case.

| S766AZ/EDP 12206 - Inch Set (without output) | |
|---|---|
| **Cat. No.** | **Description** |
| 799A-6/150 | 0-6" (0-150mm) electronic slide caliper |
| 3732XFL-1 | 0-1" (0-25mm) electronic outside micrometer |
| **S766MAZ/EDP 12207 - Millimeter Set (without output)** | |
| **Cat. No.** | **Description** |
| 799A-6/150 | 0-6" (0-150mm) Electronic Slide Caliper |
| 3732MEXFL-25 | 0-1" (0-25mm) Electronic Outside Micrometer |
| **S766BZ/EDP 11606 - Inch Set (with output)** | |
| **Cat. No.** | **Description** |
| 798B-6/150 | 0-6" (0-150mm) Electronic Slide Caliper with output |
| 795XFL-1 | 0-1" (0-25mm) Electronic Outside Micrometer with output |
| **S766MBZ/EDP 11607 - Millimeter Set (with output)** | |
| **Cat. No.** | **Description** |
| 798B-6/150 | 0-6" (0-150mm) Electronic Slide Caliper with output |
| 795MEXFL-25 | 0-1" (0-25mm) Electronic Outside Micrometer with output |

# Tool Sets

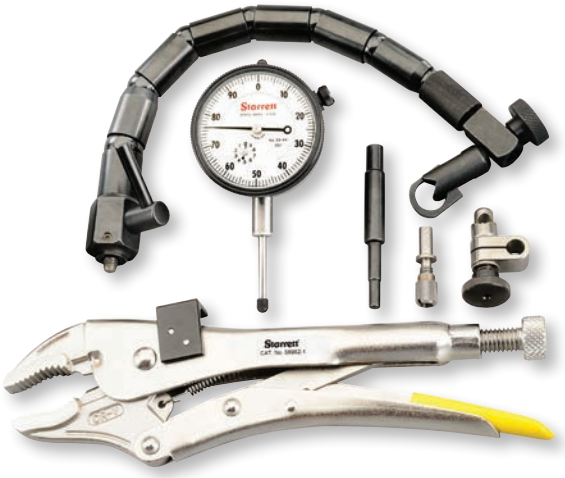
## S909, S909M Basic Precision Measuring Tool Sets

Sets contain three of the most commonly used precision tools. Furnished in attractive, protective cases.



S909Z

| S909Z/EDP 65122 - Inch Set | |
|---|---|
| **Cat. No.** | **Description** |
| T436.1XRL-1 | 1" (25mm) Outside Micrometer with Carbide Faces |
| 120A-6 | 6" (150mm) Dial Caliper |
| C604R-6 | 6" Spring Tempered Precision Rule |
| **S909MZ/EDP 65668 - Millimeter Set** | |
| **Cat. No.** | **Description** |
| V436.1MXRL-25 | 1" (25mm) Outside Micrometer with Carbide Faces |
| 120M-150 | 6" (150mm) Dial Caliper |
| C635E-150 | 6" Spring Tempered Precision Rule |



## S898Z Automotive Inspection Sets

Starrett has developed two kits that combine highly flexible configuration with several options to secure a measuring fixture to whatever surface is available to do the job. These kits will prove themselves to be invaluable to auto mechanics, providing an answer to the question: "How am I going to do that?".

### Features

- Allows very precise measurement for automotive repair
- Used to set proper distance or alignment
- Enables measuring fixture to be secured to any available surface
- Highly flexible configuration

| S898Z Inspection Kits | | |
|---|---|---|
| **Cat. No.** | **EDP** | **Description** |
| S898Z-1 | 12438 | Inspection kit with indicator, pliers, Flex-O-Post and form-fit plastic case |
| S898Z-2 | 12437 | Inspection kit with indicator, pliers, Flex-O-Post, magnetic base and form-fit plastic case |



# Tool Boxes

## 300W Wooden Tool Box

Classic style chest constructed from red oak and veneered plywood with strong, durable tongue and groove joinery.

### Features and Specifications

- Green felt lined
- Polished chrome plated hardware
- Oak and veneered plywood construction with lacquer finish
- 10 drawers



## 200W Wooden Tool Chest

The 200W Wooden Tool Box is beautiful, meticulously crafted, and adds a touch of class to any shop – at work or home. Most toolmakers, machinists and other craftsmen have a substantial investment in their tools, carefully maintaining them, and taking great pride in ownership. This high quality, great looking tool box provides exactly the right storage for your valuable tools. At Starrett, we know as much as anyone about the quality, workmanship and pride that goes into a great tool. We are proud to offer this high quality wooden toolbox – the perfect match for products made by "The Worlds' Greatest Toolmakers."

### Features and Specifications

- Solid poplar construction
- Two drawers with zinc plated, commercial grade slides
- Keyed locks on drawers and lid for secure tool storage
- Green felt lined
- Brass hardware
- Starrett logo laser engraved on the lid
- Made in the USA



**300W Wooden Toolbox**

| Cat. No. | EDP | Dimensions Length x Width x Depth | Description |
|---|---|---|---|
| 300W | 20938 | 20" x 10" x 13.5" | Toolbox Only, Furnished without Tools |

**200W Wooden Toolbox**

| Cat. No. | EDP | Dimensions Length x Width x Depth | Description |
|---|---|---|---|
| 200W | 55208 | 19" x 14.5" x 12.5" | Toolbox Only, Furnished without Tools |





# DATA COLLECTION SYSTEMS

# DataSure® WIRELESS DATA COLLECTION

## 100% DATA COLLECTION: ERROR-FREE AND FAST

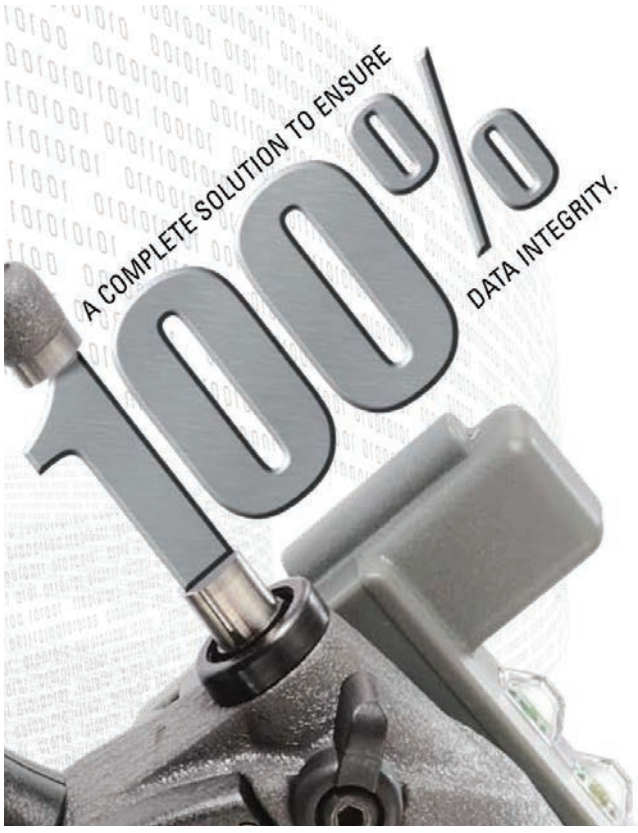
The DataSure Wireless Data Collection System allows real-time, 100% error-free data collection. From simple installations to systems covering thousands of square feet, data can be collected and analyzed much faster than with manual inspection and data entry.

With manual inspection data collection, the repetitive hand movements required to pick up tools, measure parts, put tools down, and then record results is time consuming. Furthermore, hand writing or keying in data leads to mistakes that result in scrap, excess inventory, and even rejected parts.

With DataSure, just measure and send for fast and error-free data.

DataSure also eliminates problems associated with data cables including placement, installation, safety and high cost. DataSure makes it easy to bring a precision measuring tool to the work, rather bringing the work to the tool.

DataSure is a full shop wireless solution. It works not only with Starrett tools, but also Mitutoyo, Sylvac, CDI Tools, Mahr, Tesa and other brands.




## DataSure Facts

DataSure wireless data collection systems consist of three primary components:

- Miniature radios (End Nodes) attached to the data output port of an electronic tool
- A Gateway that connects to a PC
- Routers to extend the system's range and make the network more robust

## A Comprehensive, Robust Solution

- Works in almost any environment
- Maintains data integrity in electrically noisy shops
- Data receipt confirmation signal
- DataSure stores several readings
- DataSure adapts to all major electronic measuring tools
- "IT" friendly and easily installs on a standard PC

A wide variety of End Nodes are available, allowing DataSure to interface with electronic measuring tools from virtually all major manufacturers



# DataSure® WIRELESS DATA COLLECTION



## DataSure Technical Overview

- DataSure users receive confirmation at the tool, indicating successful or unsuccessful data transmission
- End Node radios can store up to 10 readings in the event that the main system is down or busy
- The DataSure radio system works with Starrett, Mahr, Mitutoyo, Sylvac, CDI tools, and many other gages with output
- One DataSure Gateway can handle up to 100 tools, with 25 to 40 tools in a typical installation
- Each radio's range is approximately 65 feet (20 meters). Adding Routers can increase range in 100 foot increments.
- The DataSure system features a license-free 916MHz ISM band radio and a self-configuring and self-healing network
- Data acquisition from tools can be initiated by operator or host control
- Network, tool and end node battery status are all automatically monitored and recorded on screen and stored in the system's database
- The multi-mode function allows one tool to be connected to a Gateway for simple installations, or up to 20 multiplexers and 100 tools for complex shop environments
- Rechargeable routers are ideal for mobile applications and large-component data collection environments such as aircraft assembly hangars, large casting foundries, and auto body stamping facilities
- Easy-to-use included software offers user configurable names for tools and groups
- DataSure's flexibility means it can output data directly to the main application screen, your SPC software, a local or networked database, and CSV file format
- IP67 rating
- Remote client access from another PC on your LAN

## IP PROTECTION

An IP number is composed of two numbers, the first referring to protection against solid objects and the second against liquids.

**First number 6**: Totally protected against dust

**Second number 7**: Protection against submersion in water under standardized conditions of pressure for 30 minutes




## DataSure Hardware

DataSure starts with superior engineering, state-of-the-art technology and rugged durability. End Nodes, Routers and Gateways are built to perform reliably in almost any environment. Sturdy construction and heavy duty materials help them withstand the rigors of everyday use under demanding conditions.

Try out the DataSure Cost Calculator, and find application profiles, white papers, FAQ's and more at **STARRETT.COM/DATASURE**





# DataSure® WIRELESS DATA COLLECTION

## End Node

The DataSure End Node plugs directly into digital tools. It sends measurement data and verifies receipt at the Gateway with a green light. The smaller 2nd Generation End Node has IP67 dust and water protection.

## Router

Each DataSure Router extends the system's range in increments of 100 feet (30 meters). They ensure system robustness by providing alternate signal paths in noisy environments.

## Gateway

The DataSure Gateway is the central point for data collection and tool management and plugs directly into a PC through a USB port.

### End Node Features

- User feedback LEDs
- On-tool data storage
- Adapts to most tools
- IP67 protection
- Power: CR2450 lithium
- **Range:** 65 ft. (20m)
- **Size:** 2.2" x 2.0" x 0.49" (55.3mm x 43.2mm x 17.8mm)

### Router Features

- Range extender
- Transmits around interference
- Wall mount or mobile
- **Power:** AC, NiMH
- **Range:** 100 ft. (30m)
- **Size:** 7.0" x 5.5" x 2.5" (178mm x 140mm x 63.5mm)

### Gateway Features

- USB
- Sends data to application or database
- Multi-file export features
- Unique system ID
- **Power:** USB
- **Range:** 100 ft.. (30m)
- **Size:** 7.0" x 5.5" x 2.5" (178mm x 140mm x 63.5mm)










## Single Piece RS232 Cable and Adaptor

Single-piece cable with adaptor allows attachment to an RS232 9-pin port.

| Direct PC Connection Cables | | |
|---|---|---|
| **Part No.** | **EDP** | **For Use with Starrett Tool Numbers** |
| PT61963 | 66636 | 714, 760, 786, 733, 762, 788, 749, 764, 790, 751, 769, 2600-1, 753, 773, 2600-4, 756, 777, 2600-8, 3752 |
| PT62425 | 67658 | 2000, 2001 |
| PT62606 | 68822 | 797B, 5000, 5001, 5002, 5003, 5004, 5005, 5006, 781 |
| PT26441 | 65893 | 2700 USB Connection |



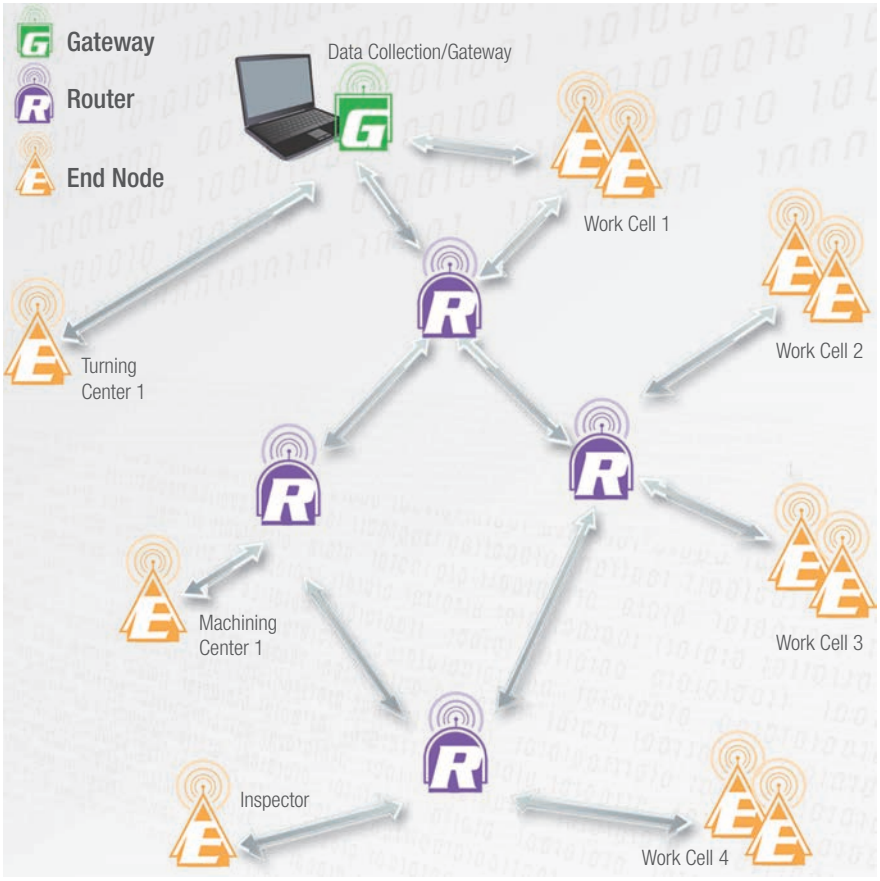
# DataSure® WIRELESS DATA COLLECTION



## A DataSure Shop-floor

The illustration (right) demonstrates how a large, multi-workstation shop might be networked with DataSure.

Tools at various locations collect data. The End Nodes send data to the nearest Router, and then to the Gateway, or directly to the Gateway if that is the best path. The Gateway sends a signal back through the same path to the End Node to confirm receipt of the data.









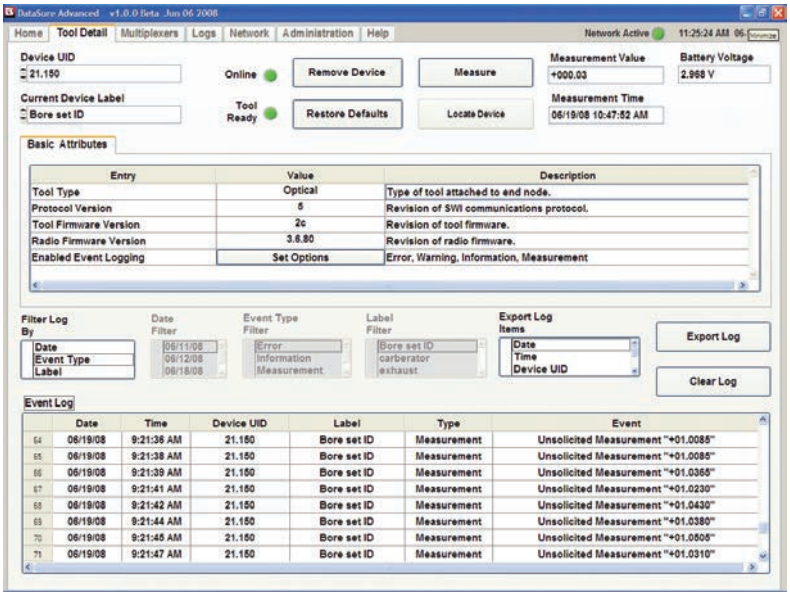



# DataSure® WIRELESS DATA COLLECTION

## DataSure Software

**DataSure Advanced 2nd Generation Wireless Data Collection Manager** software connects and manages your tools, network, data and third party SPC applications.

- Monitors your wireless network, tools, system status, end node battery voltages and tools measurements all from one screen
- Measurements can be initiated and viewed directly from the home page
- Data can be exported in CSV format
- Data is stored on a local or network database with programmable, scheduled backup
- Remote personnel can configure tools, export data and monitor activity via intranet with no additional software
- Virtual multiplexers allow data to be directed from specific tools to multiple software applications
- Each radio end node can be personalized with a descriptive name
- Drag and Drop tools on multiplexers
- Fast and easy label changes for tools
- Fast response for measurement
- System OS Requirements: Windows® 2000, XP Home and Pro with SP2, SP3, Vista SP1, Vista SP2, Windows® 7 32 bit, Windows® 7 64 bit
- Data can also connect directly to your SPC application via com port or DDE (Dynamic Data Exchange) link




Above: DataSure Advanced Wireless Data Collection Manager Software provides a powerful, intuitive interface and works well with many popular SPC applications.



# DataSure®

WIRELESS DATA COLLECTION



## Adding DataSure to Your Facility

To add DataSure to your facility, simply contact us or use our online system calculator. We will work with you to specify a system for your application.

We will add new End Nodes and Output Connectors to those listed below as needed. Please call to discuss your requirements.

Note that new End Nodes or Routers for a current system must be made to match the Group Number of your existing components.

## 719 Software Wedge™

**EDP 66490**

This configurable serial I/O software allows you to input real-time data from Starrett gages and data collectors directly into spreadsheets and databases.




**DataSure Gateway, Router, End Nodes, Connectors & Accessories**

| Cat. No. | EDP | Description |
|---|---|---|
| 1500-1-UN | 12051 | Gateway, USB, 917MHz |
| 1500-2-N | 12059 | Router, 916MHz, 120/240 VAC |
| 1500-3A-1N | 12530 | End Node, Starrett Opto |
| 1500-3A-2N | 12531 | End Node, Starrett IP67 Micrometer |
| 1500-3A-3N | 12532 | End Node, Starrett 3rd Gen. |
| 1500-3A-4N | 12533 | End Node, Starrett 2700 Indicators |
| 1500-3A-5N | 12534 | End Node, Starrett Cat. No. 2000 |
| 1500-3A-6N | 12535 | End Node, Mitutoyo 6-Pin |
| 1500-3A-7N | 12536 | End Node, Mitutoyo w/o absolute encoder |
| 1500-3A-8N | 12537 | End Node, RS232, Jumpered Port Pins |
| 1500-3A-9N | 12538 | End Node, Mitutoyo IP66 Micrometer |
| 1500-3A-10N | 12539 | End Node, Mitutoyo IP65 Micrometer |
| 1500-3A-11N | 12540 | End Node, Marposs E4N |
| 1500-3A-12N | 12541 | End Node, Universal 10-pin connector |
| 1500-3A-13N | 12542 | End Node, Absolute Digimatic Indicator |
| 1500-3A-14N | 12543 | End Node, Mahr-Federal with µMaxum and XL |
| 1500-3A-15N | 12544 | End Node, Opto/Duplex |
| 1500-3A-16N | 12545 | End Node, Mahr-Federal EX |
| 1500-3A-18N | 12565 | End Node, Starrett 798 Calipers |
| 1500-3A-20N | 69854 | End Node, TESA Microhite |
| 1500-3A-21N | 00046 | End Node, Starrett 2900 |
| PT62785-0 | 12188 | Mushroom head fastener kit to attach end nodes to tool (Two pair included with each end node) |
| PT62742 | 62024 | Gateway or Router Mounting Bracket |
| PT63297-1N | 12546 | Replacement Output Connector, Starrett Opto |
| PT63298-2N | 12547 | Replacement Output Connector, Starrett IP67 Mic |
| PT63299-3N | 12548 | Replacement Output Connector, Starrett 3rd Gen. |
| PT63300-4N | 12549 | Replacement Output Connector, Starrett 2700 Ind |
| PT63301-5N | 12550 | Replacement Output Connector, Starrett 2000/2001/3752 |
| PT63302-6N | 12551 | Replacement Output Connector, Mitutoyo 6-Pin |
| PT63303-7N | 12552 | Replacement Output Connector, Mitutoyo W/O Absolute |
| PT63304-8N | 12553 | Replacement Output Connector, RS-232 |
| PT63305-9N | 12554 | Replacement Output Connector, Mitutoyo IP66 Mic |
| PT63306-10N | 12555 | Replacement Output Connector, Mitutoyo IP65 Mic |
| PT63307-11N | 12556 | Replacement Output Connector, Digimatic W/D-Sub 9 Pin |
| PT63308-12N | 12557 | Replacement Output Connector, Universal Mitutoyo 10 Pin |
| PT63309-13N | 12558 | Replacement Output Connector, Absolute Digimatic |
| PT63310-14N | 12559 | Replacement Output Connector, Mahr Federal Umaxum Indicator |
| PT63311-15N | 12560 | Replacement Output Connector, Opto/Duplex |
| PT63312-16N | 12561 | Replacement Output Connector, Mahr Federal Ex |
| PT63389-18N | 12562 | Replacement Output Connector, Starrett 798 Calipers |

# DataSure® WIRELESS DATA COLLECTION

## A DataSure Throughput and Accuracy Study

In a controlled, 100% inspection test to measure the impact of DataSure on throughput and quality assurance, we made three measurements per part and recorded the data on 500 parts.

Methods 1 and 2 involve time-consuming hand movements to pickup and put down the tool in order to record data. Measurement with DataSure is fast and direct. The slowest method (#1) required 29 second per part with many errors. With DataSure the same task was nearly 5 times faster – with no errors.

### Method 1: Measure, Handwrite Results, Remote Data Entry

- 37 time/motion elements, 28.9 sec./part
- 62 entry errors

Factors affecting accuracy and throughput:

- Measurement must stop to handwrite results.
- Illegible handwritten numbers, mistakes noted but not corrected, data written in shorthand and inspector's handwriting misread by the transcriber
- Value can change when the inspector releases the caliper
- Data entry errors at the PC

### Method 2: Measure and Enter Results to PC

- 20 time/motion elements: 15.3 sec./part
- 4 data entry errors

Factors affecting accuracy and throughput:

- Alternating measuring and data entry caused errors
- Caliper not seated correctly when released to key-in data
- Missed data entry, incorrect keystrokes, entry to wrong cell

### Method 3: Measure and Enter Results Directly with DataSure

- 17 time/motion elements: 6.6 sec./part
- 0 entry errors

Factors affecting accuracy and throughput:

- Measurement technique is maintained
- No interpretation or memory errors
- Immediate, direct data entry eliminates errors







# Gage Multiplexers

## 7612 and 7613 4-Port GageMux USB

**FAST, SIMPLE AND FLEXIBLE**

Starrett 4-port gage multiplexers make it fast and easy to connect multiple gages to a PC. Interface is through USB and USB keyboard outputs, as well RS232 ports.

With the 7612 GageMux, no software wedge or other intermediary software is required. The PC "sees" the connection from the 7612 as a keyboard. Simply, open any document on your computer that accepts input, position your cursor, then send the data from the tool. That data will be input at the cursor location.

The 7613 GageMux USB 4-port gage is similar to the 7612 except that it does not have the keyboard function. It requires the Starrett 719 Software Wedge or a similar product to input data into the PC.

From manufacturing methods and materials to a built-in, power-saving mode, the GageMux was designed to be an environmentally friendly product.

### Features and Specifications

- 4 input ports
- Simple set-up, your PC automatically installs USB driver when GageMux is plugged into PC's USB port – does not require software configuration
- Supports USB 2.0, RS232 and keyboard output
- Operating modes: Static (Normal) mode operation or Dynamic (MIN/MAX/TIR)
- Footswitch input, LED status light on each input, host command operation and set up

| 7612 and 7613 GageMux, Cables and Accessories | | |
|---|---|---|
| **Cat. No.** | **EDP** | **Description** |
| 7612 | 69886 | GageMux 4 port, USB, RS232 and keyboard output; Includes USB cable and 110V AC power supply |
| 7613 | 69885 | GageMux 4 port, USB and RS232 includes USB cable and 110V AC power supply |
| **7612 and 7613 GageMux Cables** | | |
| 795SCM | 69892 | Connect 795 Micrometer |
| 733SCM | 69893 | Connect 733 Micrometer and 2600 Indicator |
| 798SCM | 69894 | Connect 798 Caliper |
| 797SCM | 69895 | Connect 797 Caliper |
| 2700SCM | 69896 | Connect 2700 Indicators |
| 2900SCM | 68751 | Connect 2900 Indicators |
| **7612 and 7613 GageMux Accessories** | | |
| 7612FTS | 69905 | Industrial Foot Switch with 6' cable |
| 7612PS | 69899 | 220/50 External Power Supply |
| 719 | 66490 | Software Wedge allows direct input to PC (7613 only) |




## 719 Software Wedge™ (for 7613 only)

This configurable serial I/O software allows real-time data input from Starrett gages through the 7613 GageMux directly into spreadsheets and databases.



# SmartCables™

## SmartCables

### EASY TOOL-TO-PC CONNECTION AND DATA TRANSFER

SmartCable makes it fast and easy to connect a measuring tool to a PC. The interface provides the ability to connect through USB and USB keyboard outputs.

With the SmartCable keyboard output, no software wedge or other intermediary software is required. The PC "sees" the connection from the SmartCable™ as a keyboard. Simply, open any document on your computer that accepts input, position your cursor, then send the data from the tool. That data will be input at the cursor location.

Also available are the 795SCU and 733SKU which provide USB output for 795 Micrometers and 733 Micrometers and 2600 Indicators, respectably. They do not have the keyboard function and require 719 Software Wedge or a similar product to input the data to the PC.

From manufacturing methods and materials to a built-in, power-saving mode, the SmartCable was designed to be an environmentally friendly product.

**Smart Cable Products**

| Cat. No. | EDP | Description |
|---|---|---|
| 795SCKB | 69887 | SmartCable with USB Keyboard Output for 795 Micrometer |
| 733SCKB | 69888 | SmartCable with USB Keyboard Output for 733 Micrometer and 2600 indicator type output |
| 798SCKB | 69889 | SmartCable with USB Keyboard Output for 798 Caliper |
| 797SCKB | 69890 | SmartCable with USB Keyboard Output for 797 Caliper |
| 2700SCKB | 69891 | SmartCable with USB Keyboard Output for 2700 Indicators |
| 795SCU | 69897 | SmartCable USB Ouput for 795 Micrometer |
| 733SCU | 69898 | SmartCable USB Ouput for 733 Micrometer and 2600 indicator type output |
| 2900SCKB | 68839 | SmartCable withUSB Keyboard Output for 2900 Indicators |
| 719 | 66490 | Software Wedge allows direct input to PC (795SCU and 733SCU only) |

**Direct PC Connection Cables**

| Part No. | EDP | For Use with Starrett Tool Numbers |
|---|---|---|
| PT61963 | 66636 | 714, 760, 786, 733, 762, 788, 749, 764, 790, 751, 769, 2600-1, 753, 773, 2600-4, 756, 777, 2600-8, 3752 |
| PT62425 | 67658 | 2000, 2001 |
| PT62606 | 68822 | 797B, 5000, 5001, 5002, 5003, 5004, 5005, 5006, 781 |
| PT63329 | 12732 | 798, USB Connection |
| PT26441 | 65893 | 2700 USB Connection |

### Features and Specifications

- Simple Set-up, your PC automatically installs USB driver when the SmartCable is plugged into PC's USB port
- Supports USB 2.0, RS232 and Keyboard (optional) output
- Simple plug and play set up – doesn't require software configuration
- Operating modes: Static (Normal) mode operation or Dynamic (MIN/MAX/TIR)
- LED status light

## 719 Software Wedge™ (for SCU cables)

This configurable serial I/O software allows you to input real-time data from Starrett gages through 795SCU and 733SKU cables directly into spreadsheets and databases on a PC.








# GAGE AMPLIFIERS, HARDNESS TESTERS, SURFACE TESTERS

# Gage Amplifiers

## 717 Electronic Gage Amplifier

Starrett has made electronic gaging easier with the 717 Electronic Gage Amplifier. The large analog display is easy to read and shows real-time change in measurements.

The 717 Gage Amplifier is flexible and has an accuracy within ±2% of full scale. Ranges vary from ±.010" to ±.0001" (±0.200mm to ±0.002mm), with gage graduations from .0005" to .000005" (0.01mm to 0.0001 mm).

| 717 Electronic Gage Amplifier | | |
|---|---|---|
| **Description** | **Cat. No.** | **EDP** |
| Amplifier with Power Supply Charger | 717 | 67001 |
| Lever-Type Gaging Head Range ±.010" (0.25mm) | 715-1Z | 64479 |
| Cartridge-Type Gaging Head Length 2-1/2" (64mm) Range ±.020" (0.50mm) | 715-2Z | 64480 |
| Cartridge-Type Gaging Head Pneumatic-Push, Length 2-3/4" (70mm) Range ±.040" (0.100mm) | 715-6 | 64186 |
| Cartridge-Type Gaging Head Length 1-3/8" (35mm) Range ±.020" (0.50mm) | 715-7 | 64187 |
| Cartridge-Type Gaging Head Length 2-1/2" (64mm) Range ±.040" (0.100mm) | 715-8 | 64188 |
| Cartridge-Type Gaging Head Length 3-5/8" (92mm) Range ±.080" (0.200mm) | 715-9 | 64189 |
| Height Gage and Comparator Attachment 1/4" x 1/2" (6.3 x 13.5mm) (Adapts Gaging Heads to Height Gages, Magnetic Base Indicator Holders, Dial Comparators and Test Indicator Stands.) .375" (9.5mm) Snug Hole | PT99441 | 52991 |
| Power Supply Charger for USA and Canadian Configuration – 115/120 Volts/60 Cycle | PT60636 | 63839 |
| Power Supply Charger for United Kingdom Configuration – 100-240 VAC, 47-63Hz | PT99353 | 66456 |
| Power Supply Charger for European Configuration – 100-240 VAC, 47-63Hz | PT99340 | 66455 |
| Cable to Computer (9-Pin to 9-Pin) | PT60642 | 72499 |
| Shop Floor Pro™ Software | 728-3 | 66662 |
| Software Wedge™ Program for Interfacing to Spreadsheets | 719 | 66490 |

| Ranges/Graduations | |
|---|---|
| **Range Inch** | **Each Gage Graduation** |
| ±.010" | .0005" |
| ±.002" | .0001" |
| ±.001" | .00005" |
| ±.0002" | .00001" |
| ±.0001" | .000005" |
| **Millimeter** | |
| ±0.200 mm | 0.01mm |
| ±0.100 mm | 0.005mm |
| ±0.020 mm | 0.001mm |
| ±0.010 mm | 0.0005mm |
| ±0.002 mm | 0.0001mm |

### Features

- Dual inputs for cumulative/differential measurements
- Selectable inch or millimeter ranges
- Selectable digital or analog output
- Simple "push-button" calibration
- Mirrored gage display for parallax-free readability
- Rugged metal case can be used anywhere in the shop
- Uses standard Starrett lever and cartridge-type probes
- Remote zero using PC
- Front panel data send button
- Single and continuous data send modes
- Serial Data Output via front panel button, PC or optional foot switch

### Accuracy

- Within ±2% of full scale

### Power Requirements

- 110 volt VAC/60Hz (AC adaptor furnished)

### Data Output

- Digital: ASCII serial data
- Analog: ±2.5 VDC/Full scale

### Size

- Dimensions: 9-1/4" Height x 5-1/2" Width x 5-1/2" Depth (235 x 140 x 140mm)
- Weight: 6 lb (2.7kg)








717 Electronic Gage Amplifier with 252 Transfer Gage and 715-1Z Gaging Head

# Gage Amplifiers

## 776 Gage-Chek™ Multi-Axis Measured Value Display

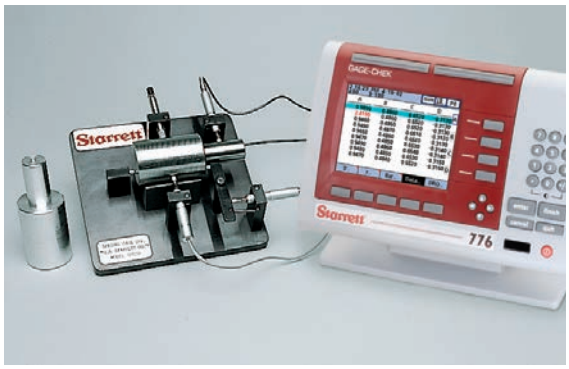
The Gage-Chek™ 776 is a multi-axis measured value display that accepts up to eight probe inputs. It features intuitive visual display, helpful audio cues and user-defined formulas. GAGE-CHEK also reports dynamic Min/Max measurements, provides SPC analysis from an integrated database, and includes connectivity to PCs and other Starrett tools.

### Features

| Specifications 776 Gage-Chek Multi-Axis Measured Value Display | |
|---|---|
| LCD | 6" color |
| Display Digit Size | .45" |
| Resolution Down To | .000004"/.0001mm |
| Operating Temperature | 32º - 115 °F |
| Enclosure (W x H x D) | 11.5" x 7.5" x 2.75" |
| Base Width (W x H x D) | 10" x 2" x 7.5" |
| Enclosure Weight | 3.5 lbs |
| Base Weight | 7 lbs |
| Input Voltage Range | 85 VAC - 264 VAC |
| Input Frequency | 43 Hz - 63 Hz |
| Inputs | 1-, 4- and 8-axis input available |
| External Connections | Foot Switch, Remote Keypad, Touch Probe, RS232C Serial Port, Parallel Port |
| Outputs | 2 Relay Outputs |

- Large (6") color flat-panel LCD screen built into a compact ergonomically designed case with an adjustable tilt base allows comfortable positioning for the operator
- Supports 1, 4 or 8 input channels. These can be mathematically combined to display dimensions such as flatness, volume or runout.
- Screens include individual readings with the capacity to display four lines simultaneously (each line 9/16" high), bar and dial position style displays, graphs and histograms of measurement statistics, and tables of measurement and SPC data
- Supports Starrett 776 LVTD probes and Heidenhain Specto style 12mm and 30mm range digital probes
- Measurements can be taken by the operator or in a semi-automated manner
- Large comfortable buttons allow easy selection of measurement functions, display screen changes, data entry and zeroing the screen
- Speaker and external jack outputs can be adjusted to compensate for noisy work environments. Earphones can be plugged into speaker jack for silent operation.
- Two 3" x 1/2" keys placed over the screen can be programmed as hot keys for frequently used functions
- Optional foot switch available




The 776 accepts multiple gage inputs simultaneously – invaluable for applications such as this Starrett special gage fixture

# Gage Amplifiers



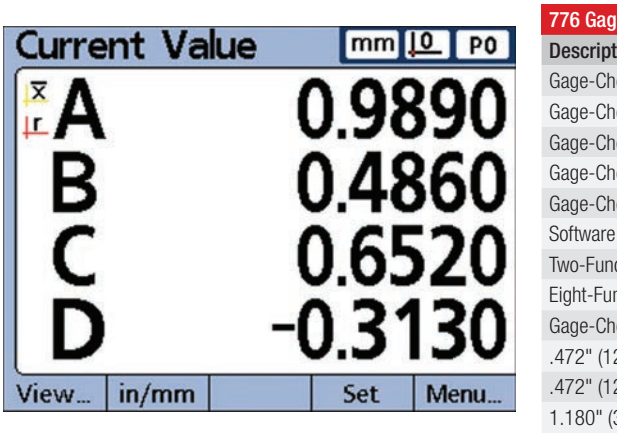

776 LVDT Probes



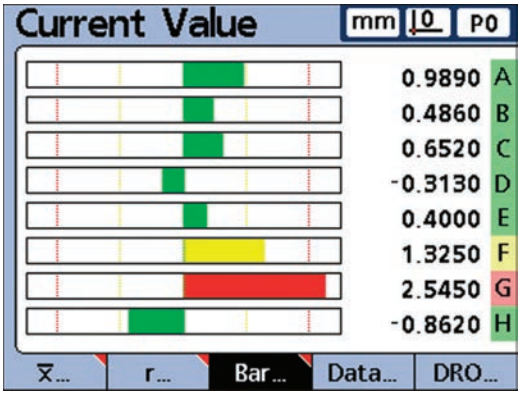









DRO View: Gage-Chek™ 776 features large, easy-to-read numerical display with custom dimension labels. Out of tolerance conditions are quickly identified by a change to red. Icons indicate that a process study has been performed, complete with in/out of tolerance alert. Mode switches include inch/metric, absolute/incremental, decimal degree/degrees, minutes, seconds.



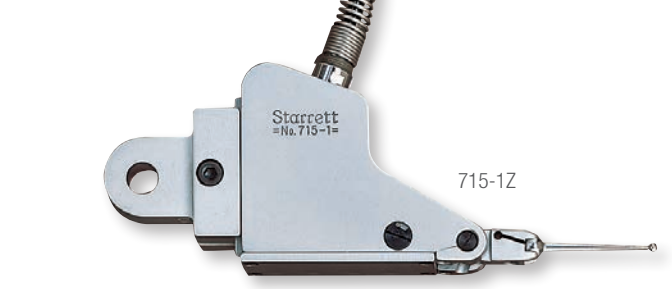

Displays all gages plugged into the gage chek at one time. It automatically displays marginal and error indications with multi-color display.

| 776 Gage-Chek Multi-Axis Measured Value Display | | |
|---|---|---|
| **Description** | **Cat. No.** | **EDP** |
| Gage-Chek – 140-SP with 4 Inputs, Specto | 776A | 68635 |
| Gage-Chek – 180-SP with 8 Inputs, Specto | 776B | 68636 |
| Gage-Chek – 110-ST with 1 Input, LVDT | 776C | 68761 |
| Gage-Chek – 140-ST with 4 Inputs, LVDT | 776D | 68762 |
| Gage-Chek – 180-ST with 8 Inputs, LVDT | 776E | 68763 |
| Software Wedge RS232 for Windows | 719 | 66490 |
| Two-Function Foot Switch | PT99530 | 68637 |
| Eight-Function Remote Keypad | PT62514 | 68638 |
| Gage-Chek Instruction Manual | PT62515 | 68639 |
| .472" (12mm) Length Probe, Specto | 776-12 | 68640 |
| .472" (12mm) Length Probe Radial Exit, Specto | 776-12R | 68796 |
| 1.180" (30mm) Length Probe, Specto | 776-30 | 68641 |
| 1.180" (30mm) Length Probe Radial Exit, Specto | 776-30R | 68797 |
| 9.849" (3 meter) Extension Cable for Specto Probe | PT05713 | 68172 |
| 32.89" (10 meter) Extension Cable for Specto Probe | PT05727 | 68773 |
| ±.010" (0.25mm) Lever Type Probe, LVDT | 776-1Z | 68817 |
| ±.020" (0.50mm) Traditional Probe, LVDT | 776-2 | 68818 |
| ±.020" (0.50mm) Short Probe, LVDT | 776-7 | 68819 |
| ±.040" (0.100mm) Probe, LVDT | 776-8 | 68820 |
| ±.100" (2.54mm) Probe, LVDT | 776-9 | 68821 |
| 6' (1.82 meter) Extension Cable for LVDT | PT05414 | 68828 |
| 13' (4.5 meter) Extension Cable for LVDT | PT05415 | 68829 |




Heidenhain Specto Length Probes

# Gage Amplifiers




715-1Z



715-2Z




715-6




715-7




715-8




715-9

## 715 Electronic Gage Amplifier Gage Heads

### 715-1Z Lever-Type Head

- Mounts directly in place of dial indicators with dovetail or AGD lug-type backs
- .078" (2mm) diameter contact standard .031" (0.8mm) and .062" (1.6mm)
- Diameter carbide contacts are available

### 715-2Z* Cartridge-Type Heads

- Hardened steel contact with radius tip. Head will accept all standard AGD contact points.
- .375" (9.5mm) mounting diameter allows replacement of standard AGD dial indicators

### 715-6, 715-7, 715-8, and 715-9 Cartridge-Type Heads

- Tungsten carbide ball contacts
- Head will accept any AGD style contact**
- Half-bridge construction, stainless steel body
- .375" (9.5mm) mounting diameter allows replacement of standard AGD dial indicators

| 715 Electronic Gage Amplifier Gage Heads | | | | |
|---|---|---|---|---|
| **Spindle Range** | **Length** | **Contact Pressure** | **Cat. No.** | **EDP** |
| ±.010" (0.25mm) measuring range | | 8-12 grams | 715-1Z | 64479 |
| ±.020" (0.50mm) | 2-1/2" (64mm) | 25-35 grams | 715-2Z* | 64480 |
| ±.040" (1.02mm) | 2-3/4" (70mm) | 70 grams | 715-6 | 64186 |
| ±.020" (0.51mm) | 1-3/8" (35mm) | | 715-7 | 64187 |
| ±.040" (1.02mm) | 2 -/2" (64mm) | | 715-8 | 64188 |
| ±.080" (2.03mm) | 3-5/8" (92mm) | | 715-9 | 64189 |

715-1Z, -2Z, -6, -7, -8, -9 Gaging Heads come with a 6' (1.8m) cable and male connector.
* Longer range cartridge-type gaging heads are available, quoted on application.
** 715-9 head will accept all standard AGD contacts.

# Bench Hardness Testers

## 3814 Analog Bench Hardness Tester

The 3814 Hardness Tester provides reliable Rockwell Hardness values on all types of metal and alloys, hard or soft, and in many shapes. This reliable bench hardness tester has a high quality casting, is ergonomically designed for easy operation and is engineered to ensure accurate results. It is an ideal basic hardness solution, economically priced to suit a variety of lab, workshop, toolroom and inspection department applications. The 3814 conforms to ASTM E-18 standard. The tester is furnished with a diamond indentor, a 1/16" (1.6mm) ball indentor, three certified test blocks, four test tables – 5.87" (149mm) and 2.5" (63.5mm) flat anvils, 5/8"(15.9mm) spot anvil and a standard vee anvil – and an accessory case.

### Features

- Ability to handle Rockwell Scales A through H and K
- Stable cast iron construction
- Ideal basic hardness testing for many typical applications

| 3814 Hardness Testers | | |
|---|---|---|
| **Description** | **Cat. No.** | **EDP** |
| Analog Hardness Tester | 3814 | 67754 |
| Hardness Tester Stand | PT06145 | 72519 |

| Specifications | |
|---|---|
| **Minor Load** | 10Kgf |
| **Major Load** | A: 60Kgf, B: 100Kgf, C: 150Kgf |
| **Test Force Application** | (Dead weight applies test force) |
| **Test Force Control** | Hydraulic Dashpot System |
| **Results Display** | Analog – Dial Gage |
| **Throat Depth** | 6.6" (168mm) |
| **Maximum Test Height** | 6.69" (169.9mm) * |
| **Unit Height/Width/Depth** | 30" x 8.5" x 20"<br>(762 x 216 x 508mm) |
| **Unit Weight** | 267 lb (121kg) |

* Requires bench alteration.






# Bench Hardness Testers

## 3816 Digital Bench Hardness Tester

The 3816 Bench Hardness Tester offers easy, fully automated testing procedures and provides highly sensitive and accurate readings. The 3816 measures the full regular Rockwell Scales according to ASTM and SAE guidelines and accommodates all types of hard or soft metals and alloys, in numerous configurations. The tester is furnished with a diamond indentor, a 1/16" (1.6mm) ball indentor, three certified test blocks, four test tables – 5.87" (149mm) and 2.5" (63.5mm) flat anvils, 5/8"(15.9mm) spot anvil and a standard vee anvil and an accessory case.

### Features

- Automated routines reduce operator involvement and speeds measurements
- Large, easy-to-view LED panel displays proper load setting
- Programmable scale conversions, dwell times and sample counter
- Sample averaging is automatically calculated
- RS232C output
- Convenient mini-printer for outputting readings
- Quality base or superstructure castings provide stability and a large working area

| 3816 Hardness Testers | | |
|---|---|---|
| **Description** | **Cat. No.** | **EDP** |
| Digital Bench Hardness Tester | 3816 | 67755 |
| Hardness Tester Stand | PT06145 | 72519 |
| **Accessories* for 3816 Digital Bench Hardness Tester** | | |
| "C" Regular | PT05245 | 67944 |
| 1/16" (1.6mm) Ball Unit | PT05249 | 67948 |
| RA Test Block (Rockwell A Scale 80) | PT05069 | 67897 |
| RB Test Block (Rockwell B Scale 90) | PT05059 | 67888 |
| RC Test Block (Rockwell C Scale 63) | PT05050 | 67879 |
| Master Block Set, Rockwell C Scale | PT05272 | 67969 |

* For additional listings of test blocks and accessories, refer to the following pages in this section.

| Specifications | |
|---|---|
| **Minor Load** | 10Kgf |
| **Major Load** | A: 60Kgf, B: 100Kgf, C: 150Kgf |
| **Test Force Application** | (Dead weight applies test force) |
| **Test Force Control** | Motorized |
| **Results Display** | Digital Readout |
| **Throat Depth** | 6.6" (168mm) |
| **Maximum Test Height** | 6.69" (169.9mm) ** |
| **Unit Height/Width/Depth** | 28" x 8.9" x 19.6"<br>(711 x 226 x 498mm) |
| **Unit Weight** | 187 lb (85kg) |

** Requires bench alteration.



# Hardness Testing

## Test Blocks and Accessories for Hardness Testers

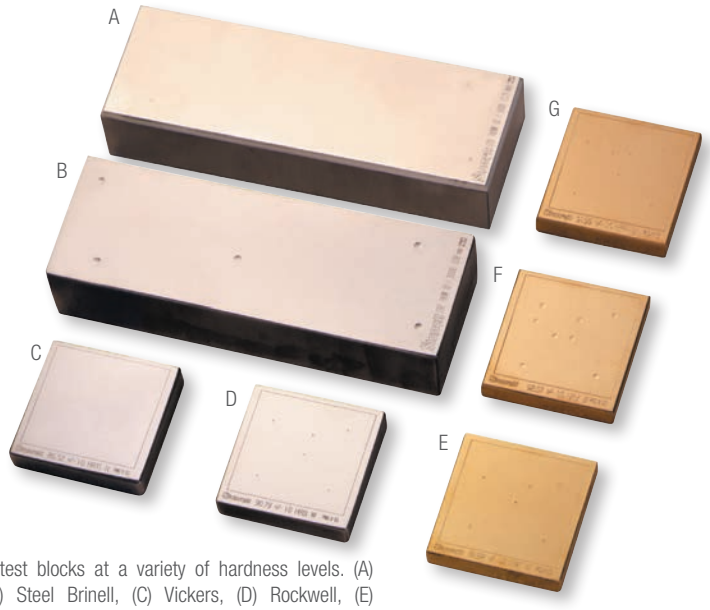
Starrett blocks can be used to test Rockwell, Brinell or Vickers scales. They are available in steel, brass and aluminum. Each block is serialized, with a certificate detailing the environmental conditions used to test the block.

Actual readings are given, with the averages of these readings: min. reading, max reading and a repeatability figure. The blocks are calibrated according to ASTM E-18 standards, ANSI (NCSL) Z540-1, (ISO) 10012-1, ISO/IEC 17025 and Mil-std 45662A.

Starrett hardness test blocks are manufactured from square steel or brass plates, as opposed to the more common round bar stock. The use of the plate gives a more accurate and consistent surface for inspection. Metallurgical tests have proven that during the production of round bar stock, suspended carbides in the mix migrate to the center of the rod. The scientific name for this condition is carbide segregation and results in different readings being found in the center of a rod rather than at its outer edges. Some manufacturers remedy this situation by removing the centers from their blocks.

Hardness test blocks are designed to be used only on one side and the indents should be more than .010" from the centers of two indents or no closer to the block's edge than .040".

Calibration kits are also available from Starrett. No facility with a hardness tester in use should be without a calibration kit. These kits come with from 3 to 20 calibrated test blocks and the serialized penetrator that was used to inspect each of the blocks in the set. When a discrepancy is detected in a tester, these kits allow you to determine the direction to proceed to resolve the issue.




Rockwell and Brinell test blocks at a variety of hardness levels. (A) Aluminum Brinell, (B) Steel Brinell, (C) Vickers, (D) Rockwell, (E) 187.5kg/2.5mm Brinell, (F) Extra-Soft Rockwell and (G) Brass Rockwell.

**Rockwell Test Blocks**

| Description † | Part No. | EDP |
|---|---|---|
| RC63 Test Block | PT05050 | 67879 |
| RC60 Test Block | PT05051 | 67880 |
| RC55 Test Block | PT05052 | 67881 |
| RC50 Test Block | PT05053 | 67882 |
| RC45 Test Block | PT05054 | 67883 |
| RC40 Test Block | PT05055 | 67884 |
| RC35 Test Block | PT05056 | 67885 |
| RC30 Test Block | PT05057 | 67886 |
| RC25 Test Block | PT05058 | 67887 |
| RB90 Test Block | PT05059 | 67888 |
| RB80 Test Block | PT05060 | 67889 |
| RB70 Test Block | PT05061 | 67890 |
| RB60 Test Block | PT05062 | 67891 |
| RB50 Test Block | PT05063 | 67892 |
| RB40 Test Block | PT05064 | 67893 |
| RB30 Test Block | PT05065 | 67894 |
| RB20 Test Block | PT05067 | 67895 |
| RB10 Test Block | PT05068 | 67896 |
| RA80 Test Block | PT05069 | 67897 |
| RA70 Test Block | PT05091 | 67898 |
| RA60 Test Block | PT05092 | 67899 |
| RF100 Test Block | PT05100 | 67900 |
| RF90 Test Block | PT05101 | 67901 |
| RF80 Test Block | PT05102 | 67902 |
| RF70 Test Block | PT05103 | 67903 |
| RF60 Test Block | PT05104 | 67904 |
| RF50 Test Block | PT05105 | 67905 |
| RE100 Test Block | PT05106 | 67906 |
| RE90 Test Block | PT05107 | 67907 |
| RE80 Test Block | PT05108 | 67908 |
| RE70 Test Block | PT05112 | 67909 |
| RE60 Test Block | PT05113 | 67910 |
| RE50 Test Block | PT05114 | 67911 |

**Rockwell Test Blocks**

| Description † | Part No. | EDP |
|---|---|---|
| HR30N80 Test Block | PT05115 | 67912 |
| HG30N70 Test Block | PT05122 | 67913 |
| HR30N60 Test Block | PT05123 | 67914 |
| HR30N50 Test Block | PT05124 | 67915 |
| HR30N40 Test Block | PT05125 | 67916 |
| HR30T80 Test Block | PT05127 | 67917 |
| HR30T70 Test Block | PT05128 | 67918 |
| HR30T60 Test Block | PT05129 | 67919 |
| HR30T50 Test Block | PT05130 | 67920 |
| HR30T40 Test Block | PT05177 | 67921 |
| HR30T30 Test Block | PT05178 | 67922 |
| HR30T20 Test Block | PT05179 | 67923 |
| HR30T10 Test Block | PT05180 | 67924 |
| HR15N90 Test Block | PT05181 | 67925 |
| HR15N80 Test Block | PT05182 | 67926 |
| HR15N70 Test Block | PT05183 | 67927 |
| HR15T90 Test Block | PT05184 | 67928 |
| HR15T80 Test Block | PT05185 | 67929 |
| HR15T70 Test Block | PT05186 | 67930 |
| HR15T60 Test Block | PT05187 | 67931 |
| HR45T70 Test Block | PT05188 | 67932 |
| HR45T60 Test Block | PT05189 | 67933 |
| HR45T50 Test Block | PT05191 | 67934 |
| HR45T40 Test Block | PT05192 | 67935 |
| HR45T20 Test Block | PT05193 | 67936 |
| HR45T10 Test Block | PT05194 | 67937 |
| HRH90 Test Block | PT05195 | 67938 |
| HRH80 Test Block | PT05196 | 67939 |
| HRR120 Test Block | PT05197 | 67940 |
| HR30Y Test Block | PT05198 | 67941 |
| HRM Test Block | PT05199 | 67942 |
| HR15W Test Block | PT05200 | 67943 |

† Values expressed are not exact but will range within acceptable limits

# Hardness Testing

## Test Blocks and Accessories for Hardness Testers

| Brinell Test Blocks | | |
|---|---|---|
| **Description** | **Part No.** | **EDP** |
| 3000kg High Brinell Test Block | PT05257 | 67956 |
| 3000kg Low Brinell Test Block | PT05258 | 67957 |
| 500kg High Brinell Test Block | PT05259 | 67958 |
| 500kg Low Brinell Test Block | PT05260 | 67959 |




Standard and special anvils

| Anvils and Table | | | |
|---|---|---|---|
| **Letter** | **Description** | **Part No.** | **EDP** |
| A | Pedestal Anvil | PT05267 | 67964 |
| B | 2-1/2" Flat Anvil | PT05268 | 67965 |
| C | Small "V" Anvil | PT05269 | 67966 |
| D | Large "V" Anvil | PT05270 | 67967 |
| E | 8" Anvil Testing Table | PT05271 | 67968 |




Penetrators - Contact Starrett for more information



PT05272 HRC 3-Block Master Calibration Kit

| Master Calibration Kits | | |
|---|---|---|
| **Description** | **Part No.** | **EDP** |
| HRC 3-Block Master Calibration Kit | PT05272 | 67969 |
| HR30N 3-Block Master Calibration Kit | PT05273 | 67970 |
| HRB 3-Block Master Calibration Kit | PT05276 | 67971 |
| C&B Scale 20-Block Master Calibration Kit | PT05277 | 67972 |
| C&30N Scale 6-Block Master Calibration Kit | PT05278 | 67973 |

| Penetrators | | | |
|---|---|---|---|
| **Letter** | **Description** | **Part No.** | **EDP** |
| E | "C" Regular, No Thread | PT05245 | 67944 |
| E | Indentron with Internal Thread | PT05246 | 67945 |
| G | Versitron/New Age with External Thread | PT05247 | 67946 |
| E | "N" Regular, No Thread | PT05248 | 67947 |
| D | 1/16" (1.6mm) Ball with Holder | PT05249 | 67948 |
| C | 1/8" (1.7mm) Ball Complete with Holder | PT05250 | 67949 |
| B | 1/4" (6.4mm) Ball Complete with Holder | PT05251 | 67950 |
| A | 1/2" (12.7mm) Ball Complete with Holder | PT05252 | 67951 |
| | 1/16" (1.6mm) Carbide Ball Only, with Certification | PT05253 | 67952 |
| | 1/8" (1.7mm) Carbide Ball, with Certification | PT05254 | 67953 |
| | 1/4" (6.4mm) Carbide Ball, with Certification | PT05255 | 67954 |
| | 1/2" (12.7mm) Carbide Ball, with Certification | PT05256 | 67955 |
| | Heavy Load, Vickers 5kg Load | PT05261 | 67960 |
| F | Heavy Load Indentor Vickers | PT05264 | 67961 |
| | Min. Brinell 2 1/2mm Ball | PT05265 | 67962 |
| | Min. Brinell Block 187 1/2kg, 2-1/2mm Ball | PT05266 | 67963 |



Includes base instrument, impact device D, calibrated test block, custom carry case, cleaning brush and operation manual

## 3811A Compact Hardness Tester

The 3811A is a state of the art, digital portable hardness tester, designed to test the hardness of large, hard metal parts.

The 3811A combines fast test speeds with ample memory and output. It performs tests that easily convert to most popular hardness scales such as Rockwell, Brinell, Vickers and Shore.

This compact hardness tester is loaded with useful functions usually found only on high priced models.

**3811A Hardness Tester & Accessories**

| Cat. No. | EDP | Description |
|---|---|---|
| 3811A | 69881 | Digital portable hardness tester with impact device D,calibrated test block, cleaning brush and carry case |
| HT-1800-110 | 20940 | D+15 Impact Device |
| HT-1800-115 | 20941 | DL Impact Device |
| HT-1800-125 | 20942 | G Impact Device |
| HT-1800-130 | 20943 | C Impact Device |
| HT-1800-120 | 20944 | DC Impact Device |
| HT-1800-100 | 20945 | Replacement D Impact Device |
| HT-1800-102 | 20946 | Replacement Cable For All Impact Devices |
| HT-2500-105 | 20947 | Replacement Impact Body |
| HT-1300-01 | 20948 | Leeb D Test Block |
| HT-1100G-01 | 20949 | Leeb G Test Block |
| S38R | 67285 | Support Ring Set |

**3811A Portable Hardness Tester with Integrated, Multi-functional Features**

| Style | Applications |
|---|---|
| D+15 | Very narrow contact area with a set backed measurement coil. Measures hardness in grooves and recesses. Weight: 80g |
| DC | Extremely short impact device. Used for very confined spaces such as, holes, cylinders and internal measurements |
| C | Reduced impact energy probe (2 ft-lb) for measuring hardness of coatings, surface hardened, thin wall or impact sensitive components. Applies superficial indentation. Weight: 75g |
| G | Enlarged test tip and increased impact energy range (72 ft-lb – approx. 9 times the D). For lower quality finishes measuring in the Brinell range only (max. 650 HB). Designed for components like heavy castings, forgings. Weight: 250g |
| DL | Needle front section with 4mm diameter and 50mm length. Ideal for testing in confined spaces, the base of grooves and special components like gear wheels. Steel/Cast steel |

# Hardness Testers

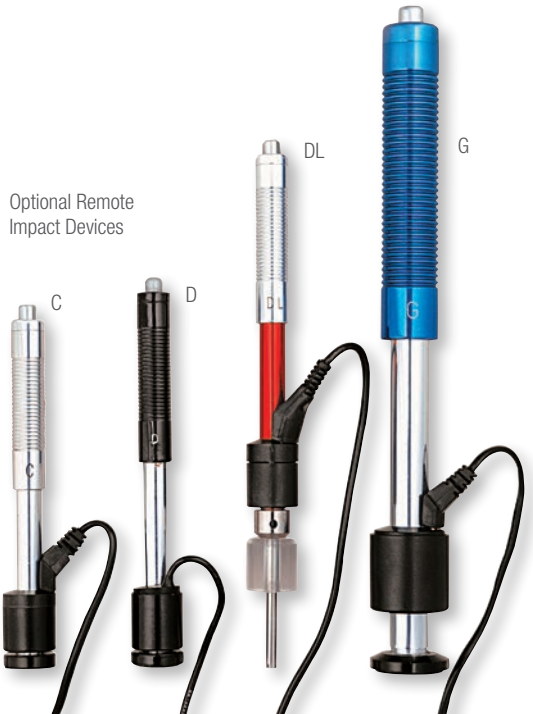
### Specifications

- Accuracy: ±0.5% (referred to L=800)
- Repeatability accuracy: ± 4L units (L=Leeb)
- Measuring range: 200-960 HL
- For steel and cast steel, alloy tool steel, stainless steel, grey cast iron, spheroidal iron, cast aluminum, brass, bronze, wrought copper alloy
- Tool steel should be about 1" thick solid material or larger
- Operating temperature: 5-104 °F
- Dimensions: 5.96 x 2.938 x 1.270" (150 x 74 x 32mm)
- Weight: 8.6 oz. (245 grams)

### Features

- Leeb style tester designed for large, hard parts – load the impact body and place the impact device on your test piece
- Easy to use keypad operation – push the button to begin testing and obtain reading
- Auto identification of impact device
- Large LCD display with back light
- USB ouput
- Automatic conversions to Rockwell, Brinell, Vickers and Shore
- Automatic mean value as well as Min and Max values
- Uses two AA alkaline batteries with low power indicator
- Memory capacity (100 groups)
- Optional impact devices and special support rings

Optional Remote Impact Devices



# Hardness Testers

## 3810A Digital Portable Hardness Tester

The 3810A is a state-of-the-art digital instrument designed to test the hardness of large hard metal parts. Loaded with useful functions such as USB output and a built in printer, the 3810A is an ideal choice for fast, accurate hardness testing.

This versatile tester can perform tests that easily convert to the most popular hardness scales, including Rockwell, Brinell, Vickers and Shore.

The tester is easy to use. Simply load the impact body, place the impact body on your test piece, then push the button to begin testing.

The 3810A is designed to test large hard parts that cannot be brought to a bench top machine. For example, tool steel should be close to 1" thick of solid material. The 3810A comes with a D impact device, calibration block, cleaning brush, manual and a carrying case.



| 3810A Hardness Tester & Accessories | | |
|---|---|---|
| **Cat. No.** | **EDP** | **Description** |
| 3810A | 69871 | Tester, D impact device, calibration block, cleaning brush, operation manual, custom carry case |
| HT-1800-110 | 20940 | D+15 impact device. Very narrow contact area with set backed measurement coil. Measures hardness in grooves and recesses. |
| HT-1800-115 | 20941 | DL impact device. Needle front section with 4mm diameter and 50mm length. For testing in confined spaces such as groove bases and special components such as gear wheels. |
| HT-1800-125 | 20942 | G impact device. For components such as heavy castings and forgings. Enlarged test tip and increased impact energy range. For lower quality finishes measuring in the Brinell range only. G block required. |
| HT-1800-130 | 20943 | C impact device. Reduced impact energy probe for measuring hardness of coatings and surface hardened, thin wall or impact- sensitive components. Applies superficial indentation. |
| HT-1800-120 | 20944 | DC impact device. Very short for confined areas such as internal bores for various inside measurements. |
| HT-1800-100 | 20945 | Replacement D impact device. Universal standard probe for a wide variety of applications. |
| HT-1800-102 | 20946 | Replacement cable for all impact devices |
| HT-2500-105 | 20947 | Replacement impact body D |
| HT-1300-01 | 20948 | Leeb D test block |
| HT-1100G-01 | 20949 | Leeb G test block |
| S38R | 67285 | Support ring set |



### Specifications

- Accuracy: ±0.5% (referred to L=800)
- Repeatability accuracy: ±4L units (L=Leeb)
- Measuring range: 200-960 HL
- Materials: steel & cast steel, alloy tool steel, stainless steel, grey cast iron, spheroidal iron, cast aluminum, brass, bronze, wrought copper alloy
- Battery type: AA alkaline (4)
- Operating temperature: 5-104 °F
- Dimensions: 150 x 74 x 32mm
- Weight: 245 grams
- Includes 3810A tester, impact device D, calibration test block, cleaning brush, operation manual, custom carry case
- Available options include DC, D+15, DL, G, C impact devices, and special support rings

### Functions

- Easy to use keypad operation
- Auto identification of impact device
- Large LCD display with back light
- USB ouput
- Automatic conversions to: Brinell, Rockwell B & C, Vickers and Shore
- Automatic mean value as well as Min & Max values
- Battery indicator
- Memory capacity (100 groups)

# Hardness Testers

## Technical Data for Starrett Hardness Impact Devices

| Technical Data for Impact Devices | | D/DC/DL | D+15 | C | G |
|---|---|---|---|---|---|
| Impact Energy | | 11 Nmm | 11 Nmm | 3 Nmm | 90 Nmm |
| Mass of the Impact Body | | 5.5g | 7.8g | 3.0g | 20g |
| Test Tip DL: 7.3 g | Hardness | 1600 HV | 1600 HV | 1600 HV | 1600 HV |
| | Diameter | 3mm | 3mm | 3mm | 5mm |
| | Material | Tungsten carbide | Tungsten carbide | Tungsten carbide | Tungsten carbide |
| Impact Device | Diameter | 20mm | 20mm | 20mm | 30mm |
| | Length | 147/86mm | 162mm | 141mm | 254mm |
| | Weight | 75/50 g | 80 g | 75 g | 250 g |
| Max. Hardness of Sample | | 940 HV | 940 HV | 1000 HV | 650 HB |
| Preparation of Surface | Roughness class ISO | N7 | N7 | N5 | N9 |
| | Max. roughness depth Rt | 10µm | 10µm | 2.5µm | 30µm |
| | Average roughness Ra | 2µm | 2µm | 0.4µm | 7µm |
| Min. Weight of Sample | Of compact shape | 5kg | 5kg | 1.5kg | 15kg |
| | On solid support | 2kg | 2kg | 0.5kg | 5kg |
| | Coupled on plate | 0.1kg | 0.1kg | 0.02kg | 0.5kg |
| Min. Thickness of Sample | Coupled | 3mm | 3mm | 1mm | 10mm |
| | Min. thickness of layers | 0.8mm | 0.8mm | 0.2mm | — |
| Indentation of Test Tip with 300 HV | Diameter | 0.54mm | 0.54mm | 0.38mm | 1.03mm |
| | Depth | 24µm | 24µm | 12µm | 53µm |
| Indentation of Test Tip with 600 HV | Diameter | 0.45mm | 0.45mm | 0.32mm | 0.90mm |
| | Depth | 17µm | 17µm | 8µm | 41µmC |
| Indentation of Test Tip with 800 HV | Diameter | 0.35mm | 0.35mm | 0.30mm | — |
| | Depth | 10µm | 10µm | 7µm | — |

## Application and Hardness Ranges for Starrett Hardness Impact Devices

| Optional Impact Devices | | | | | |
|---|---|---|---|---|---|
| **Material** | **HRC** | **HRB** | **HB** | **HV** | **HSD** |
| **Impact Device – D, DC Measuring Range 200-900†** | | | | | |
| Steel | 20.0-67.9 | 59.6-99.5 | 80-647 | 80-940 | 32.2-99.5 |
| C.W. Tool Steel | 20.4-67.1 | | | 80-898 | |
| Gray Cast Iron | | | 93-334 | | |
| Nodular Cast Iron | | | 131-387 | | |
| Cast Aluminum | | | 30-159 | | |
| Brass | | 13.5-95.3 | 40-173 | | |
| Bronze | | | 60-290 | | |
| Copper | | | 45-315 | | |
| **Impact Device – D+15, Measuring Range 300-900† (not shown)** | | | | | |
| Steel and Cast Steel | 19.3-67.9 | | 80-638 | 80-937 | 33.3-99.3 |
| **Impact Device – C, Measuring Range 350-950†** | | | | | |
| Steel and Cast Steel | 20.0-69.5 | | 80-683 | 80-996 | 31.9-99.6 |
| **Impact Device – G, Measuring Range 300-750†** | | | | | |
| Steel and Cast Steel | | 47.7-99.9 | 90-646 | | |
| Gray Cast Iron | | | 92-326 | | |
| Nodular Cast Iron | | | 127-364 | | |
| **Impact Device – DL, Measuring Range 300-900†** | | | | | |
| Steel and Cast Steel | 20-68 | 37-100 | 80-650 | 80-940 | 30-97 |

† Leeb Measuring Range





# Roundness Testers

NEW!



## RT500 Roundess Tester

High speed roundness systems for bearings, automotive and precision industries. A range of roundness products robust enough for the shop floor but accurate enough for any inspection room.

The new RT500 offers a flexible solution for all your roundness and form requirements with a variety of systems and application specific accessories along with fixtures that can be tailored to your specific need. The most important benefit these systems offer is speed. As manufacturing volumes increases, in precision industries all too often the bottleneck is metrology. High measurement throughput systems ensure higher sampling rates are achieved while also supporting increased manufacturing volumes. Full ISO compliant measurements can be taken with ±25nm accuracy and 30nm gage resolution. The X-sight touch screen software platform with intuitive navigation make the RT500 roundness system as easy to use as a Sat Nav or Smart Phone with everything you need at your fingertips.

### Features

- Easy to use software
- Large color display, easy viewing of results
- Touch screen operation
- Measures: Roundness/Flatness, Coaxiality, Eccentricity; Concentricity, Radial Runout, Squareness, and Parallelism

| RT500 Roundess Tester | |
|---|---|
| **Cat. No.** | **EDP** |
| RT500 | 37215 |

| Specifications | |
|---|---|
| **Measuring Capacity** | |
| Max Diameter (in) | 11.8" |
| Max Diameter (mm) | 300mm |
| Height (in) | 11" |
| Height (mm) | 280mm |
| Weight (lb) | 44lb |
| Weight (kg) | 20kg |
| **Work Table** | |
| Diameter (in) | 4.9" |
| Diameter (mm) | 125mm |
| Centering (in) | ±0.149" |
| Centering (mm) | ±1.25mm |
| Leveling | 30 arc minutes |
| Height of Neutral Plane (in) | 2" |
| Height of Neutral Plane (mm) | 51mm |
| **Spindle** | |
| Speed of Rotation | 15RPM Max |
| **Gage** | |
| Range (in) | 0.079" |
| Range (mm) | 2mm |
| Resolution | 30nm |
| **Filter** | |
| Type | None, Gaussian, Robust Gaussian |
| Standard Filter Cut-Offs | 1–15upr, 1–50upr, 1–150upr, 15–150upr, 1–500upr, 15–500upr |
| Special Filters | User Selectable and Bandpass |

# Roundness Testers

## RT800 Roundess Tester

Working closely with manufacturers across a wide range of industries including bearings, automotive and aerospace engineering, Starrett has focused on the key attributes that are most important for quality control in today's precision industries.

The new RT800 offers a flexible solution for all your roundess and form requirements with a variety of systems and application-specific accessories along with fixtures that can be tailored to your specific need.

### Features

- Easy to use software
- Large color display, easy viewing of results
- Touch screen operation
- Measures: Roundness/Flatness, Coaxiality, Eccentricity; Concentricity, Radial Runout, Squareness, Parallelism, Interrupted Surfaces and Thickness

| RT800 Roundess Tester | |
|---|---|
| **Cat. No.** | **EDP** |
| RT800 | 3720 |

| Specifications | |
|---|---|
| **Measuring Capacity** | |
| Max Diameter (in) | 11.8" |
| Max Diameter (mm) | 300mm |
| Height (in) | 11" |
| Height (mm) | 280mm |
| Weight (lb) | 44lb |
| Weight (kg) | 20kg |
| **Work Table** | |
| Diameter (in) | 4.9" |
| Diameter (mm) | 125mm |
| Centering (in) | ±0.049" |
| Centering (mm) | ±1.25mm |
| Leveling | 30 arc minutes |
| Height of Neutral Plane (in) | 2" |
| Height of Neutral Plane (mm) | 51mm |
| **Spindle** | |
| Speed of Rotation | 15RPM Max |
| **Gage** | |
| Range (in) | 0.079" |
| Range (mm) | 2mm |
| Resolution | 30nm |
| **Filter** | |
| Type | None, Gaussian, Robust Gaussian |
| Standard Filter Cut-Offs | 1–15upr, 1–50upr, 1–150upr, 15–150upr, 1–500upr, 15–500upr |
| Special Filters | User Selectable and Bandpass |



# Roughness Testers

## SR100 Surface Roughness Tester

The SR100 portable surface roughness tester is powerful, accurate and easy to use. With the SR100, you can measure roughness almost anywhere. It is ideal for checking large components, structures, auditing batch production prior to shipment and production line process control.

The innovative SR100 separates into two pieces to measure surface roughness. The bottom half of the SR100 contains the traverse mechanism and stylus pickup assembly which is placed on the surface to be measured. Its wide base ensures stability. The upper half includes a large LCD display, start button, mode and parameter buttons, comfortably hand-held for easy operation and clear viewing.

### Features

- Large LCD window
- Measures Ra at the touch of a button
- In addition to basic roughness parameters Ra and Rz, also measures advanced Rp, Rv and Rt parameters
- Five second cycle time
- Result saved until the next measurement is taken
- Switches between inch and metric mode without remeasuring
- Use right out of the box – little or no operator training required
- Automatic shut-off after five minutes of inactivity
- Configured with the most common industrial settings to ensure correlation between multiple operators (see specifications)
- Simple and reliable calibration routine
- Uses standard off-the-shelf calculator type batteries with a minimum life of 5,000 measurements
- Includes SR100 two-piece assembly, calibration standard, batteries, operation guide and a carrying case

**SR100 Surface Roughness Tester & Accessories**

| Cat. No. | EDP | Description |
|---|---|---|
| SR100 | 20950 | SR100 two-piece surface roughness tester assembly, calibration standard, batteries, operation guide and a carrying case |







SR100 uses an infra-red (IrDA) link between the upper and lower units to provide remote, cable free operation up to a distance of 40" (one meter).

| Technical Specifications | | |
|---|---|---|
| Gage range | 0.008"/200µm | |
| Accuracy | 5% of reading + 4µin/+ 0.1µm | |
| Pick up type | Piezoelectric | |
| Gage force | .007 oz/200mg | |
| Stylus | Diamond, Radius 200µin/5µm | |
| Cut off value | 0.03"/0.8mm ±15% | |
| Filter | 2CR | |
| Traverse length | 0.2"/5mm | |
| Traverse speed | 0.08"/sec, 2mm/sec | |
| Display units | µin/µm | |
| Battery life | 5,000 operations minimum | |
| **Parameter results** | | |
| Ra, Rz, Rv, Rp, Rt | | |
| **Parameters** | **Range** | **Resolution** |
| Ra: | 1600µin/40µm | 0.4µin/0.01µm |
| Rz, Rv, Rp, Rt: | 7800µin/199µm | 4µin/0.1µm |
| **Dimensions** | | |
| Overall dimensions | 4.92 x 3.15x 1.5"/125 x 80 x 38mm | |
| Weight | 7oz/200gm | |
| **Component dimensions and condition** | | |
| Min bore | 2.6"/65mm | |
| Min diameter | 1.0"/25mm | |
| Max temperature | 95 °F/35 °C | |
| **Nominal operating conditions** | | |
| Temperature | 68 °F/20 °C | |
| Humidity | 0 to 80% non condensing | |
| **Storage conditions** | | |
| Temperature | 32 °F to 122 °F/0 to 50 °C | |
| Humidity | 0 to 80% non condensing | |

# Roughness Testers

## SR300 and SR400 Surface Roughness Tester

The SR300 and SR400 instruments offer a versatile solution for all your roughness requirements with a variety of systems and application specific accessories along with fixtures that can be tailored to your specific need.

### Any Surface, Any Height

The inclusion of a 50mm stylus lift with right angle attachment and more than 70mm stylus reach means that even the most challenging surfaces can be measured without the need for expensive riser blocks, stands or fixtures. The anti-slip V-feet also mean the system can be used on flat or curved surfaces. The stylus can even measure upside down!

### USB Connectivity

Through its industry standard Type A USB port and mini USB port the SR300 and SR400 Surface Roughness Testers provide extensive connectivity options to many standard devices.

| Measurement Capability | | SR300 | SR400 |
|---|---|---|---|
| Gage | Range | 200µm, 100µm, 10µm | 400µm, 100µm, 10µm |
| | Resolution | 100nm, 20nm, 10nm | 50nm, 10nm, 5nm |
| | Noise Floor (Ra) | 250nm, 150nm, 100nm | 150nm, 100nm, 50nm |
| | Repeatability (Ra) | 1% of value + noise | 0.5% of value + noise |
| | Pickup Type | Inductive | |
| | Gage Force | 150 - 300mg | |
| | Stylus Tip Radius | 5µm (200µin) default/2µm (80µin) or 10µm (400µin) optional | |
| | Measurement Type | Skidded | |
| Calibration | Process | Automated software calibration routine | |
| | Standards | Able to calibrate to ISO 4287 roughness standards | |
| Analysis | Filter Cut-Off | 0.25mm/0.8mm/2.5mm | |
| | Filter Type | 2CR/Gaussian | |
| | Evaluation Length | 0.25 - 12.5mm (0.01 - 0.49in) | 0.25 - 25.0mm (0.01 - 0.98in) |
| | Max. X Axis Range | 17.5mm | 25.5mm |
| Speed | Measuring Speed | 1mm/sec (0.04in/sec) | |
| | Returning Speed | 1.5mm/sec (0.06in/sec) | |
| **Analysis Capability** | | **SR300** | **SR400** |
| Parameters | Standards | ISO 4287, ISO 13565-1, ISO 13565-2, ASME 46.1, JIS 0601, N31007 | |
| | ISO Basic | Ra, Rv, Rp, Rz, Rt, Rq, Rsk, Rmr, Rdq, Rpc, RSm, Rz1max | |
| | ISO Advanced | Optional | Rk, A1, A2, Mr1, Mr2, Rpk, Rvk |
| | ASME | Ra, Rv, Rp, Rz, Rt, Rq, Rsk, Rdq, RSm, Rpm, Rda | |
| | JIS | Ra, Rv, Rp, Rz, Rt, Rq, Rsk, Rmr, Rdq, RSm, RzJIS, Rc, Rku, Rdc | |
| | Other | R3z (Daimler Benz) | |
| | ISO Primary | Optional | Pa, Pv, Pp, Pz, Pt, Pq, Psk, Pmr, Pdq, Ppc, PSm, Pz1max |
| | Units | µm/µin | |

### Features

- Large screen display
- Many application specific parameter options
- Comprehensive selection of optional accessories and pickups
- Long traverse length and extended pickup reach
- Stores up to 100 readings
- Anti-slip feet perfect for mounting on flat or curved surfaces
- Rubberized molding adds protection and better grip in the hand; invaluable in shop floor environments
- Orientation - fix the display in 1 of 4 orientations; perfect for awkward measurements
- Simple Set Up - shortcuts provided for all the key settings to give instant access with just a single touch
- Profile Graph - detailed graph shows measured area to help identify problem areas
- Measure - tactile measurement button, great when device is being used overhead or inside pipes
- Includes traverse unit, TalyProfile Lite software, stylus lift, calibration standard, manual and carrying case

| SR300 and SR400 Surface Roughness Tester and Accessories | | |
|---|---|---|
| **Cat. No.** | **EDP** | **Description** |
| SR300 | 21000 | SR300 display and 17.5mm traverse unit |
| SR400 | 21001 | SR400 display and 25mm traverse unit |
| SR-112-1510 | 20961 | 7.875"/200mm extension rod with lead |
| SR-112-1534 | 20962 | Reference standard |
| SR-112-1517 | 20963 | Support stand |
| SR-112-2693 | 20964 | Column and standard |
| SR-112-1502 | 20965 | Standard pickup with 200µ"/5µmm stylus |
| SR-112-1503 | 20957 | Standard pickup with 400µ"/10µm stylus |
| SR-155-P28495 | 20129 | Small bore pickup |
| SR-112-1505 | 20959 | Right angle pickup |
| SR-112-1506 | 20960 | Recess Pickup |
| SR-112-3680 | 20952 | TalyProfile Gold - 2D analysis software with cable |
| SR-112-3681 | 20953 | TalyProfile Silver - 2D analysis software with cable |
| SR-K509-1578 | 20954 | TalyProfile 8'/2.5m cable |
| SR-K509-1820 | 20955 | TalyProfile 5'/1.5m cable |
| SR-112-4570 | 20998 | USB thermal printer |
| SR-112-4571 | 20999 | Thermal paper |
| SR-112-4545 | 20220 | Plug adaptors |
| 252Z-14 | 55890 | 252 height transfer gage |
| PT99560 | 72796 | Clamp to attach SR300 and SR400 to 252 height transfer gage |

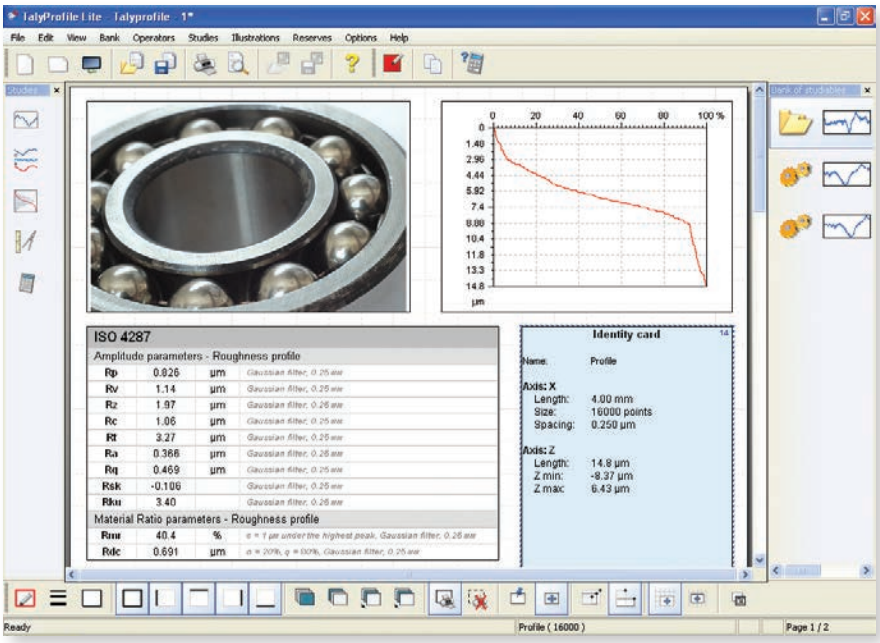




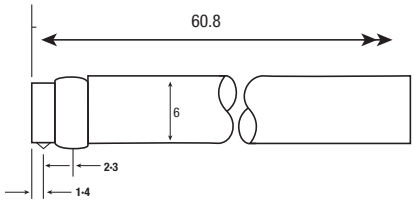

## TalyProfile

### ADVANCED SURFACE FINISH ANALYSIS

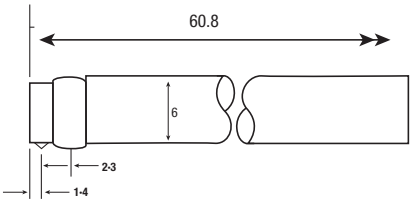
TalyProfile is a dedicated PC based software package designed for use with the SR300 and SR400 instruments. Three versions are available. TalyProfile "Lite" has all functions typically used for a shopfloor inspection. TalyProfile "Silver" has enhanced features for R&W parameters, a statistics module and full report printing. TalyProfile "Gold" has complete laboratory analysis functions.



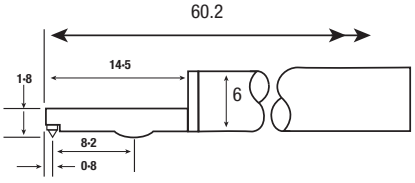

| TalyProfile | Lite | Silver | Gold |
|---|---|---|---|
| Surtonic S-series acquisition | x | x | x |
| Desktop publishing templates | x | x | x |
| Multi-language support | x | x | x |
| EN, FR, DE, ES, IT, PL, CN, KR | x | x | x |
| Leveling | x | x | x |
| Symmetries | x | x | x |
| Zoom | x | x | x |
| ISO 4287 | x | x | x |
| Material Ratio Curve | x | x | x |
| Area of a hole/peak | x | x | x |
| Profile parameters and curves | x | x | x |
| Roughness and waviness curves | x | x | x |
| Distance measurement | x | x | x |
| Multiple file format reports | | x | x |
| Report printing | | x | x |
| Form Talysurf data import | | x | x |
| Tolerance limits (pass/fail) | | x | x |
| Data file explorer | | x | x |
| ISO 13565 Automotive | | x | x |
| Interactive Mr curve | | x | x |
| Step height measurement | | x | x |
| Form removal | | | x |
| Filtering by FFT | | | x |
| Thresholding | | | x |
| Frequency spectrum | | | x |
| Power spectrum density | | | x |
| Retouch profile point | | | x |
| Rk parameters | | | x |
| Rk parameters curves | | | x |
| ISO 12085 R&W motifs | | | x |



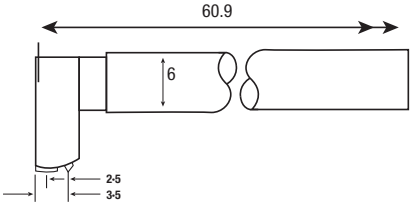

**Standard Pick-Up**
for general surface roughness measurement
**Code SR-112-1502** (5µm tip radius)
**Code SR-112-1503** (10µm tip radius)




**Right Angle Pick-Up**
for measurement at right angles to the direction of traverse
**Code SR-112-1505**




**Small Bore Pick-Up**
for general use in small bores, grooves and on narrow surfaces
**Code SR-155-P28495**




**Recess Pick-Up**
for measuring into deep recess
**Code SR-112-1506** recess 5.7mm (0.23")

## TalyProfile Parameters

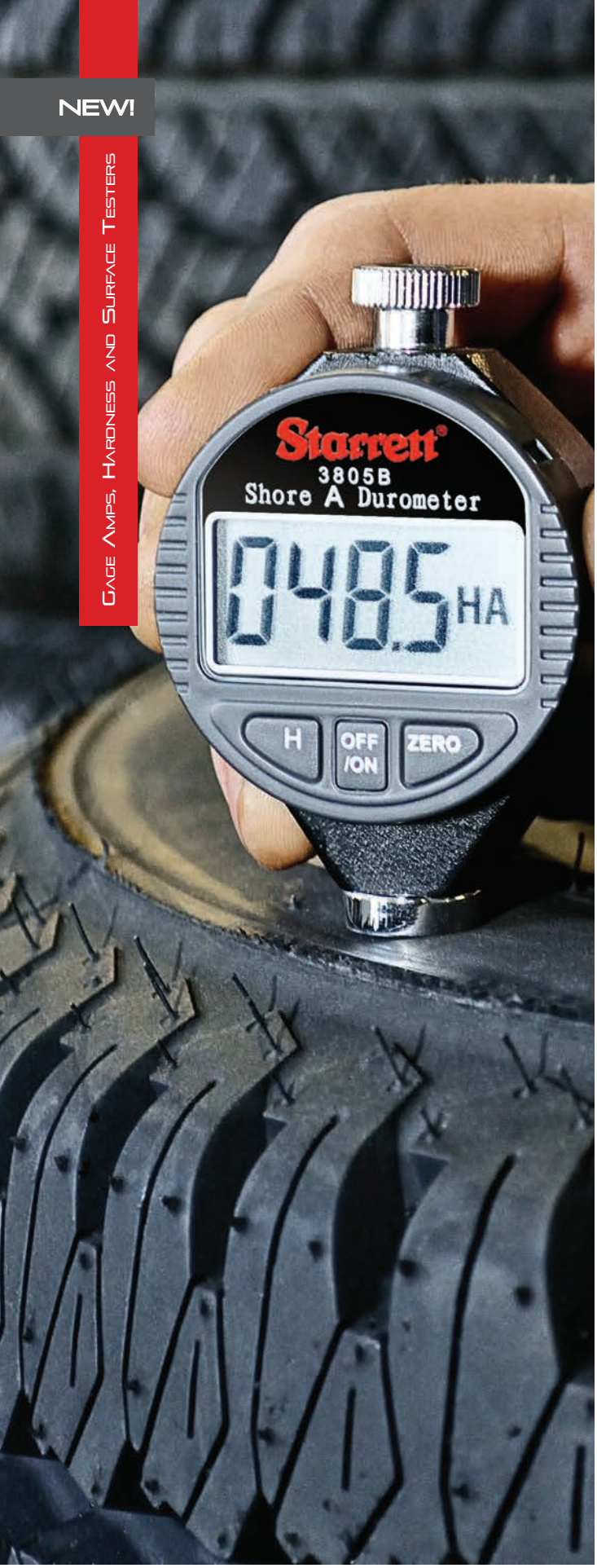
Roughness parameters obtained by filtering: Ra, Rq, Rt, Rp, Ry, Rku, Rsk, RSm, Rz, RΔq, RTp, RHTp, Rlo, RPC, RzJIS, R3z

Parameters on the raw profile (unfiltered): Pa, Pq, Pt, Pp, Pv, Pku, Psk, PSm, Pz, PΔq, PTp, PHTp, PLo, PPc

Parameters obtained by double filtering (DIN 4776): Rk, Rpk, Rvk, MR1, MR2, A1, A2, Rpk,

Parameters obtained by the motifs method ("R&W)*: R, AR, Pt, Rx, SR, SAR, Nr, Kr, W, AW, Wte, Wx, SW, SAW, Nw, Kw, Rke, Rpke, Rvke, Trc, HTrc

* Only with gold or silver versions




# Electronic Durometers

## 3805B Electronic Durometer

The 3805B is designed to fit comfortably and firmly in your hand. Its large LED display and simple three button control make the 3805B Durometer easy to use.

The 3805B measures Shore A values for a wide variety of soft materials including: rubber: soft vulcanized (i.e. tire), natural nitrile; elastomeretric materials (rubber and rubber-like): GR-S, GR-1, neoprene, thiokol, flexible polyacrylic esters; other softer materials including wax, felt, leather, etc. (materials that would normally yield under fingernail pressure).

### Features and Specifications

- Extra large LED display
- Simple 3-button control
- Auto Hold feature
- Measuring range: 0-100 HSA
- Deviation: <1% H
- Resolution: 0.5 H
- Accurate and repetitive deviation = 20~90HSA
- HSA <±1 grade
- Custom carrying case

| 3805B Electronic Durometer | | |
|---|---|---|
| **Description** | **Cat. No.** | **EDP** |
| 3805B Electronic Durometer in plastic case | 3805B | 69882 |
| 3 Rubber Test Block Certified Set | SRB-3 | 68200 |



# Thickness Gages

## 3812 Ultrasonic Thickness Gage

The 3812 Ultrasonic Thickness Gage is a state-of-the-art digital ultrasonic thickness gage packed with features typically found only on high end models.

It measures the thickness of metallic and non-metallic materials such as steel, aluminum, titanium, plastics, ceramics, glass and any other good ultrasonic wave conductor that has parallel top and bottom surfaces.

This dynamic ultrasonic thickness gage accurately displays readings in either inch or millimeter units after a simple calibration to a known thickness or sound velocity.

| 3812 Ultrasonic Thickness Gage and Accessories | | |
|---|---|---|
| **Description** | **Cat. No.** | **EDP** |
| 3812 Ultrasonic Thickness Gage, software, USB cable, couplant gel and carry case | SRB-3 | 68200 |




### Features and Specifications

- 4 digit LCD display with back light
- Upper/Lower limit preset alarm
- Measurement and scanning capabilities
- Adjustable sound velocity
- Extended memory
- 20 memory groups (100 files/group)
- Minimum display unit: 0.001" (0.01mm) selectable
- .040-12.0" measuring range (in steel with standard probe)
- 3280-32805ft/s (1000-9999m/s) sound velocity range
- 32-122 °F operating temperature
- 5MHz Frequency
- 4Hz update range
- USB output
- Power supply: Two 3V AA alkaline batteries with approximately 100 hours of life (with the backlight off)
- Power consumption: Working current is less than 3V
- Accuracy: ± (0.5% thickness + .001")
- Dimensions: 5.90" x 2.91" x 1.30" (150 x 74 x 33mm)
- Weight: 8.6oz (245g)
- Includes tester and cables, software, USB cable, couplant gel and a rugged, form fit carrying case



# Thickness Gages

## 3813 Coating Thickness Gage

The 3813 Coating Thickness Gage is a state-of-the-art coating thickness gage that utilizes the characteristics of both eddy current and magnetic induction to perform two types of thickness calculation.

The gage uses an integrated probe to automatically determine whether the substrate is ferrous or non-ferrous. Then, it either detects the thickness of non-magnetic coating on a magnetic substrate (ferrous) or the insulating coating on a non-magnetic conductive substrate (non-ferrous).

Testing performance is non-destructive and extremely accurate. The 3813 is ideal for a broad range of applications in manufacturing, engineering and commercial inspection.

| 3813 Thickness Gage | | |
|---|---|---|
| Cat. No. | EDP | Description |
| 3813 | 69883 | Coating Thickness Gage with steel and aluminum substrate samples, four calibrated thickness samples, batteries, manual and case |

### Features and Specifications

- Measuring range: 0-40mils (0-1000µm) max.
- Resolution: 0.1µm/0.1mils (0-99µm) or 1µm (over 100µm)
- Guaranteed tolerance (after one-point calibration): ±1-3%n or 2µm (whichever is greater)
- 4-digit display, .40" (10mm) height,
- Minimum measuring area: .20" x .20" (5 x 5mm)
- Minimum radius of curvature: Convex: .12" (3mm), Concave: 1.2" (30mm)
- Minimum substrate thickness: Ferrous: 20 mils (0.5mm), Non-ferrous: 2 mils (50µm)
- Zero calibration
- Foil calibration
- Maximum surface temperature of test object: 302 °F (maximum contact time 2 seconds)
- Power source: Four AA batteries
- Includes steel and aluminum substrate samples
- Includes four calibrated thickness samples
- Dimensions: 6.39" x 2.74" x 1.27" (161 x 69 x 32mm)
- Weight: 9oz. (260g)









# SPECIAL GAGING

# Special Gaging

## The Starrett Special Gage Division

Even with our extremely broad catalog of products, some application measurement requirements can not be met with a standard tool – they require a custom solution.

One way Starrett stands out from other precision tool providers is our willingness to work directly with our customers to develop custom tools and gages. Established over 50 years ago, our Special Gage Division is an independent group within the Company that devotes its total effort to developing and building special gages.

Once we determine that no "off-the-shelf" product is applicable, our engineers begin a dialog with the customer to develop a custom tool for the specific task.

Together, we discover what you want and need. Then, we design and build a special tool or gage that will perform to your expectations – with rugged construction, easy and intuitive operation, Starrett quality and guaranteed to meet your specifications for accurate, reliable part measurement.

Design work is treated in a strictly confidential manner. Design-and-build prices are quoted at no charge. Prices are fixed at order entry.





Custom designed and built
Area Flow Gage

## Single-Source Reliability

We make and use electronic indicators, AGD dial, electronic and mechanical micrometer heads, and all of the other tools or gages that provide the output from the custom gage.

We also make DataSure® Wlreless Data Collection Systems, which we have integrated into an increasing number of special gages so measurement data can be gathered and recorded with 100% reliability.

Simply put, our service and expertise are second to none – we control the entire process from concept through design, manufacture, inspection and delivery.

We offer the resources of this unique problem-solving division to innovate, design, and build the equipment you need to control product quality and reduce dimensional gaging costs.

The following pages show some examples of gages. we have developed and built.

## Contact Us

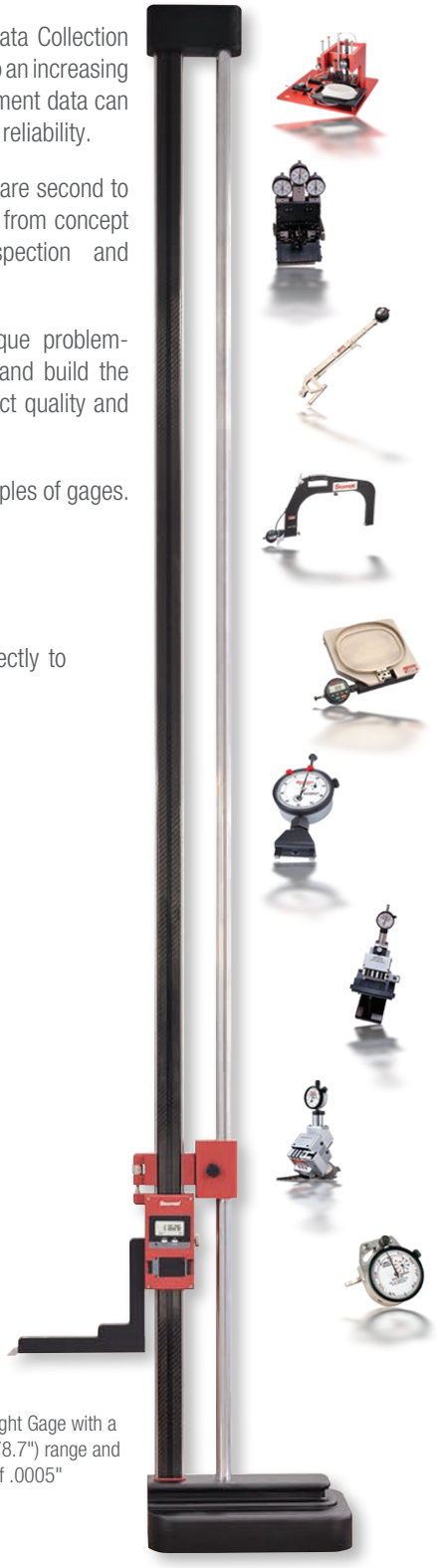
We encourage you to contact us directly to discuss your application.

**Tel.:** (978) 249-3551 x407

**E-mail:** specialgage@starrett.com

**FAX:** (978) 249-3699

The L. S. Starrett Company
Special Gage Division
121 Crescent Street
Athol, MA 01331-1915



Custom Height Gage with a 2000mm (78.7") range and resolution of .0005"

## Special Gage Division Mission

We design and build dimensional measuring instruments that provide guaranteed performance to meet our customers' specifications. We are in the business of solving measuring problems when standard gages cannot be used.

Find out more about Starrett Custom Solutions at: **starrett.com/custom**

# Special Gaging

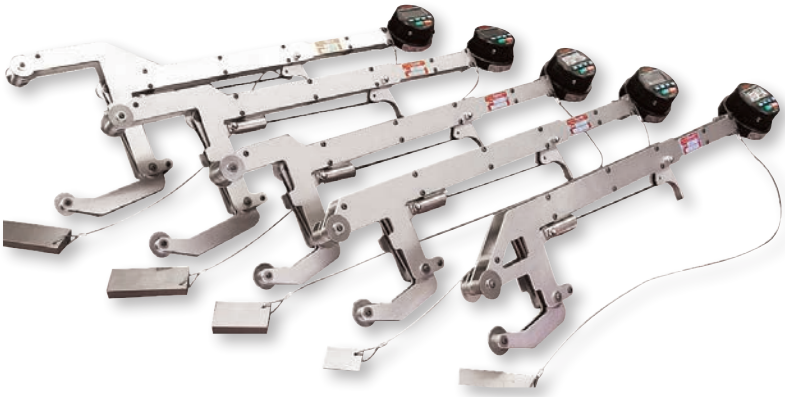
## Measuring Hot Steel During Rolling, Forging or Extruding

Starrett Special Gage was asked by a customer to develop a new gage for measuring hot steel flat stock during the rolling process.

The old measuring device utilized a gage with a crude fractional dial that did not provide accurate or repeatable results. In addition, it often stuck to the hot steel and ruined the piece being measured. Even worse, on several occasions, the old process caused burn injuries to the operator.

The customer needed a new solution that provided precise and reliable results, a much lower scrap rate, and ensured operator safety.

The application presented some unique challenges. Any operation that requires contact with hot steel is dangerous and must be of very brief duration.



The Hot Steel Gage is now a family of products with capacities up to 12"



Hot Steel Gage with a DataSure End Node

## From Problem to Solution

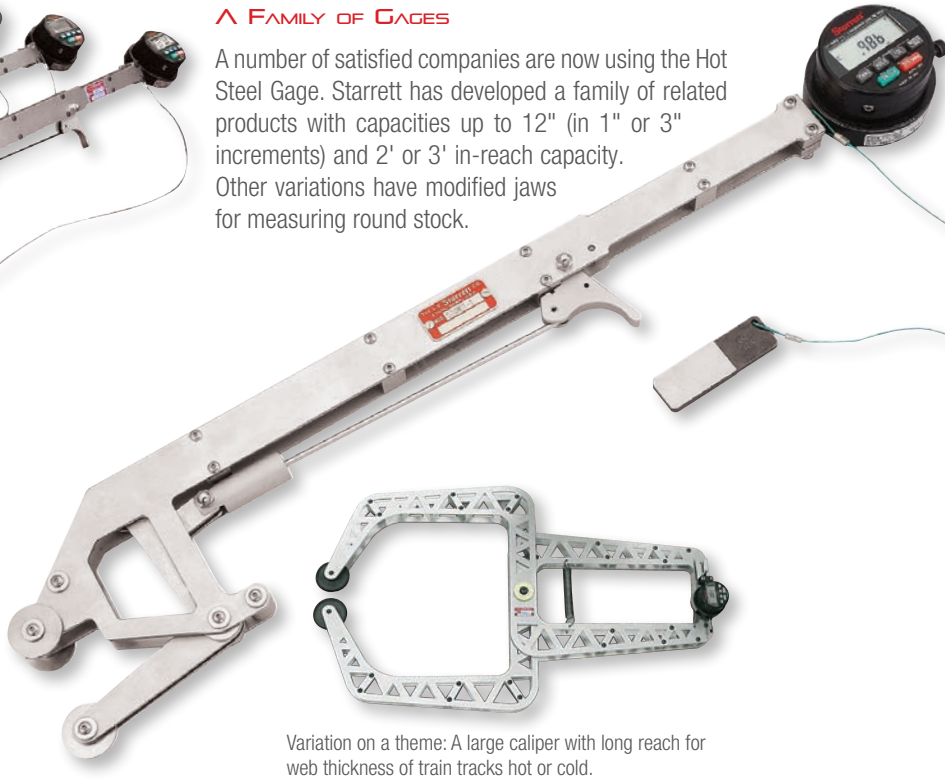
After collaboration between the engineering staffs of our customer and the Starrett Special Gage group, a radically different gage was developed that met all of the design criteria.

## The Hot Steel Gage

- Takes measurements quickly, with only two seconds of contact
- Uses an electronic indicator with a hold feature to lock the reading so it can be safely read away from the dangerous area, and in better light conditions
- Nickel plated to minimize radiant heat transfer
- The operator's hand stays 12" away from the hot steel
- The gage is very accurate, measuring to ±.003"

## A Family of Gages

A number of satisfied companies are now using the Hot Steel Gage. Starrett has developed a family of related products with capacities up to 12" (in 1" or 3" increments) and 2' or 3' in-reach capacity. Other variations have modified jaws for measuring round stock.



Variation on a theme: A large caliper with long reach for web thickness of train tracks hot or cold.

## DataSure® Wireless Data Collection

Starrett introduced the DataSure Wireless Data Collection System several years after the hot steel gage was developed and it was a perfect fit for this application.

With DataSure, the measurement data can be recorded and sent to a data collection application with 100% reliability immediately after it is recorded by the indicator.

Many manufacturers now include DataSure when they order these gages, and existing gages have been field-retrofitted.



# Special Gaging

## Container Fit Measurement for the Food and Plastics Industries

### PI-GAGES FOR I.D. AND O.D.

Starrett PI-Gages protect product quality by maintaining critical diameter tolerances of plastic lids and containers where shrinkage, temperature and mold affect parts manufacturing. The diameter of these parts is critical to the sealing integrity between lids and containers.

We have developed a wide variety of hand held and fixture gages for many related applications. Starrett PI-Gages measure diameters accurately to within .001".

Designed to measure any flexible circular part, variations of these gages have been in use for over 25 years, and have become the standard of the industry.



## Fixtures for Large O.D. or I.D. Measurement



Metal band I.D. fixture for 1/2-gallon container



Master in position to set indicator to zero




Top of 1/2-gallon container in measuring position

## PI-Plate Gage for O.D.

This gage ensures container quality requirements with an easy-to-use gage system. With either electronic indicators (and data collection), or dial indicators, this gage measures flexible product diameters to .001" accuracy.

Each gage from the 2" to 4" range through the 10" to 12" range is set to zero with the master. Push the button on the indicator to insert a part and release the button to gage a part within ±.025" diameter range from the master size. They provide quick changes from size-to-size, ease of use, and .001" accuracy will ensure process control.



# Special Gaging



## Pneumatic Food Tray Measurement

This gage measures width, length, and height of food trays.

Full part length contacts ensure the correct dimensions for every measured parameter.

The gage employs a system of pneumatics to withdraw probes for quick, easy loading and unloading of trays.

A steel master is used to replicate a perfect part. The electronic indicators are then set to their mean values.

The result is a reliable and accurate system with fast throughput to measure a specialized, complex part.

## Measurement of the Interface of a Coffee Cup and Lid

Most of us have heard the story – a large fast food chain is sued because the lid came off of a Styrofoam coffee cup and scalded a customer. The company lost the suit and the word went down to find a way to make sure that the lid stays on and the cup does not leak – a specialized, difficult measurement that required a custom solution.

The hand held gage pictured provides the perfect solution to this application. The cup and lid are both measured with the same gage, with a simple sensor change to go from one to the other.

Each are measured to within ±.001".

The result is a reliable and accurate system that keeps the lid on the cup and prevents leaks. The fast food customer is safe from hot coffee and our customer is safe from costly lawsuits.

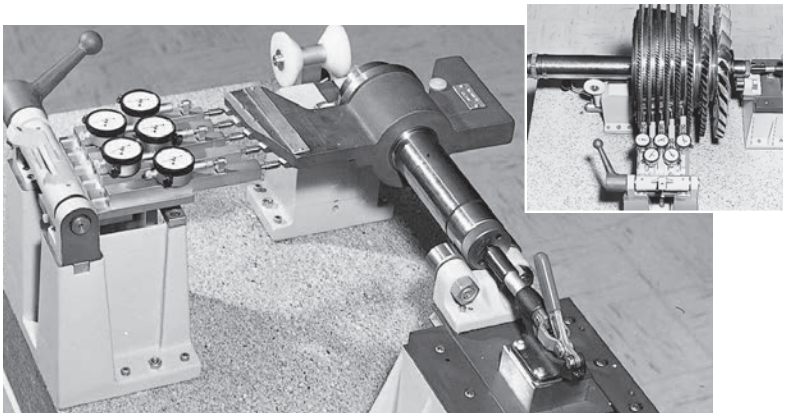


# Special Gaging

## Turbine Compressor Rotor Spacers

This inspection fixture checks gas turbine engine compressor rotor spacers for radial size and runout at five stages.

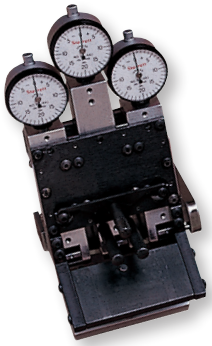
It represents a specific Starrett special gage capability — the designing and building of large, ultra-precise fixture gages mounted on Starrett precision granite surface plates which meet or exceed U.S. Federal Specification GGG-P-463C.



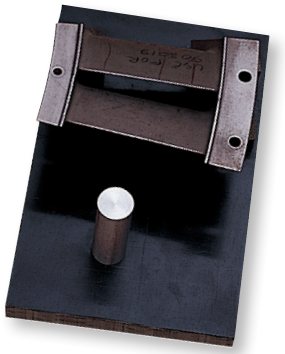
Inset: Rotor turns 360º on its axis to determine runout and radial deviation.

## Turbine Nozzle Diaphragm Opening Gage

This gage checks three critical dimensions in the nozzle. This is an older and less complex design than the gage above, and it does not measure the radial height dimension.



Gage on setting master

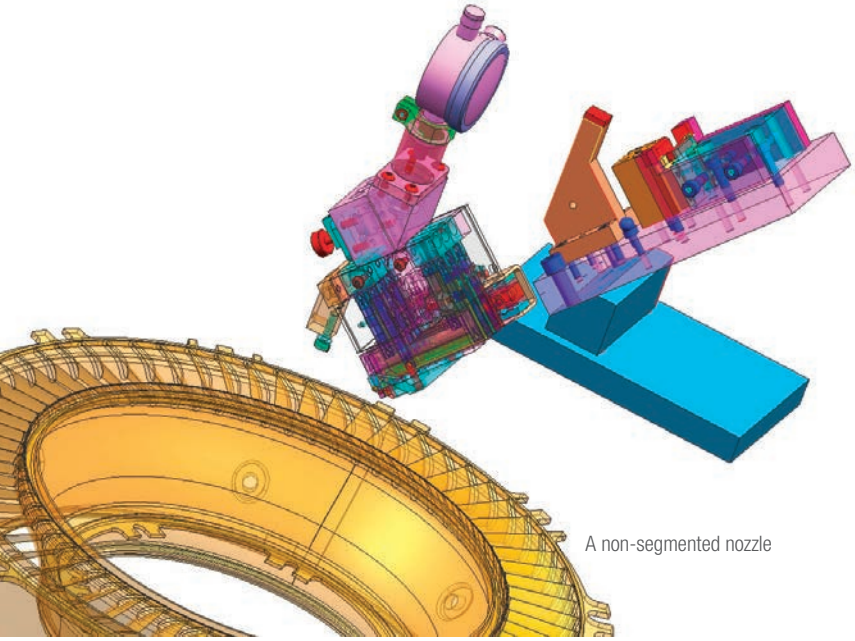


Test Master segment

## Aerospace

### AREA FLOW GAGE

Area Flow Gages measure the minimum area openings of turbine engine nozzles. Area readings are in .001 square inch resolution. It uses eight or more contacts that reach into the throat of the turbine nozzle openings. The recorded measurements are transferred via hydraulic cylinders to a dial indicator. Using mechanical linkage and hydraulics the algebraic area is transferred to the indicator or electronic probe at the top of the gage. Openings of segments are matched and located opposite one another on the engine circumference to provide a balanced air flow. These gages are custom designed for each stage of the turbine and are critical to proper engine performance and operation.



A non-segmented nozzle





# Special Gaging



## High Precision Cylinder Measurement

We offer a full range of snap gages that utilize highly polished carbide contacts to measure cylindrical parts to as close as ±.0001".

The gage has an insulated handle with a thumb activated contact lift and a bump stop.

Each gage with optional master can measure a 1" range with exceptional accuracy.

They are available as bench or handheld gages.

## Adjustable Range Snap Gages

These snap gages have a lightweight aluminum frame and low-friction ball bushing motion transfer.

The indicator can be rotated and locked for easy viewing in any position.

Ball contacts or contacts for grooves are also available. They are also available with electronic indicators.

They have simple and rugged construction including sturdy dovetail slides for range adjustment. This is a proven low maintenance gage with a long trouble-free life.

Three standard size ranges are available: 6-10", 10-14", and 14-18".

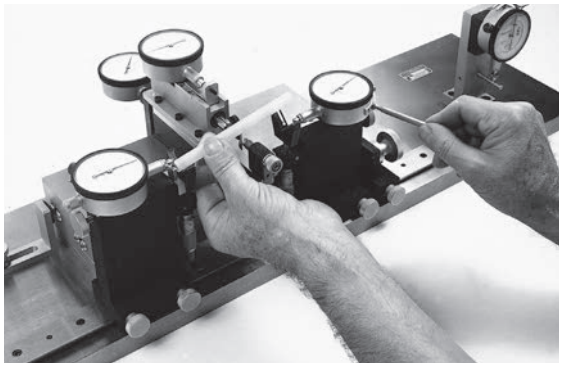









Measuring a turbine component.



Inserting ceramic cylinder in gage to check squareness and parallelism of ends, longitudinal bow and out-of-roundness

## Multi-Readout and Special Purpose Gages

This complex five-station fixture gage checks critical dimensions and geometry of precision cylinders.

This single fixture checks overall length to ±.010", squareness and parallelism of the ends to within .002", longitudinal bow to within .005", out-of-roundness to within .003" T.I.R, and wall thickness to within ±.003".

The gage includes micrometer head height adjustment of the work-staging V-rests. It has precision ball slide mounts for dial indicators at two of the stations and wear-resisting carbide contacts at all gaging stations.

# Special Gaging

## Outside and Inside Diameter Gages

Individually designed and built for each application, these gages have a low-friction ball bushing direct-transfer mechanism and will repeat within one graduation.

It is made of aluminum for light weight and to preserve the proper "feel". Gage contacts and rest feet are carbide for long wear.

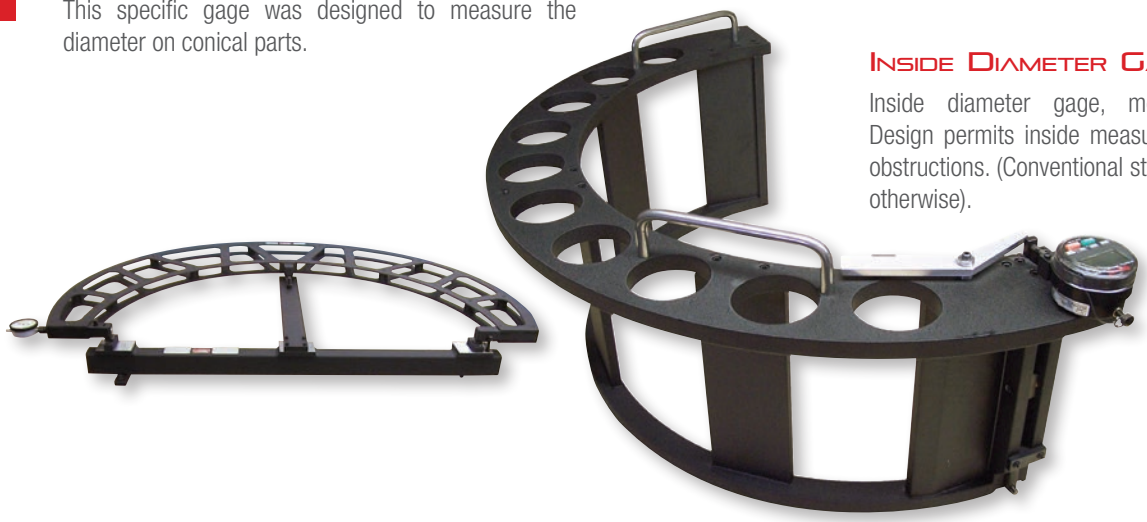
The steel tube master has carbide rests and pads for accuracy and wear control.

Shown here is an angled outside diameter gage in position on the setting master to set the indicator to zero.

This specific gage was designed to measure the diameter on conical parts.



Angled outside Diameter Gage with Setting Master

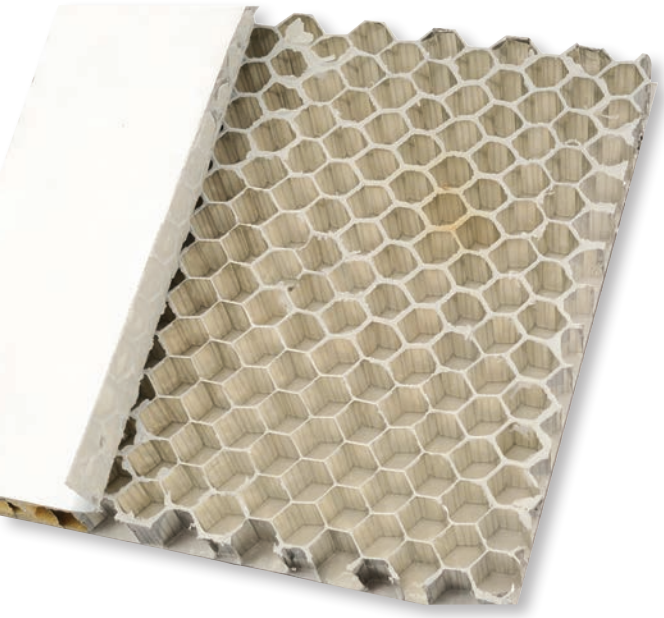


## Inside Diameter Gage

Inside diameter gage, moderately deep reach. Design permits inside measuring, while clearing hub obstructions. (Conventional straight bar would be used otherwise).



# Special Gaging



## Ultra-Light Honeycomb Deep Throat and Large Diameter Gages

A large diameter or deep-throated gage no longer has to be heavy and hard to handle. Starrett special gage engineers have studied the physical and structural properties of honeycomb aluminum, establishing standards covering the selection and use of this lightweight material.

The results were long-range measurement to close tolerances in hand-held gages of many configurations, all combining great rigidity with light weight and ease of handling.

It measures diameters to 72" (180cm) and throat depths to 24" (60cm).

## Ultra-Light Deep Throat Gage

This deep throat indicating micrometer gage solves the problem of checking the .281" (±.005") thickness of a fan rotor shaft at a point nearly 15" from its edge.







## Ultra-Light Large Diameter Gage

This gage is used as an indicating snap gage by setting the indicator to zero with the set master and then reading the part size variations on the indicator.

The setting master is a Starrett 234 End Measuring Rod with insulated grips and saddle-centering mounts.

Sizes are available from 18" to 24" through 84" to 90".

This gage can be made into an adjustable snap gage by fitting one end with a micrometer and the other end with an indicator. They are available with dial or electronic indicators.

Other concepts are available to suit specific requirements.

# Special Gaging

## Special Geometries

### Thickness Gages

We have fulfilled many requests for special purpose gages to measure material thickness in hard to reach areas.



Thickness gage with roller contacts





Wall thickness gages

## Quick-Adjusting Micrometer Head

We have developed a number of custom gages utilizing a Starrett 30380 Quick Adjusting Micrometer Head. It greatly increases the speed with which measurements can be taken.

Pressing a button on the thimble allows the spindle to slide along its axis to any position within its range. Releasing the button re-engages the spindle threads, and thimble rotation is then used for final size adjustment.

Gages with these micrometer heads can save a lot of time when taking precise measurements in hard to access areas



## Dial Protractor Heads

Starrett Dial Protractor Heads for special applications permit rapid angular measurements. With 90º range and graduations of 5' they will assure accurate measurements.

Specifications – Bezel diameter is 2-1/4"; case thickness is 1.34" from crystal to back; .25" dia. input shaft projects .63" from back of case. Main dial reading to customer specification; graduation – specify 0º5', 0º10' or 0º15'. Also available with balanced dials and with counterclockwise figures in red.



# Special Gaging

## Universal Bench Gage

Sizes from 0 to 4" are rapidly checked to .0001" accuracy with a dial or electronic indicator. The gage range is ±.100" from the zero set point on a master. A rugged ball bushing motion transfer provides accuracy for many maintenance-free years.

With optional contacts, this gage can be quickly set up to check inside and outside diameters, slot and groove widths, length or thickness, and splines or gear pitch diameters.

Move the lockable slide to reverse this gaging direction. Attach the required contacts and set the indicator to zero with a master. You are ready to gage a different part in less than five minutes.

The gage is also available with a digital indicator that will hold the reading from one sweep over the part to eliminate errors.



Contacts are available for numerous applications. Optional 2- or 3-point contact sets are available with flat or rounded faces, conical points, steel or carbide balls, and pins for over-roll dimensions.

## Data Collection

SPC requires accurate input of product dimensions. Speed and accuracy are the demands met by this special gage and the 776 Gage -Chek™.

One special gage and one 776 displays and stores up to eight dimensions. As shown, the larger diameter, small diameter, concentricity and length are checked in one step. It takes less than ten seconds to take and store all four dimensions.

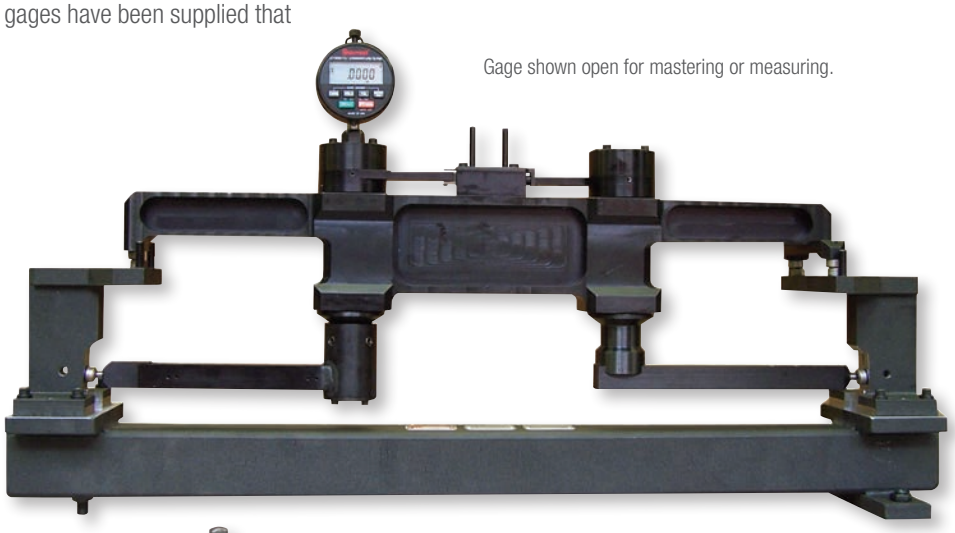
The actual sizes are entered into the 776 display. Both the variance from nominal size plus actual size can be displayed.



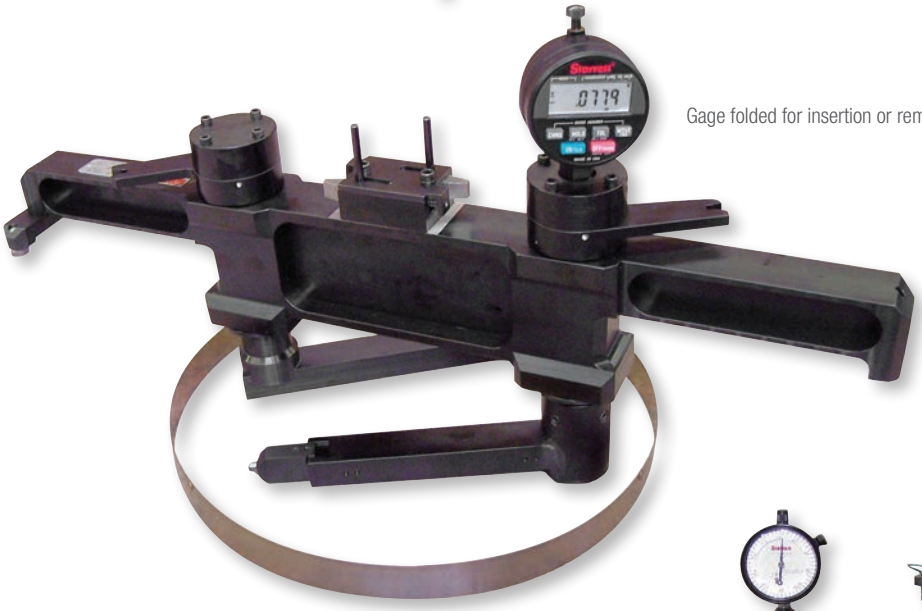
# Special Gaging

## Inside Diameter Double-Turret Gages

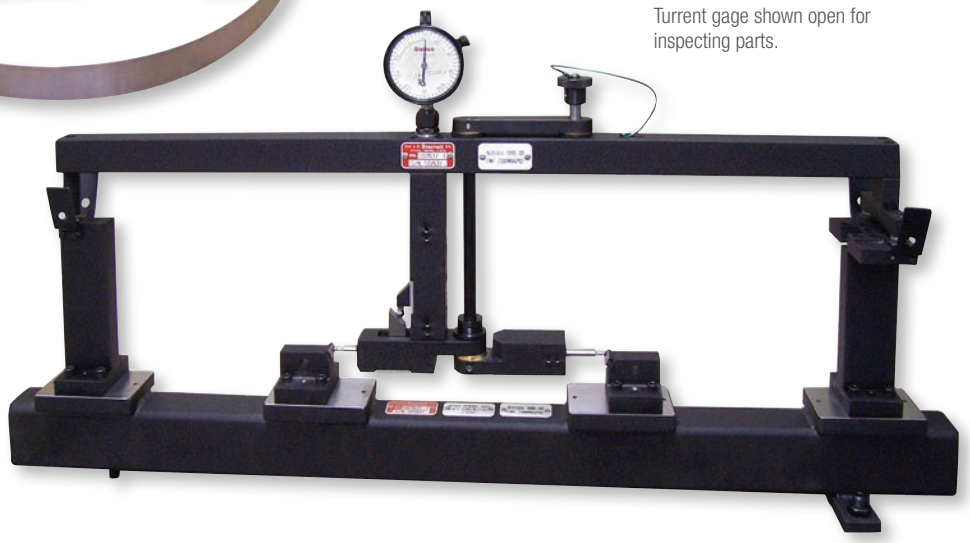
This gage was designed to fit through a diameter much smaller than the one to be gaged. A double-turret gage can check an I.D. up to two times larger than the hole it will pass through. Single-turret gages can be designed for I.D.s up to one and one-half times larger than the hole it will pass through. Accurate gages have been supplied that will reach 36" deep.



Gage shown open for mastering or measuring.



Gage folded for insertion or removal.



Turrent gage shown open for inspecting parts.

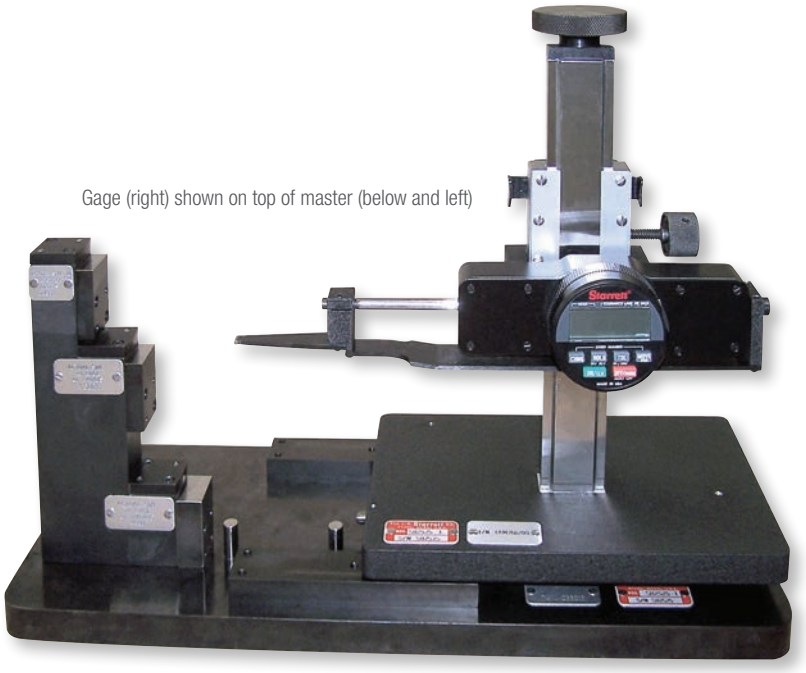
# Special Gaging

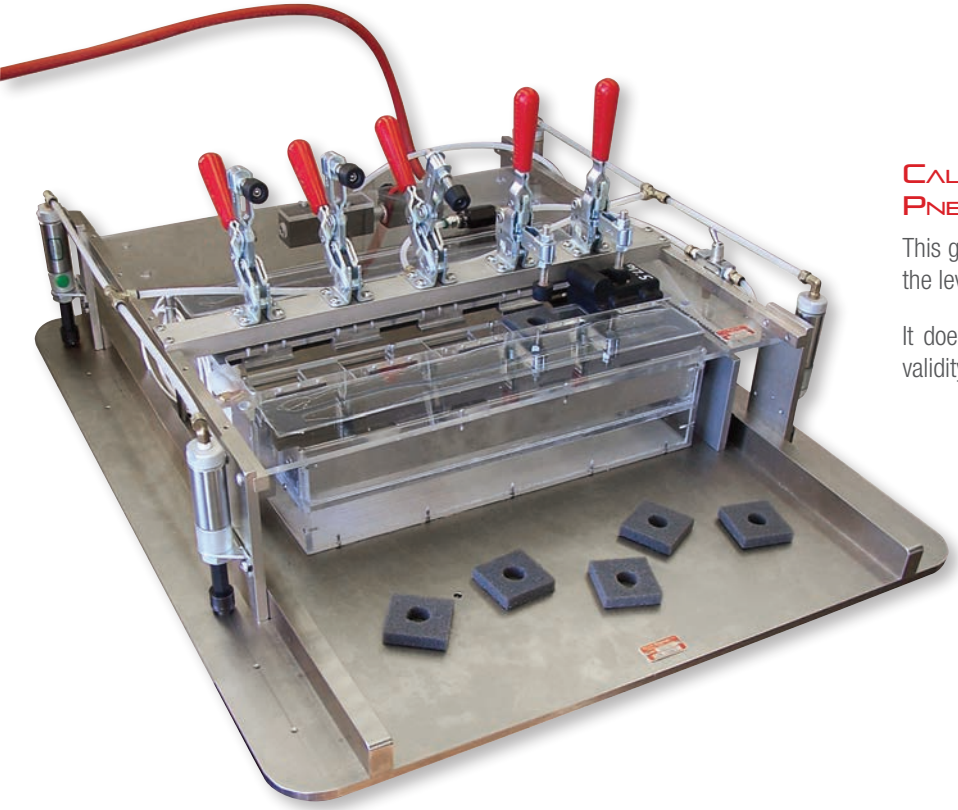
## Variable Height Diameter Radius Gage

Diameters, radii and lengths (from known "bump stops") can be measured using this long gaging range, electronic indicator assembly.

It is capable of locking into position at specific heights and moved up or down as needed.

Gage (right) shown on top of master (below and left)





## Calibration Gage with Pneumatic Adjustment

This gage is used to check the equipment that detects the level of a chemical in two tanks.

It does not do the actual measuring, but verifies the validity/compliance of the detectors.













# Performance Racing




## Stagger Pro 1000

The Stagger Pro 1000 utilizes electronic caliper technology to quickly and accurately record front and rear stagger for oval track car setup. The Stagger Pro is simple to use and eliminates potential errors that could result in costly setup mistakes. With simple button presses the Stagger Pro quickly measures each tire and calculates the front and rear stagger. Adjustable to accomodate a variety of tire sizes.

## Ride Height Gage

Controlling the ride-height of a car is one of the most strict rules in racing. Starrett developed a custom-engineered Ride Height Gage that provides easier, more precise measurement before and after the race.






## Cylinder Bore Gage

The design of the cylinder gage is to access the engine's piston cylinder cavity through the spark plug opening. The design allows a quick check of racing specifications of the cylinder cavity diameter, especially modifications beyond what's acceptable, without the need to dismantling the engine block for acess.





# SQUARES

# Squares

Starrett squares are offered in a practical variety of styles to suit the needs of the individual, whether it be a toolmaker, mechanic, carpenter, or a "do-it-yourself" homeowner.

The Starrett name has always been associated with squares because our founder, Laroy Starrett, invented the combination square in 1877. The success of this tool led to the beginning of The L.S. Starrett Company in 1880. The combination square is one of the world's most practical and versatile tool inventions – the basic tool for every builder and craftsman.

## Squares

In this section you will see combination squares, solid test or try squares, and special squares for tool and diemakers and carpenters.

To check squareness at the highest level of accuracy, we recommend our TS True Squares. These are available in three styles down to the amazing accuracy of 1/4 second. These are listed in the Gage Block Section of this catalog.

We also offer granite squares which are listed in the Granite Surface Plate Section of this catalog. The main purpose of these squares is for checking the X, Y, and Z axes on CNC machine tools and coordinate measuring machines.



### Combination Squares Feature:

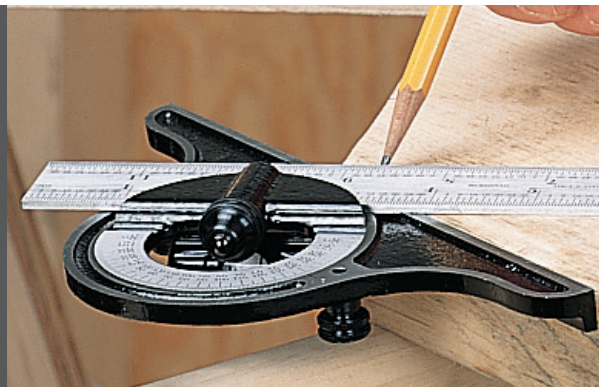
- A choice of smooth-finished forged and hardened (longer wearing) steel square head and center head, or a cast iron square head and center head. All bearing surfaces are accurately ground.
- A choice of stable cast iron protractors – reversible or non-reversible style – all nicely finished with a black, durable finish
- Protractors are furnished as reversible, with shoulders on both sides of the blade, or non-reversible, with a single shoulder on one side of the blade only. All protractors also have a spirit level.
- Protractor heads have revolving turrets with direct-reading double graduations, 0-180º in opposite directions. This permits the direct reading of angles and supplementary angles.
- Most square heads have a handy spirit level and a hardened scriber
- Square blades and protractor heads come in a choice of regular or Starrett no-glare satin chrome finish
- A reversible lock bolt allows the blade to be turned over or end-for-end without removing the lock bolt or nut. This ensures true alignment of the blade and heads.
- Square blades feature easy-to-read, sharp graduations and are available in many convenient styles
- Separate parts and attachments available

### Tips for Using Squares and Center Heads

First, make sure your square is clean and that it is located against a flat surface – burrs on metal or knots and bumps on wood will throw squareness off.

Second, to scribe a line, the steel scriber can be used on any material, but usually on metal. A carpenter's pencil is normally used on wood, but if finer lines are needed, a light cut with a utility knife may be used. This is also handy when scribing cross grain.

Third, when using a center head on a piece that may not be completely round, it is good practice to scribe more than two intersecting lines.



# Combination Squares

Starrett combination squares consist of a photo-engraved, hardened and tempered steel rule (or blade) on which is mounted on an adjustable square head.

Starrett Combination Square Heads are made of cast iron or forged and hardened steel and are not to be confused with the cheap imitation plastic or die cast heads on the market. The value of Starrett tools is that they are accurate and will last.

As the name indicates, these tools can be used for many different purposes – a complete substitute for a whole set of common solid try squares, a 45 degree miter, a depth gage, a height gage, a marking or scribing gage, a level, a plumb and, by withdrawing the blade, it can also be used as a precision rule. This saves littering the workbench with too many tools, each being necessary but may be used less. This results in the goal of all good craftsmen – better accuracy and greater efficiency.

The combination square with center head is a basic combination set. The center head is a convenient and accurate way to find the center of round work.

Complete combination sets feature the combination square with a center head and with either a reversible or non-reversible protractor. Details of the protractors are also included in the Protractor and Angle Measurements Section of this catalog.



Combination square

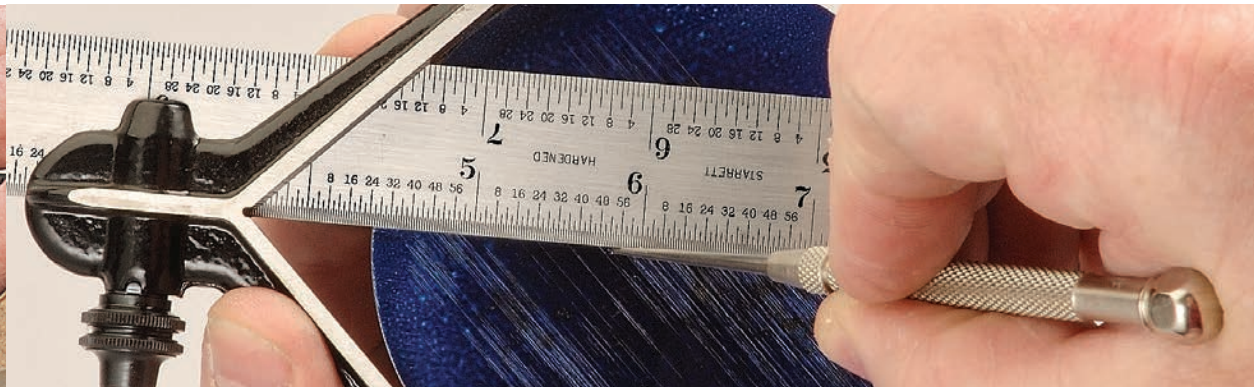


Combination square with head



Combination set





# Combination Squares

## 11H Cast Iron Heads

With reversible lock bolt, scriber, spirit level (except 4"), and hardened steel, photo-engraved blade with regular or satin chrome finish. Cast iron head with black wrinkle finish.

## 33H Forged and Hardened Steel Heads

These squares have the same features as the 11 cast iron heads except that the square heads are forged hardened steel with smooth, black enamel finish.



C11H-12-4R



C33H-12-4R

| 4-24" Combination Squares with Square Head | | | 11H | | 33H | |
|---|---|---|---|---|---|---|
| | | | Cast Iron Heads with Black Wrinkle Finish | | Forged and Hardened Steel Heads with Smooth Black Enamel Finish | |
| Size | Graduation | Blade | Cat. No. | EDP | Cat. No. | EDP |
| 4" | 4R – 8ths, 16ths, Quick Reading 32nds, 64ths | Regular | 11H-4-4R | 50049 | 33H-4-4R | 50203 |
| | | Satin Chrome | C11H-4-4R | 56360 | C33H-4-4R | 56390 |
| 6" | 4R – 8ths, 16ths, Quick Reading 32nds, 64ths | Regular | 11H-6-4R | 50051 | 33H-6-4R | 50205 |
| | | Satin Chrome | C11H-6-4R | 56362 | C33H-6-4R | 56392 |
| 6" | 16R – Quick Reading 32nds, 64ths, Aircraft Quick Reading 50ths, 100ths | Regular | 11H-6-16R | 50053 | 33H-6-16R | 50207 |
| | | Satin Chrome | C11H-6-16R | 56364 | C33H-6-16R | 56394 |
| 12" | 4R – 8ths, 16ths, Quick Reading 32nds, 64ths | Regular | 11H-12-4R | 50055 | 33H-12-4R | 50209 |
| 12" | 4R – 8ths, 16ths, Quick Reading 32nds, 64ths | Satin Chrome | C11H-12-4R | 56366 | C33H-12-4R | 56396 |
| | | | C11H-12-4RW/SLC* | 66896 | C33H-12-4RW/SLC* | 66897 |
| 12" | 16R – Quick Reading 32nds, 64ths, Aircraft Quick Reading 50ths, 100ths | Regular | 11H-12-16R | 50057 | 33H-12-16R | 50211 |
| | | Satin Chrome | C11H-12-16R | 56368 | C33H-12-16R | 56398 |
| 18" | 4R – 8ths, 16ths, Quick Reading 32nds, 64ths | Regular | 11H-18-4R | 50059 | 33H-18-4R | 50213 |
| | | Satin Chrome | C11H-18-4R | 56370 | C33H-18-4R | 56400 |
| 18" | 16R – Quick Reading 32nds, 64ths, Aircraft Quick Reading 50ths, 100ths | Regular | 11H-18-16R | 50061 | 33H-18-16R | 50215 |
| | | Satin Chrome | C11H-18-16R | 56372 | C33H-18-16R | 56402 |
| 24" | 4R – 8ths, 16ths, Quick Reading 32nds, 64ths | Regular | 11H-24-4R | 50063 | 33H-24-4R | 50217 |
| | | Satin Chrome | C11H-24-4R | 56374 | C33H-24-4R | 56404 |
| 24" | 16R – Quick Reading 32nds, 64ths, Aircraft Quick Reading 50ths, 100ths | Regular | 11H-24-16R | 50065 | 33H-24-16R | 50219 |
| | | Satin Chrome | C11H-24-16R | 56376 | C33H-24-16R | 56406 |
| **150-600mm Combination Squares with Square Head** | | | **11MH** | | **33MH** | |
| 150mm | mm and 1/2mm Both Sides | Regular | 11MH-150 | 56241 | 33MH-150 | 56247 |
| | | Satin Chrome | C11MH-150 | 56380 | C33MH-150 | 56410 |
| 300mm | mm and 1/2mm Both Sides | Regular | 11MH-300 | 56243 | 33MH-300 | 56249 |
| | | Satin Chrome | C11MH-300 | 56382 | C33MH-300 | 56412 |
| 600mm | mm and 1/2mm Both Sides | Regular | 11MH-600 | 56245 | 33MH-600 | 56251 |
| | | Satin Chrome | C11MH-600 | 56384 | C33MH-600 | 56414 |
| **300-600mm and 11-3/4 – 23-1/2" Combination Squares with Square Head** | | | **11MEH** | | **33MEH** | |
| 300mm and 11-3/4" | 1/2mm and 32nds One Side; mm and 64ths Reverse Side | Regular | 11MEH-300 | 50067 | 33MEH-300 | 50221 |
| | | Satin Chrome | C11MEH-300 | 56386 | C33MEH-300 | 56416 |
| 600mm and 23-1/2" | 1/2mm and 32nds One Side; mm and 64ths Reverse Side | Regular | 11MEH-600 | 56121 | 33MEH-600 | 50237 |
| | | Satin Chrome | C11MEH-600 | 56388 | C33MEH-600 | 56418 |

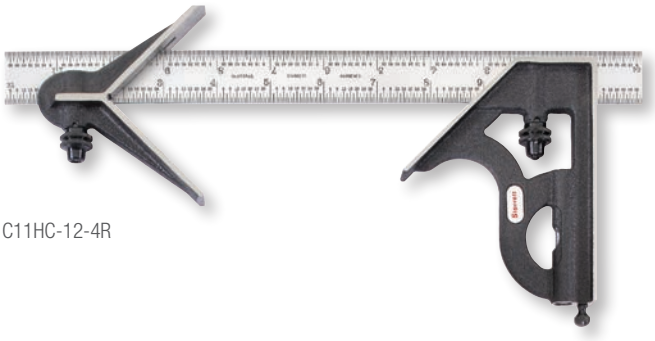
* Includes redemption card for Standard Letter of Certification (SLC).

# Combination Squares

## Combination Squares with Center Heads

### 11HC Cast Iron Heads

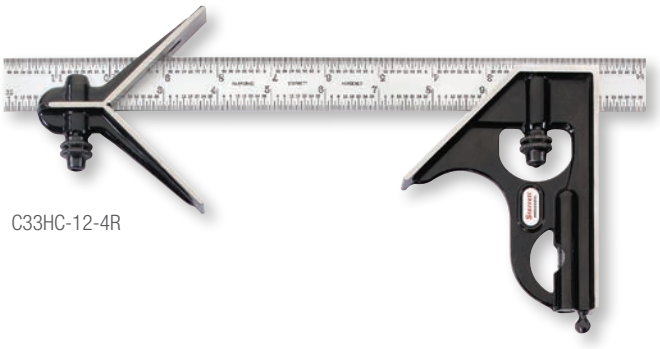
With reversible lock bolts, scriber, spirit level (except 4"), and hardened steel, photo-engraved blade with regular or satin chrome finish. Cast iron heads with black wrinkle finish.



C11HC-12-4R

### 33HC Forged and Hardened Steel Heads

These squares have the same features as the 11HC cast iron heads except that the square heads and center heads are forged hardened steel with smooth, black enamel finish.



C33HC-12-4R

| 4-24" Combination Squares with Square and Center Heads | | | 11HC | | 33HC | |
|---|---|---|---|---|---|---|
| | | | Cast Iron Heads with Black Wrinkle Finish | | Forged and Hardened Steel Heads with Smooth Black Enamel Finish | |
| Size | Graduation | Blade | Cat. No. | EDP | Cat. No. | EDP |
| 4" | 4R – 8ths, 16ths, Quick Reading 32nds, 64ths | Regular | 11HC-4-4R | 50050 | 33HC-4-4R | 50204 |
| | | Satin Chrome | C11HC-4-4R | 56361 | C33HC-4-4R | 56391 |
| 6" | 4R – 8ths, 16ths, Quick Reading 32nds, 64ths | Regular | 11HC-6-4R | 50052 | 33HC-6-4R | 50206 |
| | | Satin Chrome | C11HC-6-4R | 56363 | C33HC-6-4R | 56393 |
| 6" | 16R – Quick Reading 32nds, 64ths, Aircraft Quick Reading 50ths, 100ths | Regular | 11HC-6-16R | 50054 | 33HC-6-16R | 50208 |
| | | Satin Chrome | C11HC-6-16R | 56365 | C33HC-6-16R | 56395 |
| 12" | 4R – 8ths, 16ths, Quick Reading 32nds, 64ths | Regular | 11HC-12-4R | 50056 | 33HC-12-4R | 50210 |
| | | Satin Chrome | C11HC-12-4R | 56367 | C33HC-12-4R | 56397 |
| 12" | 16R – Quick Reading 32nds, 64ths, Aircraft Quick Reading 50ths, 100ths | Regular | 11HC-12-16R | 50058 | 33HC-12-16R | 50212 |
| | | Satin Chrome | C11HC-12-16R | 56369 | C33HC-12-16R | 56399 |
| 18" | 4R – 8ths, 16ths, Quick Reading 32nds, 64ths | Regular | 11HC-18-4R | 50060 | 33HC-18-4R | 50214 |
| | | Satin Chrome | C11HC-18-4R | 56371 | C33HC-18-4R | 56401 |
| 18" | 16R – Quick Reading 32nds, 64ths, Aircraft Quick Reading 50ths, 100ths | Regular | 11HC-18-16R | 50062 | 33HC-18-16R | 50216 |
| | | Satin Chrome | C11HC-18-16R | 56373 | C33HC-18-16R | 56403 |
| 24" | 4R – 8ths, 16ths, Quick Reading 32nds, 64ths | Regular | 11HC-24-4R | 50064 | 33HC-24-4R | 50218 |
| | | Satin Chrome | C11HC-24-4R | 56375 | C33HC-24-4R | 56405 |
| 24" | 16R – Quick Reading 32nds, 64ths, Aircraft Quick Reading 50ths, 100ths | Regular | 11HC-24-16R | 50066 | 33HC-24-16R | 50220 |
| | | Satin Chrome | C11HC-24-16R | 56377 | C33HC-24-16R | 56407 |
| **150-600mm Combination Squares with Square and Center Heads** | | | **11MHC** | | **33MHC** | |
| 150mm | mm and 1/2mm Both Sides | Regular | 11MHC-150 | 56242 | 33MHC-150 | 56248 |
| | | Satin Chrome | C11MHC-150 | 56381 | C33MHC-150 | 56411 |
| 300mm | mm and 1/2mm Both Sides | Regular | 11MHC-300 | 56244 | 33MHC-300 | 56250 |
| | | Satin Chrome | C11MHC-300 | 56383 | C33MHC-300 | 56413 |
| 600mm | mm and 1/2mm Both Sides | Regular | 11MHC-600 | 56246 | 33MHC-600 | 56252 |
| | | Satin Chrome | C11MHC-600 | 56385 | C33MHC-600 | 56415 |
| **300-600mm and 11-3/4 – 23-1/2" Combination Squares with Square and Center Heads** | | | **11MEHC** | | **33MEHC** | |
| 300mm and 11-3/4" | 1/2mm and 32nds One Side; mm and 64ths Reverse Side | Regular | 11MEHC-300 | 50068 | 33MEHC-300 | 50222 |
| | | Satin Chrome | C11MEHC-300 | 56387 | C33MEHC-300 | 56417 |
| 600mm and 23-1/2" | 1/2mm and 32nds One Side; mm and 64ths Reverse Side | Regular | 11MEHC-600 | 50075 | 33MEHC-600 | 50238 |
| | | Satin Chrome | C11MEHC-600 | 56389 | C33MEHC-600 | 56419 |

# Combination Sets

## Combination Square wtih Center and reversible Protractor Heads

### 435 Square, Center and Protractor Head

### CAST IRON

With reversible lock bolts, scriber, spirit level in both square head and protractor head, direct reading double 180º protractor scale, hardened steel, photo-engraved blade. Cast iron heads with black wrinkle finish. Also available with satin chrome blade and protractor head.



C435-12-4R

### 434 Forged and Hardened Steel Square and Center Heads, Cast Iron Protractor Head

### THE VERY BEST SETS AVAILABLE

These squares have the same features as the 435 except that the square heads and center heads are forged, hardened steel with smooth, black enamel finish.



C434-12-4R



Supplied in protective case

| 12-24" Combination Sets with Square, Center and Reversible Protractor Head and Blade | | | 435 Sets | | 434 Sets | |
|---|---|---|---|---|---|---|
| | | | Cast Iron Heads with Black Wrinkle Finish | | Forged and Hardened Square and Center Heads, Cast Iron Protractor Head with Smooth Black Finish | |
| Size | Graduation | Blade | Cat. No. | EDP | Cat. No. | EDP |
| 12" | 4R – 8ths, 16ths, Quick Reading 32nds, 64ths | Regular | 435-12-4R | 51556 | 434-12-4R | 51542 |
| | | Satin Chrome | C435-12-4R | 66682 | C434-12-4R | 51548 |
| | | | | | C434-12-4R W/SLC* | 66898 |
| 12" | 16R – Quick Reading 32nds, 64ths, Aircraft Quick Reading 50ths, 100ths | Regular | 435-12-16R | 51557 | 434-12-16R | 51543 |
| | | Satin Chrome | | | C434-12-16R | 51549 |
| 18" | 4R – 8ths, 16ths, Quick Reading 32nds, 64ths | Regular | 435-18-4R** | 51558 | 434-18-4R** | 51544 |
| | | Satin Chrome | | | C434-18-4R** | 51550 |
| 18" | 16R – Quick Reading 32nds, 64ths, Aircraft Quick Reading 50ths, 100ths | Regular | | | 434-18-16R** | 51545 |
| | | Satin Chrome | | | C434-18-16R** | 51551 |
| 24" | 4R – 8ths, 16ths, Quick Reading 32nds, 64ths | Regular | 435-24-4R** | 51559 | 434-24-4R** | 51546 |
| | | Satin Chrome | | | C434-24-4R** | 51552 |
| 24" | 16R – Quick Reading 32nds, 64ths, Aircraft Quick Reading 50ths, 100ths | Regular | | | 434-24-16R** | 51547 |
| | | Satin Chrome | | | C434-24-16R** | 51553 |
| **300-600mm Combination Sets with Square, Center and Reversible Protractor Head and Blade** | | | **435M Sets** | | **434M Sets** | |
| 300mm | mm and 1/2mm Both Sides | Regular | 435M-300 | 66177 | 434M-300 | 56255 |
| | | Satin Chrome | C435M-300 | 61918 | C434M-300 | 56420 |
| 600mm | mm and 1/2mm Both Sides | Regular | 435M-600** | 66681 | 434M-600** | 56256 |
| | | Satin Chrome | | | C434M-600** | 56421 |
| **300-600mm and 11-3/4 – 23-1/2" Combination Sets with Square, Center and Reversible Protractor Head and Blade** | | | **435ME Sets** | | **434ME Sets** | |
| 300mm and 11-3/4" | 1/2mm and 32nds One Side; mm and 64ths Reverse Side | Regular | 435ME-300 | 51560 | 434ME-300 | 51554 |
| | | Satin Chrome | | | C434ME-300 | 56422 |
| 600mm and 23-1/2" | 1/2mm and 32nds One Side; mm and 64ths Reverse Side | Regular | 435ME-600** | 51561 | 434ME-600** | 51555 |
| | | Satin Chrome | | | C434ME-600** | 56423 |

* Includes redemption card for Standard Letter of Certification (SLC).

** Does not include case.

# Combination Sets

## Combination Square with Center and Non-Reversible Protractor Head

### 9 Combination Sets with Square, Center and Non-reversible Protractor Head

#### CAST IRON

With reversible lock bolts, scriber, spirit level in both square head and protractor head, direct reading double 180º protractor scale, and hardened steel, photo-engraved blade. Cast iron heads with black wrinkle finish. Also available with satin chrome blade and protractor head.





Supplied in protective case



9-12-4R

| 12-24" Combination Sets with Square, Center and Non-reversible Protractor Head and Blade | | | | |
|---|---|---|---|---|
| | | | Cast Iron Heads with Black Wrinkle Finish | |
| Size | Graduation | Blade | Cat. No. | EDP |
| 12" | 4R – 8ths, 16ths, Quick Reading 32nds, 64ths | Regular | 9-12-4R | 50042 |
| | | Satin Chrome | C9-12-4R | 50046 |
| 12" | 16R – Quick Reading 32nds, 64ths, Air Craft Quick Reading 50ths, 100ths | Regular | 9-12-16R | 50043 |
| 18" | 4R – 8ths, 16ths, Quick Reading 32nds, 64ths | Regular | 9-18-4R | 50044 |
| 24" | 4R – 8ths, 16ths, Quick Reading 32nds, 64ths | Regular | 9-24-4R | 50045 |
| **300-600mm Combination Sets with Square, Center and Non-reversible Protractor Head and Blade** | | | | |
| 300mm | mm and 1/2mm Both Sides | Regular | 9M-300 | 56253 |
| 600mm | mm and 1/2mm Both Sides | Regular | 9M-600 | 56254 |
| **300-600mm and 11-3/4 – 23-1/2" Combination Sets with Square, Center and Non-Reversible Protractor Head and Blade** | | | | |
| 300mm and 11-3/4" | 1/2mm and 32nds One Side; mm and 64ths Reverse Side | Regular | 9ME-300 | 50047 |
| 600mm and 23-1/2" | 1/2mm and 32nds One Side; mm and 64ths Reverse Side | Regular | 9ME-600 | 50048 |

# Combination Sets

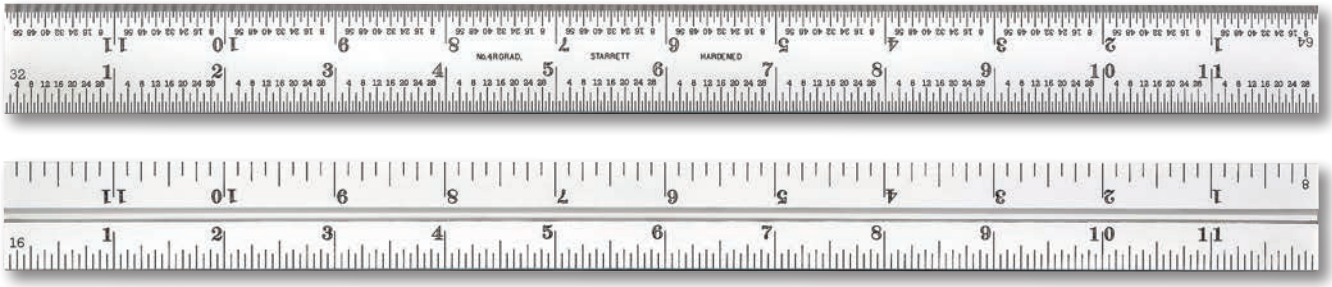
## Blades for Combination Squares, Sets and Bevel Protractors

### INCH, MILLIMETER AND INCH/MILLIMETER

The blades listed below fit any head according to the sizes noted in the charts on all combination squares, combination sets and bevel protractors. The 12", 18", 24", 36" and 48" and 300mm and 600mm sizes are interchangeable. Exception: Starrett 33J and 8 Combination Squares. (For these, see 33J and 8 listings.)

| Size | Approx. Width x Thickness | Graduation | Finish | Cat. No. | EDP |
|---|---|---|---|---|---|
| **Inch Blades Only for Combination Squares, Sets and Bevel Protractors** | | | | | |
| 4" | 5/8" x 1/16" | 4R – 8ths, 16ths, Quick Reading 32nds, 64ths | Regular | B4-4R | 50076 |
| | | | Satin Chrome | CB4-4R | 50077 |
| 4" | 5/8" x 1/16" | 16R – Quick Reading 32nds, 64ths, Aircraft Quick Reading 50ths, 100ths | Satin Chrome | CB4-16R | 50078 |
| 6" | 3/4" x 5/64" | 4R – 8ths, 16ths, Quick Reading 32nds, 64ths | Regular | B6-4R | 50079 |
| | | | Satin Chrome | CB6-4R | 50080 |
| 6" | 3/4" x 5/64" | 16R – Quick Reading 32nds, 64ths, Aircraft Quick Reading 50ths, 100ths | Regular | B6-16R | 50081 |
| | | | Satin Chrome | CB6-16R | 50082 |
| 12" | 1" x 3/32" | 4R – 8ths, 16ths, Quick Reading 32nds, 64ths | Regular | B12-4R | 50083 |
| | | | Satin Chrome | CB12-4R | 50084 |
| 12" | 1" x 3/32" | 6R – Aircraft Quick Reading 50ths and 10ths | Satin Chrome | CB12-6R | 50085 |
| 12" | 1" x 3/32" | 16R – Quick Reading 32nds, 64ths, Aircraft Quick Reading 50ths, 100ths | Regular | B12-16R | 50086 |
| | | | Satin Chrome | CB12-16R | 50087 |
| 18" | 1" x 3/32" | 4R – 8ths, 16ths, Quick Reading 32nds, 64ths | Regular | B18-4R | 50088 |
| | | | Satin Chrome | CB18-4R | 50089 |
| 18" | 1" x 3/32" | 16R – Quick Reading 32nds, 64ths, Aircraft Quick Reading 50ths, 100ths | Regular | B18-16R | 50090 |
| | | | Satin Chrome | CB18-16R | 50091 |
| 24" | 1" x 3/32" | 4R – 8ths, 16ths, Quick Reading 32nds, 64ths | Regular | B24-4R | 50092 |
| | | | Satin Chrome | CB24-4R | 50093 |
| 24" | 1" x 3/32" | 6R – Aircraft Quick Reading 50ths and 10ths | Satin Chrome | CB24-6R | 50094 |
| 24" | 1" x 3/32" | 16R – Quick Reading 32nds, 64ths, Aircraft Quick Reading 50ths, 100ths | Regular | B24-16R | 50095 |
| | | | Satin Chrome | CB24-16R | 50096 |
| 36" | 1" x 3/32" | 4R – 8ths, 16ths, Quick Reading 32nds, 64ths | Satin Chrome | CB36-4R | 50097 |
| | | 16R – Quick Reading 32nds, 64ths, Aircraft Quick Reading 50ths, 100ths | Satin Chrome | CB36-16R | 50098 |
| 48" | 1" x 3/32" | 4R – 8ths, 16ths, Quick Reading 32nds, 64ths | Satin Chrome | CB48-4R | 67102 |
| **Millimeter Blades Only for Combination Squares, Sets and Bevel Protractors** | | | | | |
| 150mm | 19mm x 2mm | 35 – mm and 1/2mm Both Sides | Regular | B150-35 | 55985 |
| | | | Satin Chrome | CB150-35 | 55988 |
| 300mm | 25mm x 2.4mm | 35 – mm and 1/2mm Both Sides | Regular | B300-35 | 55986 |
| | | | Satin Chrome | CB300-35 | 55989 |
| 600mm | 25mm x 2.4mm | 35 – mm and 1/2mm Both Sides | Regular | B600-35 | 55987 |
| | | | Satin Chrome | CB600-35 | 55990 |
| **Inch and Millimeter Blades Only for Combination Squares, Sets and Bevel Protractors** | | | | | |
| 150mm and 5-3/4" | 19mm x 2mm | 36 – 1/2mm and 32nds One Side; mm and 64ths Reverse Side | Regular | B150-36 | 55991 |
| | | | Satin Chrome | CB150-36 | 55992 |
| 300mm and 11-3/4" | 25mm x 2.4mm | 36 – 1/2mm and 32nds One Side; mm and 64ths Reverse Side | Regular | B300-36 | 50101 |
| | | | Satin Chrome | CB300-36 | 55993 |
| 600mm and 23-1/2" | 25mm x 2.4mm | 36 – 1/2mm and 32nds One Side; mm and 64ths Reverse Side | Regular | B600-36 | 50102 |
| | | | Satin Chrome | CB600-36 | 55994 |

All sizes packed one per envelope.



# Combination Square Blades

## Square Heads, Center Heads and Protractor Heads for Combination Squares, Combination Sets and Bevel Protractors

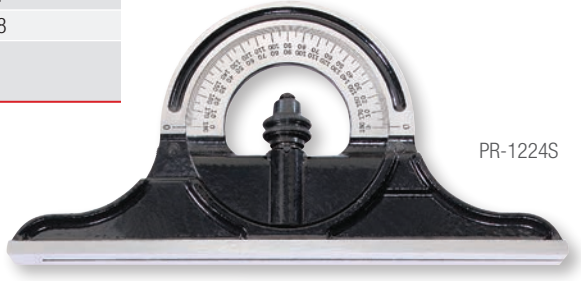
The heads listed fit any blade according to the sizes noted in the charts on all combination squares, combination sets and bevel protractors. Sizes 12", 18", 24", 36", and 48" and 300mm and 600mm are interchangeable. When ordering, specify complete catalog number and length of blade. Exception: Starrett 33J and 8 Combination Squares. (For these, see 33J and 8 listings.)



H11-1224



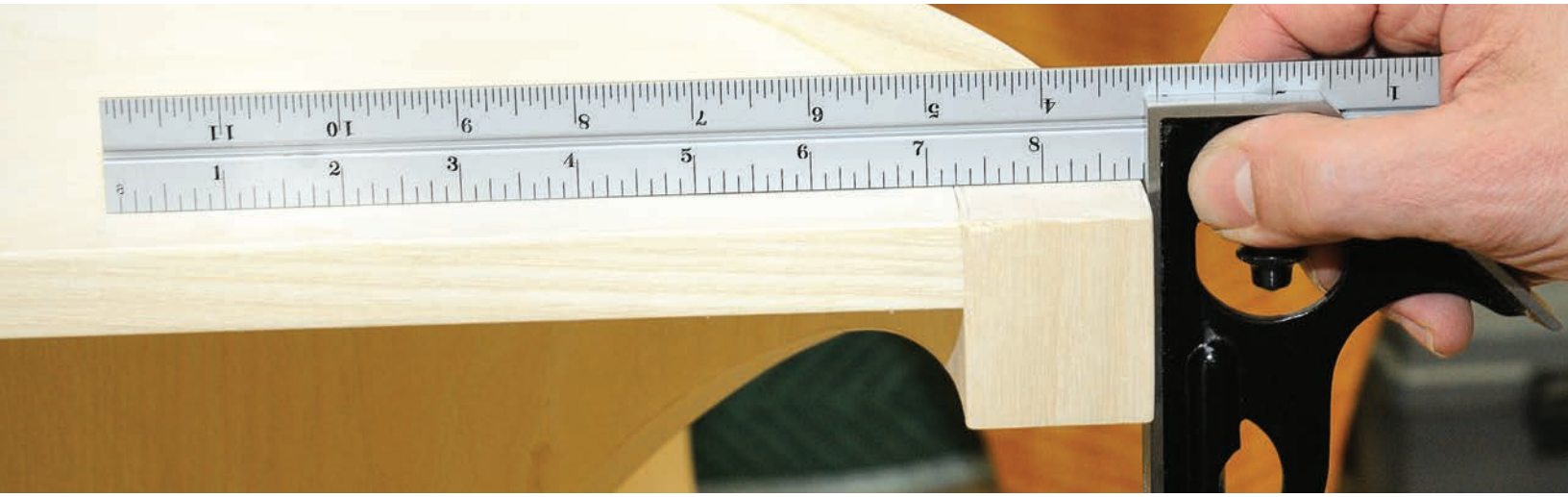
C33-1224



PR-1224S

| Square Heads Only for Combination Squares, Combination Sets and Bevel Protractors | | | | |
|---|---|---|---|---|
| Fits | Cast Iron Black Wrinkle Finish | | Forged and Hardened Steel with Smooth Black Enamel Finish | |
| Blade Size | Cat. No. | EDP | Cat. No. | EDP |
| 4" | H11-4 | 50069 | H33-4 | 50223 |
| 6" | H11-6 | 50070 | H33-6 | 50224 |
| 12" (300mm)<br>18"<br>24" (600mm) | H11-1224 | 50071 | H33-1224 | 50225 |
| **Center Heads Only for Combination Squares, Combination Sets and Bevel Protractors** | | | | |
| 4" | C11-4 | 50072 | C33-4 | 50226 |
| 6" | C11-6 | 50073 | C33-6 | 50227 |
| 12" (300mm)<br>18"<br>24" (600mm) | C11-1224 | 50074 | C33-1224 | 50228 |
| **Protractor Heads – Cast Iron (Fits blades 12" and up) for Combination Squares, Combination Sets and Bevel Protractors** | | | | |
| | Reversible | | Nonreversible | |
| Finish | Cat. No. | EDP | Cat. No. | EDP |
| Black Wrinkle | PR-1224W | 52525 | PNR-1224W | 50107 |
| Black Wrinkle, Chrome on Turret | CPR-1224W | 64601 | CPNR-1224W | 50108 |
| Black Smooth | PR-1224S | 52515 | | |
| Black Smooth, Chrome on Turret | CPR-1224S | 52516 | | |

For prices of lock bolts, contact the Parts Department.
4" Center Head Max. Inspection Dia.: 3.125"
6" Center Head Max. Inspection Dia.: 4.3"
12"-24" Center Head Max. Inspection Dia.: 5.3"

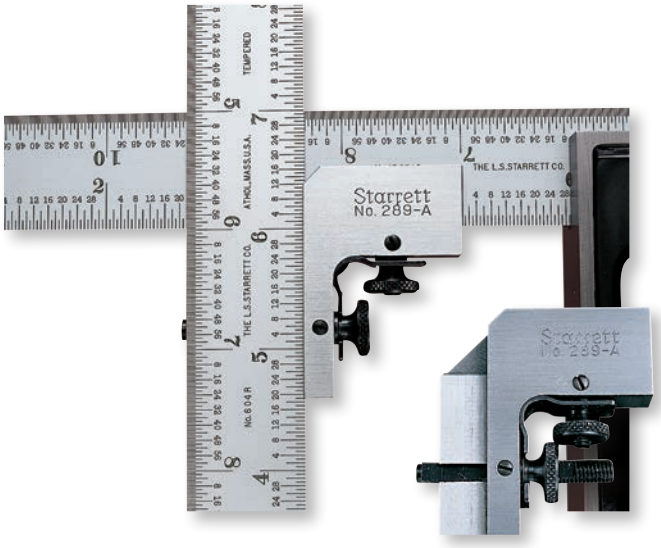


# Combination Squares

## 289 Attachments for Combination Squares

These attachments fit combination square blades 1" (25mm) wide and permit attaching rules, blades or thin steel try squares, up to 1" (25mm) wide, at right angles to the blade of the square for laying out key seats, centers, scribing horizontal lines, and measuring diameters. Available in two sizes listed below. Both sizes can also be used with 289C Height and Depth Gage Attachment.

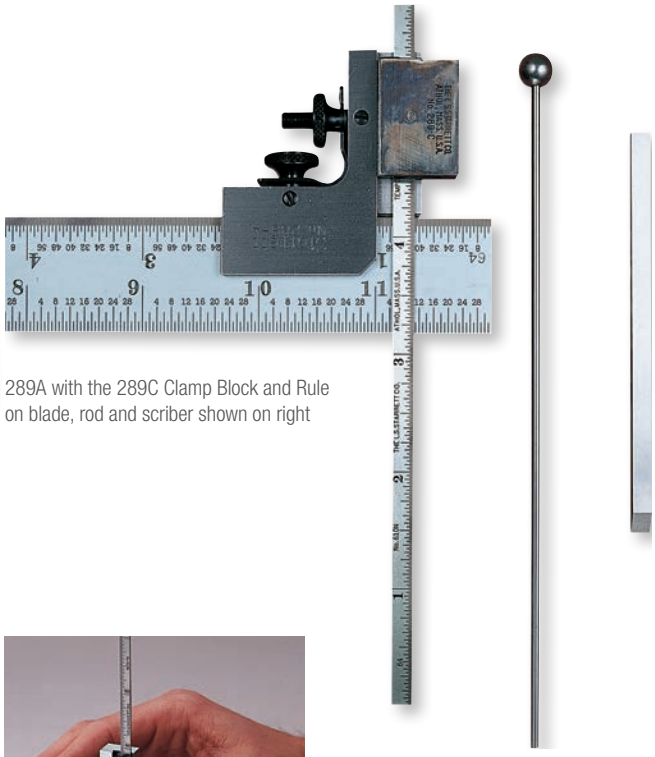
| 289 Attachments for Combination Squares | | | | |
|---|---|---|---|---|
| Range | Seat Length | | | |
| Blade/Rule | Blade | Rule | Cat. No. | EDP |
| 1" (25mm) | 1-9/16" (40mm) | 1-11/16" (43mm) | 289A | 51322 |
| | 2-3/8" (60mm) | 2-3/8" (60mm) | 289B | 51323 |



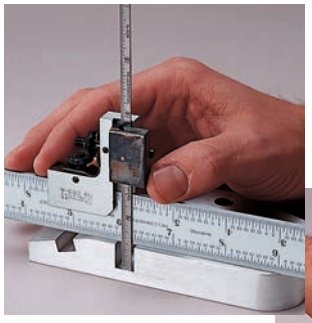

## 289C Height and Depth Gage Set for Combination Squares

When combined with the 289A or 289B Attachments, this set converts any combination square or set having blades up to 1" (25mm) wide into a height gage or depth gage. In addition to a clamp block, the set has a scriber, 6" rule (610N-6) and a 6" (150mm) rod, any one of which may be inserted in the clamp and locked in position. By applying the scriber, a practical height gage results. Use of the rule converts the tool to a depth gage for measuring in 64ths of an inch. With the rod used as a depth gage, small recesses and holes can also be checked.

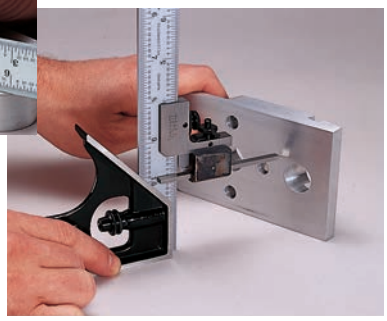
| 289C Height and Depth Gage Set for Combination Squares | | |
|---|---|---|
| Cat. No. | EDP | Description |
| 289C | 51324 | Clamp Block with Scriber, Rule and Rod |



289A with the 289C Clamp Block and Rule on blade, rod and scriber shown on right



Measuring depth



Measuring height

# Combination Squares

## 8 Large Combination Squares

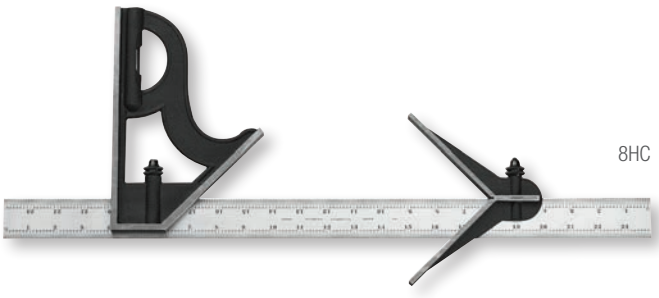
**24"**

Extra large, heavy-duty construction throughout. The square head is 8-3/8" long and the center head has 4-1/4" arms. Furnished with 24" blade, 1-1/2" wide x 1/10" thick, with distinctive, photo-engraved graduations. Heads are cast iron and have black wrinkle finish.

- Reversible lock bolts
- Accurate spirit level
- Hardened steel blade

| 8 Large Combination Squares | | | |
|---|---|---|---|
| **Description** | **Graduation** | **Cat. No.** | **EDP** |
| With Square Head Only | 4 – 8ths, 6ths, 32nds, 64ths | 8H | 50037 |
| With Square Head and Center Head | | 8HC | 50038 |
| **Blade Only for 8 Large Combination Squares** | | | |
| 24" Blade | 4 – 8ths, 16ths, 32nds, 64ths | B824-4 | 50041 |
| **Heads Only for 8 Large Combination Squares** | | | |
| Square Head | | H8 | 50039 |
| Center Head* | | C8 | 50040 |

* Max. Inspect Diameter: 7.5"



8HC

## 10 Student Combination Squares

These tools were designed to train and develop apprentices to lay out and check their work more efficiently. The combination square is far superior to clumsy, old-style solid workshop-grade squares that are still being used in some vocational schools and apprenticeship programs around the world. The student's advantages are:

- Rugged, cast iron square head will outlast cheap plastic and die-cast imitations
- Accurate, hardened and tempered square blade offered in inch, millimeter, and inch and millimeter combined
- Reversible lock bolt allows the blade to be turned over or end-for-end so that all four graduated edges may be used
- The combination square, as its name indicates, handles many jobs, saving the apprentice from buying more individual tools. This combination square can be used as a try square, 45º miter, a depth gage, a height gage, a layout tool, and as a rule.
- Optional center head is available to increase the versatility of this universal measuring tool

| Inch | | | |
|---|---|---|---|
| **Size** | **Graduation** | **Cat. No.** | **EDP** |
| 6" | 4R – 8ths, 16ths, Quick Reading 32nds, 64ths | 10H-6-4R | 64942 |
| **Millimeter** | | | |
| 150mm | mm and 1/2mm Both Sides | 10MH-150 | 64943 |
| **Inch and Millimeter** | | | |
| 150mm (5-3/4") | 1/2mm and 32nds One Side mm and 64ths Reverse Side | 10MEH-150 | 64944 |
| **Center Head Only** | | | |
| **Description** | | **Cat. No.** | **EDP** |
| Center Head to Fit 10 Squares | | C11-6 | 50073 |

* Max. Inspect Diameter: 4.3"



10H-6-4R

# Combination Squares

## 33J Junior Combination Squares

6"

These squares are used by mechanics, toolmakers and patternmakers because of their compact, small size and light weight. Both blade and heads are smaller than on regular squares. Heads are drop forged, hardened steel and have smooth, black enamel finish. Blades 4" long may be ordered individually as listed below. Blades are furnished in regular finish, except where indicated.




33HC-6-4R

| 33J Junior Combination Squares | | | | |
|---|---|---|---|---|
| **Blade Length** | **Description** | **Graduation** | **Cat. No.** | **EDP** |
| 6" | With Square Head Only | 4R – 8ths, 16ths, Quick Reading 32nds, 64ths | 33JH-6-4R | 50229 |
| | | 16R – Quick Reading 32nds, 64ths, Aircraft Quick Reading 50ths, 100ths | 33JH-6-16R | 50231 |
| 6" | With Square Head and Center Head | 4R – 8ths, 16ths, Quick Reading 32nds, 64ths | 33JHC-6-4R | 50230 |
| | | 16R – Quick Reading 32nds, 64ths, Aircraft Quick Reading 50ths, 100ths | 33JHC-6-16R | 50232 |
| **Blades Only** | | | | |
| 6" | Blade | 4R – 8ths, 16ths, Quick Reading 32nds, 64ths | B33J-4R | 50235 |
| | | | CB33J-4R* | 67100 |
| | | 16R – Quick Reading 32nds, 64ths, Aircraft Quick Reading 50ths, 100ths | B33J-16R | 50236 |
| | | | CB33J-16R* | 67101 |
| 4" | Blade | 4R – 8ths, 16ths, Quick Reading 32nds, 64ths | B4-4R | 50076 |
| | | | CB4-4R* | 50077 |
| | | 16R – Quick Reading 32nds, 64ths, Aircraft Quick Reading 50ths, 100ths | CB4-16R* | 50078 |
| **Heads Only** | | | | |
| Square Head | | | H33-4 | 50223 |
| Center Head** | | | C33-4 | 50226 |

* Blade in satin chrome finish.
** Max. Inspect Diameter - 3.125"



# Master Precision Squares

## 20 Master Precision Squares

### 1-1/2-36"/40-910MM

The finest precision-checking squares – not graduated. Squareness accuracy to .0001" (0.0025mm) every 6" (150mm).

These hardened steel squares are used when extreme accuracy is required. The beams and blades are hardened, ground and lapped to ensure parallelism and straightness. The beam is grooved at the inner corner for clearance of burr or dirt. Made of high quality tool steel, with the finest of craftsmanship throughout.




20-3

**20 Master Precision Squares**

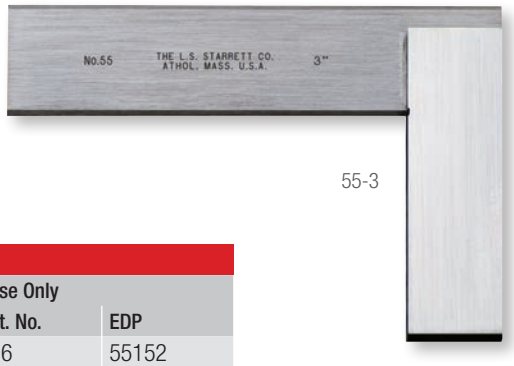
| Size – Length of Blade* | | Length of Beam | | Squares Only | | Case Only | |
|---|---|---|---|---|---|---|---|
| Inch | mm | Inch | mm | Cat. No. | EDP | Cat. No. | EDP |
| 1-1/2" | 40 | 1-1/2" | 40 | 20-1 1/2 | 50128 | 916 | 55152 |
| 3" | 75 | 2-3/8" | 60 | 20-3 | 50130 | 951 | 55153 |
| 4-1/2" | 115 | 3 -1/2" | 90 | 20-4 1/2 | 50132 | 918 | 55154 |
| 6" | 150 | 4-5/16" | 110 | 20-6<br>20-6 W/SLC‡ | 50134<br>66899 | 919 | 55155 |
| 12" | 300 | 7" | 180 | 20-12<br>20-12 W/SLC‡ | 50136<br>66900 | 20ZZ-12 | 55156 |
| 24" | 600 | 12-5/16" | 310 | 20-24 | 50140 | 20ZZ-24† | 55158 |
| 36" | 910 | 20" | 500 | 20-36** | 50142 | 20ZZ-36† | 55159 |

Larger squares can be furnished; quoted on application.
* Length of blade from the inner edge of the beam to the end of the blade.
** 36" (910mm) and larger size squares have special screws to secure the blade to the beam.
† Rack-type case.
‡ Includes redemption card for Standard Letter of Certification (SLC).

## 55 Master Precision Squares with Beveled Edges

### 1-1/2-6"/40-150MM

These 55 Hardened Steel Squares are the same as the 20 Squares described above, except that the blades are beveled on both edges of each side, which provides an excellent visual line contact with the work.




55-3

**55 Master Precision Squares with beveled edges**

| Size – Length of Blade* | | Length of Beam | | Squares Only | | Case Only | |
|---|---|---|---|---|---|---|---|
| Inch | mm | Inch | mm | Cat. No. | EDP | Cat. No. | EDP |
| 1-1/2" | 40 | 1-1/2" | 40 | 55-1 1/2 | 50277 | 916 | 55152 |
| 3" | 75 | 2-3/8" | 60 | 55-3 | 50279 | 951 | 55153 |
| 4-1/2" | 115 | 3-1/2" | 90 | 55-4 1/2 | 50281 | 918 | 55154 |
| 6" | 150 | 4-5/16" | 110 | 55-6 | 50283 | 919 | 55155 |

* Length of blade from the inner edge of the beam to the end of the blade.

# Squares

## 3020 Toolmakers' Grade Stainless Steel Squares

### 2-31/32 - 12-1/32"/50-175MM

This high quality toolmakers' square is not graduated and offers squareness accuracy to .0002" (0.005mm) for every 6" (150mm).

They feature hardened, ground and lapped stainless steel construction on both the blade and the beam. The beam is machined at the inner corner for clearance of burr or dirt.

Packed one in a plastic case. 12" square and set of 4 squares shipped in box with fitted foam insert. Wood cases as listed may be purchased separately.

**3020 Toolmakers' Grade Stainless Steel Squares**

| Size – Length of Blade* | | Length of Beam | | Squares Only | | Case Only | |
|---|---|---|---|---|---|---|---|
| Inch | mm | Inch | mm | Cat. No. | EDP | Cat. No. | EDP |
| 2-31/32" | 75 | 1-31/32" | 50 | 3020-3 | 12225 | 951 | 55153 |
| 3-31/32" | 100 | 2-31/32" | 75 | 3020-4 | 12226 | 918 | 55154 |
| 5-29/32" | 150 | 3-29/32" | 100 | 3020-6 | 12227 | 919 | 55155 |
| 12-1/32" | 300 | 6-7/8" | 175 | 3020-12 | 12228 | 20ZZ-12 | 55156 |
| Complete Set of all 4 Squares | | | | S3020Z | 12229 | | |

* Length of blade from the inner edge of the beam to the end of the blade.




3020-6

## 61 "Reliable" Try Square

### 6"/150MM

A very useful try square – attractively designed, light and convenient. The blade is hardened, not graduated, and is firmly held by a special bolt and nut permitting the tool to be readily taken apart, if desired, for regrinding the blade and stock.

**61 "Reliable" Try Square**

| Cat. No. | EDP | Size – Length of Blade | Length of Beam |
|---|---|---|---|
| 61 | 50303 | 6" (150mm) | 3-1/2" (90mm) |




61



# Double Squares

## 13, 13M Double Squares with Hardened Blades

**4-6"/100-150MM**

These squares are very popular with machinists, toolmakers, and patternmakers. The sliding blades are adjustable making it practical for a wide variety of uses. The faces of the head are ground square, and the 6" (150mm) size has a level.

The bevel blade is available, featuring an octagon angle 45º at one end and a hexagon angle 60º at the other end, clearly marked.

A drill grinding blade, also available for 6" (150mm) squares, is beveled to 59º for drill grinding on one end and 41º (the cutting angle of countersinks for machine screws) at the other. Both ends have quick-reading 64ths grads. and the graduation is located to measure perpendicularly to the axis of the drill. By reading the graduations, the center point can be easily and accurately located.

The 6" square head used with the drill grinding blade is approximately 3-1/2" (90mm) long, and the faces approximately 9/16" (14mm) wide.

| Inch Reading Double Squares – 4R Graduation – 8ths, 16ths, 32nds, 64ths | | | |
|---|---|---|---|
| **Size** | **Description** | **Cat. No.** | **EDP** |
| 4" | With graduated blade only | 13A | 50109 |
| 6" | With graduated blade only | 13C | 50111 |
| | With graduated and bevel blades | 13E | 50112 |
| | Drill grinding blade only for 6" (150mm) squares | 13D | 50114 |
| **Millimeter Reading Double Squares – mm Both Edges One Side; mm and 1/2mm Reverse Side** | | | |
| 100mm | With graduated blade only | 13MA | 56278 |
| | With graduated and bevel blades | 13MB | 56279 |
| 150mm | With graduated blade only | 13MC | 56280 |
| | With graduated and bevel blades | 13ME | 56263 |



13F Double Square complete with graduated blade, beveled blade, and drill grinding blade.

# Double Squares

## 14, 14M Double Steel Squares with Hardened and Ground Head and Blades

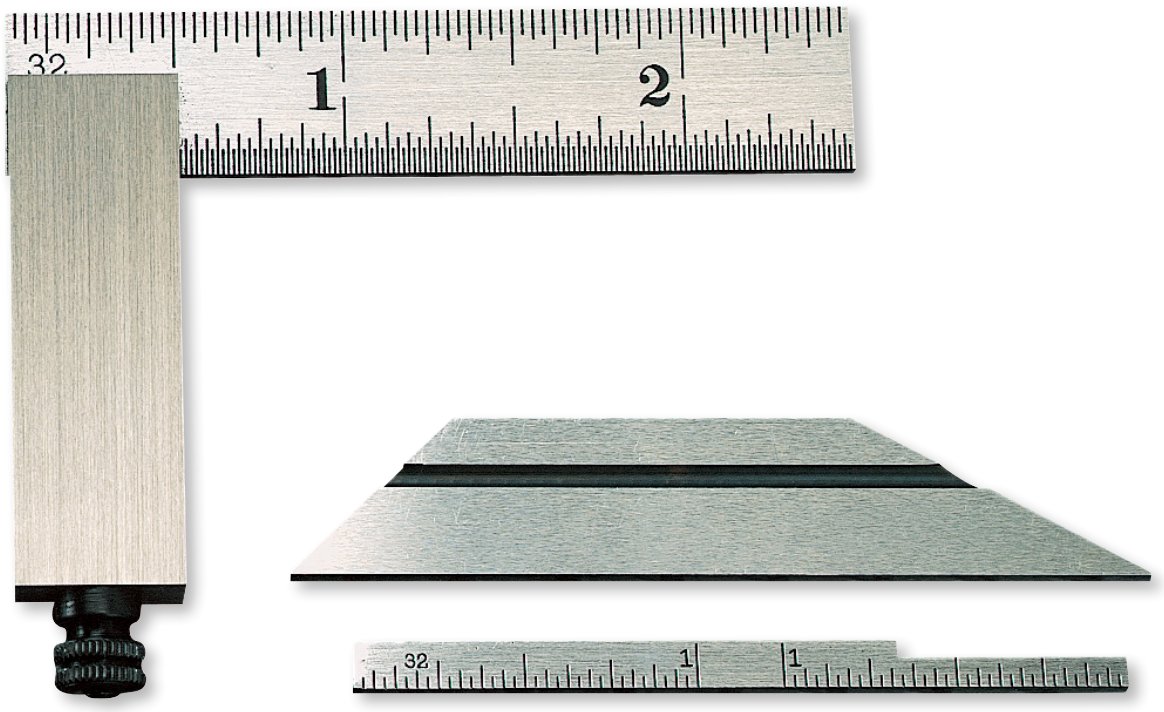
### 2-1/2"/50MM

Designed for tool and diemakers, these fine precision double steel squares have adjustable blades, ideal for tight fits. A knurled clamping nut accurately locks the blades in any position.

Beveled blade is 45º on one end and 30º on the other.

2-1/4" (58mm) Narrow blade has 32nds and 64ths graduations. It is 5/32" (4mm) wide over a length of approximately 1-5/8" (41mm) and cut away at one end to a width of 3/32" (2.4mm).

| 14 Inch Reading Double Steel Squares – 32nds, 64ths | | | | |
|---|---|---|---|---|
| **Size** | **Graduation** | **Description** | **Cat. No.** | **EDP** |
| 2-1/2" | 32nds, 64ths | With Graduated Blade Only | 14A | 50117 |
| | | Complete with Graduated Narrow Blade and Bevel Blade | 14D | 50118 |
| **14M Millimeter Reading Double Steel Squares– mm Both Edges One Side; mm and 1/2mm Reverse Side** | | | | |
| 50mm | mm, 1/2mm | With Graduated Blade Only | 14MA | 56260 |
| | | Complete with Graduated Narrow Blade and Bevel Blade | 14MD | 56261 |




14D Double Square complete with graduated, bevel and narrow blades.

# Diemakers' Squares

## 453, 453M Diemakers' Squares with Angular and Sliding Blade Adjustment

**2-1/2"/50MM**

The sliding blades of this tool and diemakers' square can be adjusted at an angle (up to approximately 10º) with the beam for measuring the clearance in dies (see sectional view). The larger knurled thumb screw locks the blades at any position, and the smaller one tilts the blades at an angle. To set the blades at an angle, first release the blade clamp screw, then the blade may be tilted to the desired angle by turning the small knurled screw into the beam. The blade can be held in position by tightening the clamping screw. Head and blades are hardened and ground.

The inch reading blade is graduated on one side, upper edge in 32nds, lower edge in 64ths and the millimeter reading blade is graduated in millimeters and 1/2 millimeters.

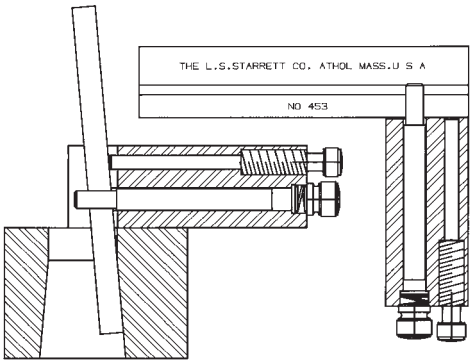
The bevel blade is approximately 2-1/2" (63mm) long x 1/2" (12.5mm) wide and is beveled to 30º on one end and 45º on the other.

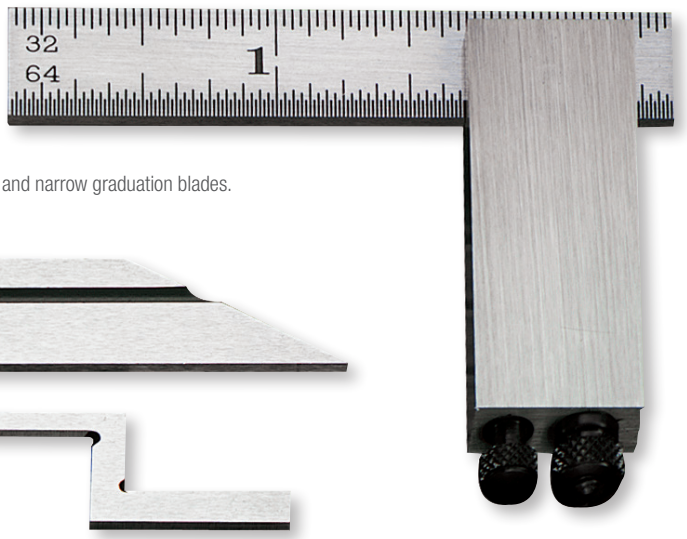
The narrow graduated blade has 32nds graduation on one side, and 64ths on the other. It is 5/32" (4mm) wide over a length of approximately 1-5/8" (41mm) and cut away at one end to a width of 3/32" (2.4mm).

The offset blade is used where it would be impossible to sight a straight blade. It protrudes from the square about 1-1/2" (38mm) and is 1/8" (3mm) wide. Both sides of each edge are beveled to provide good visual line contact.

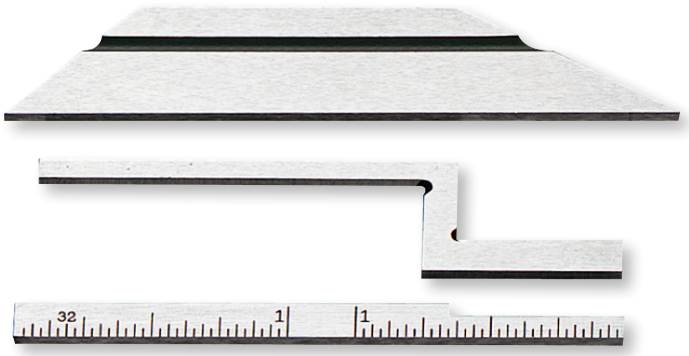
| 453 Inch Reading Diemakers' Squares – Graduation 32nds, 64ths | | | |
|---|---|---|---|
| **Size** | **Description** | **Cat. No.** | **EDP** |
| 2-1/2" | With Standard Graduated Blade | 453A | 52345 |
| | With Standard, Narrow Blades | 453C | 52347 |
| | Complete With Standard, Bevel, Narrow and Offset Blades | 453E | 52349 |
| | Complete With Standard, Bevel, Narrow and Offset Blades in Case | 453EZ | 52351 |
| **453M Millimeter Reading Diemakers' Squares – Graduation mm and 1/2mm** | | | |
| 50mm | With Standard Graduated Blade | 453MA | 52346 |
| | With Metric Standard, Narrow Blades | 453MC | 52348 |

Sectional View




453E complete with standard, bevel, offset and narrow graduation blades.



# Diemakers' Squares

## 457 Improved Diemakers' Square with Angular Adjustment

**10º-0º-10º**

The 457 Improved Diemakers' Square is a highly useful tool for tool and diemakers, especially for measuring die clearances. It is also very handy for patternmakers to check angles and drafts on patterns.

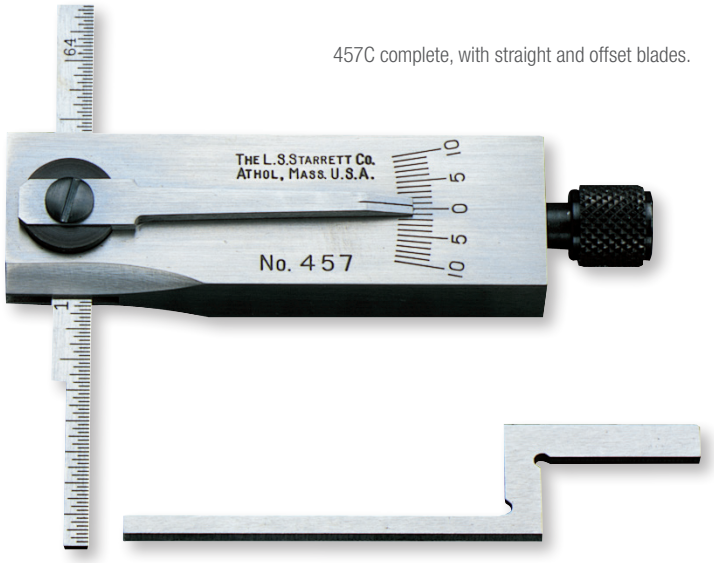
The beam of this square is graduated to show the setting in degrees of the blades. Blades can be set for any angle up to 10°, either side of 0º and the angle is indicated by the line on the pointer.

The graduated blade has 32nds of an inch on one side, and 64ths on the other. It is 5/32" (4mm) wide over a length of approximately 1-5/8" (41mm) and cut away at one end to a width of 3/32" (2.4mm).

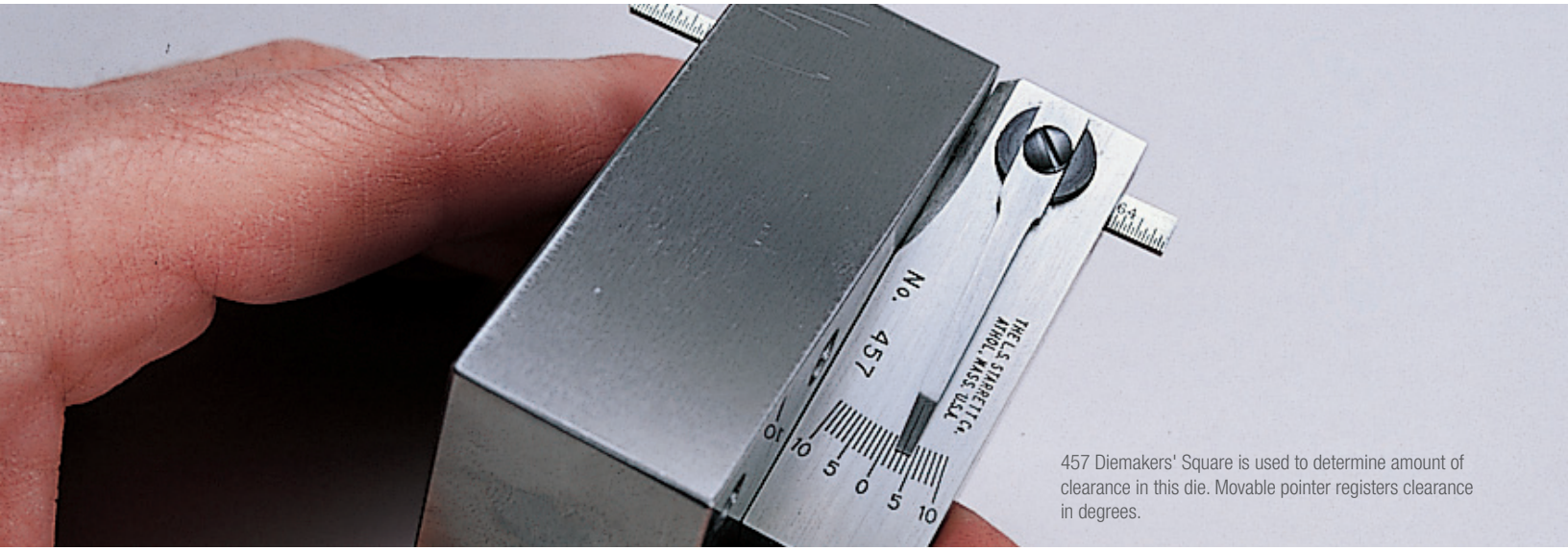
The offset blade, which is used where it would be impossible to insert the straight blade, protrudes from the square about 1-1/2" (38mm). It is 1/8" (3mm) wide and both sides of each edge are beveled to give visual line contact.

The beam is beveled adjacent to the blade so that the blade is readily visible when checking in holes, slots, etc. Blades and beams are hardened and ground.

| Angular Range 10º-0º-10º | | |
|---|---|---|
| **Description** | **Cat. No.** | **EDP** |
| With Straight Blade Only | 457A | 52428 |
| Complete, With Straight and Offset Blades | 457C | 52429 |




457C complete, with straight and offset blades.




457 Diemakers' Square is used to determine amount of clearance in this die. Movable pointer registers clearance in degrees.



# PRECISION RULES, STRAIGHT EDGES, PARALLELS

# Precision Rules

## Precision Steel Rules

Starrett rules are made from fine quality steel and produced to the highest precision standards, making them the most accurate and readable precision steel rules available. Through over 130 years of experience, we have developed the following versatile features, designs and styles:

### Our product line consists of:

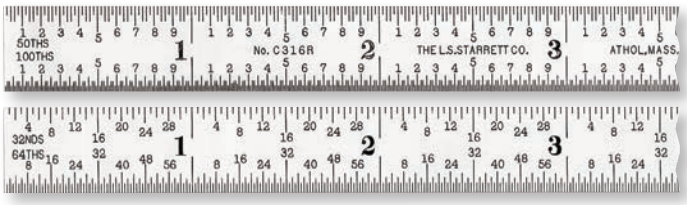
- Full-flexible 1/64"-1/50" (0.4-0.5mm) thick
- Semi-flexible 1/50-1/40" (0.5-0.6mm) thick
- Spring-tempered 3/64" (1.2mm) thick
- Heavy spring-tempered 1/10" (2.5mm) thick
- Stainless steel 1/64" or 3/64" (0.4 or 1.2mm) thick
- Graduation styles are inch, millimeter, inch and millimeter, shrink, and special graduations
- All rules are photo-engraved and tempered for long life and flexibility







Rule with Aircraft Quick-Reading Graduations on lower edge




Rule with Quick-Reading Graduations on both edges




### Accuracy

- All of our precision steel rules are photo-engraved
- We inspect to Starrett Master Standards, which are traceable to the National Institute of Standards and Technology
- Measuring Tip: When using a precision rule for very close accuracy, the eye can read better by measuring between two lines rather than from the end of the rule to a line

### Readability Features

- The numbering size and style is distinctive and more readable than ordinary rules
- Advanced, staggered graduations- When reading lines, it is much easier to count lines of differing lengths than those that resemble a comb. All Starrett graduations are staggered in a height pattern that makes reading easy. For reading very fine graduations such as 50ths (.020") or 100ths (.010") of an inch, Starrett designed an improved pattern of lines called "Aircraft Quick-Reading Graduations" (see photo). The name stems from its extreme popularity in aircraft plants and other shops using decimals. This pattern is also used on some of our millimeter rules.
- Quick-reading figures are furnished with finer graduations for easier counting. Most all inch graduations of 1/32" and finer have subdivisions numbered (see photo).
- All rules are available in Starrett no-glare satin chrome finish for easier reading and rust resistance
- There are still some old "D" style rules on the market. These have one square and one rounded end. All Starrett rules are ground square on both ends. This provides better efficiency through the ability to read from either end on all edges.



# Precision Rules



## Useful Variation Features of Our Standard Precision Rules

### End Graduations

End graduations are useful for measuring depths, widths of shoulders, recesses, grooves, etc. They are graduated in 32nds of an inch or millimeters on both ends of one side as shown at the right.

### Adjustable Steel Hook Rules

These improved Hook Rules feature an adjustable double hook that can be shortened or extended on either side in relation to any one of the four graduations on the rule. This allows accurate measurements from shallow or deep shoulders and also permits setting inside calipers to any of the graduations. Hooks are hardened and may be adjusted or removed by a slight turn of an eccentric stud.

### Steel Hook Rules with Reversible Hook

These convenient Hook Rules permit accurate measurements, even when the user cannot see if the rule is aligned with the measuring edge. This is especially useful for measuring from round corners, through hubs, for setting inside calipers, etc. The single hook is hardened and may be reversed or removed by a slight turn of an eccentric stud.

### Narrow Hook Rules with Reversible Hook

These useful Hook Rules are similar to the Hook Rules described above, but have a narrow blade (only 3/16" [4.8mm] wide) which permits measurements through holes as small as 7/32" (5.5mm) in diameter. Hooks are hardened and may be reversed or removed by a partial turn of the eccentric stud.

### Steel Rule with Tapered End

This 6" rule, our C310T-6, is a favorite with all mechanics because the tapered end permits measuring insides of small holes, narrow slots, grooves, recesses, etc. The rule has a taper from 1/2" width at the 2" graduation to 1/8" width at the end. Accurate, distinctive, photo-engraved graduations in 32nds are on one side and 64ths on the reverse side, with graduations always in a normal, easy-to-read position. Made of tempered, full-flexible steel with satin chrome finish.

### Steel Rule with Pocket Clip

This handy 6" rule is designed for frequent use. It is made of tempered, full-flexible steel and has accurate, photo-engraved graduations in 32nds on one edge and 64ths on the opposite edge, with satin chrome finish. C310K-6.





















# Precision Rules

## Inch Graduation Styles

### 1

First Edge: 10ths, 20ths, 50ths, 100ths

Second Edge: 12ths, 24ths, 48ths

Fourth Edge: 14ths, 28ths

Third Edge: 16ths, 32nds, 64ths



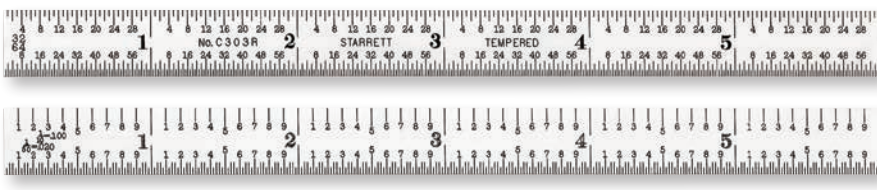

### 3R*

First Edge: 32nds

Second Edge: 64ths

Fourth Edge: 10ths

Third Edge: 50ths



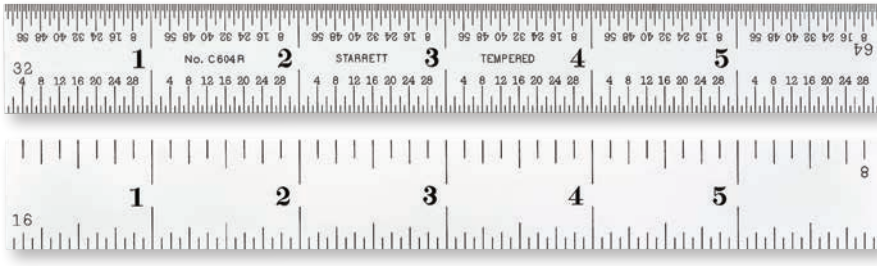

### 4R*

First Edge: 64ths

Second Edge: 32nds

Fourth Edge: 8ths

Third Edge: 16ths



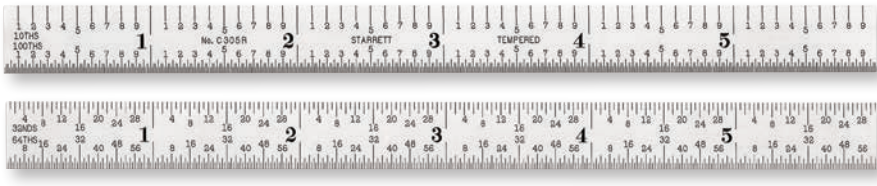

### 5R*

First Edge: 10ths

Second Edge: 100ths

Fourth Edge: 32nds

Third Edge: 64ths



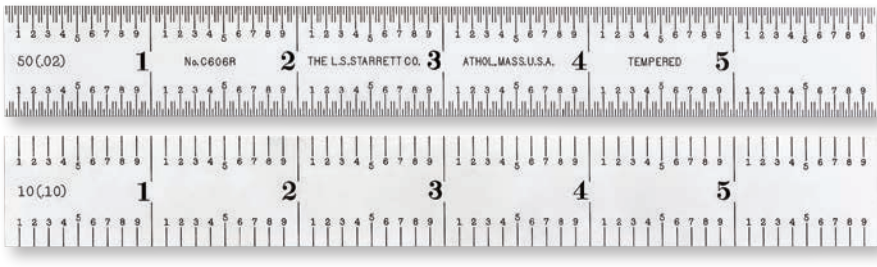

### 6R*

First Edge: 50ths

Second Edge: 50ths

Fourth Edge: 10ths

Third Edge: 10ths




* Suffix "R" designates Quick-Reading graduations

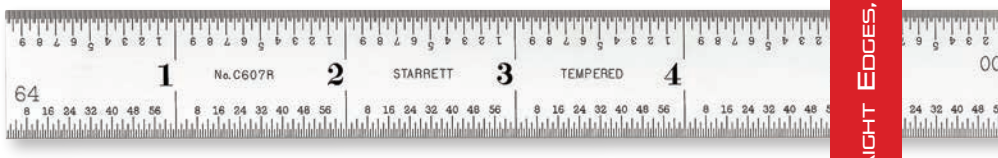
**NOTE**: All rules under 1" in width have single row of inch figures. Rules 1" and wider have double row of inch figures, and each edge represents the bottom edge reading left to right.

# Precision Rules

## Inch Graduation Styles

### 7R*

First Edge: 100ths
Second Edge: 64ths




Fourth Edge: 32nds
Third Edge: 16ths



### 9R*

First Edge: None
Second Edge: 64ths




Fourth Edge: 16ths
Third Edge: 32nds



### 10R*

First Edge: 64ths
Second Edge: 32nds




### NO.11

First Edge: None
Second Edge: 100ths




Third Edge: None
Fourth Edge: 64ths



### 16R*

First Edge: 50ths
Second Edge: 100ths




Fourth Edge: 32nds
Third Edge: 64ths



* Suffix "R" designates Quick-Reading graduations

**NOTE**: All rules under 1" in width have single row of inch figures. Rules 1" and wider have double row of inch figures, and each edge represents the bottom edge reading left to right.

# Steel Rules

## Steel Rules with Inch Graduations

**1-144"**

All rules furnished with Starrett satin chrome finish, except where noted. Additional sizes and variations available by special order.

### Rules include

- Full-Flexible
- Semi-Flexible
- Spring-Tempered
- Heavy Spring-Tempered

| Key to Starrett Rule Numbering System: | |
|---|---|
| **Prefixes:** | |
| C | Satin Chrome Finish |
| DH | Double Hook |
| H | Single Hook |
| **Suffixes:** | |
| E | End Graduations |
| K | With Pocket Clip |
| N | Narrow-Type Rule |
| R | Quick-Reading |
| S | Semi-Flexible |
| T | Tapered End |

| Length | Width x Thickness | Graduations | Feature Remarks | Cat. No. | EDP |
|---|---|---|---|---|---|
| **1-4" Spring-Tempered Steel Rules with Inch Graduations** | | | | | |
| 1" | 1/2" x 3/64" | 4R – 8ths, 16ths, Quick-Reading 32nds, 64ths | | *C604R-1 | 56464 |
| 2" | | | | *C604R-2 | 56465 |
| 3" | 9/16" x 3/64" | 4R – 8ths, 16ths, Quick-Reading 32nds, 64ths | | *C604R-3 | 56466 |
| 4" | 5/8" x 3/64" | 4R – 8ths, 16ths, Quick-Reading 32nds, 64ths | | *C604R-4 | 56467 |
| **6" Full-Flexible Steel Rules with Inch Graduations** | | | | | |
| 6" | 1/2" x 1/64" | 3R – Quick-Reading 10ths, Aircraft Quick-Reading 50ths, 32nds and 64ths | | *C303R-6 | 51334 |
| 6" | 1/2" x 1/64" | 4R – 8ths, 16ths, Quick-Reading 32nds and 64ths | | *C304R-6 | 66008 |
| 6" | 1/2" x 1/64" | 5R – Quick-Reading 10ths, Aircraft Quick-Reading 100ths, 32nds and 64ths | With Standard Letter of Certification† | *C305R-6 | 51347 |
| | | | | *C305R-6 W/SLC | 66880 |
| 6" | 1/2" x 1/64" | 6R – One Side Only – Quick-Reading 10ths (.10) Top Edge; Aircraft Quick-Reading 50ths (.02) Bottom Edge | | *C306R-6 | 51352 |
| 6" | 1/2" x 1/64" | 9R – 16ths and Quick-Reading 32nds on One Side; Quick-Reading 64ths on Reverse Side | | *C309R-6 | 51357 |
| 6" | 1/2" x 1/64" | 10R – Quick-Reading 32nds, 64ths on One Side Only | | *C310R-6 | 51368 |
| 6" | 1/2" x 1/64" | 10 – 32nds and 64ths on One Side Only | With Pocket Clip | *C310K-6 | 56701 |
| 6" | 1/2" x 1/64" | 10 – 32nds One Side; 64ths on Reverse Side | With Tapered End | *C310T-6 | 56700 |
| 6" | 1/2" x 1/64" | 16R – Quick-Reading 32nds, 64ths, Aircraft Quick-Reading 50ths and 100ths | | *C316R-6 | 51374 |
| 6" | 1/2" x 1/64" | 9R – 16ths and Quick-Reading 32nds on One Side; Quick-Reading 64ths on Reverse Side | Stainless Steel | *1309R-6 | 53204 |
| **6" Semi-Flexible Steel Rules with Inch Graduations** | | | | | |
| 6" | 3/4" x 1/50" | 3R – Quick-Reading 10ths, Aircraft Quick-Reading 50ths, 32nds and 64ths | | *C303SR-6 | 51335 |
| 6" | 3/4" x 1/50" | 4R – 8ths, 16ths, Quick-Reading 32nds and 64ths; End Graduations in 32nds Both Ends, One Side | End Graduations | *C304SRE-6 | 51343 |

† Includes redemption card for Standard Letter of Certification (SLC).

*Indicates rules with single row of inch figures (all rules under 1" width). Rules without asterisk have double row of inch figures, and each edge represents the bottom edge reading left to right (rules 1" and wider).




H604R-6 with Reversible Hook

# Steel Rules

## Steel Rules with Inch Graduations

**1-144"**

All rules furnished with Starrett satin chrome finish, except where noted. Additional sizes and variations available by special order.

### Rule Case Options

- Protective case with see through front (standard)
- Leather-like case with pocket clip (optional)




| Cases for 6"/150mm Rules | | |
|---|---|---|
| **Description** | **Cat. No.** | **EDP** |
| Case with Clip for 1/2" (12.7mm) Wide Rules | 1612 | 55433 |
| Case with Clip for 3/4" (19mm) Wide Rules | 1634 | 55434 |

| 6" Spring-Tempered Steel Rules with Inch Graduations | | | | | |
|---|---|---|---|---|---|
| **Length** | **Width x Thickness** | **Graduations** | **Feature Remarks** | **Cat. No.** | **EDP** |
| 6" | 3/4" x 3/64" | 1 – 10ths, 20ths, 50ths, 100ths; 12ths, 24ths, 48ths; 16ths, 32nds, 64ths; 14ths, 28ths | See Below** | *C601-6 | 52639 |
| 6" | 3/4" x 3/64" | 4R – 8ths, 16ths, Quick-Reading 32nds and 64ths | Regular Steel Finish | *604R-6 | 52645 |
| | | | | *C604R-6 | 52678 |
| | | | With Standard Letter of Certification† | *C604R-6 W/SLC | 66884 |
| 6" | 3/4" x 3/64" | 4R – 8ths, 16ths, Quick-Reading 32nds and 64ths End Graduations in 32nds Both Ends, One Side | End Graduations | *C604RE-6 | 52660 |
| 6" | 3/4" x 3/64" | 4R – 8ths, 16ths, Quick-Reading 32nds and 64ths | Regular Steel Finish With Reversible Hook | *H604R-6 | 52667 |
| | | | With Reversible Hook | *CH604R-6 | 52673 |
| | | | Regular Steel Finish With Adjustable Double Hook | *DH604R-6 | 52662 |
| | | | With Adjustable Double Hook | *CD604R-6 | 52665 |
| 6" | 3/4" x 3/64" | 6R – Both Sides – Aircraft Quick-Reading 50ths (.02) Both Edges One Side, Quick-Reading 10ths (.10) Both Edges, Opposite Side | | *C606R-6 | 52652 |
| 6" | 3/4" x 3/64" | 7R – 16ths, Quick-Reading 32nds, 64ths, Aircraft Quick-Reading 100ths | | *C607R-6 | 52688 |
| 6" | 3/4" x 3/64" | 16R – Quick-Reading 32nds, 64ths, Aircraft Quick-Reading 50ths, 100ths | | *C616R-6 | 52701 |
| 6" | 3/4" x 3/64" | 4R – 8ths, 16ths, Quick-Reading 32nds and 64ths | Stainless Steel | *1604R-6 | 53210 |
| 6" | 3/16" x 3/64" | 10 – 32nds One Side and 64ths on Reverse Side | Regular Steel Finish; Narrow Rule | *610N-6 | 52694 |
| | | | Narrow Rule | *C610N-6 | 52696 |
| | | | Regular Steel Finish; Narrow Rule with Hook | *H610N-6 | 52697 |
| | | | Narrow Rule with Hook | *CH610N-6 | 52699 |
| 6" | 3/16" x 3/64" | 11 – 64ths on One Side and 100ths on Reverse Side | Regular Steel Finish; Narrow Rule | *611N-6 | 52700 |

†Includes redemption card for Standard Letter of Certification (SLC).

*Indicates rules with single row of inch figures (all rules under 1" width). Rules without asterisk have double row of inch figures, and each edge represents the bottom edge reading left to right (rules 1" and wider).

**1 pattern has 12 different grads., many that are not found on usual rules. This allows the rule to be used for various purposes like laying out and cutting gear teeth (not generally used today).

# Steel Rules

## Steel Rules with Inch Graduations

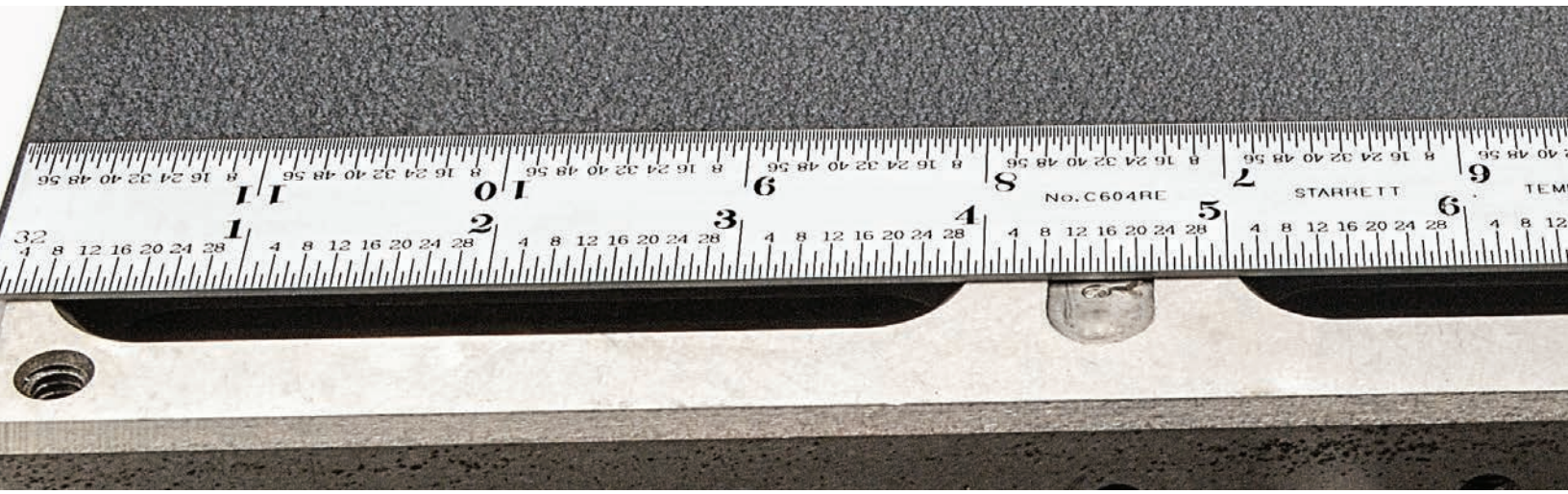
### 1-144"

All rules furnished with Starrett satin chrome finish, except where noted. Additional sizes and variations available by special order.

| Length | Width x Thickness | Graduations | Feature Remarks | Cat. No. | EDP |
|---|---|---|---|---|---|
| **12" Full-Flexible Steel Rules with Inch Graduations** | | | | | |
| 12" | 1/2" x 1/64" | 4R – 8ths, 16ths, Quick-Reading 32nds and 64ths | | *C304R-12 | 66009 |
| 12" | 1/2" x 1/64" | 5R – Quick-Reading 10ths, Aircraft Quick-Reading 100ths, 32nds and 64ths | With Standard Letter of Certification† | *C305R-12<br>*C305R-12 W/SLC | 51348<br>66881 |
| 12" | 1/2" x 1/64" | 6R – One Side Only – Quick-Reading 10ths (.10) Top Edge; Aircraft Quick-Reading 50ths (.02) Bottom Edge | | *C306R-12 | 51353 |
| 12" | 1/2" x 1/64" | 10R – Quick-Reading 32nds and 64ths One Side Only | | *C310R-12 | 56429 |
| 12" | 1/2" x 1/64" | 16R – Quick-Reading 32nds, 64ths, Aircraft Quick-Reading 50ths and 100ths | | *C316R-12 | 51375 |
| **12" Semi-Flexible Steel Rules with Inch Graduations** | | | | | |
| 12" | 1" x 1/50" | 3R – Quick-Reading 10ths, Aircraft Quick-Reading 50ths, 32nds and 64ths | | C303SR-12 | 51336 |
| 12" | 1" x 1/50" | 4R – 8ths, 16ths, Quick-Reading 32nds and 64ths; End Graduations in 32nds Both Ends, One Side | End Graduations | C304SRE-12 | 51344 |
| **12" Spring-Tempered Steel Rules with Inch Graduations** | | | | | |
| 12" | 1" x 3/64" | 1 – 10ths, 20ths, 50ths, 100ths; 12ths, 24ths, 48ths; 16ths, 32nds, 64ths; 14ths, 28ths | See Note on Previous Page ** | C601-12 | 52640 |
| 12" | 1" x 3/64" | 4R – 8ths, 16ths, Quick-Reading 32nds and 64ths | Regular Steel Finish<br><br>With Standard Letter of Certification† | 604R-12<br>C604R-12<br>C604R-12 W/SLC | 52647<br>52679<br>66885 |
| 12" | 1" x 3/64" | 4R – 8ths, 16ths, Quick-Reading 32nds and 64ths; End Graduations in 32nds Both Ends, One Side | End Graduations | C604RE-12 | 52661 |
| 12" | 1" x 3/64" | 4R – 8ths, 16ths, Quick-Reading 32nds and 64ths | Regular Steel Finish With Reversible Hook<br>With Reversible Hook<br>Regular Steel Finish With Adjustable Double Hook<br>With Adjustable Double Hook | H604R-12<br>CH604R-12<br>DH604R-12<br>CD604R-12 | 52669<br>52674<br>52664<br>52666 |
| 12" | 1" x 3/64" | 6R – Both Sides – Aircraft Quick-Reading 50ths (.02) Both Edges, One Side; Quick-Reading 10ths (.10) Both Edges, Opposite Side | | C606R-12 | 52653 |
| 12" | 1" x 3/64" | 7R – 16ths, Quick-Reading 32nds, 64ths, Aircraft Quick-Reading 100ths | | C607R-12 | 52689 |
| 12" | 1" x 3/64" | 16R – Quick-Reading 32nds, 64ths, Aircraft Quick-Reading 50ths, 100ths | | C616R-12 | 52702 |
| 12" | 1" x 3/64" | 4R – 8ths, 16ths, Quick-Reading 32nds and 64ths | Stainless Steel | 1604R-12 | 53211 |
| 12" | 3/16" x 3/64" | 10 – 32nds One Side and 64ths on Reverse Side | Regular Steel Finish; Narrow Rule<br>Narrow Rule<br>Regular Steel Finish; Narrow Rule with Hook | *610N-12<br>*C610N-12<br>*H610N-12 | 52695<br>67103<br>52698 |

† Includes redemption card for Standard Letter of Certification (SLC).

* Indicates rules with single row of inch figures (all rules under 1" width). Rules without asterisk have double row of inch figures, and each edge represents the bottom edge reading left to right (rules 1" and wider).



# Steel Rules

## Steel Rules with Inch Graduations

### 1-144"

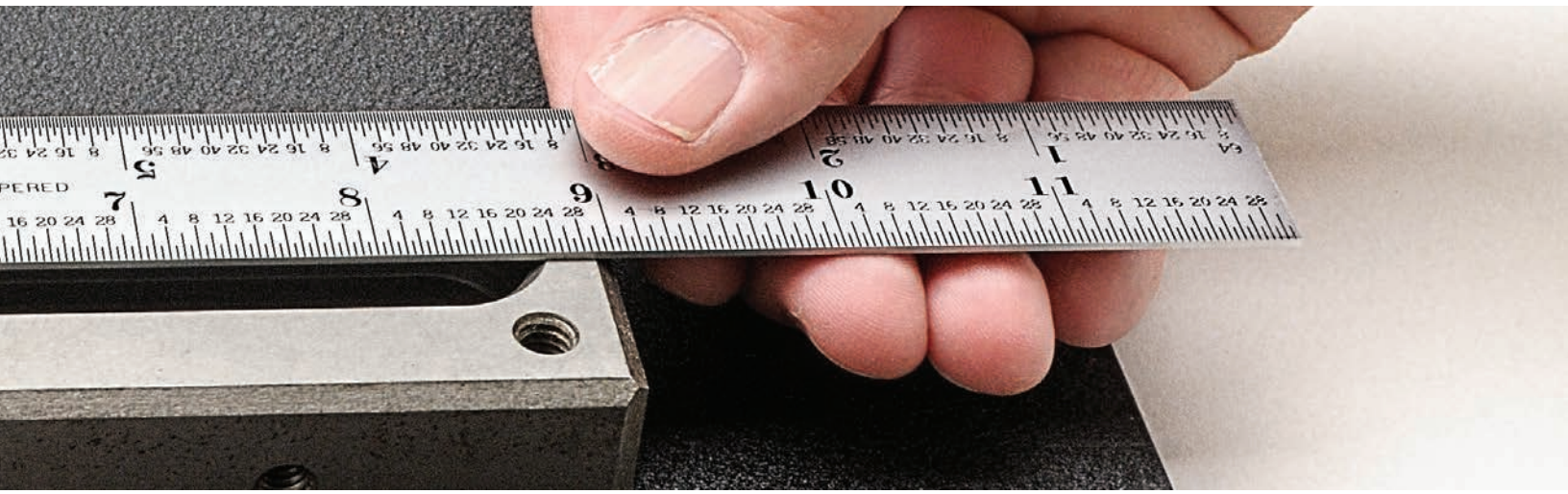
All rules furnished with Starrett satin chrome finish, except where noted. Additional sizes and variations available by special order.

| Length | Width x Thickness | Graduations | Feature Remarks | Cat. No. | EDP |
|---|---|---|---|---|---|
| **18" Full-Flexible Steel Rules with Inch Graduations** | | | | | |
| 18" | 3/4" x 1/50" | 5R – Quick-Reading 10ths, Aircraft Quick-Reading 100ths, 32nds and 64ths | | *C305R-18 | 51349 |
| 18" | 3/4" x 1/50" | 16R – Quick-Reading 32nds, 64ths, Aircraft Quick-Reading 50ths and 100ths | | *C316R-18 | 51376 |
| **18" Spring-Tempered Steel Rules with Inch Graduations** | | | | | |
| 18" | 1-1/8" x 3/64" | 4R – 8ths, 16ths, Quick-Reading 32nds and 64ths | With Standard Letter of Certification†<br>With Hook | C604R-18<br>C604R-18 W/SLC<br>CH604R-18 | 52680<br>66886<br>52675 |
| **24" Full-Flexible Steel Rules with Inch Graduations** | | | | | |
| 24" | 3/4" x 1/50" | 4R – 8ths, 16ths, Quick-Reading 32nds and 64ths | | C304R-24 | 56645 |
| 24" | 3/4" x 1/50" | 5R – Quick-Reading 10ths, Aircraft Quick-Reading 100ths, 32nds and 64ths | | *C305R-24 | 51350 |
| 24" | 3/4" x 1/50" | 16R – Quick-Reading 32nds, 64ths, Aircraft Quick-Reading 50ths and 100ths | | *C316R-24 | 51377 |
| **24" Semi-Flexible Steel Rules with Inch Graduations** | | | | | |
| 24" | 1" x 1/50" | 3R – Quick-Reading 10ths, Aircraft Quick-Reading 50ths, 32nds and 64ths | | C303SR-24 | 51338 |
| **24" Spring-Tempered Steel Rules with Inch Graduations** | | | | | |
| 24" | 1-1/4" x 3/64" | 4R – 8ths, 16ths, Quick-Reading 32nds and 64ths | With Standard Letter of Certification†<br>With Hook | C604R-24<br>C604R-24 W/SLC<br>CH604R-24 | 52681<br>66887<br>52676 |
| 24" | 1-1/4" x 3/64" | 7R – 16ths, Quick-Reading 32nds, 64ths, Aircraft Quick-Reading 100ths | | C607R-24 | 52691 |
| **24" Heavy Spring-Tempered Steel Rules with Inch Graduations** | | | | | |
| 24" | 1-1/4" x 1/10" | 4R – 8ths, 16ths, Quick-Reading 32nds and 64ths | With Hook | C404R-24<br>CH404R-24 | 51484<br>51494 |
| 24" | 1-1/4" x 1/10" | 16R – Quick-Reading 32nds, 64ths, Aircraft Quick-Reading 50ths and 100ths | With Hook | C416R-24<br>CH416R-24 | 51509<br>51519 |

All C404R and C416R Rules furnished with hole in end for hanging.

† Includes redemption card for Standard Letter of Certification (SLC).

* Indicates rules with single row of inch figures (all rules under 1" width). Rules without asterisk have double row of inch figures, and each edge represents the bottom edge reading left to right (rules 1" and wider).



# Precision Rules

## Steel Rules with Inch Graduations

### 1-144"

All rules furnished with Starrett satin chrome finish, except where noted. Additional sizes and variations available by special order.

| Length | Width x Thickness | Graduations | Feature Remarks | Cat. No. | EDP |
|---|---|---|---|---|---|
| **36" Spring-Tempered Steel Rules with Inch Graduations** | | | | | |
| 36" | 1-1/4" x 3/64" | 4R – 8ths, 16ths, Quick-Reading 32nds and 64ths | With Hook | C604R-36<br>CH604R-36 | 52682<br>52677 |
| 36" | 1-1/4" x 3/64" | 7R – 16ths, Quick-Reading 32nds, 64ths, Aircraft Quick-Reading 100ths | | C607R-36 | 56436 |
| **36" Heavy Spring-Tempered Steel Rules with Inch Graduations** | | | | | |
| 36" | 1-1/2" x 1/10" | 4R – 8ths, 16ths, Quick-Reading 32nds and 64ths | With Standard Letter of Certification†<br>With Hook | C404R-36<br>C404R-36 W/SLC<br>CH404R-36 | 51485<br>66888<br>51495 |
| 36" | 1-1/2" x 1/10" | 16R – Quick-Reading 32nds, 64ths, Aircraft Quick-Reading 50ths and 100ths | With Hook | C416R-36<br>CH416R-36 | 51510<br>51520 |
| **48" Spring-Tempered Steel Rules with Inch Graduations** | | | | | |
| 48" | 1-1/4" x 3/64" | 4R – 8ths, 16ths, Quick-Reading 32nds and 64ths | | C604R-48 | 52683 |
| 48" | 1-1/4" x 3/64" | 7R – 16ths, Quick-Reading 32nds, 64ths, Aircraft Quick-Reading 100ths | | C607R-48 | 56437 |
| **48-144" Heavy Spring-Tempered Steel Rules with Inch Graduations** | | | | | |
| 48" | 1-1/2" x 1/10" | 4R – 8ths, 16ths, Quick-Reading 32nds and 64ths | With Standard Letter of Certification†<br>With Hook | C404R-48<br>C404R-48 W/SLC<br>CH404R-48 | 51486<br>66889<br>51496 |
| 48" | 1-1/2" x 1/10" | 16R – Quick-Reading 32nds, 64ths, Aircraft Quick-Reading 50ths and 100ths | With Hook | C416R-48<br>CH416R-48 | 51511<br>51521 |
| 72" | 1-1/2" x 1/10" | 4R – 8ths, 16ths, Quick-Reading 32nds and 64ths | With Hook | C404R-72<br>CH404R-72 | 51488<br>51498 |
| 72" | 1-1/2" x 1/10" | 16R – Quick-Reading 32nds, 64ths, Aircraft Quick-Reading 50ths and 100ths | With Hook | C416R-72<br>CH416R-72 | 51513<br>51523 |
| 96" | 1-1/2" x 1/10" | 4R – 8ths, 16ths, Quick-Reading 32nds and 64ths | With Hook | C404R-96<br>CH404R-96 | 56191<br>56474 |
| 96" | 1-1/2" x 1/10" | 16R – Quick-Reading 32nds, 64ths, Aircraft Quick-Reading 50ths and 100ths | With Hook | C416R-96<br>CH416R-96 | 56197<br>56477 |
| 120" | 1-1/2" x 1/10" | 4R – 8ths, 16ths, Quick-Reading 32nds and 64ths | With Hook | C404R-120<br>CH404R-120 | 56192<br>56475 |
| 120" | 1-1/2" x 1/10" | 16R – Quick-Reading 32nds, 64ths, Aircraft Quick-Reading 50ths and 100ths | With Hook | C416R-120<br>CH416R-120 | 56198<br>56478 |
| 144" | 1-1/2" x 1/10" | 4R – 8ths, 16ths, Quick-Reading 32nds and 64ths | With Hook | C404R-144<br>CH404R-144 | 56193<br>56476 |
| 144" | 1-1/2" x 1/10" | 16R – Quick-Reading 32nds, 64ths, Aircraft Quick-Reading 50ths and 100ths | With Hook | C416R-144<br>CH416R-144 | 56199<br>56479 |

All C404R and C416R Rules furnished with hole in end for hanging.
† Includes redemption card for Standard Letter of Certification (SLC).



# Precision Rules

## Millimeter Graduation Styles

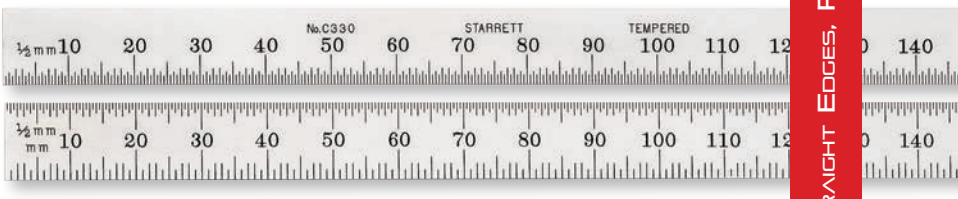
### 30

First Edge: None

Second Edge: 1/2mm

Fourth Edge: 1/2mm

Third Edge: mm




### 35

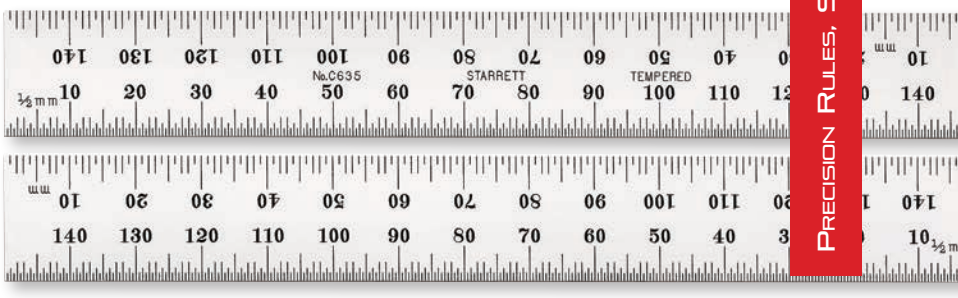
Reads both left-to-right and right-to-left.
A Starrett original feature.

First Edge: mm

Second Edge: 1/2mm

Fourth Edge: mm

Third Edge: 1/2mm




### 35E

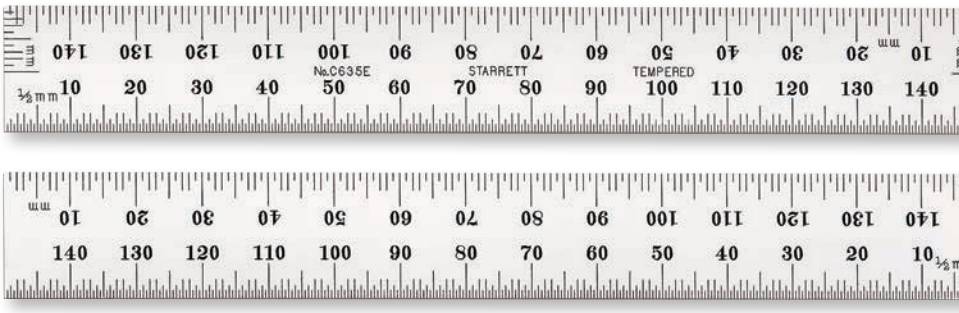
First Edge: mm

End Graduations: mm

Second Edge: 1/2mm

Fourth Edge: mm

Third Edge: 1/2mm



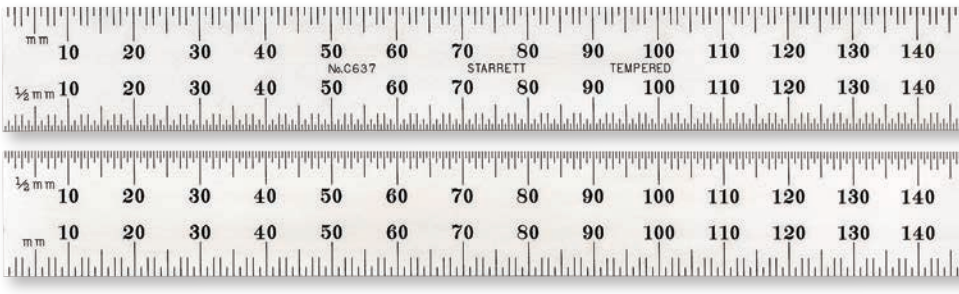

### 37

First Edge: mm

Second Edge: 1/2mm

Fourth Edge: 1/2mm

Third Edge: mm




### 37E

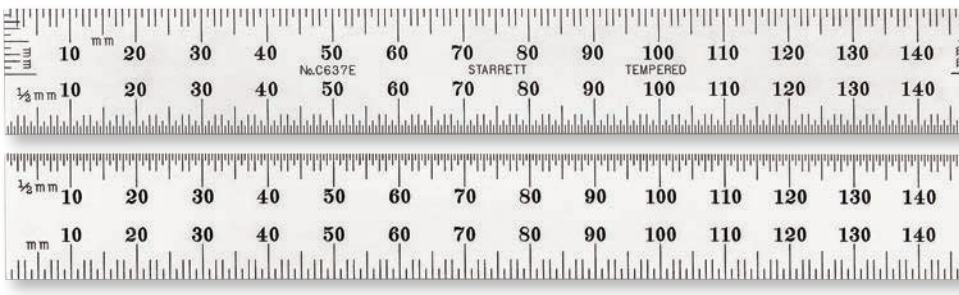
First Edge: mm

End Graduations: mm

Second Edge: 1/2mm

Fourth Edge: 1/2mm

Third Edge: mm




**NOTE**: All rules under 25mm in width have single row of millimeter figures. Rules 25mm and wider have double row of millimeter figures, and each edge represents the bottom edge reading left to right.

# Steel Rules

## Steel Rules with Millimeter Graduations

**150-1800MM**

All rules furnished with Starrett satin chrome finish, except where noted. Additional sizes and variations available by special order.

### Rules include:

- Full-Flexible
- Semi-Flexible
- Spring-Tempered
- Heavy Spring-Tempered

| Length | Width x Thickness | Graduations | Feature Remarks | Cat. No. | EDP |
|---|---|---|---|---|---|
| **150mm Full-Flexible Steel Rules with Millimeter Graduations** | | | | | |
| 150mm | 12.7 x 0.4mm | 30 – 1/2mm One Side; mm and 1/2mm on Reverse | With Standard Letter of Certification** | *C330-150<br>*C330-150 W/SLC | 51329<br>66882 |
| **150mm Spring-Tempered Steel Rules with Millimeter Graduations** | | | | | |
| 150mm | 19 x 1.2mm | 35 – mm and 1/2mm Both Sides | With Standard Letter of Certification** | C635-150<br>C635-150 W/SLC | 52630<br>66893 |
| 150mm | 19 x 1.2mm | 35E – mm and 1/2mm Both Sides; mm on Both Ends One Side | End Graduations | C635E-150 | 55968 |
| 150mm | 4.8 x 1.2mm | 35 – mm One Edge and 1/2mm One Edge on Reverse | Narrow Rule, Regular Steel Finish | 635N-150 | 70164 |
| 150mm | 19 x 1.2mm | 37 – mm and 1/2mm Both Sides | | C637-150 | 56049 |
| 150mm | 19 x 1.2mm | 37E – mm and 1/2mm Both Sides; mm on Both Ends One Side | End Graduations | C637E-150 | 55969 |
| **300mm Full-Flexible Steel Rules with Millimeter Graduations** | | | | | |
| 300mm | 12.7 x 0.4mm | 30 – 1/2mm One Side; mm and 1/2mm on Reverse | With Standard Letter of Certification** | *C330-300<br>*C330-300 W/SLC | 51330<br>66883 |
| **300mm Semi-Flexible Steel Rules with Millimeter Graduations** | | | | | |
| 300mm | 25.4 x 0.5mm | 35 – mm and 1/2mm Both Sides | | C335S-300 | 56048 |
| **300mm Spring-Tempered Steel Rules with Millimeter Graduations** | | | | | |
| 300mm | 25.4 x 1.2mm | 35 – mm and 1/2mm Both Sides | With Standard Letter of Certification** | C635-300<br>C635-300 W/SLC | 52631<br>66894 |
| **500mm Spring-Tempered Steel Rules with Millimeter Graduations** | | | | | |
| 500mm | 29 x 1.2mm | 35 – mm and 1/2mm Both Sides | | C635-500 | 52632 |
| **1000mm Spring-Tempered Steel Rules with Millimeter Graduations** | | | | | |
| 1000mm | 32 x 1.2mm | 35 – mm and 1/2mm Both Sides | | C635-1000 | 52633 |
| **1800mm Heavy Spring-Tempered Steel Rules with Millimeter Graduations** | | | | | |
| 1800mm | 38 x 2.5mm | 35 – mm and 1/2mm Both Sides | | C635-1800MM | 64299 |

** Includes redemption card for Standard Letter of Certification (SLC).

* Indicates rules with single row of millimeter figures (all rules under 25mm width). Rules without asterisk have double row of millimeter figures, and each edge represents the bottom edge reading left to right (rules 25mm and wider).

| Catalog Number Legend: | |
|---|---|
| **Prefixes:** | |
| C | Satin Chrome Finish |
| **Suffixes:** | |
| E | End Graduations |
| N | Narrow-Type Rule |
| S | Semi-Flexible |

# Precision Rules

## Millimeter and Inch Graduation Styles

### 31

First Edge: 32nds

Second Edge: 64ths




Fourth Edge: 1/2mm

Third Edge: mm



### 34

First Edge: 10ths

Second Edge: 50ths




Fourth Edge: mm

Third Edge: 1/2mm



### 36*

First Edge: 32nds

Second Edge: 1/2mm



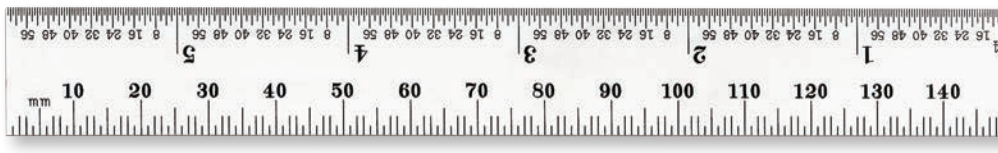

Fourth Edge: mm

Third Edge: 64ths



### CATALOG C636EM-6



**NOTE**: * Millimeter/Inch scale with emphasis on millimeter. Overall length is 150mm (5.905"). Inch graduations stop at 5-3/4" to avoid confusion.

### 31, 34, and 36* Styles are graduated as follows:

- 150mm end-to-end on mm edges and to 5-3/4" with a blank end on the inch edges
- 300mm end-to-end on mm edges and to 11-3/4" with a blank end on the inch edges
- 500mm end-to-end on mm edges and to 19-1/2" with a blank end on the inch edges
- 1000mm end-to-end on mm edges and to 39-1/4" with a blank end on the inch edges

### Catalog C636EM-6 is graduated as follows:

- 6" end-to-end on the inch edges and to 150mm with a blank end on the mm edges

# Steel Rules

## Steel Rules with Millimeter and Inch Graduations

**150MM-1000MM**

All rules are full millimeter lengths, except where noted. Additional sizes and variations available by special order.

**Rules include:**

- Full-Flexible
- Spring-Tempered

| Length | Width x Thickness | Graduations | Feature Remarks | Cat. No. | EDP |
|---|---|---|---|---|---|
| **150mm - 5-3/4" Full-Flexible Steel Rules with Millimeter and Inch Graduations** | | | | | |
| 150mm | 12 x 0.4mm | 31 – 32nds and 64ths on One Side; mm and 1/2mm on Reverse. All Four Edges Graduated from Same End | | C331-150 | 51331 |
| 5-3/4" | 12 x 0.4mm | 34 – mm and 1/2mm on One Side; Quick-Reading 10ths (.10) and Aircraft Quick-Reading 50ths (.02) on Reverse | | C334-150 | 56262 |
| **150mm - 6" Spring-Tempered Steel Rules with Millimeter and Inch Graduations** | | | | | |
| 150mm<br>5-3/4" | 19 x 1.2mm | 36 – 32nds and 1/2mm on One Side; 64ths and mm on Reverse | With Standard Letter of Certification* | C636ME-150<br>C636ME-150 W/SLC | 52634<br>66890 |
| 150mm 6" | 19 x 1.2mm | 36 – 32nds and 1/2mm on One Side; 64ths and mm on Reverse | Full 6" with Millimeter Reading to 150mm; plus a Blank End | C636EM-6 | 57064 |
| **300mm - 11-3/4" Full-Flexible Steel Rules with Millimeter and Inch Graduations** | | | | | |
| 300mm | 12.7 x 0.4mm | 31 – 32nds and 64ths on One Side; mm and 1/2mm on Reverse. All Four Edges Graduated from Same End | | C331-300 | 51332 |
| 11-3/4" | 12.7 x 0.4mm | 34 – mm and 1/2mm One Side; Quick-Reading 10ths (.10) and Aircraft Quick-Reading 50ths (.02) on Reverse | | C334-300 | 56696 |
| **300mm - 11-3/4" Spring-Tempered Steel Rules with Millimeter and Inch Graduations** | | | | | |
| 300mm<br>11-3/4" | 25.4 x 1.2mm | 36 – 32nds and 1/2mm on One Side; 64ths and mm on Reverse | With Standard Letter of Certification* | C636-300<br>C636-300 W/SLC | 52635<br>66891 |
| **500mm - 19-1/2" Full-Flexible Steel Rules with Millimeter and Inch Graduations** | | | | | |
| 500mm<br>19-1/2" | 19 x 0.5mm | 34 – mm and 1/2mm on One Side; Quick-Reading 10ths (.10) and Aircraft Quick-Reading 50ths (.02) on Reverse | | C334-500 | 56697 |
| **500mm - 19-1/2" Spring-Tempered Steel Rules with Millimeter and Inch Graduations** | | | | | |
| 500mm<br>19-1/2" | 29 x 1.2mm | 36 – 32nds and 1/2mm on One Side; 64ths and mm on Reverse | | C636-500 | 52636 |
| **1000mm - 39-1/4" Spring-Tempered Steel Rules with Millimeter and Inch Graduations** | | | | | |
| 1000mm<br>39-1/4" | 32 x 1.2mm | 36 – 32nds and 1/2mm on One Side; 64ths and mm on Reverse | With Standard Letter of Certification* | C636-1000<br>C636-1000 W/SLC | 52637<br>66892 |

* Includes redemption card for Standard Letter of Certification (SLC).



| Key to Starrett Rule Numbering System: | |
|---|---|
| **Prefixes:** | |
| C | Satin Chrome Finish |
| **Suffixes:** | |
| EM | English/ Metric |
| ME | Metric/English |

# Steel Rules

## Steel Rules with Shrink Graduations

**12", 24"**

These spring-tempered, satin chrome finished shrink rules are for laying out wood and metal patterns and core boxes for casting metals. Graduated to give shrink allowances directly, they come in 12" and 24" lengths with shrinks from 1/16-3/8" per foot.

The average shrinkage figures are for metals cast with uniform sections under normal conditions (see table). When using, be sure that the size and shape of castings are considered, since thick castings have less shrink and thin castings more shrink than the figures shown.

**NOTE**: Also see 62 Rule Holder. A very useful tool for patternmakers.

**Steel Rules with Shrink Graduations**

| Length | Width x Thickness | Shrink Per Foot | Graduation | Cat. No. | EDP |
|---|---|---|---|---|---|
| 12" | 1" x 3/64" | 1/16" | 6R – Aircraft Quick-Reading 50ths (.02) Both Edges One Side; Quick-Reading 10ths (.10) Both Edges Opposite Side | C100A-12 | 50452 |
| 12" | 1" x 3/64" | 1/10" | 4R – 8ths, 16ths, Quick-Reading 32nds, 64ths | C374-12 | 51430 |
| | | 1/8" | | C370-12 | 51428 |
| 12" | 1" x 3/64" | 5/32" | 4R – 8ths, 16ths, Quick-Reading 32nds, 64ths | C389-12 | 51473 |
| 12" | 1" x 3/64" | 3/16" | 6R – Aircraft Quick-Reading 50ths (.02) Both Edges One Side; Quick-Reading 10ths (.10) Both Edges Opposite Side | C100F-12 | 50458 |
| 12" | 1" x 3/64" | 3/16" | 4R – 8ths, 16ths, Quick-Reading 32nds, 64ths | C375-12 | 51432 |
| | | 7/32" | | C376-12 | 51434 |
| | | 1/4" | | C377-12 | 51435 |
| | | 9/32" | | C378-12 | 51437 |
| | | 5/16" | | C368-12 | 51424 |
| | | 3/8" | | C369-12 | 51426 |
| 24" | 1-1/4" x 3/64" | 1/16" | 6R – Aircraft Quick-Reading 50ths (.02) Both Edges One Side; Quick-Reading 10ths (.10) Both Edges Opposite Side | C100A-24 | 50453 |
| 24" | 1-1/4" x 3/64" | 1/10" | 4R – 8ths, 16ths, Quick-Reading 32nds, 64ths | C374-24 | 51431 |
| | | 1/8" | | C370-24 | 51429 |
| | | 5/32" | | C389-24 | 51474 |
| 24" | 1-1/4" x 3/64" | 3/16" | 6R – Aircraft Quick-Reading 50ths (.02) Both Edges One Side; Quick-Reading 10ths (.10) Both Edges Opposite Side | C100F-24 | 50459 |
| 24" | 1-1/4" x 3/64" | 3/16" | 4R – 8ths, 16ths, Quick-Reading 32nds, 64ths | C375-24 | 51433 |
| | | 1/4" | | C377-24 | 51436 |
| | | 5/16" | | C368-24 | 51425 |
| | | 3/8" | | C369-24 | 51427 |



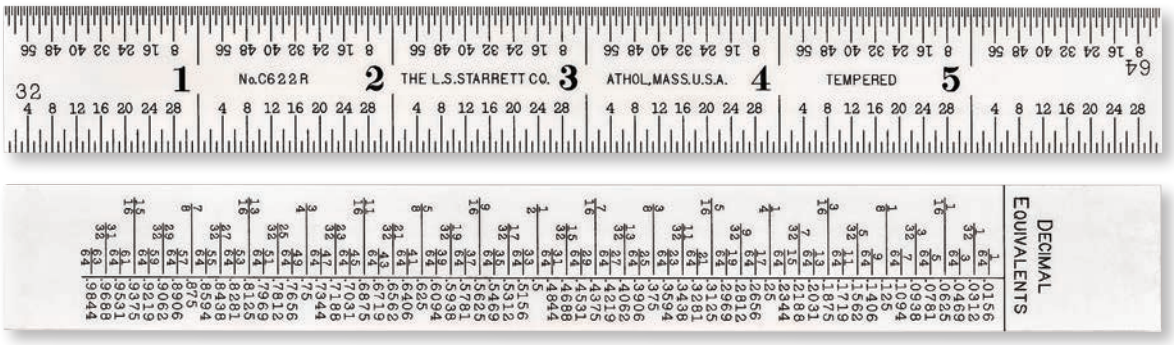

| Average Shrinkage of Castings (Inches per Foot) | |
|---|---|
| Cast Iron | 1/8" |
| Malleable Iron | 1/8" |
| Steel | 1/4" |
| Brass | 3/16" |
| Copper | 3/16" |
| Aluminum | 3/16" |
| Lead | 5/16" |
| Zinc | 5/16" |
| Britannia | 1/32" |
| Tin Alloys | 1/12" |

# Steel Rules

## C622R-6 Steel Rule with Decimal Equivalents

6"

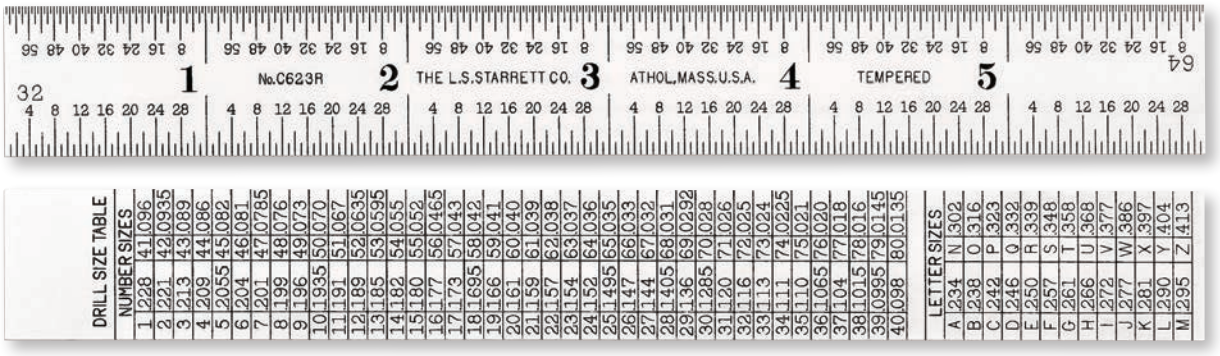
One side of this handy rule has accurate, photo-engraved, distinctive graduations in both Quick-Reading 32nds and 64ths. The reverse side has a legible table of fractions and decimal equivalents. Made of finest spring-tempered steel with no-glare satin chrome finish.




## C623R-6 Steel Rule with Letter and Number Drill Sizes

6"

This practical shop rule has accurate, photo-engraved graduations in 32nds and 64ths with Quick-Reading figures on one side. The reverse side has letter sizes of drills from A to Z with corresponding diameters in thousandths and also number sizes from 1 to 80 with diameters in thousandths. Made of fine spring-tempered steel with no-glare satin chrome finish.




| 6" Steel Rule with Decimal Equivalents | | | |
|---|---|---|---|
| **Width x Thickness** | **Graduation** | **Cat. No.** | **EDP** |
| 3/4" x 3/64" | 10R – Quick-Reading 32nds and 64ths One Side and Decimal Equivalents on Reverse Side | C622R-6 | 56660 |
| **6" Steel Rule with Letter and Number Drill Sizes** | | | |
| 3/4" x 3/64" | 10R – Quick-Reading 32nds and 64ths One Side and Letter and Number Drill Sizes on Reverse Side | C623R-6 | 56661 |

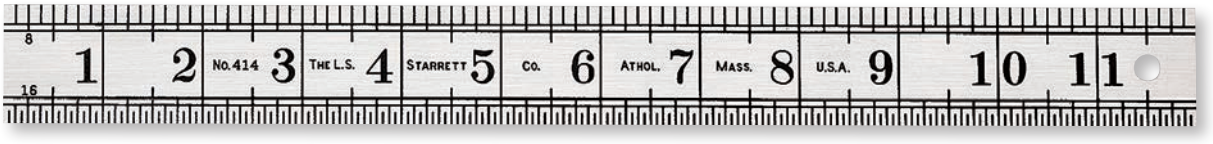
# Steel Rules

## 414 Steel General Utility Rules – English Pattern

**12", 24"**

These tempered steel rules are designed to meet the general-utility measuring needs of schools and shops, wood-workers, tinsmiths, metalworkers, bench-work, etc. Photo-engraved graduations are heavier than conventional machine-divided rules and easy to read. The two edges on both sides are graduated with the upper edges in 8ths and the lower edges in 16ths of an inch. A 1/4" hang-hole is on one end.

| 414 Steel General Utility Rules – English Pattern | | | | |
|---|---|---|---|---|
| **Length** | **Width x Thickness** | **Graduation** | **Cat. No.** | **EDP** |
| 12" | 1-1/4" x 1/16" | 8ths, 16ths of an Inch, Both Sides | 414-1 | 51499 |
| 24" | | | 414-2 | 51500 |




## 471 Steel Folding Rule with Circumference Measurement

**24"**

Tinsmiths and other mechanics appreciate this rule because it measures diameters up to 24" as well as the equivalent circumference measurement in direct-reading circumference inches, up to 75". Entirely eliminates the need for circumference calculations. Made of fine, spring-tempered steel and jointed at the center with two 12" folds. Photo-engraved graduations.



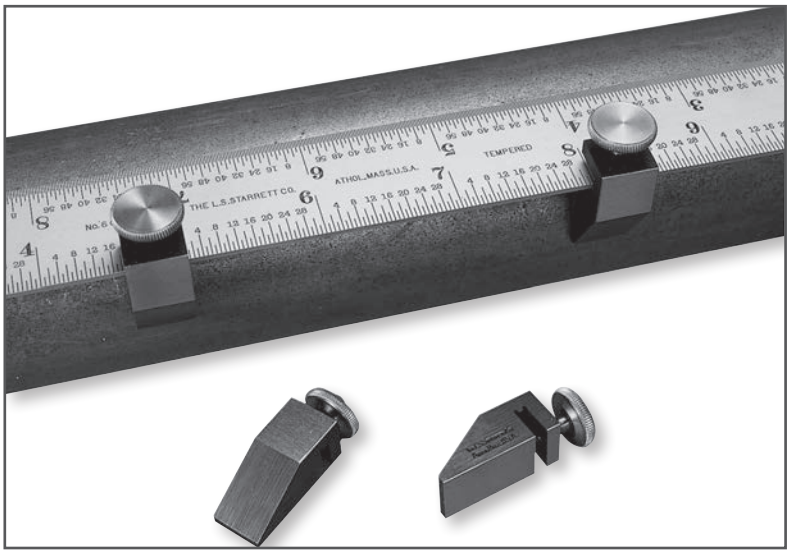
| 24" Steel Folding-Rule with Circumference Measurement | | | |
|---|---|---|---|
| **Width x Thickness** | **Graduation** | **Cat. No.** | **EDP** |
| 3/4" x 1/32" | 8ths and Circumference 8ths on One Side; 16ths on Reverse Side | 471 | 52483 |

# Clamps

## Key Seat Clamps

These key seat clamps convert steel rules, combination square blades and straight edges into key seat rules for laying out keyways and scribing parallel lines on round work. They can be easily attached or removed. Made of steel, case hardened, and accurately ground, they are 1" long x 7/16" wide (25 x 11mm) and have a 7/64" (2.8mm) slot width. Available in pairs only.

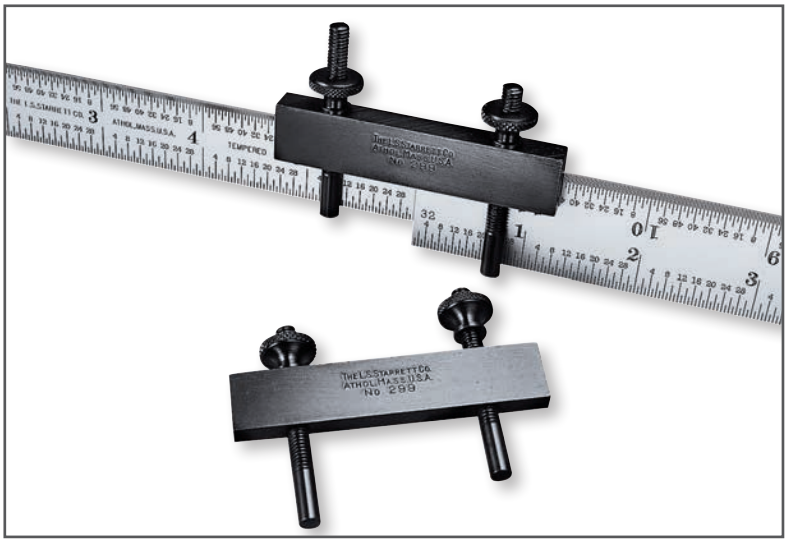
| Key Seat Clamps | | |
|---|---|---|
| **Cat. No.** | **EDP** | **Description** |
| 298 | 51327 | Pair of Key Seat Clamps |



## Rule Clamp

This useful tool is for clamping two steel rules together, end to end, making one long rule for measuring longer lengths than a single rule. Since the clamp bolts have independent adjustment, the rule clamp will hold rules of the same or different widths up to 1-1/4" (32mm). This clamp is handy for mechanics whose tool chests will not hold rules over 12" (300mm) long.

| Rule Clamp | | |
|---|---|---|
| **Cat. No.** | **EDP** | **Description** |
| 299 | 51328 | Rule Clamp |



# Holders

## 62 Rule Holder

The 62 Rule Holder is designed primarily for patternmakers, toolmakers and machinists. It will hold any rule or combination square blade from 3/4 – 1-9/16" (19-40mm) wide in an upright position for use in transferring measurements with surface gages, etc. It is also handy for use as a depth gage. A large knurled clamp nut securely locks the rule in the holder.

The base is approximately 3-1/8" long and 2-1/2" wide (80 x 60mm). There is a depression on each side for thumb and fingers for handling convenience.

| 62 Rule Holder | | |
|---|---|---|
| **Description** | **Cat. No.** | **EDP** |
| Holder Only | 62 | 50304 |

## 423 Small Steel Rules with Holder

**1/4, 3/8, 1/2, 3/4, 1"**

This set of five small rules is extremely useful for measurements in confined or hard-to-reach locations. They are especially suitable for measuring grooves, short shoulders, recesses, keyways, and in tool and die work.

The 4" long holder is well balanced. The rules are easily inserted in the slotted end of the holder and are rigidly clamped in place by a slight turn of a knurled nut. Two slots are provided, so the rules can be held at 30º or 45º, either square in a slot or tipped to one side.

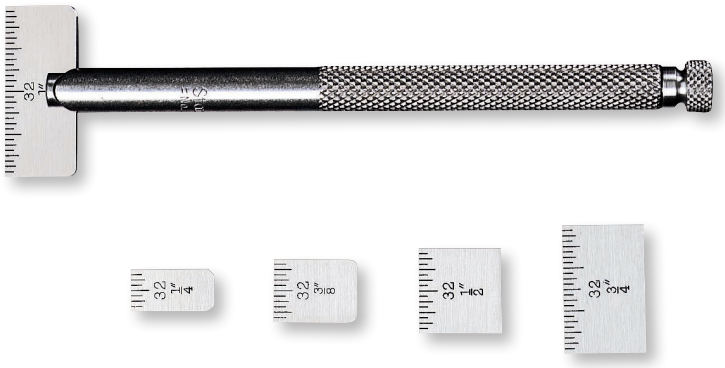
Thicknesses up to 1/16" can be clamped in either slot. Rules are made of thin, spring-tempered steel, with bright finish and highly accurate, photo-engraved graduations. Each rule is graduated in 32nds of an inch on one side and 64ths on the reverse.

| 423 Small Steel Rules with Holder | | |
|---|---|---|
| **Description** | **Cat. No.** | **EDP** |
| Set of 5 Rules with Holder in Attractive, Protective Case | S423Z | 51524 |
| Holder Only | 110 | 50475 |



Transferring measurements with a Starrett Surface Gage used in conjunction with rule and rule holder





# Steel Straight Edges

## 380 Steel Straight Edges

## 385 Steel Straight Edges with Bevel Edge

**12-72"/300-1800MM**

## 387 Steel Straight Edges with Bevel and Graduated Edge

**12-48"/300-1200MM**



Top, 380-12; middle, 385-12; bottom, 387-12







These straight edges are precision ground and nicely finished to rigid Starrett standards. They are unexcelled for drawing or scribing straight lines and checking surfaces for straightness. Their thickness and design permit them to retain shape and accuracy, but still be portable and easy to handle.

The 380 straight edge is not beveled or graduated. The 385 straight edge is beveled one edge, but not graduated. The 387 straight edge has one edge that is both beveled and graduated in 32nds of an inch.

The 380 and 385 straight edges in sizes 36" and longer are marked with arrows at two suspension points. If the straight edges are brought to the work and used on edge, they should be suspended at these two points to minimize deflection. Most jobs involve the use of straight edges in the flat position – and it is in this position that we check most stringently.

| Steel Straight Edges | | | | 380 | | 385 with Bevel | | 387 with Bevel, Graduations | |
|---|---|---|---|---|---|---|---|---|---|
| Length | | Width x Thickness | | | | | | | |
| Inch | mm | Inch | mm | Cat. No. | EDP | Cat. No. | EDP | Cat. No. | EDP |
| 12 | 300 | 1-13/32 x 11/64 | 36 x 4.4mm | 380-12 | 51438 | 385-12 | 51455 | 387-12 | 51468 |
| 18 | 450 | 1-13/32 x 11/64 | 36 x 4.4mm | 380-18 | 51439 | 385-18 | 51456 | 387-18 | 51469 |
| 24 | 600 | 1-13/32 x 11/64 | 36 x 4.4mm | 380-24<br>380-24 W/SLC* | 51440<br>66895 | 385-24 | 51457 | 387-24 | 51470 |
| 36 | 900 | 2-13/32 x 7/32 | 60 x 5.5mm | 380-36 | 51441 | 385-36 | 51458 | 387-36 | 51471 |
| 48 | 1200 | 2-13/32 x 7/32 | 60 x 5.5mm | 380-48 | 51442 | 385-48 | 51459 | 387-48 | 51472 |
| 72 | 1800 | 3-5/32 x 9/32 | 80 x 7mm | 380-72 | 51444 | 385-72 | 51461 | | |

* Includes redemption card for Standard Letter of Certification (SLC).

## 386 Draftsmen's Steel Straight Edges with Bevel Edge

**12-72"/300-1800MM**

These straight edges are thinner than our 385 straight edge (3/32" or 2.4mm) making them easier for draftsmen to use. Available in lengths up to 72" long. They have an attractive nickel plated finish, are beveled on one edge, and have a convenient hang-hole on one end.

| 386 Draftsmen's Steel Straight Edges with bevel edge | | | | | |
|---|---|---|---|---|---|
| Length | | Width x Thickness | | | |
| Inch | mm | Inch | mm | Cat. No. | EDP |
| 12 | 300 | 1-9/16 x 3/32 | 40 x 2.4 | 386-12 | 51462 |
| 24 | 600 | 1-9/16 x 3/32 | 40 x 2.4 | 386-24 | 51463 |
| 36 | 900 | 1-9/16"x 3/32 | 40 x 2.4 | 386-36 | 51464 |
| 48 | 1200 | 2-1/8 x 3/32 | 54 x 2.4 | 386-48 | 51465 |
| 72 | 1800 | 2-5/8 x 7/64 | 66 x 2.8 | 386-72 | 51467 |





S384JZ Parallel Set

# Parallels

## 384 Steel Parallels

### 1/8" X 1" - 1/2" X 1-1/4"/3 X 25MM - 13 X 31MM

The 384 Steel Parallels are hardened and ground to close limits. They are indispensable for inspection and layout work or for various setups on drill presses, milling and grinding machines, shapers, etc. Furnished in pairs, 6" length, they are made from a special grade of tool steel, hardened and accurately ground on the four sides. In tool rooms or machine shops, several pairs of these parallels will be of great value.

**384 Steel Parallels, 6" (150mm) Length**

| Thickness | | Width | | Pairs | |
|---|---|---|---|---|---|
| Inch | mm | Inch | mm | Cat. No. | EDP |
| 1/8" | 3mm | 1" | 25mm | 384A | 51445 |
| 3/16" | 5mm | 7/8" | 22mm | 384C | 51447 |
| 1/4" | 6mm | 3/4" | 19mm | 384E | 51449 |
| | | 1" | 25mm | 384F | 51450 |
| 3/8" | 10mm | 1/2" | 13mm | 384G | 51451 |
| | | 3/4" | 19mm | 384H | 51452 |
| 1/4" | 6mm | 3/8" | 10mm | 384M | 63645 |
| | | 1/2" | 13mm | 384N | 63646 |
| | | 5/8" | 16mm | 384P | 63647 |
| 3/8" | 10mm | 1" | 25mm | 384R | 63648 |
| 1/2" | 13mm | 5/8" | 16mm | 384S | 63649 |
| | | 3/4" | 19mm | 384T | 63650 |
| | | 1" | 25mm | 384W | 63651 |
| | | 1-1/8" | 28mm | 384X | 63652 |
| | | 1-1/4" | 31mm | 384Y | 63653 |

**384 Steel Parallel Sets**

| Description | Cat. No. | EDP |
|---|---|---|
| Set of 4 Pairs – Sizes A, C, E, G – In Case | S384JZ | 51453 |
| Set of 4 Pairs – Sizes N, M, P, F – In Case | S384-1Z | 63676 |
| Set of 4 Pairs – Sizes G, H, R, M – In Case | S384-2Z | 63677 |
| Set of 5 Pairs – Sizes S, T, W, X and Y – In Case | S384-3Z | 63678 |



# Parallels

## 154 Adjustable Parallels

### 3/8 – 2-1/4"/9.5-57MM

These adjustable parallels provide a wide range of use in layout, gaging, inspection work and for setups on various machine tools. Their adjustablity makes it possible to adjust them to exact size by micrometer measurement and also permits use in place of several solid-type parallels.

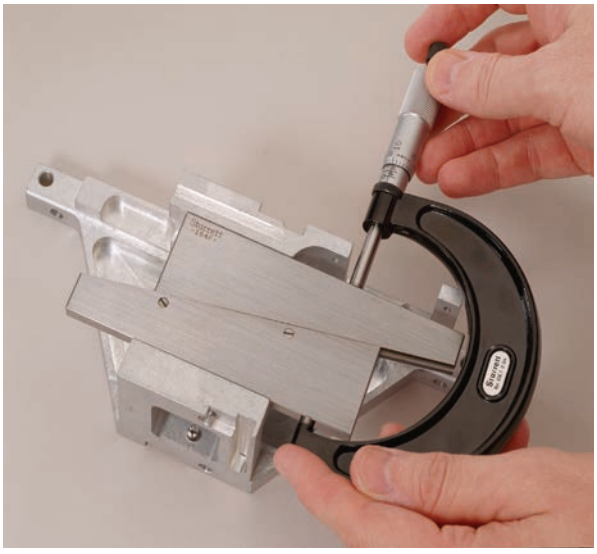
These parallels are useful as gages in checking the size of slots and openings. They are also convenient for use in machine vises, for leveling or adjusting work on setups of milling and grinding machines, shapers, planers, drill presses and for many other applications.

Parallels slide smoothly and can be easily adjusted. The smaller sizes A, B, and C, are locked by one screw while the larger sizes, D, E, and F, have two lock screws. All parallels are 9/32" (7mm) thick.

| 154 Adjustable Parallels | | | | | |
|---|---|---|---|---|---|
| **Range** | | **Length** | | **Cat. No.** | **EDP** |
| 3/8 – 1/2" | 9.5-12.7mm | 1-3/4" | 45mm | 154A | 50578 |
| 1/2 – 11/16" | 12.7-17.5mm | 2-1/8" | 55mm | 154B | 50579 |
| 11/16 – 15/16" | 17.5-24mm | 2-11/16" | 70mm | 154C | 50580 |
| 15/16 – 1-5/16" | 24-33mm | 3-9/16" | 90mm | 154D | 50581 |
| 1-5/16 – 1-3/4" | 33-44mm | 4-3/16" | 105mm | 154E | 50582 |
| 1-3/4 – 2-1/4" | 44-57mm | 5-1/16" | 130mm | 154F | 50583 |
| **154 Adjustable Parallel Sets** | | | | | |
| **Description** | | | | **Cat. No.** | **EDP** |
| Set of 4 Parallels – Sizes A, B, C, D – In Case | | | | S154SZ | 50584 |
| Set of 6 Parallels – Sizes A, B, C, D, E, F – In Case | | | | S154LZ | 50586 |
| Case Only for Set of 4 | | | | S154SZZ | 55194 |
| Case Only for Set of 6 | | | | S154LZZ | 55195 |



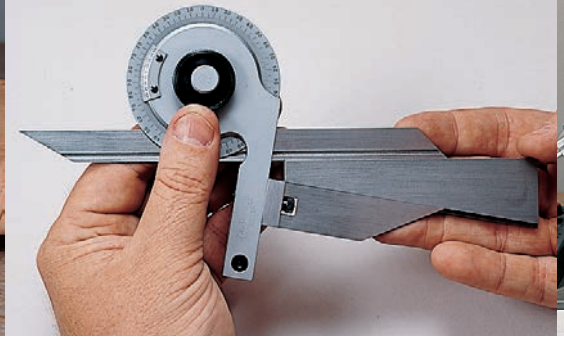
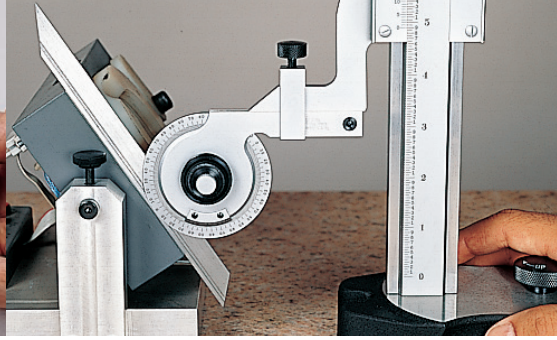

Set S154LZ with 154E in foreground



Checking inside measurement of slot with parallel and outside micrometer



# PROTRACTORS, ANGLE MEASUREMENT

# Protractors

## 359 Precision Universal Bevel Vernier Protractors with Fine Adjustment

### GRADUATIONS IN DEGREES THRU 360º

These tools are designed for precision measuring and for laying out angles. The protractor is one of the most valuable and useful tools for the kit of every good toolmaker, inspector or machinist.

| 359 Precision Universal Bevel Vernier Protractors - Graduations in Degrees through 360º | | | |
|---|---|---|---|
| Blade Size | Graduation | In Case Cat. No. | EDP |
| 7" | 5 min. or 1/12 degree | C359BZ | 51394 |
| 12" | 5 min. or 1/12 degree | C359DZ | 51396 |
| 7" and 12" | 5 min. or 1/12 degree | C359FZ | 51398 |
| | | C359FZ W/SLC* | 66929 |

| Accessories for 359 Precision Universal Bevel Vernier Protractors | | |
|---|---|---|
| Description | Cat. No. | EDP |
| 7" Blade Only | PT04780 | 70538 |
| 12" Blade Only | PT04781 | 70539 |
| Acute Angle Attachment Only | PT99329 | 51392 |

* Includes redemption card for Standard Letter of Certification (SLC).

### Readability Features

- Satin chrome finish on all reading surfaces – eliminates glare and resists rust
- Sharp, machine-divided graduations

### Ease-of-Handling Features

- Available with hardened 7" (175mm) or 12" (300mm) blades which can be rotated to the desired angle and adjusted to the desired length
- Both the dial and the blade can be locked independently
- An acute angle attachment is available
- Flush surfaces on the base permits use on height gages
- One side of the tool is flat so it can be laid on paper or on the work

### Accuracy Features

- Machine-divided graduations read to 5 minutes (1/12 of a degree) and accuracy is finer than can be read
- The most convenient, ultra-sensitive fine adjustment for precision setting

## How to Read a Vernier on Universal Bevel Protractors

Universal Bevel Protractors with Vernier can be accurately read to 5 minutes (5') or 1/12 of a degree. The dial of the protractor is graduated both to the right and left of zero up to 90 degrees. The Vernier scale is also graduated to the right and left of zero up to 60 minutes (60'), each of the 12 Vernier graduations representing 5 minutes. Any angle can be measured, and remember that the Vernier reading must be read in the same direction from zero as the protractor, either left or right.

Since 12 graduations on the Vernier scale occupy the same space as 23 graduations or 23 degrees on the protractor dial, each Vernier graduation is 1/12 degree or 5 minutes shorter than 2 graduations on the protractor dial. Therefore, if the zero graduation on the Vernier scale coincides with a graduation on the protractor dial, the reading is in exact degrees, but if some other graduation on the Vernier scale coincides with a protractor graduation, the number of Vernier graduations multiplied by 5 minutes must be added to the number of degrees read between the zeros on the protractor dial and Vernier scale.

### Example:

★In the illustration on the below, the zero on the Vernier scale lies between the "50" and "51" on the protractor dial to the left of the zero, indicating 50 whole degrees. Also reading to the left, the 4th line on the Vernier scale coincides with a graduation on the protractor dial as indicated by the asterisks (*) and therefore 4 x 5 minutes or 20 minutes are to be added to the number of degrees. The reading of the protractor therefore, is 50 degrees and 20 minutes (50º 20').



# Steel Protractors

## C19 Steel Protractor

**0-180º**

This is a highly useful and accurate tool for setting bevels, transferring angles, small squaring tasks, checking cutter clearances within certain limits, and many other applications.

- Double graduations from 0-180º in opposite directions permitting the direct reading of angles and supplementary angles
- The back of the tool is flat for ease of use
- The blade can be locked firmly at any angle by the lock nut
- Satin chrome finish for ease of reading and resistance to rust

## C183 Steel Protractor

**0-180º**

This protractor is exactly the same as the C19, except that is has a rectangular head, thus providing four convenient working edges.

## C182 Steel Protractor

**0-180º**

This protractor has the same type of head as our 19 but it is designed for draftsmen, civil engineers, and others who need a protractor that will allow the drawing of any number of radial lines at any angle through a common center. This is especially useful for someone in the field who can only carry a minimum of equipment. Weight is approximately 3 ounces.

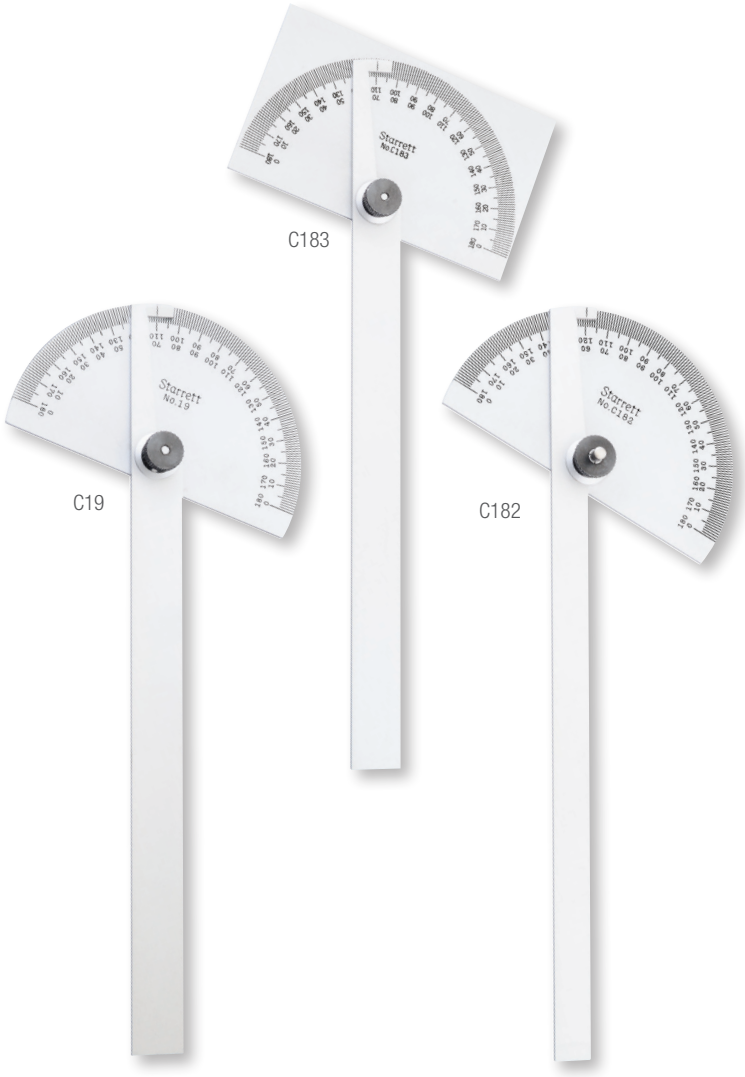
To use the protractor, the fulcrum point is pressed into the drawing at the required center. This is done by removing the fulcrum point from the hub, pressing it in the drawing, and then placing the protractor hub over the fulcrum point. The desired angles can then be laid out.

The fulcrum point can be left in the tool. Press the whole tool down so that the point penetrates the drawing. (However, this will make it harder to find the center.)

When not in use, the fulcrum point can be drawn back into the hub and frictionally held in a safe position.

Satin chrome finish for ease of reading and resistance to rust.

Furnished with one needle point and one cone point.






Side view of protractor with fulcrum point in place

| Steel Protractors | | | |
|---|---|---|---|
| **Blade Length** | **Range** | **Cat. No.** | **EDP** |
| 6" | 0-180º | C19 | 50127 |
| | | C183 | 50672 |
| | | C183 W/SLC* | 66930 |
| | | C182 | 64361 |

* Includes redemption card for Standard Letter of Certification (SLC).

# Protractors

## 193 Steel Protractor

**0-180º**

This protractor can be used with the 47 Universal Bevel by setting it against the revolving stud, which quickly and economically converts it into a Bevel Protractor. Protractor has double graduations from 0-180º in opposite directions.

| Steel Protractor | | |
|---|---|---|
| Range | Cat. No. | EDP |
| 0-180º | 193 | 50696 |




193

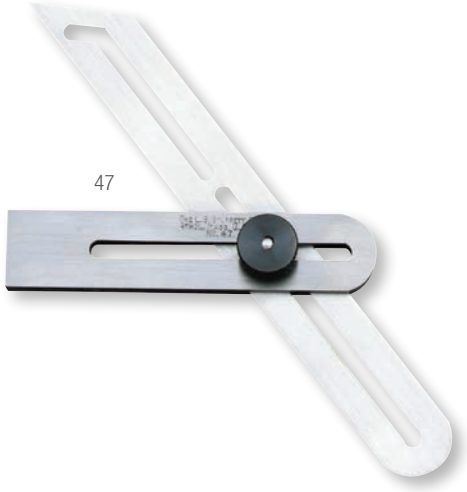
## 47 Universal Bevel

**6"/150MM**

This improved Universal Bevel has both offset and straight slots in the blade, in combination with straight slots in the stock that allow for a wide variety of adjustment and angle settings that are impossible to obtain with many ordinary bevels.

Length of the blade is 6" (150mm), and the stock, 3-1/2" (90mm). The stock lies flat on the work or paper since the head of the clamping bolt is recessed. This tool can be set to duplicate an angle from a master, or it may be easily converted into a Bevel Protractor by using this tool with the 193 Protractor.

| Universal Bevel | | |
|---|---|---|
| Blade Length | Cat. No. | EDP |
| 6" | 47 | 50266 |



47



## Special Dial Protractor Heads

We make dial protractor heads for special applications that permit rapid angular measurements over a 90º range, in increments of 5 minutes.

These special tools are similar to AGD Group-2 Dial Indicators. They have a rear-mounted rotary input shaft attached to a movable arm that measures the angle in relation to a fixed arm.

They are available with continuous or balanced dials and with clockwise or counterclockwise reading.

(See our Special Gage section for more information.)



# Protractors

## 493 Protractor and Depth Gages

**0-180º**

The ability to measure angles and depths is combined in these convenient tools.

### C493

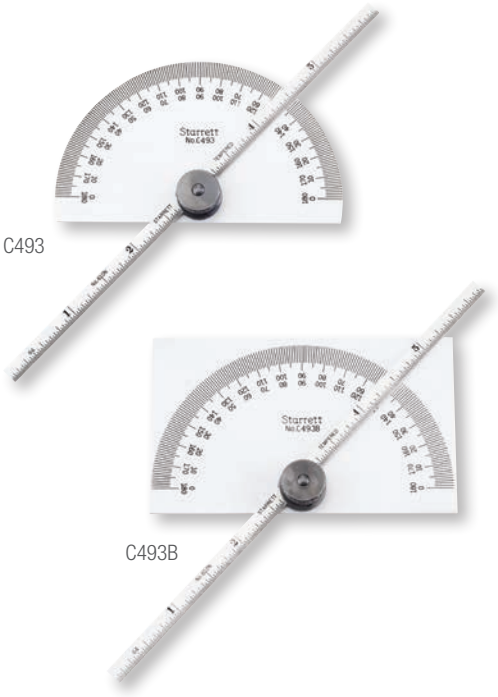
- Angular measurement is from 0-180º in opposite directions allowing the direct reading of angles and supplementary angles
- Depths are measured from a 6" (150mm) blade (our C610N)
- Both tools have a flat surface on the back of the head permitting laying the tool flat on paper or work
- No-glare satin chrome finish
- Semicircular head

### C493B

This gage is exactly the same as the C493, except that it has a rectangular protractor head which provides four convenient working edges.

| C493 Protractor and Depth Gages | | | | |
|---|---|---|---|---|
| Cat. No. | EDP | Blade Length | Blade Graduations | Range |
| C493 | 52532 | 6" | 32nds, 64ths | 0-180º |
| C493B | 52534 | | | |

| Replacement Blades | | |
|---|---|---|
| Cat. No. | EDP | Blade Length |
| C610N-6 | 52696 | 6" |
| C610N-12 | 67103 | 12" |




## 22C Drill Point Gage

**59º**

This gage was designed specifically for use in drill grinding. It provides a quick, accurate way for determining the correct drill point angle of 59º and the correct length of drill lips necessary for clean-cut drilling at maximum feeds and speeds.

- The sliding head may be adjusted to any position along the rule and locked by a thumb nut
- The head is beveled to 59º (the correct drill point angle), and is also graduated in 32nds along the 59º face for measuring the drill lips which should be of equal lengths
- The hook rule has accurate, machine-divided graduations in 8ths, 16ths, quick-reading 32nds and 64ths
- Hook is adjustable and can be shortened or extended on either side of the rule, and may also be removed if desired
- Tool can also be used as a Plain Rule, Hook Rule, Depth Gage, and Slide Caliper
- Will handle up to a 2" diameter drill

| 22C Drill Point Gage | | | | | |
|---|---|---|---|---|---|
| | | Head | | Hook Rule | |
| Cat. No. | EDP | Bevel | Graduations | Length | Graduations |
| 22C | 50150 | 59º | 32nds | 6" | 8ths, 16ths; Quick-Reading 32nds, 64ths |



# Bevel Protractors

## 490, 491 Reversible Bevel Protractors

0-180º

## 12 Non-reversible Bevel Protractors

0-180º

### Readability Features

- Starrett satin chrome blades and protractor heads for easier reading are available (on 12" sizes)
- Direct reading 0-180º in opposite directions, permitting the direct reading of angles and supplementary angles

### Ease-of-Handling Features

- Reversible lock bolt allows choice of which graduated side of the blade faces the operator
- The 12 is non-reversible, meaning the blade is on the outside of the frame, so the frame stays on the same side of the workpiece
- The 490 and 491 are reversible, meaning there is a shoulder on both sides of the blade, allowing the tool to be reversed so the same angle can be scribed or measured left and right

### Long-Life and Accuracy Features

- Protractor heads are made of stable cast iron and finished with a choice of attractive black wrinkle finish or smooth black finish
- Tempered steel blades with accurate, photo-engraved graduations
- A spirit level indicates when the base reference surface is level – a feature not usually available on comparable protractors



C490-12-4R non-reversible bevel protractor with black wrinkle finish



C12-12-4R reversible bevel protractor with smooth finish



Close-up of spirit level on back side of protractor

**Bevel Protractors**

| Size | Blade Finish | Graduation | Reversible Black Wrinkle Finish Cat. No. | EDP | Reversible Black Smooth Finish Cat. No. | EDP | Non-reversible Black Wrinkle Finish Cat. No. | EDP |
|---|---|---|---|---|---|---|---|---|
| 12" | Satin Chrome | 4R: 8ths, 16ths, Quick Reading, 32nds, 64ths | C491-12-4R | 64602 | C490-12-4R | 52514 | C12-12-4R | 64290 |
| | | | | | | | C12-12-4R W/SLC* | 66931 |
| | Regular | | 491-12-4R | 52521 | 490-12-4R | 52511 | 12-12-4R | 50103 |
| 18" | Regular | 4R: 8ths, 16ths, Quick Reading, 32nds, 64ths | 491-18-4R | 52522 | 490-18-4R | 52512 | 12-18-4R | 50104 |
| 24" | Regular | 4R: 8ths, 16ths, Quick Reading, 32nds, 64ths | 491-24-4R | 52523 | 490-24-4R | 52513 | 12-24-4R | 50105 |
| 300mm and 11-3/4" | Regular | 1/2mm and 32nds one side; mm and 64ths, reverse side | 491ME-300 | 52524 | | | 12ME-300 | 50106 |

Since the protractor heads and blades are furnished with combination square sets, individual protractor heads or blades can be ordered separately. See the Squares section for information and catalog numbers.

* Includes redemption card for Standard Letter of Certification (SLC).



# CALIPERS, DIVIDERS, TRAMMELS

# Spring-Type Calipers



274, 275, 277 Calipers

Quick-adjusting spring nut



## 274, 275, 277 Toolmakers' Spring-Type Calipers and Dividers with Round Legs and Solid Nut

### 3, 6"/75, 150MM

Toolmakers' Calipers and Dividers are the finest tools of their type. Designed for toolmakers and all good mechanics who require finer adjustment and better balance so a more sensitive "feel" can be obtained. Precision made to rigid Starrett standards throughout.

The fulcrum stud is hardened and the bearing surfaces of the legs are large enough to prevent any side deflection. The bow spring is strong and flexible, and the adjustment is centrally located in the legs to assure smooth action.

| 274, 275, 277 Toolmakers' Spring-Type Calipers and Dividers | | | | | | | |
|---|---|---|---|---|---|---|---|
| Size and Approx. Capacity | | Inside Calipers | | Outside Calipers | | Dividers | |
| Inch | mm | Cat. No. | EDP | Cat. No. | EDP | Cat. No. | EDP |
| 3" | 75mm | 274-3 | 51301 | 275-3 | 51305 | 277-3 | 51309 |
| 6" | 150mm | 274-6 | 51303 | 275-6 | 51307 | 277-6 | 51311 |



Pre-setting a 275-6 outside caliper to a rule for a transfer measurement

## 73, 79, 83 "Yankee" Spring-Type Calipers and Dividers with Flat Legs and Quick-Spring or Solid Nut

### 4, 6, 8, 12"/100, 150, 200, 300MM

"Yankee" Calipers and Dividers are made from a high-grade steel and well-finished. The legs are made of flat stock and are very durable. The fulcrum stud is hardened and has a smooth bearing surface. The bow spring, although flexible, is exceedingly strong to assure reliability.

All sizes are available with either spring nut or solid nut. The Starrett quick-adjusting automatic-closing spring nut is designed for making fast, positive adjustments. The threads of the nut firmly engage the screw at the slightest pressure from the leg. When the pressure is withdrawn, the nut automatically releases itself, sliding freely over the screw. This feature saves time in opening and closing.

| 73 "Yankee" Spring-Type Inside Calipers | | | | | |
|---|---|---|---|---|---|
| Size and Approx. Capacity | | Solid Nut | | Quick-Spring Nut | |
| Inch | mm | Cat. No. | EDP | Cat. No. | EDP |
| 4" | 100mm | 73A-4 | 50334 | 73B-4 | 50335 |
| 6" | 150mm | 73A-6 | 50336 | 73B-6 | 50337 |
| 8" | 200mm | 73A-8 | 50338 | 73B-8 | 50339 |
| 12" | 300mm | 73A-12 | 50342 | 73B-12 | 50343 |
| **79 "Yankee" Spring-Type Outside Calipers** | | | | | |
| 4" | 100mm | 79A-4 | 50364 | 79B-4 | 50365 |
| 6" | 150mm | 79A-6 | 50366 | 79B-6 | 50367 |
| 8" | 200mm | 79A-8 | 50368 | 79B-8 | 50369 |
| 12" | 300mm | 79A-12 | 50372 | 79B-12 | 50373 |
| **83 "Yankee" Spring-Type Dividers** | | | | | |
| 4" | 100mm | 83A-4 | 50376 | 83B-4 | 50377 |
| 6" | 150mm | 83A-6 | 50378 | 83B-6 | 50379 |
| 8" | 200mm | 83A-8 | 50380 | 83B-8 | 50381 |
| 12" | 300mm | 83A-12 | 50384 | 83B-12 | 50385 |

# Hermaphrodite Calipers

## Hermaphrodite Calipers

Starrett Hermaphrodite Calipers are used in layout work for locating and testing centers, laying out distances from an edge, etc.

We offer a complete choice from which machinists and toolmakers can select to best suit their requirements.

The rugged, properly shaped legs are made of finely finished, high-grade steel.

Sizes listed are the lengths of the legs.

Actual measuring capacity is approximately one-third greater than the leg size.

## 243 Firm-Joint Hermaphrodite Calipers

**6"/150MM**

This caliper features a round, adjustable leg and an improved firm-joint, which allows the joint to be adjusted at any tension. The leg that holds the adjustable point is offset.

## 563 Firm-Joint Hermaphrodite Calipers

**6"/150MM**

This caliper has a round, adjustable point held by a straight leg. An improved, firm-joint feature permits the joint to be adjusted at any desired tension.

## 42 Lock-Joint Hermaphrodite Calipers with Fine-Adjustment

**6, 8"/150, 200MM**

These calipers have an adjustable point, locking joint and fine-adjustment feature for close measurements. After the legs have been set to approximate size and the joint locked, the final adjustment is made by a few turns of the knurled adjusting nut.

| 243 and 563 Firm-Joint Hermaphrodite Calipers | | | |
|---|---|---|---|
| Size* | | | |
| Inch | mm | Cat. No. | EDP |
| 6" | 150mm | 243-6 | 51143 |
| | | 563-6 | 52572 |
| **42 Lock-Joint Hermaphrodite Calipers** | | | |
| 6" | 150mm | 42-6 | 50263 |
| 8" | 200mm | 42-8 | 50264 |

* Actual capacity is one-third greater than the listed size.



# Firm and Lock-Joint Calipers



## Improved Firm-Joint Calipers

### 26 (Outside)

6-36"/150-900MM

### 27 (Inside)

6-24"/150-600MM

- Improved joint designed for tension adjustment
- Tension will not change with leg movement
- Legs are made from a high-grade steel, are ruggedly constructed and well-finished



## Lock-Joint Calipers with Fine-Adjustment

### 38 (Outside) and 39 (Inside)

6-24"/150-600MM

- Joint can be quickly and firmly locked by a partial turn of the large knurled disc
- Spring washer under the disc maintains proper leg tension when joint is unlocked
- Provided with an adjusting screw to permit fine-adjustments for close measurements
- Once legs have been set to approximate size and joint locked, final adjustment is made by a few turns of the knurled adjusting nut
- Legs are made of well shaped high-grade steel and are ruggedly constructed and nicely finished



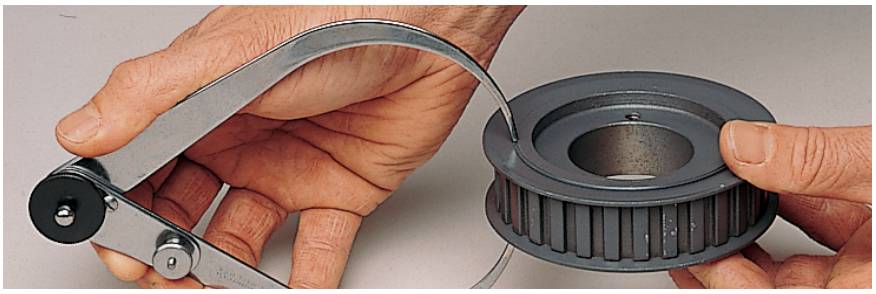
## Lock-Joint Transfer Type Calipers with Fine-Adjustment

### 36 (Outside) and 37 (Inside)

6-24"/150-600MM

One of the handiest and most versatile calipers ever made, Starrett Lock-Joint Transfer Calipers feature a transfer arm, a fine-adjustment screw, and a locking joint.

- Transfer arm allows transfer measurements from places where it is necessary to move the legs after they have been set to size
- Adjusting screw permits close adjustment for fine measurements
- Once legs have been set to approximate size and the joint locked, final adjustment is made with a few turns of the knurled adjusting nut
- Joint can be quickly and firmly locked by a partial turn of the large knurled disc
- Spring washer under the disc maintains proper tension of legs when joint is loosened
- Ruggedly constructed legs from high-grade steel and are well-shaped and nicely finished



**Firm and Lock-Joint Calipers**

| Size* | | 26 Outside Calipers | | 27 Inside Calipers | | 36 Outside Calipers | | 37 Inside Calipers | | 38 Outside Calipers | | 39 Inside Calipers | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| in | mm | Cat. No. | EDP | Cat. No. | EDP | Cat. No. | EDP | Cat. No. | EDP | Cat. No. | EDP | Cat. No. | EDP |
| 6 | 150 | 26-6 | 50186 | 27-6 | 50193 | 36-6 | 50245 | 37-6 | 50249 | 38-6 | 50253 | 39-6 | 50257 |
| 12 | 300 | 26-12 | 50189 | 27-12 | 50196 | 36-12 | 50246 | 37-12 | 50250 | 38-12 | 50254 | 39-12 | 50258 |
| 18 | 450 | 26-18 | 50190 | 27-18 | 50197 | | | | | | | | |
| 24 | 600 | 26-24 | 50191 | 27-24 | 50198 | 36-24 | 50248 | 37-24 | 50252 | 38-24 | 50256 | 39-24 | 50260 |
| 36 | 900 | 26-36 | 50192 | | | | | | | | | | |

* Actual capacity is one-third greater than the listed size.

# Trammel Heads



## 59 Trammel Heads, Divider Points, Attachments

The 59 Trammel Head is very useful for laying out and scribing circles beyond the capacity of ordinary dividers. The trammel heads have a clamping device that firmly holds various attachments.

The attachments consist of two sizes of caliper legs, 6", 9-1/2" (150, 238mm), two sizes of divider points 6", 9" (150, 225mm) which are eccentric for close settings, and a set of four ball points with holder. The ball points with 6" (150mm) holder are for scribing circles from the center of any hole up to 1-1/2" (38 mm) in diameter. One of the large caliper legs features a joint operated by an eccentric thumb piece for fine adjustments. A pencil may be clamped in either head in place of the caliper legs or divider points.

The heads will accommodate any size beam from 3/4 – 1-1/2" (19-38mm) in width. Since beam length requirements vary widely, and they are easy for the user to fashion, we do not furnish a beam.



## 50 Improved Trammel Heads with Divider Points, Pencil Socket

Used to measure the distance between points that are too great to be reached with dividers. The heads are die cast with black wrinkle finish and have hardened, forged steel divider points. The points screw into the heads, and the pencil socket accompanying each set of trammel heads can be used in place of either point. 50A has an adjustable point. Longer points (5"/125mm) are also available. A beam is not furnished with these trammels. The heads will accommodate a beam up to 3/8" (9.5mm) thick and 3/4" (19mm) wide.

| 50 Improved Trammel Heads | | | | |
|---|---|---|---|---|
| Point Size | | | | |
| Inch | mm | Description | Cat. No. | EDP |
| 3, 2-1/2 | 75, 63 | (Adjustable) Includes 2 Heads, 2 Points, Pencil Socket | 50A | 50268 |
| 3 | 75 | Includes 2 Heads, 2 Points, Pencil Socket | 50B | 50269 |
| **50 (Longer) Points Only** | | | | |
| 5, 4-1/2 | 125, 113 | 2 Adjustable Points for Starrett 50A | 50CA | 50270 |
| 5 | 125 | 2 Points for Starrett 50B | 50CB | 50271 |

| 59 Trammel Heads, Divider Points, Attachments | | |
|---|---|---|
| Description | Cat. No. | EDP |
| 2 Trammel Heads, 2 Small Points (6"/150mm) | 59A | 50297 |
| Set of 4 Ball Points and One Holder Only | 59B | * |
| Pair Small Caliper Legs Only (6"/150mm) | 59C | * |
| Pair Large Caliper Legs Only (9-1/2"/228mm) | 59D | * |
| Large Points Only (9"/225mm) | 59E | 50301 |
| Complete Set: 59A, B, C, D, E | 59F | 50302 |

* 59B, 59C and 59D sold only as part of 59F set.

# Steel Beam Trammels

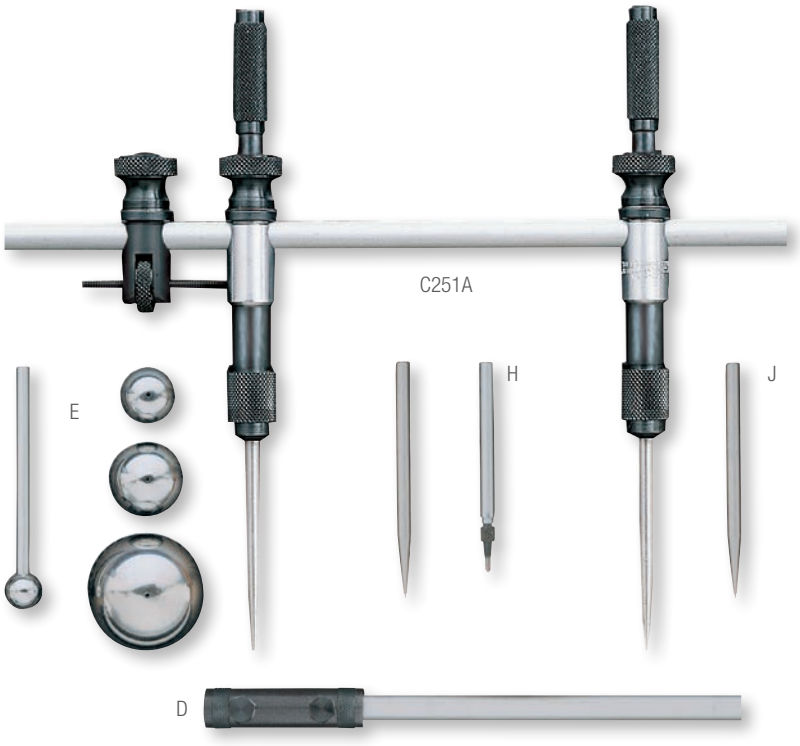
## C251 Steel Beam Trammels and Attachments

### 10-1/2 – 20"/260 - 500MM BEAMS

A rigid, well-designed trammel for layout, scribing, and measuring distances and circles. The top of the beam is flattened so that when the trams are clamped in position, they will not turn from pressure on the points. The trams are held in place by spring friction, which prevents them from sliding when the nuts are loosened for setting. One tram has a fine-adjusting screw for the points.

Each tram has a knurled swivel grip at the top that turns freely, making it very convenient to swing the tool when scribing circles. The 3" (75mm) points may be adjusted for length in the spring chucks and can be easily replaced with caliper legs or other attachments listed. The ball points with 3" (75mm) holder permit working from holes up to 1-1/2" (38mm) in diameter. A pair of 3" (75mm) caliper points is included with each trammel.

- Ideal for draftsmen, engineers, metal-workers for layout work, scribing and measuring
- Furnished with rigid steel beam – 10-1/2" (263mm), 14-1/2" (360mm) or 20" (500mm) sizes
- Bright chrome finish for longer life, resistance to corrosion
- Highly versatile – handy attachments available to extend range and measure




| C251 Steel Beam Trammels | | | | | | | |
|---|---|---|---|---|---|---|---|
| Max. Dividing Range | | Max. Circle Scribing Diameter Range | | Beam Size | | | |
| Inch | mm | Inch | mm | Inch | mm | Cat. No. | EDP |
| 9" | 225mm | 18" | 450mm | 10-1/2" | 263mm | C251A | 51205 |
| 13-1/2" | 338mm | 26" | 650mm | 14-1/2" | 363mm | C251B | 51207 |
| 18" | 450mm | 36" | 900mm | 20" | 500mm | C251C | 51209 |

| C251 Trammel Individual Attachments Only | | | |
|---|---|---|---|
| Description | Photo Key | Cat. No. | EDP |
| Coupling, with Extra 20" (600mm) Beam (When used with C251C will scribe circle 72" [1800mm] diameter) | D | C251D | 51211 |
| Ball Points and Holder | E | C251E | 51212 |
| Steel Point and Socket (One) (Has .076" [1.9mm] hole diameter to hold leads) | H | C251H | 51214 |
| Needle Point (Chrome not available) (One) | J | 251J | 51203 |



# HOLE GAGES, SLOT GAGES

# Small Hole Gages

## 829 Small Hole Gages

**.125-.500"/3.2-12.7MM**

These full-ball gages are used for general work.






## 830 Small Hole Gages

**.125-.500"/3.2-12.7MM**

These gages are exactly the same as the 831 Small Hole Gage except that all gages are only 2" (50mm) long, making them convenient to use in close quarters.






# Small Hole Gages

## Small Hole Gages

These small hole gages are well balanced tools that are ideal for accurately measuring small holes, slots, grooves, and recesses in all kinds of work. They all feature:

- Hardened-ball measuring surface with two-point contact
- Radius on each gage is less than the minimum diameter to be measured, which provides the two-point contact necessary for maximum accuracy
- Smooth, sensitive adjustment for better feel, giving more accurate measurements
- The adjustment of the gage beyond their range is restricted by a safety stop that prevents breakage

Accurate measurements are obtained by slightly "rocking" these gages in the hole to be measured. This will guarantee contact at the true diameter. The final size is then obtained by measuring over the ball contacts with a micrometer.

## 831 Small Hole Gages

### .125-.500"/3.2-12.7MM

These gages are exactly the same as the 829 Hole Gage except that the gaging surface is a half-ball with a flat bottom. This permits use in even the most shallow holes, slots, and recesses.

| Range | | Approx. Length | | | |
|---|---|---|---|---|---|
| Inch | mm | Inch | mm | Cat. No. | EDP |
| **829 Small Hole Gages** | | | | | |
| .125-.200 | 3.2-5.1 | 2-7/8 | 75 | 829A | 53070 |
| .200-.300 | 5.1-7.6 | 3 | 80 | 829B | 53071 |
| .300-.400 | 7.6-10.2 | 3-3/8 | 85 | 829C | 53072 |
| .400-.500 | 10.2-12.7 | 3-1/2 | 90 | 829D | 53073 |
| Set of 4 in Case | | | | S829EZ | 53074 |
| **831 Small Hole Gages** | | | | | |
| .125-.200 | 3.2-5.1 | 2-13/16 | 70 | 831A | 53083 |
| .200-.300 | 5.1-7.6 | 3-1/8 | 80 | 831B | 53084 |
| .300-.400 | 7.6-10.2 | 3-3/8 | 85 | 831C | 53085 |
| .400-.500 | 10.2-12.7 | 3-1/2 | 90 | 831D | 53086 |
| Set of 4 in Case | | | | S831EZ | 53087 |
| **830 Small Hole Gages** | | | | | |
| .125-.150 | 3.2-3.8 | | | 830A | 53076 |
| .150-.200 | 3.8-5.1 | | | 830B | 53077 |
| .200-.300 | 5.1-7.6 | 2 | 50 | 830C | 53078 |
| .300-.400 | 7.6-10.2 | | | 830D | 53079 |
| .400-.500 | 10.2-12.7 | | | 830E | 53080 |
| Set of 5 in Case | | | | S830FZ | 53081 |



# Telescoping Gages

## 229 Telescoping Gages with One Telescoping Arm

**1/2-6"/13-150MM**

- Features a handle, one rigid contact arm and one spring-tensioned telescoping contact arm

| 229 Telescoping Gages | | | | | |
|---|---|---|---|---|---|
| Range | | Handle Length | | | |
| Inch | mm | Inch | mm | Cat. No. | EDP |
| 1/2 – 3/4 | 13-19 | 2-3/8 | 60 | 229A | 50923 |
| 3/4 – 1-1/4 | 19-32 | | | 229B | 50924 |
| 1-1/4 – 2-1/8 | 32-54 | | | 229C | 50925 |
| 2-1/8 – 3-1/2 | 54-89 | | | 229D | 50926 |
| 3-1/2 – 6 | 89-150 | 3-1/4 | 82 | 229E | 50927 |

| 229 Telescoping Gage Sets | | |
|---|---|---|
| Description | Cat. No. | EDP |
| Set of 3, 229A, B, C in Case | S229FZ | 50928 |
| Set of 5, 229A, B, C, D, E in Case | S229GZ | 50929 |

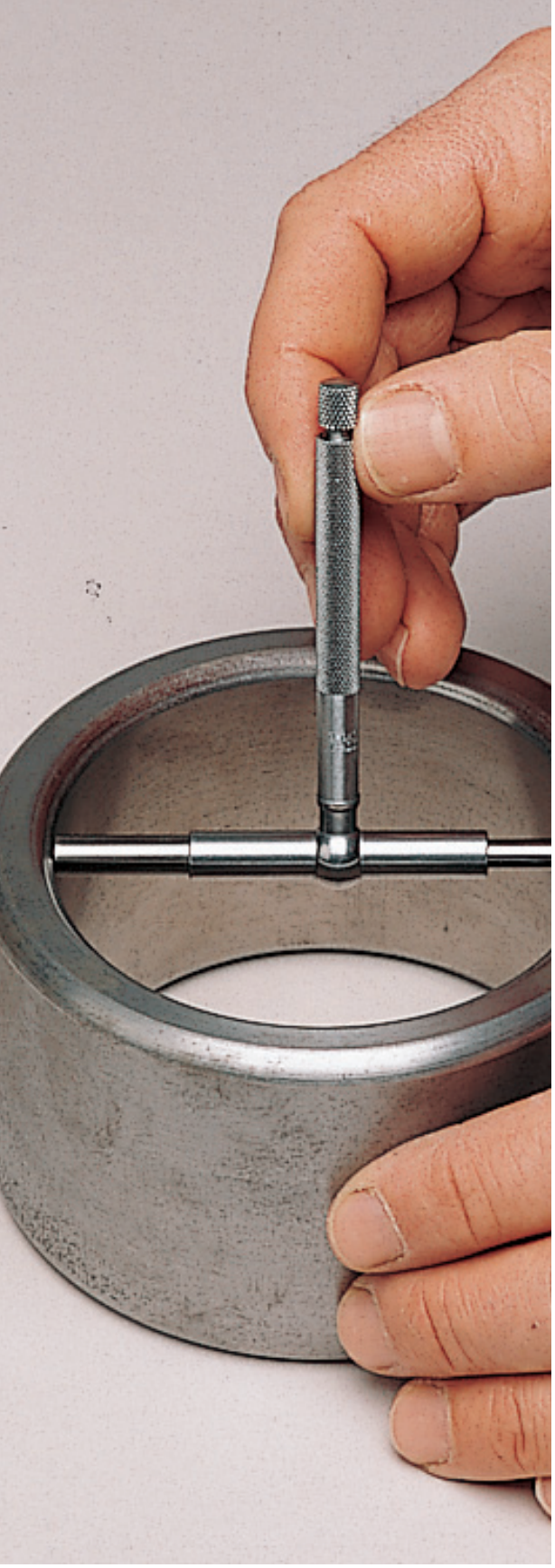
Handles can be individually ordered and/or ordered in larger sizes such as 8", 12" or longer, similar to 579 Telescoping Gage listing, upon request.



### Telescoping Gages

Starrett telescoping gages are used for determining the true size of holes, slots, and recesses up to 6" (150mm). The ends of both contacts are hardened and ground to a radius to allow proper clearance on the smallest hole the gage will enter. These tools must be slightly "rocked" in the hole being measured to ensure that the tool is on the proper diameter before it is locked and withdrawn. The final hole size is obtained by measuring over the gage contacts with a micrometer.







# Telescoping Gages

## 579 Self-Centering Telescoping Gages with Two Telescoping Arms

### 5/16-6"/8-150MM

- Similar to the 229 Telescoping Gage with a slightly greater range and two telescoping contacts
- Handles are rigidly attached to the contact plungers and are automatically self-centering
- Constant spring tension gives uniform contact pressure
- Both plungers are easily locked at any desired setting

**579 Telescoping Gages**

| Range | | Handle Length | | | |
|---|---|---|---|---|---|
| Inch | mm | Inch | mm | Cat. No. | EDP |
| 5/16 – 1/2" | 8-13mm | 2-3/8" | 60mm | 579A | 52610 |
| | | 8" | 200mm | 579A-8 | 63192 |
| | | 12" | 300mm | 579A-12 | 63195 |
| 1/2 – 3/4" | 13-19mm | 2-3/8" | 60mm | 579B | 52611 |
| | | 8" | 200mm | 579B-8 | 63193 |
| | | 12" | 300mm | 579B-12 | 63196 |
| 3/4 – 1-1/4" | 19-32mm | 2-3/8" | 60mm | 579C | 52612 |
| | | 8" | 200mm | 579C-8 | 63194 |
| | | 12" | 300mm | 579C-12 | 63197 |
| 1-1/4 – 2-1/8" | 32-54mm | 2-3/8" | 60mm | 579D | 52613 |
| | | 8" | 200mm | 579D-8 | 67114 |
| | | 12" | 300mm | 579D-12 | 63198 |
| 2-1/8 – 3-1/2" | 54-89mm | 2-3/8" | 60mm | 579E | 52614 |
| | | 8" | 200mm | 579E-8 | 67115 |
| | | 12" | 300mm | 579E-12 | 63199 |
| 3-1/2 – 6" | 89-150mm | 3-1/4" | 82mm | 579F | 52615 |
| | | 8" | 200mm | 579F-8 | 67116 |
| | | 12" | 300mm | 579F-12 | 63200 |

**579 Telescoping Gage Sets**

| Description | Cat. No. | EDP |
|---|---|---|
| Set of 4, 579A, B, C, D in Case | S579GZ | 52616 |
| Set of 6, 579A, B, C, D, E, F in Case | S579HZ | 52617 |

Handles can be individually ordered. Handles longer than 12" (300mm) are available on special order.

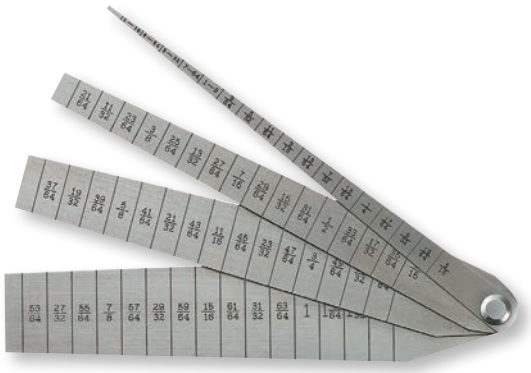


# Taper Gages

## 267 Taper Gage

**1/16 – 1-1/16"**

- Specially designed for rapid, accurate checking of inside diameters of tubing
- Also very useful for general gaging of slot widths, hole sizes, setting calipers, etc.
- Thin, tapered leaves graduated to measure inside diameters or widths from 1/16" to 1-1/16" in 64ths of an inch
- Nicely finished spring-tempered steel, approximately 1" wide by 5-1/4" long



## 270 Taper Gage

**.010-.150"/0.3-4MM**

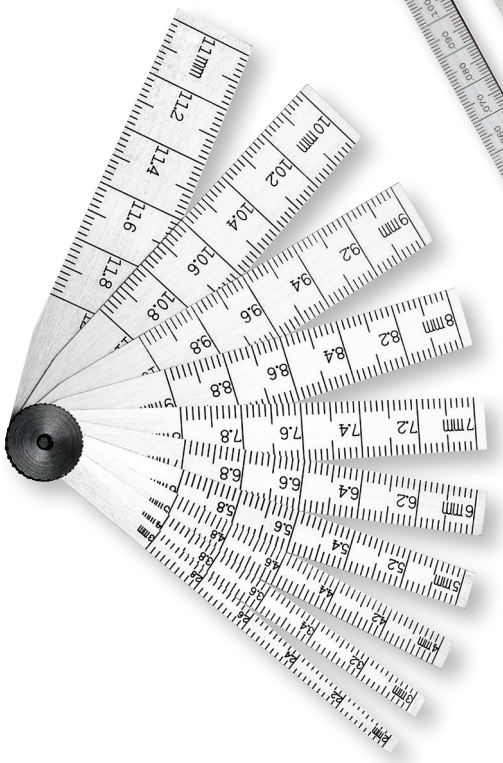
- Very useful tool, especially for bearing work and for gaging slots
- Made of quality tool steel and accurately tapered throughout entire length for quick and convenient measuring
- 7/16" (11mm) wide by 6-1/4" (160mm) long
- Can be used as a precision shim
- One side graduated from .010" to .150" in thousandths of an inch; the reverse side from 0.3mm to 4mm in one-twentieth of a mm (0.05mm)



## 269, 269M Taper Gages

**.100-1"/2-25MM**

- These gages are for determining hole sizes in dies and all kinds of other work
- Read in thousandths of an inch or 0.02mm
- Made of tempered steel with a locking device for fixing any leaf in position for use



| 267 Taper Gage | | | | |
|---|---|---|---|---|
| **Description** | | | **Cat. No.** | **EDP** |
| Taper Gage, 1/16 – 1-1/16" range | | | 267 | 51286 |
| **270 Taper Gage** | | | | |
| Taper Gage, .010-.150"/0.3-4mm range | | | 270 | 51292 |
| **269 Taper Gages - .001" Graduation** | | | | |
| **Range** | **Length** | **Leaves** | **Cat. No.** | **EDP** |
| .100-.500" | 2-1/2" | 8 | 269A | 51290 |
| .500-1" | 2-3/4" | 10 | 269B | 51291 |
| **269M Taper Gages - 0.02mm Graduation** | | | | |
| 2-12mm | 64mm | 10 | 269MA | 56031 |
| 12-25mm | 70mm | 13 | 269MB | 56032 |

### Taper Gages

These are named "taper" gages only because of their shape. They do not measure taper, but they do measure hole and slot sizes. They are quick to use, very accurate, and are a convenient size.




# FIXED GAGE STANDARDS

# Gage Sets

## S4000 Precision Steel Pin Gage Sets

**.011-1.000"**

Precision gage pins are used to determine small hole sizes, for gaging slots, and finding hole distances.

| S4000 Pin Gages - Plus Sets | | | |
|---|---|---|---|
| **Range** | **No. of Gages** | **Cat. No.** | **EDP** |
| .011-.060" (+) | 50 | S4000-060 | 67480 |
| .061-.250" (+) | 190 | S4002-250 | 67482 |
| .251-.500" (+) | 250 | S4004-500 | 67484 |
| .501-.625" (+) | 125 | S4006-625 | 67486 |
| .626-.750" (+) | 125 | S4008-750 | 67488 |
| .751-.832" (+) | 82 | S4010-832 | 67490 |
| .833-.916" (+) | 84 | S4012-916 | 67492 |
| .917-1.000" (+) | 84 | S4014-1 | 67494 |
| **S4000 Pin Gages - Minus Sets** | | | |
| .011-.060" (-) | 50 | S4001-060 | 67481 |
| .061-.250" (-) | 190 | S4003-250 | 67483 |
| .251-.500" (-) | 250 | S4005-500 | 67485 |
| .501-.625" (-) | 125 | S4007-625 | 67487 |
| .626-.750" (-) | 125 | S4009-750 | 67489 |
| .751-.832" (-) | 82 | S4011-832 | 67491 |
| .833-.916" (-) | 84 | S4013-916 | 67493 |
| .917-1.000" (-) | 84 | S4015-1 | 67495 |

### Features

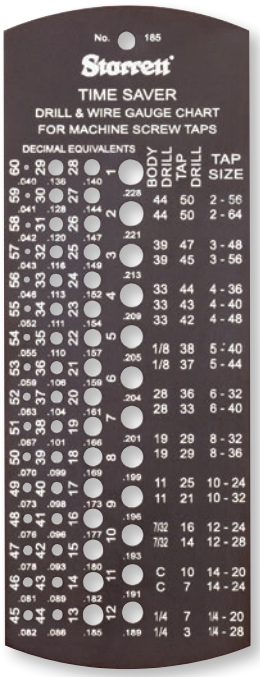
- Color coded, fully adjustable Go/No-Go gage handle furnished with each set
- Sets are supplied in rugged, high impact protective cases with each space marked for the appropriate gage
- Inspection certificate with every set
- All Starrett pin gages are manufactured to a 0.0002" tolerance
- Plus and minus tolerance sets
- Offered in 0.001" increments
- Each pin is centerless lapped and is clearly etched with the stated size
- All gages are 2 inches long and hardened to RC 60/64
- All sharp corners are broken

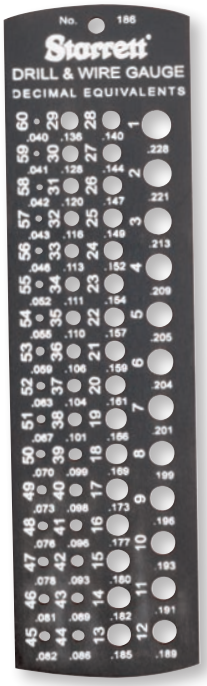
| Handles for 4000 Pin Gages | | |
|---|---|---|
| **Description** | **Cat. No.** | **EDP** |
| Handle for .011-.060" Pin Gages | PT45065 | 45060 |
| Handle for .061-.250" Pin Gages | PT45250 | 45250 |
| Handle for .251-.500" Pin Gages | PT45500 | 45500 |
| Handle for .501-.625" Pin Gages | PT45625 | 45625 |
| Handle for .626-.750" Pin Gages | PT45750 | 45750 |
| Handle for .751-.832" Pin Gages | PT45832 | 45832 |
| Handle for .833-.916" Pin Gages | PT45916 | 45916 |
| Handle for .917-1.000" Pin Gages | PT45066 | 45001 |

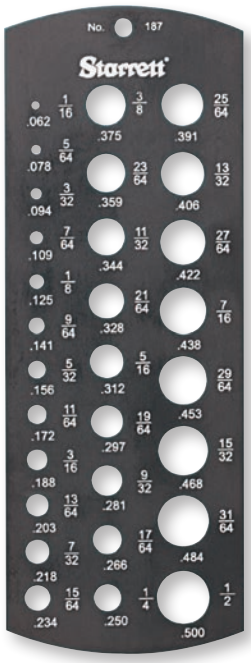


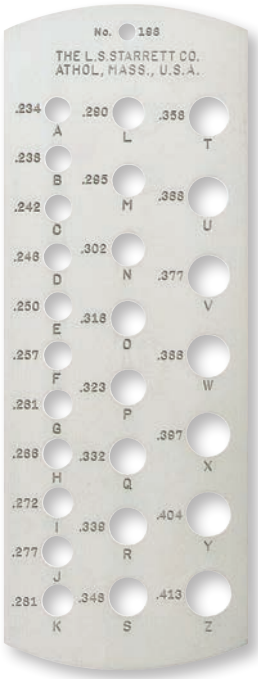

S4002-250 190, piece set

# Drill and Wire Gages




## 185 Time Saver® Tap and Drill Gage

**NOS. 1-60/.228-.040"**

- Correct sizing of tap drill for any common size machine screw tap in "NF" National Fine or "NC" National Coarse Thread
- Leaves the right amount of stock for approximately 65% full thread
- Shows correct drill body size
- 60 holes with number sizes and decimal equivalents
- Black matte finish with information steel stamped on one side and white marked on the reverse side for quick, clear reading

## 186 Drill and Steel Wire Gage

**NOS. 1-60/.228-.040"**

- Widely used by mechanics for twist drills and steel drill rod
- Similar to 185, without the tap and drill information
- 60 holes from 1 to 60
- Marked with number sizes and decimal equivalents
- Black matte finish with gage information steel stamped on one side and white marked on reverse for quick, clear reading

## 187 Jobbers' Drill Gage – Hardened

**1/16-1/2"**

- Quick sizing of any twist drill from 1/16-1/2" by 64ths
- 29 holes marked with drill size in inches and decimal equivalents
- Rigidly tested after hardening
- Black matte finish with gage information steel stamped on one side and white marked on reverse for quick, clear reading

## 198 Standard Letter Size Drill Gage

**A-Z**
**.234-.413" DIA.**

- Quick, convenient checking of letter size drills
- Twenty-six holes provided, giving corresponding drill sizes from "A" through "Z" with decimal equivalents from .234" diameter through .413" diameter
- Hardened with a satin finish

| Fixed Gages | | | |
|---|---|---|---|
| Cat. No. | EDP | Description | Dimensions Thickness x Width x Length |
| 198 | 50718 | Standard Letter Size Drill Gage | 5/64 " x 2-5/16" x 6-1/4" |
| 186 | 50676 | Drill and Steel Wire Gage | 5/64" x 1-1/2" x 5-1/2" |
| 187 | 50677 | Jobbers' Drill Gage | 5/64" x 2-5/16" x 6-1/4" |

| 185 Time Saver Tap and Drill Gage | | | | | |
|---|---|---|---|---|---|
| | | Range | | | Dimensions |
| Cat. No. | EDP | Tap Size | Tap Drill | Body Drill | Thickness x Width x Length |
| 185 | 50675 | 2-56 to 1/4-28 | 50 to 3 | 44 to 1/4 | 5/64" x 2-5/16" x 6-1/4" |

# Wire and Standard Gages




## 286 Drill and Steel Wire Gage – Hardened

**61-80/.039-.0135"**

This gage is for selecting the correct size of twist drills and steel drill rod in smaller sizes ranging from 61 to 80. For convenience, each hole is marked with the size number and the corresponding decimal equivalent. Attractive satin finish. Small compact size, approximately 1/16" thick, 3/4" wide and 2" long.

## 188 English Standard Wire Gage – Hardened

**(BIRMINGHAM OR STUBS' IRON WIRE GAGE)**
**1-36/.300-.004"**

This gage is popular for gaging iron wire, hot and cold rolled sheet steel, and in some cases, sheet iron by the English Standard Wire system also known as Birmingham or Stubs.

Gage has convenient decimal equivalents of each number on the reverse side. Satin finish.

## 281 American Standard Wire Gage – Hardened

**(OR B.&S.) FOR NON-FERROUS METALS**
**0-36/.325-.005"**

This gage is the generally accepted standard for non-ferrous metals as adopted by brass manufacturers. It is especially useful for electricians and others to gage sheet, plate and wire made of non-ferrous metals like copper, brass, aluminum, etc. Screw slotting cutters are also made to this gage.

Gage has decimal equivalents on the reverse side. Satin finish.

## 287 American Steel and Wire Co. Gage

**(WASHBURN & MOEN) STANDARD**
**0-36/.3065-.009"**

This gage is designed for gaging steel wire and drill rod to the American Steel & Wire Co. (Washburn & Moen) Standard and checks sizes from 0-36. (Also known as United States Steel Wire Gage.) Decimal equivalents are given on the back. Satin finish.

## 280 Piano Tuners' Gage – Hardened

**AMERICAN STEEL AND WIRE CO. STANDARD**
**12-28/.029-.071"**

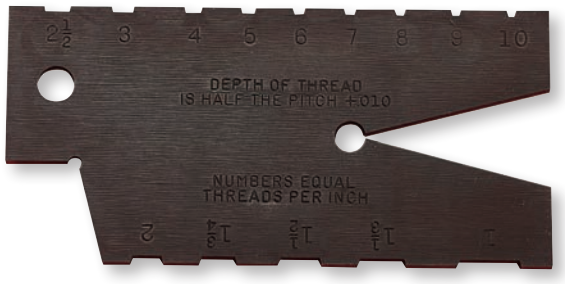



The 280 Gage is designed for gaging steel music wire and has a range from 12 to 28. Convenient decimal equivalents on reverse side. Diameter of the gage is 1-9/16" and it has a satin finish.

## 283 U.S. Standard Gage – Hardened

**SHEET, PLATE IRON AND STEEL GAGE**
**0-36/.3125-.007"**

This gage is made to the United States Standard for uncoated sheet, plate iron and steel, and is based on weights in ounces per square foot. The gage has a satin finish and decimal equivalents on the reverse side.




## 284 Acme Standard Screw Thread Gage – Hardened

**29º**

This gage is a standard for grinding and setting tools when cutting Acme threads. Acme threads have the same depth as square threads but the sides of the threads are at an inclination of 14-1/2º (29º included angle). This form of thread is used extensively and has in many instances replaced the square thread in machine construction. The advantages of the Acme thread are its strength and the ease by which it can be cut compared with square threads. The angles and edges of this gage are hardened, ground and carefully tested.

In use, the angle on the thread cutting tool is checked on the large precision-ground V at the end of the gage. The tool is then ground on the end to the width of the slot of whatever pitch is being turned. It is then set in the lathe using the half angle.

**NOTE:** Like other Starrett gages, these tools are carefully tested for accuracy after hardening.



188



281



287



283

## Standards for Sheet and Wire Gages with Corresponding Starrett Gages

**Dimensions of Sizes in Decimal Parts of an Inch**

| Number of Wire Gage | 281 American or Brown & Sharpe | 188 245 Birmingham or Stubs' Iron Wire | 287 Washburn & Moen, Worcester, MA* | 280 American S. & W. Co's. Music Wire Gage | Stubs' Steel Wire | 283 U.S. Standard Gage for Sheet and Plate Iron and Steel |
|---|---|---|---|---|---|---|
| 00000000 | .731429 | | | | | |
| 0000000 | .651356 | | | | | |
| 000000 | .580049 | | | .004 | | .46875 |
| 00000 | .516549 | | | .005 | | .4375 |
| 0000 | .460000 | .454 | .3938 | .006 | | .40625 |
| 000 | .409642 | .425 | .3625 | .007 | | .375 |
| 00 | .364797 | .380 | .3310 | .008 | | .34375 |
| 0 | .324861 | .340 | .3065 | .009 | | .3125 |
| 1 | .289279 | .300 | .2830 | .010 | .227 | .28125 |
| 2 | .257626 | .284 | .2625 | .011 | .219 | .265625 |
| 3 | .229423 | .259 | .2437 | .012 | .212 | .250 |
| 4 | .204307 | .238 | .2253 | .013 | .207 | .234375 |
| 5 | .181941 | .220 | .2070 | .014 | .204 | .21875 |
| 6 | .162023 | .203 | .1920 | .016 | .201 | .203125 |
| 7 | .144285 | .180 | .1770 | .018 | .199 | .1875 |
| 8 | .128490 | .165 | .1620 | .020 | .197 | .171875 |
| 9 | .114424 | .148 | .1483 | .022 | .194 | .15625 |
| 10 | .101897 | .134 | .1350 | .024 | .191 | .140625 |
| 11 | .090742 | .120 | .1205 | .026 | .188 | .125 |
| 12 | .080808 | .109 | .1055 | .029 | .185 | .109375 |
| 13 | .071962 | .095 | .0915 | .031 | .182 | .09375 |
| 14 | .064084 | .083 | .0800 | .033 | .180 | .078125 |
| 15 | .057068 | .072 | .0720 | .035 | .178 | .0703125 |
| 16 | .050821 | .065 | .0625 | .037 | .175 | .0625 |
| 17 | .045257 | .058 | .0540 | .039 | .172 | .05625 |
| 18 | .040303 | .049 | .0475 | .041 | .168 | .050 |
| 19 | .035891 | .042 | .0410 | .043 | .164 | .04375 |
| 20 | .031961 | .035 | .0348 | .045 | .161 | .0375 |
| 21 | .028462 | .032 | .03175 | .047 | .157 | .034375 |
| 22 | .025347 | .028 | .0286 | .049 | .155 | .03125 |
| 23 | .022572 | .025 | .0258 | .051 | .153 | .028125 |
| 24 | .020101 | .022 | .0230 | .055 | .151 | .025 |
| 25 | .017900 | .020 | .0204 | .059 | .148 | .021875 |
| 26 | .015941 | .018 | .0181 | .063 | .146 | .01875 |
| 27 | .014196 | .016 | .0173 | .067 | .143 | .0171875 |
| 28 | .012641 | .014 | .0162 | .071 | .139 | .015625 |
| 29 | .011258 | .013 | .0150 | .075 | .134 | .0140625 |
| 30 | .010025 | .012 | .0140 | .080 | .127 | .0125 |
| 31 | .008928 | .010 | .0132 | .085 | .120 | .0109375 |
| 32 | .007950 | .009 | .0128 | .090 | .115 | .01015625 |
| 33 | .007080 | .008 | .0118 | .095 | .112 | .009375 |
| 34 | .006305 | .007 | .0104 | | .110 | .00859375 |
| 35 | .005615 | .005 | .0095 | | .108 | .0078125 |
| 36 | .005000 | .004 | .0090 | | .106 | .00703125 |
| 37 | .004453 | | | | .103 | .006640625 |
| 38 | .003965 | | | | .101 | .00625 |
| 39 | .003531 | | | | .099 | |
| 40 | .003145 | | | | .097 | |

* Also called the U.S. Steel Wire Gage

**Fixed Gages**

| Cat. No. | EDP | Description |
|---|---|---|
| 286 | 51320 | Drill and Steel Wire Gage |
| 188 | 50678 | English Standard Wire Gage |
| 281 | 51316 | American Standard Wire Gage |
| 287 | 51321 | American Steel & Wire Co. Steel Wire Gage |
| 280 | 51315 | Piano Tuners' Gage |
| 283 | 51318 | U.S. Standard Gage |
| 284 | 51319 | Acme Standard Screw Thread Gage |

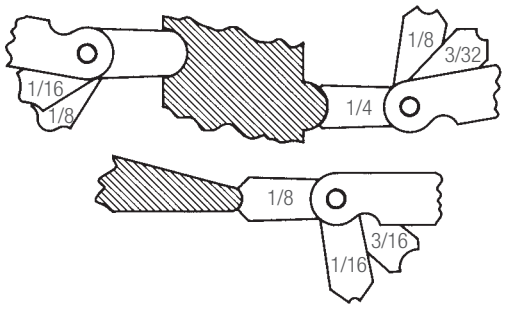
# Wire and Standard Gages

## 178, 178M Fillet or Radius Gages with Locking Device

### 1/32-1/2"/1-15MM

These gages are very useful for tool and diemakers, machinists, screw machine operators, patternmakers and other mechanics to lay out and check radii of tools, dies, patterns, etc.

Made in two inch sizes and two millimeter sizes as listed below, each gage has leaves for measuring both concave and convex radii, with each leaf stamped with the radius size. Any one of the leaves can be securely locked in position by a locking device. Made of nicely finished, high quality steel.



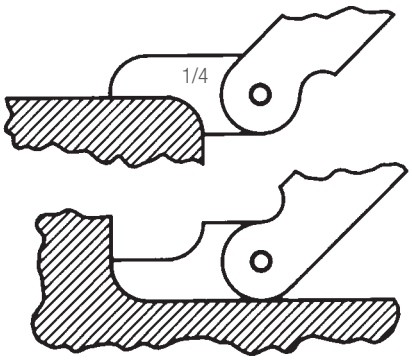



| Inch Reading | | | | |
|---|---|---|---|---|
| **Range (Concave and Convex)** | **Increments** | **Leaves** | **Cat. No.** | **EDP** |
| 1/32-1/4" | 64ths | 30 | 178A | 50664 |
| 17/64-1/2" | | 32 | 178B | 50666 |
| **Millimeter Reading** | | | | |
| 1-3mm | 0.25mm | 34 | 178MA | 50665 |
| 3-7mm | 0.5mm | | | |
| 7.5-15mm | 0.5mm | 32 | 178MB | 50667 |

## 272, 272M Fillet or Radius Gages

### 1/32-33/64"/0.75-13MM

An external and internal radius on each leaf permits both concave and convex surfaces to be measured. The leaves are specially shaped for use in any position at any angle to measure fillets and radii in corners or against shoulders. Each leaf is stamped with the radius size and has an eccentric mounting for clearance between the leaf and the case when the gage is opened.





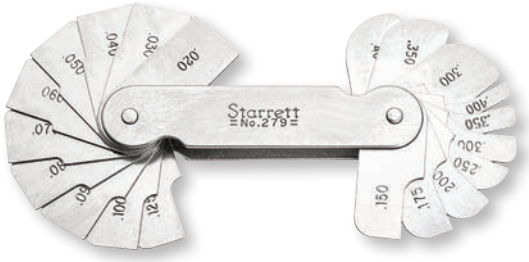


| Inch Reading | | | | |
|---|---|---|---|---|
| **Range (Concave and Convex)** | **Increments** | **Leaves** | **Cat. No.** | **EDP** |
| 1/32-17/64" | 64ths | 16 | 272A | 51296 |
| 9/32-33/64" | | | 272B | 51298 |
| **Millimeter Reading** | | | | |
| 0.75-5mm | 0.25mm | 18 | 272MA | 51297 |
| 5.5-13mm | 0.5mm | 16 | 272MB | 51299 |

## 279 Fillet or Radius Gages

### .020-.4000

This gage is similar to our 272, except that it has twenty leaves with radii from .020-.400" inclusive. Nine leaves have concave and convex radii from .020-.10" inclusive by .010", four leaves with concave and convex radii from .125-.20" inclusive by .025", one leaf with concave and convex radii of .250", three leaves with concave radii only from .300-.400" inclusive by .050" and three leaves with convex radii only from .300-.400" by .050".




| Inch Reading | | | |
|---|---|---|---|
| **Range (Concave and Convex)** | **Leaves** | **Cat. No.** | **EDP** |
| .020-.400" | 20 | 279 | 51314 |

# Angle and Center Gages

## 466 Angle Gage

**1-45º**

A convenient, timesaving tool for inspectors, toolmakers, and diesinkers when checking angles. Tool also replaces a protractor in many instances. The gage has 18 leaves, each with a different angle including 14-1/2º (1/2 the Acme Standard of 29º). Leaves are made of the finest spring-tempered steel and both the angle edge and two sides are ground. Approximately 9/32" thick, 1-1/16" wide and 4-3/16" long.




| 466 Angle Gage | | | | |
|---|---|---|---|---|
| Range | Leaves | Angles Available | Cat. No. | EDP |
| 1-45º | 18 | 1º, 2º, 3º, 4º, 5º, 7º, 8º, 9º, 10º, 12º, 14º, 14-1/2º, 15º, 20º, 25º, 30º, 35º, 45º | 466 | 52463 |

## C391 Center Gage

**60º AMERICAN NATIONAL**

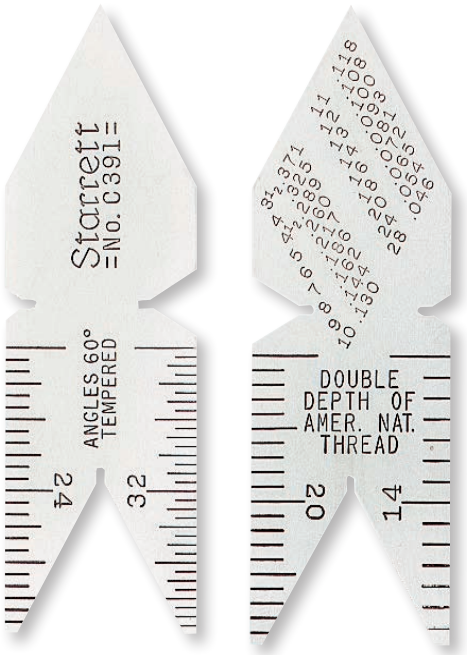
## C396 Center Gage

**55º WHITWORTH OR ENGLISH**

## C398M Center Gage

**60º METRIC**

- Extremely handy for use in grinding and setting screw cutting tools
- Meet American National or U.S. 60º, Whitworth or English 55º, and Metric 60º standards
- Very useful for finding number of threads per inch through graduations in 14ths, 20ths, 24ths and 32nds of an inch on C391 and C396
- Graduations on C398M are in mm and 1/2mm
- C391 Gage also has a table of double depths of threads for determining size of tap drills
- Made of spring-tempered steel with satin chrome finish
- Ground gaging surfaces




C391 Center Gage. Left: Front 60º angle side. Right: Back with double depths of threads gage.

| Center Gages with Inch Graduations | | |
|---|---|---|
| Cat. No. | EDP | Description |
| C391 | 51475 | American Unified National Standard, 60º |
| C396 | 51477 | Whitworth or English Standard, 55º |
| **Center Gages with Millimeter Graduations** | | |
| C398M | 51478 | Metric Standard, 60º |

# Screw Pitch Gages

## English and Metric Screw Pitch Gages

**2-1/4-84 PITCHES (INCH)**
**0.25-11.5 PITCHES (MILLIMETER)**

Screw pitch gages are among the most useful tools in any mechanics' tool box. They quickly determine the pitch of various threads. These gages consist of a substantial steel case with a number of folding leaves at both ends, each leaf having teeth corresponding to a definite pitch, marked on each leaf.

Starrett screw pitch gages are available in a wide range of sizes with different numbers of leaves in various pitch ranges.

V, Unified, American National 60º threads

Whitworth Standard 55º threads

International Metric Standard 60º threads

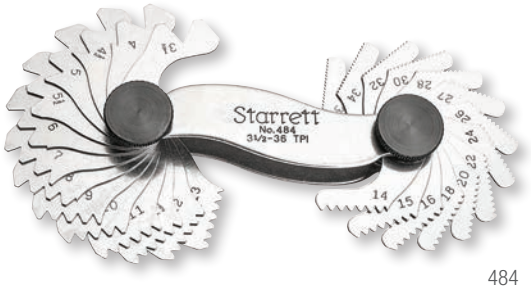
English and metric threads are similar in form, but English threads are described in threads per inch and metric threads by the distance from one crest to the next.

All screw pitch gages (except 473 and 476, which have a positive stop design) feature a locking device at both ends of the case, so leaves can be securely locked in position for use. Leaves on most gages have a special narrow design, permitting checking internal threads in nuts, etc., as well as external threads.

Various types of Starrett screw pitch gages are illustrated on the following pages, with complete specifications.




155



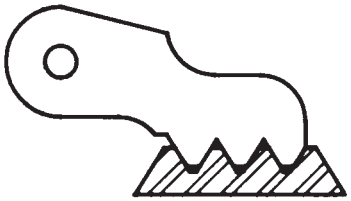

484



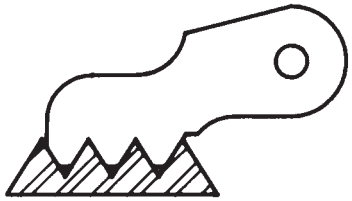

6




474



NATIONAL FORM



SHARP V

Starrett Screw Pitch Gages have the tops of the teeth flatted, permitting use of a single gage for either National Form threads or Sharp V threads

### Formulas

American Natational V Thread

$$d = D - \frac{1.299}{N} \qquad d = D - \frac{1.732}{N}$$

D = Outside diameter of tap
d = Bottom diameter of tap
N = Number of threads per inch

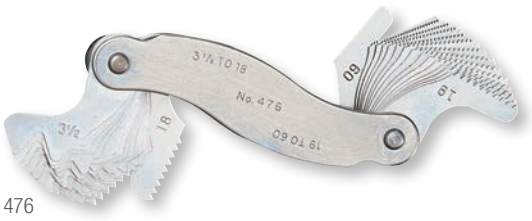
# Screw Pitch Gages

## 476 Whitworth Standard Screw Pitch Gages

55º THREADS
3 1/2-60 TPI (INCH)

## 156M, 159M International Metric Standard Screw Pitch Gages

60º THREADS



476



473



156M



159M



472

**Screw Pitch Gages**

| Cat. No. | EDP | No. of Leaves | TPI Range | Threads per Inch (TPI) | Description |
|---|---|---|---|---|---|
| 155 | 50588 | 27 | 2-1/4–28 | 2-1/4, 2-3/8, 2-1/2, 2-5/8, 2-3/4, 2-7/8, 3, 3-1/4, 3-1/2, 4, 4-1/2, 5, 5-1/2, 6, 7, 8, 9, 10, 11, 12, 13, 14, 16, 18, 20, 24, 28 | With Locking Device and 60º Center Gage |
| 484 | 67447 | 28 | 3-1/2–36 | 3-1/2, 4, 4-1/2, 5, 5-1/2, 6, 7, 8, 9, 10, 11, 11-1/2, 12, 13, 14, 15, 16, 18, 20, 22, 24, 26, 27, 28, 30, 32, 34, 36 | With Locking Device |
| 6 | 50035 | 30 | 4–42 | 4, 4-1/2, 5, 5-1/2, 6, 7, 8, 9, 10, 11, 11-1/2, 12, 13, 14, 15, 16, 18, 20, 22, 24, 26, 27, 28, 30, 32, 34, 36, 38, 40, 42 | With Locking Device and 11-1/2 and 27 Pipe Thread Pitches |
| 474 | 52486 | 28 | 4–80 | 4, 4-1/2, 5, 6, 7, 8, 9, 10, 11, 11-1/2, 12, 13, 14, 16, 18, 20, 24, 27, 28, 32, 36, 40, 44, 48, 56, 64, 72, 80 | With Locking Device and 11-1/2 and 27 Pipe Thread Pitches |
| 472 | 52484 | 51 | 4–84 | First Corner 17 Leaves: 4, 4-1/2, 5, 5-1/2, 6, 7, 8, 9, 10, 11, 11-1/2, 12, 13, 14, 15, 16, 18<br>Second Corner 17 Leaves: 20, 22, 24, 26, 27, 28, 30, 32, 34, 36, 38, 40, 42, 44, 46, 48, 50<br>Third Corner 17 Leaves: 52, 54, 56, 58, 60, 62, 64, 66, 68, 70, 72, 74, 76, 78, 80, 82, 84 | With Locking Device and 11-1/2 and 27 Pipe Thread Pitches |
| 473 | 52485 | 30 | 6–60 | 6, 7, 8, 9, 10, 11, 11-1/2, 12, 13, 14, 15, 16, 18, 20, 22, 24, 26, 27, 28, 30, 32, 34, 36, 38, 40, 42, 48, 50, 56, 60 | With Positive Stop and 11-1/2 and 27 Pipe Thread Pitches |
| 476 | 52488 | 30 | 3-1/2–60 | 3-1/2, 4, 4-1/2, 5, 6, 7, 8, 9, 10, 11, 12, 13, 14, 16, 18, 19, 20, 22, 24, 25, 26, 28, 30, 32, 36, 40, 44, 48, 50, 60 | With Positive Stop |
| 156M | 50589 | 28 | 0.25-2.50mm | 0.25, 0.30, 0.35, 0.40, 0.45, 0.50, 0.55, 0.60, 0.65, 0.70, 0.75, 0.80, 0.85, 0.90, 1, 1.10, 1.20, 1.25, 1.30, 1.40, 1.50, 1.60, 1.70, 1.75, 1.80, 1.90, 2, 2.50 | With Locking Device |
| 159M | 50591 | 28 | 0.5-11.5mm | 0.5, 0.75, 1, 1.10, 1.25, 1.5, 1.75, 2, 2.5, 3, 3.5, 4, 4.5, 5, 5.5, 6, 6.5, 7, 7.5, 8, 8.5, 9, 9.5, 10, 10.5, 11, 11.5 | With Locking Device and 60º Center Gage |

# Radius Gages

## 167, 167M

1/64-1/2"/0.5-15MM

## 167

.010-.500

## 110 Gage Holder

## S167, S167M Sets

1/64-1/2"/0.5-15MM

## SD167 Sets

.010-.500

Radii or fillets can be checked or laid out easier, faster, and more accurately with Starrett 167 Radius Gages. Available individually and in sets, fractional sizes 1/64-1/2", decimal sizes .010-.500" and in millimeters from 0.5-15mm.

Many different sets for maximum convenience. Each set is furnished in an attractive case, providing complete protection and easy, instant selection of the right gage size for the job.

### Gage Features

- Made of satin finish stainless steel – rust and stain resistant
- Each gage is clearly marked with its radius
- Each gage has five different gaging surfaces for both convex and concave radii
- All gages have precision finished radii with extra smooth, accurate edges

### Gage Holder Features

- Any gage can be used with the Starrett 110 holder which is especially useful for checking radii in confined or hard-to-reach locations
- Two slots are provided in the holder permitting gages to be held at 30º or 45º, either square in the slot or tipped to one side
- The holder is 4" (100mm) long, providing good reach and balance




Holder 110 with 167-3/16 attached

S167CHZ Radius Gage Set with 25 gages and holder in case




Gaging radii using gage with holder

**FIVE DIFFERENT GAGING SURFACES** – Ideal for Checking Convex and Concave Radii of All Types

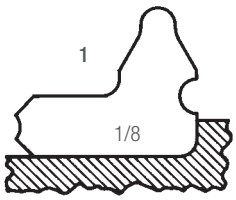



**Fig 1.** Checking concave (internal) radius with 90° arc. Also checks if sides are tangent to radius and 90° to each other.

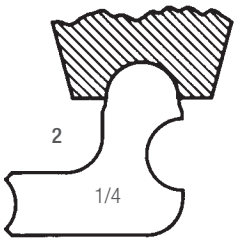



**Fig 2.** Checking concave (internal) radius with arc up to 180°. Also will check radius shown in Fig. 1 but not relationship of sides.

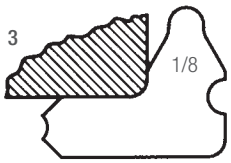



**Fig 3.** Checking convex (external) radius with 90° arc. Also checks if sides are tangent to radius and 90° to each other.

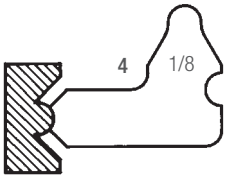



**Fig 4.** Checking convex (external) radius with arc of 90° or greater, or radii with sides as shown which would interfere with gage used as in Fig. 3.

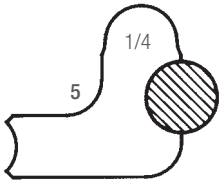



**Fig 5.** Checking convex (external) radius with arc of 180°; also less than 180° if sides of radius offer no interference.

| S167 Radius Gage Sets – Inch | | | | | |
|---|---|---|---|---|---|
| **Radii Range** | **Increments** | **Gages** | **Description** | **Cat. No.** | **EDP** |
| 1/32-17/64" | 64ths | 16 | Without Holder | S167AZ | 50615 |
| 1/64-17/64" | 64ths | 17 | With Holder | S167AHZ | 50616 |
| 9/32-1/2" | 32nds | 8 | Without Holder | S167BZ | 50617 |
| 1/32-17/64"<br>9/32-1/2" | 64ths<br>32nds | 24 | Sets 167A and S167B Combined, without Holder | S167CZ | 50618 |
| 1/64-17/64"<br>9/32-1/2" | 64ths<br>32nds | 25 | Sets 167AH and S167B Combined, With Holder | S167CHZ | 50619 |
| | | | Sets 167AH and S167B Combined,with Holder, Standard Letter of Certification* | S167CHZ W/SLC | 66876 |
| 1/32-1/2" | 32nds | 16 | Without Holder | S167DZ | 50620 |
| **S167M Radius Gage Sets – Millimeter** | | | | | |
| 1-7mm | 0.5mm | 13 | Without Holder | S167MAZ | 55817 |
| 0.5-7mm | 0.5mm | 14 | With Holder | S167MAHZ | 55818 |
| 8-15mm | 1mm | 8 | Without Holder | S167MBZ | 55819 |
| 1-7mm<br>8-15mm | 0.5mm<br>1mm | 21 | Sets S167MA and S167MB Combined, without Holder | S167MCZ | 55820 |
| 0.5-7mm<br>8-15mm | 0.5mm<br>1mm | 22 | Sets 167MB and S167MAH Combined, with Holder | S167MCHZ | 55821 |
| 1-15mm | 1mm | 15 | Without Holder | S167MDZ | 55822 |
| **SD167 Radius Gage Sets – Decimal-Inch** | | | | | |
| .020-.300 | .020 | 19 | Without Holder | SD167FZ | 63464 |
| .350-.500 | .050 | | With Holder | SD167FHZ | 63460 |
| .010-.025 | .005 | 26 | Without Holder | SD167GZ | 63433 |
| .030-.100 | .010 | | | | |
| .120-.300 | .020 | | With Holder | SD167GHZ | 63463 |
| .350-.500 | .050 | | | | |
| Holder Only | | | | 110 | 50475 |

* Includes redemption card for Standard Letter of Certification (SLC).

**Individual Radius Gage Specifications**

| 167 – Inch | | |
|---|---|---|
| **Radius** | **Cat. No.** | **EDP** |
| 1/64" | 167-1/64 | 50646 |
| 1/32" | 167-1/32 | 50622 |
| 3/64" | 167-3/64 | 50623 |
| 1/16" | 167-1/16 | 50624 |
| 5/64" | 167-5/64 | 50625 |
| 3/32" | 167-3/32 | 50626 |
| 7/64" | 167-7/64 | 50627 |
| 1/8" | 167-1/8 | 50628 |
| 9/64" | 167-9/64 | 50629 |
| 5/32" | 167-5/32 | 50630 |
| 11/64" | 167-11/64 | 50631 |
| 3/16" | 167-3/16 | 50632 |
| 13/64" | 167-13/64 | 50633 |
| 7/32" | 167-7/32 | 50634 |
| 15/64" | 167-15/64 | 50635 |
| 1/4" | 167-1/4 | 50636 |
| 17/64" | 167-17/64 | 50637 |
| 9/32" | 167-9/32 | 50638 |
| 5/16" | 167-5/16 | 50639 |
| 11/32" | 167-11/32 | 50640 |
| 3/8" | 167-3/8 | 50641 |
| 13/32" | 167-13/32 | 50642 |
| 7/16" | 167-7/16 | 50643 |
| 15/32" | 167-15/32 | 50644 |
| 1/2" | 167-1/2 | 50645 |

| 167M – mm | | |
|---|---|---|
| **Radius** | **Cat. No.** | **EDP** |
| 0.5mm | 167M-1/2 | 55795 |
| 1mm | 167M-1 | 55796 |
| 1.5mm | 167M-1 1/2 | 55797 |
| 2mm | 167M-2 | 55798 |
| 2.5mm | 167M-2 1/2 | 55799 |
| 3mm | 167M-3 | 55800 |
| 3.5mm | 167M-3 1/2 | 55801 |
| 4mm | 167M-4 | 55802 |
| 4.5mm | 167M-4 1/2 | 55803 |
| 5mm | 167M-5 | 55804 |
| 5.5mm | 167M-5 1/2 | 55805 |
| 6mm | 167M-6 | 55806 |
| 6.5mm | 167M-6 1/2 | 55807 |
| 7mm | 167M-7 | 55808 |
| 8mm | 167M-8 | 55809 |
| 9mm | 167M-9 | 55810 |
| 10mm | 167M-10 | 55811 |
| 11mm | 167M-11 | 55812 |
| 12mm | 167M-12 | 55813 |
| 13mm | 167M-13 | 55814 |
| 14mm | 167M-14 | 55815 |
| 15mm | 167M-15 | 55816 |

| 167 - Decimal-Inch | | |
|---|---|---|
| **Radius** | **Cat. No.** | **EDP** |
| .010 | 167-010 | 63434 |
| .015 | 167-015 | 63435 |
| .020 | 167-020 | 63436 |
| .025 | 167-025 | 63437 |
| .030 | 167-030 | 63438 |
| .040 | 167-040 | 63439 |
| .050 | 167-050 | 63440 |
| .060 | 167-060 | 63441 |
| .070 | 167-070 | 63442 |
| .080 | 167-080 | 63443 |
| .090 | 167-090 | 63444 |
| .100 | 167-100 | 63445 |
| .120 | 167-120 | 63446 |
| .140 | 167-140 | 63447 |
| .160 | 167-160 | 63448 |
| .180 | 167-180 | 63449 |
| .200 | 167-200 | 63450 |
| .220 | 167-220 | 63451 |
| .240 | 167-240 | 63452 |
| .260 | 167-260 | 63453 |
| .280 | 167-280 | 63454 |
| .300 | 167-300 | 63455 |
| .350 | 167-350 | 63456 |
| .400 | 167-400 | 63457 |
| .450 | 167-450 | 63458 |
| .500 | 167-500 | 63459 |

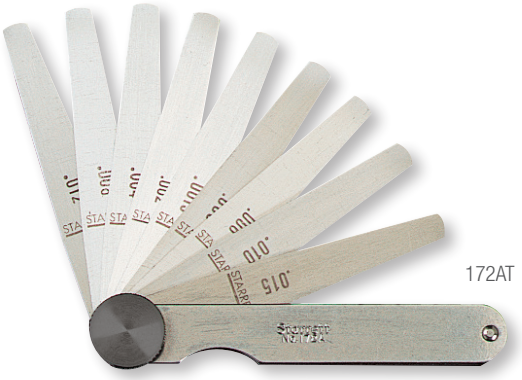
# Thickness Gages

## English and Metric Thickness Gages

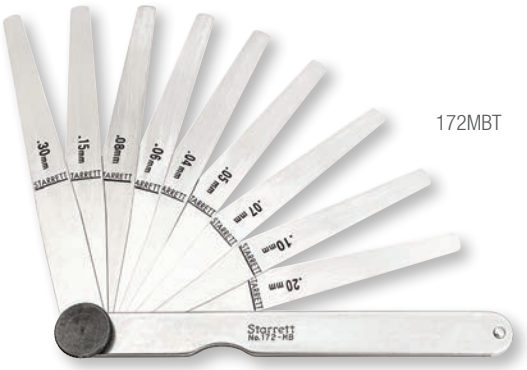
### .0015-.200"/0.03-5MM

These gages are used in automotive, aviation, diesel and farm equipment manufacture and service and also in jig, fixture, gage and experimental work. Especially useful in adjusting tappets, spark plugs, distributor points, checking bearing clearances and gear play, fitting pistons, rings and pins and gaging narrow slots. Made in a wide range of types and sizes, each having from 6 up to 26 leaves ranging in thickness from .0015-.200" and 0.03-5mm thick, straight or tapered.

- Leaves made of finest tempered-steel, carefully finished to correct thickness, individually tested and marked with thickness
- Locking device on most gages permits securely locking one or more leaves in position
- Leaves easily removed or replaced
- Rugged, substantial steel case protects leaves




172AT




172MBT




172A



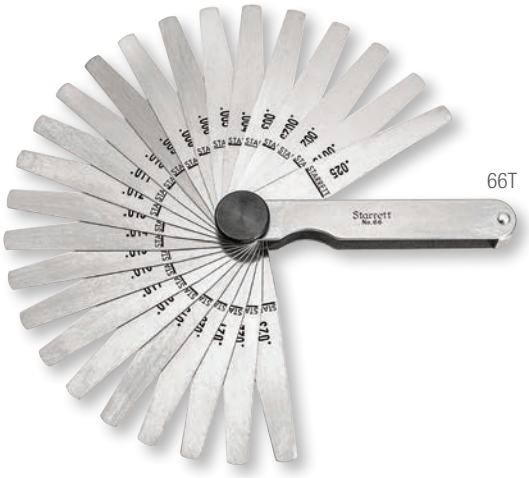
66




467




572A



66T

| Cat. No. | EDP | No. of Leaves | Size Leaves | (Range) Leaf Thickness (Inches) | Description/Remarks |
|---|---|---|---|---|---|
| **Inch Reading Thickness Gages with Straight Leaves** | | | | | |
| 172A | 50649 | 9 | 1/2 x 3-1/32" | .0015, .002, .003, .004, .006, .008, .010, .012, .015 | With Locking Device |
| 66 | 50314 | 26 | 1/2 x 3-1/32" | .0015, .002, .0025, .003, .004, .005, .006, .007, .008, .009, .010, .011, .012, .013, .014, .015, .016, .017, .018, .019, .020, .021, .022, .023, .024, .025 | With Locking Device |
| 66B | 57097 | 31 | 1/2 x 3-1/32" | .0015, .002, .0025, .003, .004, .005, .006, .007, .008, .009, .010, .011, .012, .013, .014, .015, .016, .017, .018, .019, .020, .021, .022, .023, .024, .025, .026, .028, .030, .032, .035 | With Locking Device |
| 467 | 52464 | 13 | 1/2 x 4-1/2" | .0015, .002, .003, .004, .006, .008, .010, .020, .030, .040, .075, .100, .200 | With Locking Device |
| 172E | 50654 | 8 | 1/2 x 12" | .002, .003, .004, .005, .006, .008, .010, .015 | With Locking Device |
| 572A | 57098 | 22 | 1/2 x 3-1/32" | .0015, .002, .0025, .003, .004, .005, .006, .007, .008, .009, .010, .012, .013, .014, .015, .016, .018, .020, .022, .025, .030, .035<br>6 Spark Plug Wire Gages: .025, .030, .034, .035, .040, .045 | With Locking Device and Spark Plug Wire Gages |
| 572B | 57099 | 22 | 1/2 x 3-1/32" | .0015, .002, .0025, .003, .004, .005, .006, .007, .008, .009, .010, .012, .013, .014, .015, .016, .018, .020, .022, .025, .030, .035 | With Locking Device |
| **Inch Reading Thickness Gages with Tapered Leaves** | | | | | |
| 66T | 50315 | 26 | 1/2-1/4 x 3-1/32" | .0015, .002, .0025, .003, .004, .005, .006, .007, .008, .009, .010, .011, .012, .013, .014, .015, .016, .017, .018, .019, .020, .021, .022, .023, .024, .025 | With Locking Device |
| 172AT | 50650 | 9 | 1/2-1/4 x 3-1/32" | .0015, .002, .003, .004, .006, .008, .010, .012, .015 | With Locking Device |
| 172CT | 50652 | 8 | 1/2-1/4 x 6" | .002, .003, .004, .006, .008, .010, .012, .015 | With Locking Device |
| **Millimeter Reading Thickness Gages with Straight Leaves** | | | | | |
| 66MA | 55974 | 20 | 12.7 x 77mm | 0.05, 0.10, 0.15, 0.20, 0.25, 0.30, 0.35, 0.40, 0.45, 0.50, 0.55, 0.60, 0.65, 0.70, 0.75, 0.80, 0.85, 0.90, 0.95, 1.0 | With Locking Device |
| 173MA | 57086 | 13 | 12.7 x 77mm | 0.03, 0.04, 0.05, 0.06, 0.07, 0.08, 0.09, 0.10, 0.15, 0.20, 0.30, 0.40, 0.50 | With Locking Device |
| 467M | 52465 | 13 | 12.7 x 114mm | 0.04, 0.05, 0.06, 0.07, 0.08, 0.10, 0.15, 0.20, 0.30, 1.0, 2.0, 3.0, 5.0 | With Locking Device |
| **Millimeter Reading Thickness Gages with Tapered Leaves** | | | | | |
| 172MBT | 50656 | 9 | 12.7-7 x 114mm | 0.04, 0.05, 0.06, 0.07, 0.08, 0.10, 0.15, 0.20, 0.30 | With Locking Device |
| 173MAT | 57087 | 13 | 12.7-7 x 77mm | 0.03, 0.04, 0.05, 0.06, 0.07, 0.08, 0.09, 0.10, 0.15, 0.20, 0.30, 0.40, 0.50 | With Locking Device |
| 173MCT | 57088 | 13 | 12.7-7 x 152mm | 0.03, 0.04, 0.05, 0.06, 0.07, 0.08, 0.09, 0.10, 0.15, 0.20, 0.30, 0.40, 0.50 | With Locking Device |

# "Feeler" Stock

## 666 Thickness Gage or "Feeler" Stock in Rolls

25' DISPENSER CASES .001-.015"
20', 25' CARDBOARD BOXES .0005-.025"

## 666M Thickness Gage or "Feeler" Stock in Rolls

7.6M DISPENSER CASES 0.03-0.35MM
6.1M CARDBOARD BOXES 0.40-0.50MM

This handy product includes thickness stock, housed in convenient rewindable dispenser rolls. Having the thickness stock in a case makes it very useful for cutting off the required length for adjusting tappets, spark plugs, distributor points, checking bearing clearances and gear play, fitting pistons, rings and pins, gaging narrow slots, etc. This stock is also useful for shimming in fixturing and die work.

- Handy 25' and 7.6m rolls 1/2" and 12.7mm wide, in a compact, sturdy plastic rewindable dispenser case. This case handles stock up to .015" and 0.35mm only.
- Rewind feature permits retracting thinner feeler stock into the case, preventing damage
- Roll stock in thicknesses of .016" or 0.40mm and over is furnished in 20' or 6m (nondispensable) rolls in a cardboard box. Also, the .0005", 25' size is furnished in a cardboard box.
- Made of the finest tempered steel
- Marked every 6" or 150mm with a line, thickness in thousandths of an inch or in hundredths of a mm (exception 666-1/2)
- Case provides the ability to snip off the desired length without any waste




| Thickness | Length | Cat. No. | EDP |
|---|---|---|---|
| **Inch Reading Rolls – Dispenser Case** | | | |
| .001" | | 666-1 | 52796 |
| .0015" | | 666-1 1/2 | 52797 |
| .002" | | 666-2 | 52798 |
| .0025" | | 666-2 1/2 | 52799 |
| .003" | | 666-3 | 52800 |
| .004" | | 666-4 | 52801 |
| .005" | | 666-5 | 52802 |
| .006" | | 666-6 | 52803 |
| .007" | 25' | 666-7 | 52804 |
| .008" | | 666-8 | 52805 |
| .009" | | 666-9 | 52806 |
| .010" | | 666-10 | 52807 |
| .011" | | 666-11 | 52808 |
| .012" | | 666-12 | 52809 |
| .013" | | 666-13 | 52810 |
| .014" | | 666-14 | 52811 |
| .015" | | 666-15 | 52812 |
| **Inch Reading Rolls – Cardboard Box** | | | |
| .0005" | 25' | 666-1/2 | 64210 |
| .016" | | 666-16 | 52813 |
| .017" | | 666-17 | 52814 |
| .018" | | 666-18 | 52815 |
| .019" | | 666-19 | 52816 |
| .020" | 20' | 666-20 | 52817 |
| .021" | | 666-21 | 52818 |
| .022" | | 666-22 | 52819 |
| .023" | | 666-23 | 52820 |
| .024" | | 666-24 | 52821 |
| .025" | | 666-25 | 52822 |
| **Millimeter Reading Rolls – Dispenser Case** | | | |
| 0.03mm | | 666M-3 | 52823 |
| 0.04 mm | | 666M-4 | 52824 |
| 0.05mm | | 666M-5 | 52825 |
| 0.06mm | | 666M-6 | 52826 |
| 0.08mm | | 666M-8 | 52827 |
| 0.10mm | 7.6m | 666M-10 | 52828 |
| 0.15mm | | 666M-15 | 52829 |
| 0.20mm | | 666M-20 | 52830 |
| 0.25mm | | 666M-25 | 52831 |
| 0.30mm | | 666M-30 | 52832 |
| 0.35mm | | 666M-35 | 52833 |
| **Millimeter Reading Rolls – Cardboard Box** | | | |
| 0.40mm | | 666M-40 | 52834 |
| 0.45mm | 6.1m | 666M-45 | 52835 |
| 0.50mm | | 666M-50 | 52836 |

# "Feeler" Stock

## 667 Thickness Gages or "Feeler" Stock

**.0005-.030"**

## 667M Thickness Gages or "Feeler" Stock

**0.03-0.50MM**

These gages are widely used in automotive, aviation, diesel and farm equipment manufacture and service and also in jig, fixture, gage and experimental work.

- Inch sizes are 12" long, 1/2" wide and furnished in 33 different thicknesses ranging from .0005-.030"
- Millimeter sizes are furnished in 300mm lengths, 12.7mm wide in 14 different thicknesses ranging from 0.03-0.50mm
- Rounded ends make stock easier to work with
- Made of the finest tempered steel
- Each piece marked every 6" with thickness (exception 667-1/2) and in individual envelope
- With convenient 3/16" (5mm) hole punched in the end for hanging




| Millimeter Gages – 300mm | | |
|---|---|---|
| **Thickness** | **Cat. No.** | **EDP** |
| 0.03mm | 667M-3 | 52869 |
| 0.04mm | 667M-4 | 52870 |
| 0.05mm | 667M-5 | 52871 |
| 0.06mm | 667M-6 | 52872 |
| 0.08mm | 667M-8 | 52873 |
| 0.10mm | 667M-10 | 52874 |
| 0.15mm | 667M-15 | 52875 |
| 0.20mm | 667M-20 | 52876 |
| 0.25mm | 667M-25 | 52877 |
| 0.30mm | 667M-30 | 52878 |
| 0.35mm | 667M-35 | 52879 |
| 0.40mm | 667M-40 | 52880 |
| 0.45mm | 667M-45 | 52881 |
| 0.50mm | 667M-50 | 52882 |

## Thickness Gage or "Feeler" Stock Assortments

Two complete, handy thickness gage assortments:

S667A (Inch) set consists of one each of 32 different pieces, 1/2" x 12" long from .001" through .030" thick (the entire individual range, with exception of the .0005" thickness, as listed on previous page).

S667MA (Millimeter) set consists of one each of 14 different pieces, 12.5mm x 300mm long from 0.03mm through 0.50mm thick (complete range, as on previous page).

S667D Bulk inch-reading assortment consists of 108 pieces, 1/2" x 12", in nine different thicknesses from .0015" to .015" thick. Twelve pieces of a size are packed in a box and each piece in an individual envelope. The nine boxes, together with an extra box for holding odd pieces, are packed in a convenient storage carton.



| Individual Assortments | | |
|---|---|---|
| **Cat. No.** | **EDP** | **Description** |
| S667A | 63274 | Complete Starrett Inch Thickness Gage Assortment – One Each, 32 Different Sizes |
| S667MA | 64949 | Complete Starrett Millimeter Thickness Gage Assortment – One Each, 14 Different Sizes |
| **Bulk Assortment** | | |
| S667D | 52883 | Bulk Quantity Assortment: 108 Pieces in Nine Thickness Sizes; 12 Pieces of a Size per Box; .0015, .002, .003, .004, .006, .008, .010, .012, .015" |

Packed 12 pieces of a size in a box; each piece in individual envelope; 9 boxes in a carton.

| Inch Gages – 12" | | |
|---|---|---|
| **Thickness** | **Cat. No.** | **EDP** |
| .0005" | 667-1/2 | 64209 |
| .001" | 667-1 | 52837 |
| .0015" | 667-1 1/2 | 52838 |
| .002" | 667-2 | 52839 |
| .0025" | 667-2 1/2 | 52840 |
| .003" | 667-3 | 52841 |
| .004" | 667-4 | 52842 |
| .005" | 667-5 | 52843 |
| .006" | 667-6 | 52844 |
| .007" | 667-7 | 52845 |
| .008" | 667-8 | 52846 |
| .009" | 667-9 | 52847 |
| .010" | 667-10 | 52848 |
| .011" | 667-11 | 52849 |
| .012" | 667-12 | 52850 |
| .013" | 667-13 | 52851 |
| .014" | 667-14 | 52852 |
| .015" | 667-15 | 52853 |
| .016" | 667-16 | 52854 |
| .017" | 667-17 | 52855 |
| .018" | 667-18 | 52856 |
| .019" | 667-19 | 52857 |
| .020" | 667-20 | 52858 |
| .021" | 667-21 | 52859 |
| .022" | 667-22 | 52860 |
| .023" | 667-23 | 52861 |
| .024" | 667-24 | 52862 |
| .025" | 667-25 | 52863 |
| .026" | 667-26 | 52864 |
| .027" | 667-27 | 52865 |
| .028" | 667-28 | 52866 |
| .029" | 667-29 | 52867 |
| .030" | 667-30 | 52868 |

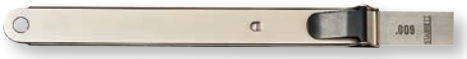
# Thickness Gages

## 806 Thickness Gage or "Feeler" Stock Holders

### CLAMP AT ONE END

## 806D Thickness Gage or "Feeler" Stock Holders

### CLAMP AT BOTH ENDS



806 with stock clamped on one end



806D with stock clamped on both ends

These 806 Thickness Gage Holders provide a handy, convenient means of rigidly holding single leaves or strips of thickness gage stock of any thickness from .001-.025" (0.03-0.5mm).

Stock up to 6" (150mm) long is easily inserted in the holder and firmly gripped in the desired position by a cam lock. This permits all of the stock to be used, because as it wears from use, the defective end can be snipped off and new stock pulled out until entirely used up.

Available in two types as listed in the chart on the right, either to clamp stock at one end or both ends. Dull nickel finish. Size approximately 3/32" thick x 9/16" wide x 5-1/4" long (2.4 x 14 x 130mm). 806D holders have contrasting finish to eliminate the possible confusion on which end holds the thicker or thinner stock.

| Thickness Gage or "Feeler" Stock Holders | | |
|---|---|---|
| **Cat. No.** | **EDP** | **Description** |
| 806 | 53039 | Holder Only - clamps stock at one end |
| 806D | 53040 | Holder Only - clamps stock at both ends |

## 245, 245M Engineers' Combination Taper, Wire and Thickness Gage

### INCH/MILLIMETER



Consists of a wire gage, a taper gage for measuring slot widths, and an assortment of thickness gage leaves, all folding within a compact steel case. The gage measures 1/2" wide x 4-3/4" long (12.7 x 120mm) and has a locking device to lock any leaf or leaves in position.

Both 245 and 245M have an English Standard wire gage leaf similar to our 188, but with shorter range, sizes numbered from 19-36 (.042-.004"), plus two additional sizes, 1/16" and 1/8". The reverse side has decimal equivalents in thousandths.

245 has a taper gage leaf for measuring slot widths from 1/64-3/16" in 64ths of an inch, the reverse side having a 3" scale graduated in 8ths and 16ths. It has nine thickness or feeler leaves as follows: .002, .003, .004, .006, .008, .010, .012, .015 and 1/16".

245M has a taper gage leaf for measuring slot widths from 0.5-5mm in 0.5mm, the reverse side having an 80mm scale graduated in mm and 1/2mm. It has eleven thickness or feeler leaves as follows: 0.04, 0.05, 0.06, 0.07, 0.08, 0.10, 0.15, 0.20, 0.30, 1 and 2mm.

| Inch Reading | | |
|---|---|---|
| **Cat. No.** | **EDP** | **Description** |
| 245 | 51170 | With taper gage, English standard wire gage and 9 Inch reading thickness gage leaves |
| **Millimeter Reading** | | |
| 245M | 51171 | With taper gage, English standard wire gage and 11mm reading thickness gage leaves |



# PRECISION SHOP TOOLS

# Surface Gages

## 56 Small Surface Gages

### (HARDENED STEEL BASE)

- Smaller base and spindle than other surface gages and is designed for lighter work
- Two frictionally held gage pins in the hardened steel base which can be pushed down and used against the edge of a surface plate or T-slot for linear work
- Weighs only ten ounces (0.28kg.) and takes up very little space in a toolbox
- Only 1-3/8" (35mm) high, including the lower sleeve in the rocker arm
- Scriber has a 3/32" (2.4mm) diameter and is 3-1/4" (82mm) long

| 56 Small Surface Gages | | | | | |
|---|---|---|---|---|---|
| Spindle | | Base | | | |
| Inch | mm | Inch | mm | Cat. No. | EDP |
| 4" | | | | 56A | 50289 |
| Two, 4" and 7" | 100 and 175mm | 2 x 1-1/2" | 50 x 38mm | 56B | 50290 |
| 7" | | | | 56C | 50291 |
| **57 Full-sized Surface Gages** | | | | | |
| Spindle Length | | Base - Length x Width | | Cat. No. | EDP |
| 9" (225mm) | | 3 x 2-9/16" | | 57A | 50292 |
| 9" and 12" (225 and 300mm) | | (75 x 65mm) | | 57B | 50293 |
| 12" (300mm) | | 3-3/4 x 3-3/8" | | 57C | 50294 |
| 12" and 18" (300 and 450mm) | | (95 x 85mm) | | 57D | 50295 |
| **Spindles, Scribers and Standard Snugs for 57 and 257 Surface Gages** | | | | | |
| Fits | Spindles | | Scribers | Standard Snugs* | |
| A and B Models | 5/16 x 9" and 12" (8mm x 225 and 300mm) | | 9/64 x 6" (3.6 x 150mm) | PT18718 (EDP 50709) with 5/16" post hole† | |
| C and D Models | 3/8 x 12" and 18" (9.5mm x 300 and 450mm) | | 5/32 x 8-1/2" (4 x 216mm) | PT18724 (EDP 50710) with 3/8" (9.5mm) post hole | |

† For snug with 8mm post hole diameter, order PT27171, EDP 66457.
* Will hold scribers, rods or indicator stems ranging from 3/32-1/4" (2.4-6.35mm) and allows use with these test indicators: 196, 651, 711**, 564**, 708**, 811**, 650, 709**
** Snugs must be used with the proper indicator holder.


56A


257A with 711GPSZ

## Surface Gages

Surface Gages are designed for a wide variety of uses. This is a basic tool for machinists and toolmakers. The main uses are for accurately scribing lines, transferring measurements and for probing surfaces in inspection work.

Lines can be scribed to heights and depths. Lines can also be scribed on horizontal surfaces referenced from gage pins on the tool.

Scribers are usually set in relation to rule graduations (our 62 Rule Holder is valuable in this respect) or height gages.

Marrying one of these tools with one of our test indicators makes easy work of checking flatness, parallelism, height and depth.

# Surface Gages

## 57 Full-sized Surface Gages

**(CAST IRON BASE)**

- Full-size surface gage with attractive finish
- Base is ground flat with two frictionally held gage pins that can be pushed down and referenced against the edge of a surface plate or T-slot for linear work

## 257 Full-sized Surface Gages

**(HARDENED STEEL BASE)**

- Finest full-size surface gage
- Stable steel base is fully hardened, ground and nicely finished
- Four frictionally held gage pins that add versatility for referencing the tool

**257 Full-sized Surface Gages**

| Spindle Length | Base - Length x Width | Cat. No. | EDP |
|---|---|---|---|
| 9" (225mm) | 2-7/8 x 2-3/8" (72 x 60mm) | 257A | 51240 |
| 9" and 12" (225 and 300mm) | | 257B | 51241 |
| 12" (300mm) | 3-1/2 x 3-3/16" (90 x 80mm) | 257C | 51242 |
| 12" and 18" (300 and 450mm) | | 257D | 51243 |

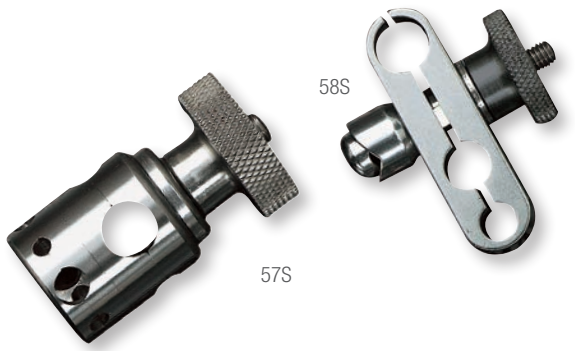
## 57S, 58S Universal Snugs for Surface Gages, Indicators and Accessories

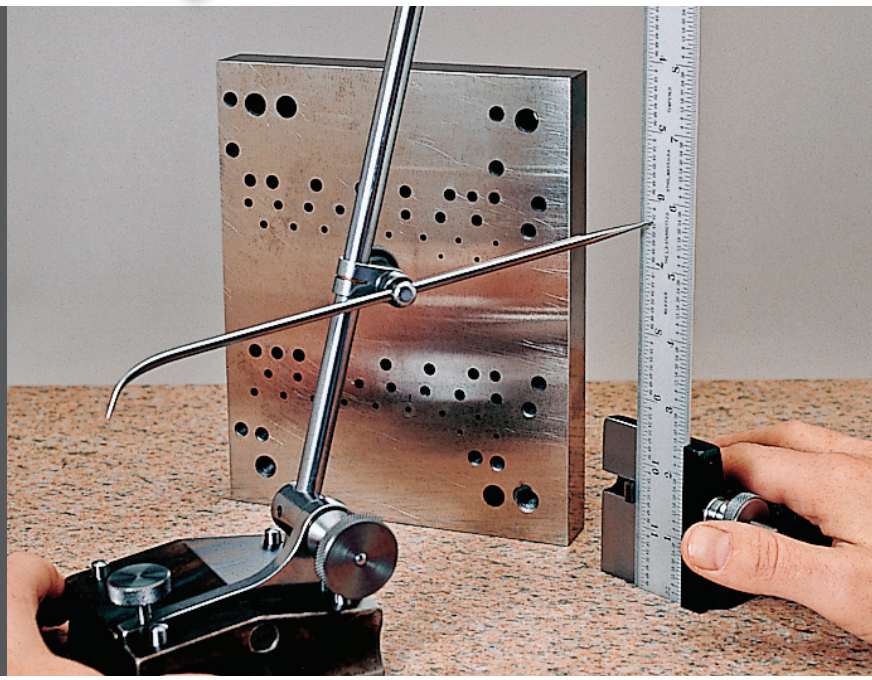
- Convenient attachment of scribers and test indicator shanks to surface gages, magnetic bases, indicator tool post holders and gage rods
- Fits all 57 and 257 Surface Gages and test indicator clamps and post holders
- Permit the use of all of our test indicators: 196, 564*, 650, 651, 708*, 709*, 711*, and 811*. (*Snugs must be used with the proper indicator holder)

**Universal Snugs for Surface Gages**

| Spindle Hole Diameters | | Gripping Hole Diameters | | | |
|---|---|---|---|---|---|
| Inch | mm | Inch | mm | Cat. No. | EDP |
| 5/16, 3/8 | 8, 9.5 | 9/64, 5/32, 3/16, 1/4 | 3.5, 4, 4.8, 6.35 | 57S | 50296 |
| 1/4, 5/16, 3/8 | 6.35, 8, 9.5 | Range from 3/32-1/4 | Range from 2.4-6.35 | 58S | 56613 |



# Scribers

## 29 Scratch Gage

This tool is extremely useful for scribing lines parallel to a given surface. It is made of steel and the head is hardened. The gage is securely locked by a knurled clamp screw and split bushing in the head.

The marker is a square piece of thin tempered-steel firmly held against the edge of the beam by a screw. The beam is graduated a full 6" by 64ths of an inch, and fine adjustments may be made by a slight rotating movement of the head.

| 29 Scratch Gage | | | |
|---|---|---|---|
| **Size Beam** | **Graduation** | **Cat. No.** | **EDP** |
| 6" (150mm) | 64ths | 29B | 50201 |

Two extra cutters sent with each gage.



29B Scratch Gage

## 70 Pocket Scribers

### CARBIDE OR HARDENED STEEL POINTS

The handle is made of steel, knurled and nickel plated. The scriber point is steel, properly hardened and finely tapered so the location of the point is not obscured.

The scriber is held firmly in the handle by a knurled chuck and when not in use can be reversed, telescoped into the handle, and locked by the chuck. The hexagon-shaped head prevents rolling.

| 70 Pocket Scribers | | | | | | |
|---|---|---|---|---|---|---|
| | **Point Length** | | **Handle Diameter** | | | |
| **Point** | **Inch** | **mm** | **Inch** | **mm** | **Cat. No.** | **EDP** |
| Steel | 2-3/8 | 60 | 1/4 | 6.4 | 70A | 50323 |
| | 2-7/8 | 72 | 3/8 | 9.5 | 70B | 50324 |
| Carbide | 2-3/8 | 60 | 1/4 | 6.4 | 70AX | 50327 |
| | 2-7/8 | 72 | 3/8 | 9.5 | 70BX | 56092 |

| Points Only for 70 Pocket Scribers | | | |
|---|---|---|---|
| **Point** | **For Starrett Scriber No.** | **Part No.** | **EDP** |
| Steel | 70A | PT02355A | 70332 |
| | 70B | PT02355B | 70333 |
| Carbide | 70AX | PT14398 | 71527 |
| | 70BX | PT19306 | 72049 |

## 67 Improved Scriber

Scribers are steel, properly tempered and well finished. The points are finely tapered so that the scriber point can be easily seen on the work. The handle, as well as the points, have a knurled grip.

The long bent point is useful for reaching through holes. The length of the scriber with the short point is 9" (225mm) and with the long bent point, 12" (300mm). Points screw into the handle and fit either end. The knurled handle is nickel-plated.

| 67 Improved Scribers | | |
|---|---|---|
| **Catalog** | **EDP** | **Description** |
| 67A | 50316 | Complete with 3 Points (1 Straight, 1 Short Bent, 1 Long Bent) |
| 67B | 50317 | With 2 Points (1 Straight, 1 Short Bent) |

| Points Only for 67 Improved Scribers | | |
|---|---|---|
| **Part** | **EDP** | **Description** |
| PT16584 | 71555 | Extra Straight Point |
| PT16585 | 71556 | Extra Short Bent Point |
| PT16586 | 71557 | Extra Long Bent Point |

## 68 Adjustable Sleeve Scriber

A very handy scriber with a point 8" (200mm) in length that is held by an adjustable knurled sleeve. The adjustable sleeve may be clamped close to or away from the working point.

The sleeve is nickel-plated. Available with or without knife point.

| 68 Adjustable Sleeve Scribers | | |
|---|---|---|
| **Cat. No.** | **EDP** | **Description** |
| 68A | 50322 | With Knife Point |
| 68B | 50321 | Without Knife Point |



70A, 67A, 68A Scribers

# Precision Shop Tools

## 1610 Kleenscribe™ Layout Dye

- Deep blue, quick-drying dye for clean, dry metal surfaces
- Brush or spray an opaque blue background that makes scribed lines stand out sharp and clear
- Will not rub off on hands or clothing or flake away
- Unaffected by cutting lubricants and heat generated during machining
- To remove, use a rag or wiper, moistened with denatured alcohol

### Ideal For Numerous Applications:

- Laying out dies, cams, templates, jigs, fixtures, patterns, castings
- Touching cutting tool to work before setting machine for cut
- Identifying tools, parts, bar stock and other shop metals
- Checking alignment of gears and wearing parts




| Kleenscribe™ Layout Dye | | |
|---|---|---|
| Size/Description | Cat. No. | EDP |
| 4 oz. (0.1 liter) Plastic Bottle | 1610-4 | 53212 |
| 16 oz. (0.5 liter) Plastic Bottle | 1610-16 | 53213 |
| 32 oz. (1 liter) Plastic Bottle | 1610-32 | 53214 |
| 11-1/2 oz. (0.3 liter) Aerosol Can | 1611 | 55896 |

## 1 Adjustable-Jaw Cut Nippers

Special design provides powerful leverage for efficient and clean cutting. Especially recommended for all applications involving wire cutting. These tools can be adjusted for wider jaw openings to easily cut tile and mosaics.

- Heat-treated steel frames for strength
- Red vinyl coated handles for a firm, comfortable grip
- Jaws can be detached and replaced, or resharpened. Jaws should be ground in pairs and referenced from the serrations
- Jaws can be adjusted on the frames. Each jaw has an allowance of about 1/4" (6.4mm) to cut tile or to adjust after resharpening.
- Stud and stop screw on the handle can be adjusted for proper jaw closure, thereby preventing damage from excess pressure on the jaws
- A flat safety spring below the cutting edges of the jaws forms a yielding seat for the end of the wire to press against while being cut
- Classic design and available with either hardened steel or carbide jaws for extra long life



1X-7

| 1 Adjustable-Jaw Cut Nippers | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|
| Size | | Capacity (Max. Wire Dia.) | | Jaw Width | | | | | Jaws Only (Pair) | |
| Inch | mm | Inch | mm | Inch | mm | Jaws | Cat. No. | EDP | Part No. | EDP |
| 5-1/2 | 138 | .050 | 1.3 | 21/32 | 16.5 | Carbide Tipped | 1X-5 1/2 | 50004 | PT01931-1 | 50006 |
| 7 | 175 | .080 | 2 | 13/16 | 21 | Carbide Tipped | 1X-7 | 50005 | PT01932-1 | 50007 |

# Precision Shop Tools

## Wiggler or Center Finder with Attachments 828

Wiggler/Center Finder S828 and four different attachments adapt to countless applications and are readily interchangeable. The attachments are snapped in the chuck without removing the collet nut and are clamped by a ball swivel-joint that permits adjustment to an angular position or true concentricity.

**With Pointed Shank 828A,** working centers can be quickly and accurately located. Spring tension on the ball of the point permits guiding the point to true concentricity so that the work can be brought into perfect alignment with the machine spindle.

**Ball Contact 828B** is useful in locating work by first bringing the contact (ball diameter .250" or 6.35mm) against the work, a slot, hole, shoulder, or end, and indexing the work to the desired position relative to the spindle.

**Disc Contact 828C,** which has a small disc at the end (.100"/2.54mm) diameter, permits use in more confined areas such as slots or shallow holes.

**Offset Indicator Holder 828D** with the Last Word® Test Indicators, the user can sweep holes or O.D.s for checking run-out or concentricity, establish center distances, check straightness or alignment of flat surfaces.

**Wiggler or Center Finder with Attachments**

| Description | Cat. No. | EDP |
|---|---|---|
| Wiggler/Center Finder, Complete With Case and 4 Attachments, 828B, C, D, PT09186 | S828HZ | 53064 |
| Wiggler/Center Finder with 3 Attachments, 828B, C, PT09186, Without Indicator Holder, Without Case | S828 | 53065 |
| Wiggler/Center Finder with Pointed Shank | 828A | 53066 |
| Pointed Shank Only | PT09186 | 71164 |
| Ball Contact Only (.250"/6.35mm Ball) | 828B | 53067 |
| Disc Contact Only (.100"/2.54mm Disc) | 828C | 53068 |
| Offset Indicator Holder Only | 828D | 53069 |



Complete set with case includes left-to-right: S828 Wiggler/ Center Finder (PT09186 Pointed Shank attached), 828B Ball Contact, 828C Disc Contact, and 828D Offset Indicator Holder

## 827 Edge Finders

### .375", .500" AND 10MM BODY DIAMETERS FOR FAST, ACCURATE WORK LOCATION

Work surfaces may be located easily, quickly and accurately with these edge finders. Work with flat, straight edges, shoulders, grooves, round work, studs, dowels or center points and scribed lines – all can be accurately located with this handy tool. Body and contacts are made of tool steel, hardened, ground and lapped to close tolerances for diameter and concentricity.

### How To Use:

Edge finders are easy to use. They are placed in a collet or chuck. The worktable is then traversed to obtain contact between the rotating edge finder and the work. Contact will shift to concentric position relative to the body and with very slight additional table adjustment, will move off center with a decided wobble. At this point, the center of the finder is exactly one-half the diameter of the contact from the work edge, permitting accurate location for other machining operations relative to the edge.

For locating center points and scribed lines, the pointed contact is used by putting a pencil or rule against the center point and making it run concentrically. Then the point is brought down to the center point or intersection of scribed lines and the table is adjusted so that when the tool barely touches the work, the lineup with the point in question can be ascertained.

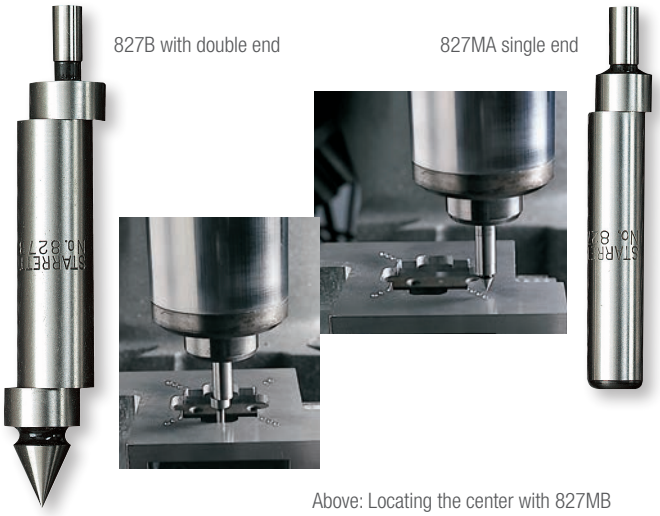
**827 Edge Finders**

| Description | Body Diameter | Contact Diameter | Cat. No. | EDP |
|---|---|---|---|---|
| Single End | .375" | .200" | 827A | 53062 |
| Double End | .500" | .200" and pointed contact | 827B | 53063 |
| Single End | 10mm | 6mm | 827MA | 56041 |
| Double End | 10mm | 6mm and pointed contact | 827MB | 66452 |

Furnished in attractive, protective case.

827B with double end

827MA single end



Above: Locating the center with 827MB
Left: Locating the edge of a part with 827MA

# Precision Shop Tools

## Collet Adaptor

This is a timesaving accessory for our 827 Edge Finders. It allows quick installation and removal of the edge finder, eliminating the need for collet changes on Bridgeports and similar machines.

It can also be used with any other attachment with a 3/8" post.

The progressive steps are: 1/4", 5/16", 3/8", 1/2", 5/8", 3/4" and 1". Step depths vary from .100" to .200".




| Collet Adaptor | | |
|---|---|---|
| **Description** | **Cat. No.** | **EDP** |
| Collet Adaptor | PT28314 | 68846 |

## "Little Giant" Jack Screws

### 190

**2-1/4"–3-3/8"/57-85MM**

### 191

**1-1/2"–2-1/4"/38-57MM**

"Little Giant" Jack Screws are very handy for leveling work on planer beds, upright drills, setting up machinery, and for general use in the toolroom or machine shop.

190 and 191 have 20-pitch screws and for those who desire a finer adjustment, the F190 has a 40-pitch screw.

An auxiliary pointed screw (D) is supplied, to be used in place of the screw with swivel cap. Extension base (E) is furnished for places where it is not possible to obtain a bearing on a flat surface. Extension V base (F) is for use against a cylindrical form.




SF190 "Little Giant" Jack Screw set, complete with all attachments

| 190 and 191 "Little Giant" Jack Screws | | | | | |
|---|---|---|---|---|---|
| **Photo Key** | **Description** | **Cat. No.** | **EDP** | **Cat. No.** | **EDP** |
| | Set Complete, with Fine-Adjusting Screw and All Attachments | SF190 | 64622 | | |
| | Set Complete with All Attachments | S190 | 50680 | S191 | 50687 |
| A | Jack Only, with Fine-Adjusting Screw | F190A | 64623 | | |
| | Jack Only | 190A | 50681 | 191A | 50688 |
| B | Extension Base | 190B | 50682 | 191B | 50689 |
| C | Extension Base | 190C | 50683 | 191C | 50690 |
| D | Auxiliary Pointed Screw with Fine-Adjusting Screw | F190D | 64624 | | |
| | Auxiliary Pointed Screw | 190D | 50684 | 191D | 50691 |
| E | Extension Base | 190E | 50685 | 191E | 50692 |
| F | Extension V Base | 190F | 50686 | 191F | 50693 |

| Specifications | 190 | | 191 | |
|---|---|---|---|---|
| **Range** | 2-1/4 – 3-3/8" | 57-85mm | 1-1/2 – 2-1/4" | 38-57mm |
| **Maximum Height with Attachments** | 6-3/8" | 162mm | 3-3/4" | 95mm |
| **Jack (A) Base Diameter** | 1-1/4" | 32mm | 1" | 25mm |
| **Extension (B)** | 2" | 50mm | 1" | 25mm |
| **Extension (C)** | 1" | 25mm | 1/2" | 13mm |

# Precision Shop Tools

## 815 Toolmakers' Hammer with Built-In Magnifying Lens

### A PRACTICAL TOOL – MAKES A GREAT GIFT TOO!

Faster, easier and more accurate spotting and punching of centerlines and intersections is now possible with the this tool.

High-power magnification makes it easy to spot the punch and strike without once removing the eyes from the work.

Weighing only four ounces (113 grams) it is made of a steel forged chromium with plated finish. Both flat and ball peen heads are hardened and are offset for use in corners or close to obstructions. Shock resistant lens and hang hole.

| 815 Toolmakers' Hammer with Built-In Magnifying Lens | | |
|---|---|---|
| **Description** | **Cat. No.** | **EDP** |
| Hammer Only | 815 | 53041 |
| Personalized (Specify Name Clearly) | 815P | 53042 |



Locating hole center on a workpiece with the 117B Center Punch and 815 Toolmakers' Hammer

## 129 Bench Blocks

The 129 Bench Block is useful for holding work when driving pins, drilling, etc. The block is made from hardened steel and ground. A V-groove across the face accommodates round and odd-shaped stock. The smooth finish preserves the finish of the work being held.

The knurled side provides a good gripping surface, making it easier to handle. Recessed base to make it lighter, yet withstands hard usage.

## 119 Bench Blocks

The 119 Bench Block is a good choice for all-around machine shop and toolroom use when a larger, heavy-duty block is required. This block weighs five pounds (2.3kg). The base is hex-shaped, so the block can be held rigidly in a vise. It is made from alloy steel, hardened, and ground, top and bottom.

| 129 and 119 Bench Blocks | | |
|---|---|---|
| **Size/Description** | **Cat. No.** | **EDP** |
| 3" (75mm) Diameter x 1-1/2" (38mm) High with Oversize Holes from 1/8-5/8" (3-16mm) Diameter and One V-Groove | 129 | 50559 |
| 4-7/8" (120mm) Diameter x 1-1/2" (38mm) High with Ten Oversize Holes from 1/8-7/8" (3-22mm) Diameter and Two V-Grooves at Right Angles | 119 | 50491 |





Above: 129
Right: 119

# Punches

## Automatic Center Punches with Adjustable Stroke



Rugged automatic center punch with adjustable stroke

### 18

Rugged automatic punches with all-steel handles and parts

- Internal mechanism automatically strikes a blow when downward pressure is applied
- Adjustable knurled cap regulates the force of the blow
- Spring tension, which regulates the blow, is constant so marks made by the point are uniform in depth and size for each setting
- All sizes are identical in style, differing only in the striking power
- The point can be easily removed for regrinding or replacement
- Heavy-duty 18C is capable of striking a much heavier blow than the other sizes



Easy one-hand precision center punching

### 818

This punch is similar to our 18C, except that it has a lightweight, knurled aluminum handle for a positive grip and easy handling

- No hammer required! Just hold the punch in an upright position, press the handle down, and a built-in mechanism strikes a perfect center mark every time.
- The force of the blow can be adjusted by turning the knurled cap
- All working parts made of properly hardened tool steel. Hardened tool steel point may easily be removed for resharpening or replacement. (Replacement PT22256)
- Works on metal, plastics, wood and other machinable materials



Automatically locates and centers holes through hinges, latches, catches, etc.

### 819 Hinge-Locating

This automatic centering punch combines all the features of our 818 lightweight aluminum punch with an exclusive self-centering locating sleeve that automatically centers starter holes for screws

- Simply engage the beveled edge of the sleeve with the countersunk hole in the hinge and press down on the handle until the built-in mechanism strikes a blow for truly concentric starting holes every time. To draw hinges, etc., sideways, tilt the punch slightly in the opposite direction.
- Eliminates the risk of drilling off center, causing screws to pull hinges or hardware off center
- Punch can be adjusted for striking light or heavy impressions by turning the knurled cap
- Point is easily removed for replacement (Replacement PT09966)

**Automatic Center Punches with Adjustable Stroke**

| Description | Length Inch | Length mm | Diameter Inch | Diameter mm | Cat./ Part No. | EDP |
|---|---|---|---|---|---|---|
| Punch | 4" | 100mm | 7/16" | 11mm | 18AA | 50119 |
| | 5" | 125mm | 9/16" | 14mm | 18A | 50120 |
| Punch, Heavy-Duty | 5-1/4" | 130mm | 11/16" | 17mm | 18C | 56757 |
| Point Only for 18AA | | | | | PT06689 | 12901 |
| Point Only for 18A | | | | | PT06690 | 12902 |
| Point Only for 18C | | | | | PT22256 | 72445 |

Special points for stamping numbers, letters, special symbols, etc. can be furnished. Contact the Special Order Department.

| 818 Automatic Center Punch | | | | | |
|---|---|---|---|---|---|
| Length Inch | Length mm | Diameter Inch | Diameter mm | Cat. No. | EDP |
| 5" | 125mm | 5/8" | 16mm | 818 | 53048 |
| **819 Hinge-Locating Automatic Center Punch** | | | | | |
| 5" | 125mm | 5/8" | 16mm | 819 | 53049 |

# Punches





## 117 Center Punches with Round Shanks

- Hardened and properly tempered
- Well proportioned
- Knurled finger grip
- Ground at the proper angle
- Accurately centered tips

## 264 Center Punches with Square Shanks

- Hardened and properly tempered
- Square knurled grip
- Will not roll
- Accurately centered tips
- Ground at the proper angle






**117 and 264 Center Punches**

| Length | | Dia. at Top of Tapered Point | | 117 | | 264 | |
|---|---|---|---|---|---|---|---|
| Inch | mm | Inch | mm | Cat. No. | EDP | Cat. No. | EDP |
| 3" | 75mm | 1/16" | 1.5mm | 117AA | 50482 | 264A | 51278 |
| 3-1/2" | 88mm | 5/64" | 2mm | | | 264B | 51279 |
| 3-3/4" | 95mm | 3/32" | 2.5mm | | | 264C | 51280 |
| 4" | 100mm | 5/64" | 2mm | 117A | 50483 | 264D | 51281 |
| | | 3/32" | 2.5mm | 117B | 50484 | | |
| | | 1/8" | 3mm | 117C | 50485 | | |
| | | 5/32" | 4mm | 117D | 50486 | | |
| 4-1/4" | 108mm | 5/32" | 4mm | | | 264E | 51282 |
| 4-1/2" | 114mm | 3/16" | 5mm | | | 264F | 51283 |
| 5" | 125mm | 1/4" | 6.5mm | 117E | 50487 | 264G | 51284 |
| Set of 5, 117AA, A, B, C, D in Plastic Case | | | | S117PC | 50488 | | |
| Set of 7, 264A, B, C, D, E, F, G in Round Red Plastic Box | | | | | | S264WB | 51285 |



# Punches






## 816 Prick Punches

- Accurately centered
- Ground at a sharp angle
- Hardened and tempered
- Knurled grip

## 800 Square-Head Nail Sets

- Round, knurled grip
- Large, square head
- Will not roll
- Beveled head prevents breakage
- Cupped punch surface
- Hardened and tempered steel




**816 and 800 Punches**

| Length | | Punch Diameter | | 816 | | 800 | |
|---|---|---|---|---|---|---|---|
| Inch | mm | Inch | mm | Cat. No. | EDP | Cat. No. | EDP |
| 4" | 100mm | 1/32" | 0.8mm | | | 800A | 53029 |
| | | 1/16" | 1.5mm | | | 800B | 53030 |
| | | 5/64" | 2mm | 816A | 53043 | | |
| | | 3/32" | 2.5mm | | | 800C | 53031 |
| | | 1/8" | 3mm | 816B | 53044 | 800D | 53032 |
| | | 5/32" | 4mm | 816D | 53046 | 800E | 53033 |
| Combination Starrett Punch Set in Plastic Case. One Each 816A, B, D Prick Punches, and Two Center Punches 117AA, B | | | | S816PC | 57078 | | |
| Set of 5 in Protective Plastic Case. One Each of 800A, B, C, D, E | | | | | | S800PC | 64131 |

# Punches



## 565 Drive Pin Punches

- Hardened and tempered steel
- Knurled grip




## B565 Brass Drive Pin Punches

- Ideal for softer materials
- Solid brass prevents damaging delicate work
- Kurled grip






| 565 and B565 Drive Pin Punches | | | | | | | |
|---|---|---|---|---|---|---|---|
| Length | | Diameter Punch | | 565 | | B565 | |
| Inch | mm | Inch | mm | Cat. No. | EDP | Cat. No. | EDP |
| 4" | 100mm | 1/16" | 1.5mm | 565A | 52578 | B565A | 12465 |
| | | 3/32" | 2.5mm | 565B | 52579 | B565B | 12466 |
| | | 1/8" | 3mm | 565C | 52580 | B565C | 12467 |
| | | 5/32" | 4mm | 565D | 52581 | B565D | 12468 |
| | | 3/16" | 5mm | 565E | 52582 | B565E | 12469 |
| | | 7/32" | 5.5mm | 565F | 52583 | B565F | 12470 |
| | | 1/4" | 6mm | 565G | 52584 | B565G | 12471 |
| | | 5/16" | 8mm | 565H | 52585 | B565H | 12472 |
| Set of 8 Punches (1 of Each Size) in Round Red Plastic Box | | | | S565WB | 52586 | | |
| Set of 8 Punches (1 of Each Size) in Protective Vinyl Case | | | | S565PC | 52587 | | |
| Set of 8 Punches (1 of Each Size) in Fabric Pouch | | | | | | SB565Z | 12473 |

# Punches






## 248 Drive Pin Punches for Machine Shop and Motor Service Work

- Extra-long drive pin punches, measuring 8" (200mm). The bodies are 4-1/2" (115mm) and the drive pin sections are 3-1/2" (90mm) long.
- Well-proportioned, hardened, properly tempered with a knurled grip
- Designed to withstand hard use
- Provide a most satisfactory punch for machine shop and motor service work
- Diameter of punches is slightly less than listed

## B248 Brass Drive Pin Punches for Machine Shop and Motor Service Work

- Same features as 248 extended length drive pin punches, but in a softer brass construction ideal for more delicate work
- Available in four sizes from 3/16" to 3/8" and as a full set of four in an attractive fabric pouch

**248 and B248 Drive Pin Punches**

| Length | | Diameter Punch | | 248 | | B248 Brass | |
|---|---|---|---|---|---|---|---|
| Inch | mm | Inch | mm | Cat. No. | EDP | Cat. No. | EDP |
| | | 1/8" | 3mm | 248A | 51181 | | |
| | | 3/16" | 5mm | 248B | 51182 | B248B | 12460 |
| 8" | 200mm | 1/4" | 6mm | 248C | 51183 | B248C | 12461 |
| | | 5/16" | 8mm | 248D | 51184 | B248D | 12462 |
| | | 3/8" | 9.5mm | 248E | 51185 | B248E | 12463 |
| Set of 5 Punches (1 of Each Size) in Protective Vinyl Case | | | | S248PC | 51186 | | |
| Set of 5 Punches (1 of Each Size) in Plain Box | | | | S248 | 51187 | | |
| Set of 4 Brass Punches (1 of Each Size) in Fabric Pouch | | | | | | SB248Z | 12464 |

# Screwdrivers






## 555 Jewelers' Screwdrivers

- Ideal for fine, delicate work
- Swivel knobs are concave to fit the finger
- Hexagonal knobs to prevent rolling
- Knurled grip
- Overall length of screwdrivers is approximately 3-3/4" (95mm)




**555 Jewelers' Screwdrivers**

| Blade Width Inch/mm | Phillips Blade No. | Complete Screwdriver Cat. No. | Complete Screwdriver EDP | Blade Only Part No. | Blade Only EDP |
|---|---|---|---|---|---|
| .025" (0.6mm) | | 555AA | 52549 | PT02449AA | 70361 |
| .040" (1mm) | | 555A | 52550 | PT02449A | 70362 |
| .055" (1.4mm) | | 555B | 52551 | PT02449B | 70363 |
| .070" (1.8mm) | | 555C | 52552 | PT02449C | 70364 |
| .080" (2mm) | | 555D | 52553 | PT02449D | 70365 |
| .100" (2.5mm) | | 555E | 52554 | PT02449E | 70366 |
| | #0 | 555F | 52561 | PT14443 | 71534 |
| Set of 6 Screwdrivers, 555AA, A, B, C, D, E – In Case | | | | S555Z-6 | 52564 |
| Set of 7 Screwdrivers, 555AA, A, B, C, D, E, F – In Case | | | | S555Z-7 | 52566 |

## Starrett Screwdrivers

- Made for relatively small and very delicate work
- Bodies are made from knurled, nickel-plated steel
- Replaceable blades, made from the best quality steel, properly tempered and nickel-plated
- A slight turn of the knurled chuck locks the blade in place
- Blades can be reversed into the screwdriver body for safety

## 551 Precision Screwdrivers

The 551 Screwdrivers with soft-touch handle are lightweight and ergonomic. The blades are made of chromium-vanadium steel, hardened and chrome-plated, allowing them to hold up well in the toughest applications.

### Features

- Precision-machined tips for top quality and exact fit
- Vapor-chromed non-slip tips
- Hardened for maximum durability
- Tapered handles allow rapid rotation
- Swivel knobs are concave to fit finger



**551 Precision Screwdrivers**

| Blade Width Inch/mm | Phillips Blade No. | Complete Screwdriver Cat. No. | Complete Screwdriver EDP |
|---|---|---|---|
| .060" (1.5mm) | | 551A | 67195 |
| .080" (2.0mm) | | 551B | 67196 |
| .100" (2.5mm) | | 551C | 67197 |
| .120" (3.0mm) | | 551D | 67198 |
| | #00 | 551E | 67199 |
| | #0 | 551F | 67200 |
| | #1 | 551G | 67201 |
| Set of 7 Screwdrivers With Case, 551A, B, C, D, E, F, G | | S551Z-7 | 67203 |
| Case Only | | S551ZZ | 67204 |





# Screwdrivers

## 553 Pocket Screwdrivers

The 533 Screwdrivers feature a hexagonally shaped head to prevent them from rolling. When not in use, the blade can be reversed into the screwdriver body for conveniently and safely carrying them in pockets. Size takes no more room than a penknife.

Handy steel and carbide scriber points are also available to fit these handles, including 70 Scriber points.

### Features

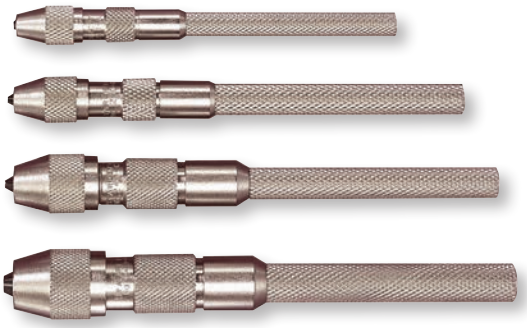
- Hexagonal head prevents rolling
- Small in size with reversable/removable blade
- Steel and carbide scriber points available
- Knurled grip



| 553 Pocket Screwdrivers | | | | | | | |
|---|---|---|---|---|---|---|---|
| Blade Width | | Blade Length | | | | Blade Only | |
| Inch | mm | Inch | mm | Cat. No. | EDP | Part No. | EDP |
| .100" | 2.5mm | 1-7/8" | 48mm | 553A | 52543 | PT02351A | 70330 |
| .150" | 3.8mm | 3" | 75mm | 553B | 52544 | PT02351B | 70331 |

| Scriber Points Only | | | | |
|---|---|---|---|---|
| | Steel | | Carbide | |
| Fits Model | Cat. No. | EDP | Cat. No. | EDP |
| 553B | PT02355B | 70333 | PT19306 | 72049 |

# Pin Vises



## 240 Pin Vises with Tapered Collets

**.010-.200"/0.25-5.1MM**

- Special tapered collet, providing maximum clamping surface
- Smaller body diameter than the chuck to allow fast opening and closing and rapid rotation when used on small work
- Available individually or as a complete set in a convenient case

| 240 Pin Vises | | | |
|---|---|---|---|
| Range | | | |
| Inch | mm | Cat. No. | EDP |
| .010-.055" | 0.25-1.4mm | 240A | 51136 |
| .025-.075" | 0.64-1.9mm | 240B | 51137 |
| .045-.135" | 1.2-3.4mm | 240C | 51138 |
| .110-.200" | 2.8-5.1mm | 240D | 51139 |
| Set of All 4 Sizes in Protective Vinyl Case | | S240Z | 51140 |



## 165 Double End Pin Vise

**0-.125"/0-3.2MM**

- Reversible collets with two size capacities at each end
- One chuck holds work or tools 0-.031" and .093-.125" diameter (0-0.8mm and 2.5-3.2mm). The other chuck holds .031-.062" and .062-.093" diameter (0.8-1.6mm and 1.6-2.5mm).
- "Back support" provided by beveled chuck ends

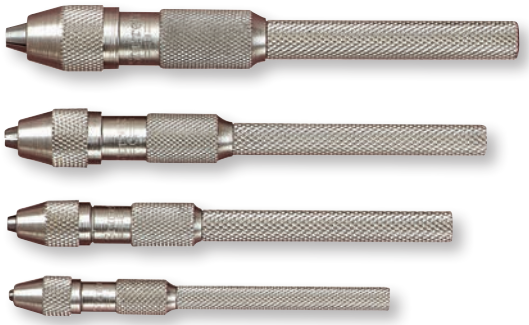
| 165 Double End Pin Vise | | | |
|---|---|---|---|
| Range | | | |
| Inch | mm | Cat. No. | EDP |
| 0-.125" | 0-3.2mm | 165 | 50608 |

### Pin Vises

Starrett pin vises are useful for securely holding small stock, taps, drills, reamers, scribers, wire, small files, and other tools. The jaws on all are hardened and with a few turns of the binding nut, a firm grip may be obtained. Handles and binding nuts are nickel-plated except for the 166 pin vise.

A hole extends through the full length of the handles so that wires of any length and any diameter up to the full size of the tool can be held.

**NOTE:** These tools not recommended for powered use.

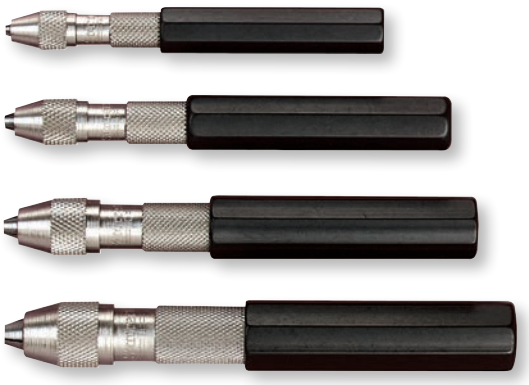


## 162 Pin Vises

**0-.187"/0-4.8MM**

The handles of these pin vises are reduced in size so that they can be rapidly rotated between thumb and finger when filing small work.

| 162 Pin Vises | | | |
|---|---|---|---|
| Range | | | |
| Inch | mm | Cat. No. | EDP |
| 0-.040" | 0-1mm | 162A | 50599 |
| .030-.062" | 0.8-1.6mm | 162B | 50600 |
| .050-.125" | 1.3-3.2mm | 162C | 50601 |
| .115-.187" | 2.9-4.8mm | 162D | 50602 |
| Set of All 4 Sizes in Protective Vinyl Case | | S162Z | 50604 |



## 166 Pin Vises with Insulated, Octagonal Handles

**0-.187"/0-4.8MM**

These pin vises are the same as our 162 except that they have an insulating PVC handle which is octagonally shaped, preventing them from rolling when laid down.

| 166 Pin Vises | | | |
|---|---|---|---|
| Range | | | |
| Inch | mm | Cat. No. | EDP |
| 0-.040 | 0-1 | 166A | 50609 |
| .030-.062 | 0.8-1.6 | 166B | 50610 |
| .050-.125 | 1.3-3.2 | 166C | 50611 |
| .115-.187 | 2.9-4.8 | 166D | 50612 |
| Set of All 4 Sizes in Protective Vinyl Case | | S166Z | 50614 |

# Pin Vises



## 93 T-Handle Tap Wrenches

The 93 T-Handle Tap Wrenches are for holding taps, drills, reamers and other small tools to be turned by hand. They are properly heat treated to withstand ordinary shop use. The jaws conform to the tool being held, making it rigid and less apt to loosen.

The 93D, E and F sizes are identical in construction to the 93A, B and C models, except that the bodies are proportionately longer. These longer tap wrenches are very handy in machine, automobile service and aviation repair shops because they eliminate the need for stocking special long taps for depths which cannot be reached with shorter wrenches.

### Features

- Sliding handle is frictionally held, permitting the handle to be removed or positioned
- Can be aligned using a lathe center or upright drilling machine to ensure a straight tap

**NOTE**: These tools are designed to hold square shanks. Round shanks can be gripped, but care must be used. Excessive tightening may break the binding nut.



## 91 Tap Wrenches

The 91 Tap Wrenches are strong and well proportioned. They are nicely finished and the gripping surfaces are properly tempered. They will firmly hold square or round shanks. They are plunger operated by knurled sleeve – the spring inside the sleeve causes plunger to back off when pressure is removed.

**NOTE:** Round shanks can be gripped, but care must be used. Excessive pressure may break the moveable V-jaw.



## 174 Tap Wrench

This is a well-designed tap wrench, ideal for holding smaller diameter taps, drills, reamers and other tools up to 1/4" (6.35mm) in diameter.

It will firmly grip round or square shanks. It is lightweight, well proportioned, and the gripping surface is properly heat treated.

| 93 T-Handle Tap Wrenches | | | | | | | |
|---|---|---|---|---|---|---|---|
| Capacity Tap Size | | Square Shank | | Body Length | | | |
| Inch | mm | Inch | mm | Inch | mm | Cat. No. | EDP |
| 1/16-3/16 | 1.6-4.7 | 1/16-5/32 | 1.6-4 | 2 | 50 | 93A | 50427 |
| 7/32-7/16 | 5.5-11 | 5/32-1/4 | 4-6.4 | 2-1/2 | 65 | 93B | 50428 |
| 1/4-1/2 | 6.4-12.7 | 3/16-5/16 | 4.7-8 | 3-1/2 | 90 | 93C | 50429 |
| 1/16-3/16 | 1.6-4.7 | 1/16-5/32 | 1.6-4 | 6 | 150 | 93D | 50430 |
| 7/32-7/16 | 5.5-11 | 5/32-1/4 | 4-6.4 | 10 | 250 | 93E | 50431 |
| 1/4-1/2 | 6.4-12.7 | 3/16-5/16 | 4.7-8 | 13 | 330 | 93F | 50432 |
| **91 Tap Wrenches** | | | | | | | |
| 1/16-1/4 | 1.6-6.35 | 3/32-5/32 | 2.4-4 | 6 | 150 | 91A | 50419 |
| 3/16-1/2 | 4.7-12.7 | 5/32-9/32 | 4-7 | 9 | 225 | 91B | 50420 |
| 1/4-5/8 | 6.35-16 | 5/32-3/8 | 4-9.5 | 12 | 300 | 91C | 50421 |
| 5/16-3/4 | 8-19 | 13/64-7/16" | 5.2-11 | 16 | 400 | 91D | 50422 |
| **174 Tap Wrench** | | | | | | | |
| No. 0-14 | | 1/4 diameter | 6.35 | 3-5/8 | 90 | 174 | 50658 |

# Precision V-Blocks

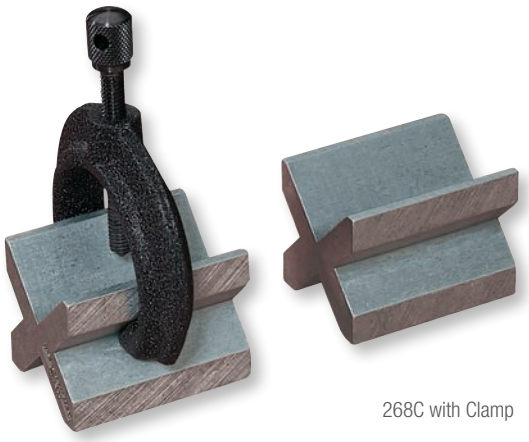
## 268 V-Blocks and Clamp

### 1-1/8"/28MM CAPACITY

- Cast iron construction
- 1-1/2" (38mm) square and 2" (50mm) long
- Clamp is ribbed for extra strength and will hold work up to 1-1/8" (28mm) in diameter

**268 V-Blocks and Clamp**

| Capacity | | | | |
|---|---|---|---|---|
| Inch | mm | Description | Cat. No. | EDP |
| 1-1/8 | 28 | 2 V-Blocks (One Pair) | 268A | 51287 |
| | | Complete Set with 2 V-Blocks (One Pair) and Clamp | 268C | 51289 |
| | | Clamp Only | 268B | 51288 |



268C with Clamp

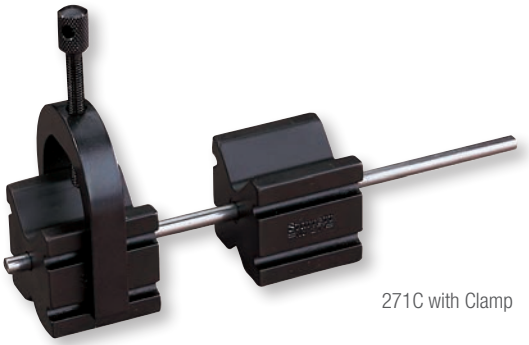
## 271 V-Blocks and Clamp

### 1-1/4"/32MM CAPACITY

- Case hardened steel for wear resistance
- For use singly or in pairs
- Includes a steel rod that passes through each block, firmly held by friction positioning to keep blocks in alignment
- Two grooves on each side of the blocks will hold the clamp for small or large work
- Steel forged clamp holds work up to 1-1/4" (32mm) in diameter

**271 V-Blocks and Clamp**

| Capacity | | | | |
|---|---|---|---|---|
| Inch | mm | Description | Cat. No. | EDP |
| 1-1/4 | 32 | 2 V-Blocks (One Pair) | 271A | 51293 |
| | | Complete Set with 2 V-Blocks (One Pair) and Clamp | 271C | 51295 |
| | | Clamp Only | 271B | 51294 |



271C with Clamp

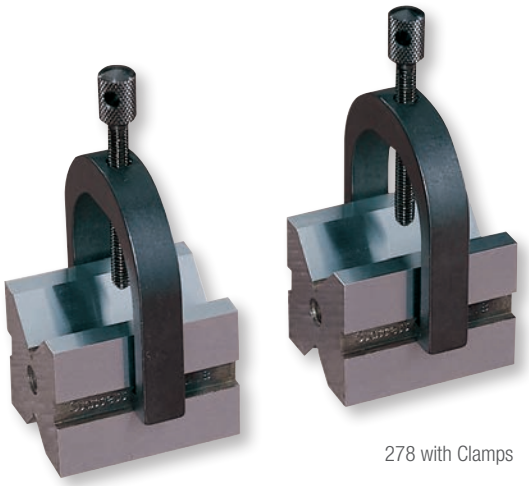
## 278 V-Blocks and Clamps

### 1"/25MM CAPACITY

- Precision ground to extreme accuracy
- Vees are central, parallel, and square with the ends and sides
- Hardened and ground steel construction
- Numbered in series so the vees in each set are always in alignment
- 1/4-20 tapped hole through the sides for attachment to an angle iron that can then be attached to a lathe faceplate or held by a magnetic chuck
- Each block is 1-1/4" (32mm) square and 1-5/8" (40mm) long

**278 V-Blocks and Clamps**

| Capacity | | | | |
|---|---|---|---|---|
| Inch | mm | Description | Cat. No. | EDP |
| 1 | 25 | Complete Set with 2 V-Blocks (One Pair) and 2 Clamps | 278 | 51312 |
| | | Clamp Only | 278B | 51313 |



278 with Clamps

## Precision V-Blocks and Clamps

Starrett V-Blocks come in a variety of styles to suit the numerous requirements of machinists. They are for general shop use and layout work, as well as for holding stock in place during light-duty milling, drilling, and grinding operations. All clamp screws have a hole to help secure the workpiece.




# Precision V-Blocks

## 566 Dual-Vee Magnetic V-Block

566

**1-3/4"/44MM CAPACITY**



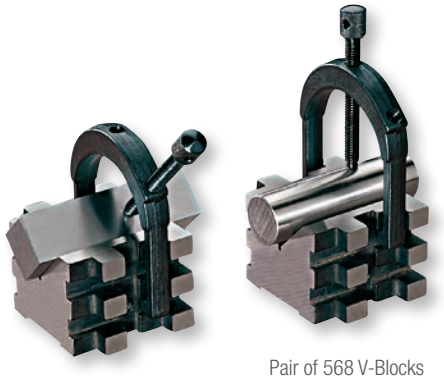

- Designed for versatility and accuracy
- All working surfaces are precision ground
- Two precision vees will hold round stock sizes from 1/4 - 1-3/4" (6.4-44mm) diameter
- Powerful, permanent magnet is controlled by a rotary switch
- All working surfaces are heat treated for long wear and stability
- Each block is 2-1/2" wide x 3" high x 3" long (63 x 75 x 75mm)

## 568 V-Blocks and Clamps for Round or Square Work

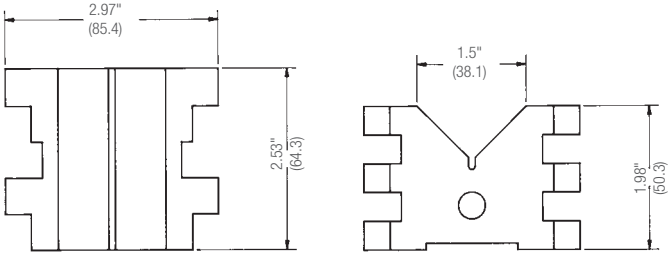
**2"/50MM ROUND CAPACITY**
**1-7/16"/36MM SQUARE CAPACITY**

These rugged and versatile blocks have the following features:

- Hardened steel, precision ground parallel and square
- V-grooves are ground central and parallel to the sides and base – perfect alignment in matched pairs
- Clamps have screw holes at 45º and 90º to hold either square or round work
- Stepped groove construction permits high or low clamp mounting for small or large work
- Clamps do not project over the width of the block, permitting it to be used on the base, ends or sides
- 3/8-16 tapped holes permit mounting blocks on faceplates or angle irons
- Each block is 2-1/2" long x 3" wide x 2" high (63 x 75 x 50mm)



Pair of 568 V-Blocks




| 566 Dual-Vee Magnetic V-Block | | | | |
|---|---|---|---|---|
| Capacity Inch | mm | Description | Cat. No. | EDP |
| 1-3/4 | 44 | Dual-Vee Magnetic V-Block | 566 | 63323 |
| **568 V-Blocks and Clamps** | | | | |
| 2" (50mm) Dia. Round; 1-7/16" (36mm) Square (1-9/16" [40mm] with Screw at Top) | | 1 V-Block and Clamp | 568A | 52590 |
| | | Complete Set with 2 V-Blocks and 2 Clamps (Matched Pair) | 568C | 52592 |
| | | Clamp Only | 568B | 52591 |

# Precision V-Blocks

## 567 V-Block and Clamp

### 1-5/16"/33MM CAPACITY

- The clamp is smaller than the outside width of the block, but has an adjustable side screw to support the block and prevent tilting
- The V at the stepped end is at right angles to the base and is handy for holding shouldered studs, pins, etc.
- A clearance hole for drilling or removing dowel pins is provided in the block
- The block has four 3/8-16 tapped holes, two in the base and one on each side for attachment to an angle iron. The angle iron holding the block can then be attached to a lathe faceplate or held by a magnetic chuck.
- The clamp is a strong forging
- The block is hardened and precision ground. The sides are parallel and the V is central and parallel to the sides and base.
- Can be used on its base, on the end or on either side

## 578 V-Block and Clamp for Larger Capacity Work

### 4"/100MM CAPACITY

This is our largest capacity V-block, which is ideal for toolroom, inspection and production work. Hardened steel

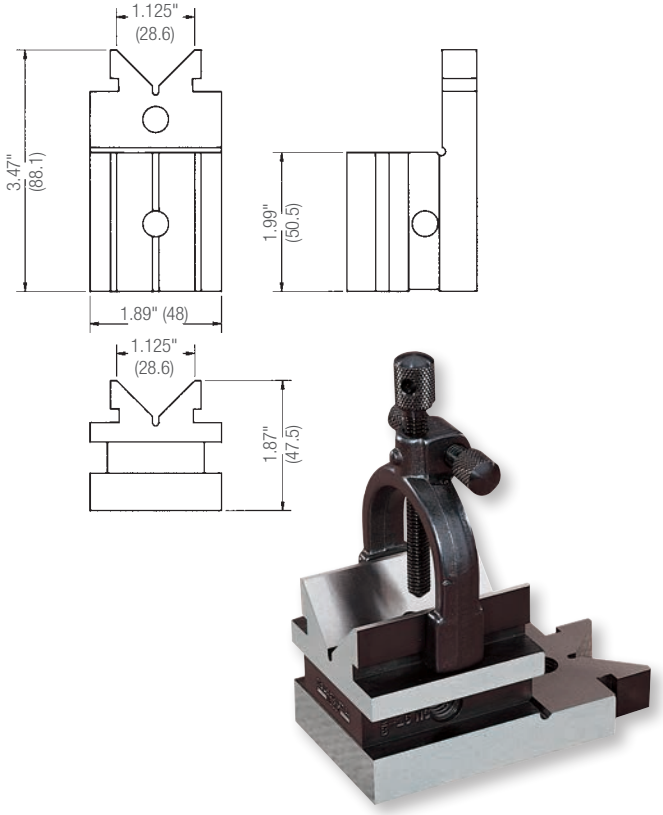
- Precision ground flat, square and parallel
- Rugged, reversible, hardened clamp can accommodate 9/16-4" (14-100mm) diameters of almost any shape of work
- No clamp interference when the block lies on either side
- Three available clamp positions
- Two tapped holes (3/8-16) in one end for mounting the V-block perpendicular to faceplates, etc.
- Available in matched pairs by special order

**567 V-Block and Clamp**

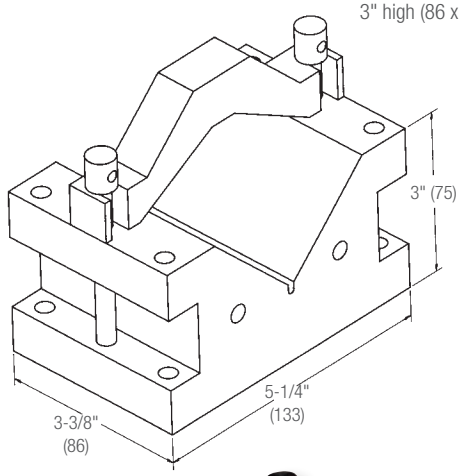
| Capacity | | | | |
|---|---|---|---|---|
| Inch | mm | Description | Cat. No. | EDP |
| 1-5/16 | 33 | Complete set with 1 V-block and 1 clamp | 567 | 52588 |
| | | Clamp only | 567B | 70885 |

**578 V-Block and Clamp**

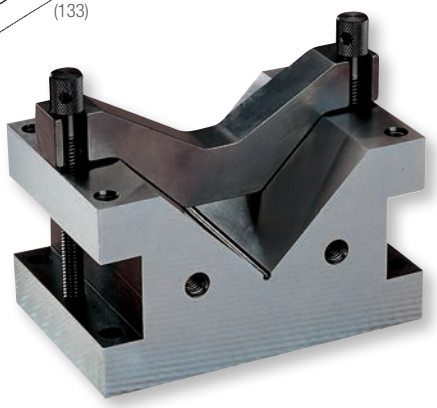
| Capacity | | | | |
|---|---|---|---|---|
| Inch | mm | Description | Cat. No. | EDP |
| V-Block and clamp for larger capacity work | | | 578 | 64960 |
| | | Clamp only with 2 screws | 578B | 64988 |




Block is 3-3/8" long x 5-1/4" wide x 3" high (86 x 133 x 75mm)




Right: V-Block with reversible clamp in downward facing position (Line drawing illustrates clamp in upward facing position)



# Precision Shop Tools

## 161 Toolmakers' Parallel Clamps

These parallel clamps are designed for maximum strength and rigidity. They are extremely useful for holding work together in tapping and drilling and on various machine setups. The ends of the jaws are rounded to permit clamping under shoulders or in recesses.

A retaining ring holds the loose jaw in alignment when the clamp is being opened or closed. The clamps are made of steel, nicely finished and hardened.



## 580 Precision Angle Plate

These angle plates are invaluable for accurate work in toolroom and small production applications when flatness, squareness and parallelism is important.

- Hardened and tempered steel
- Precision ground, square and parallel
- Convenient step for smaller work 3/4" (19mm) down from the top and a 1/4" (6.35mm) seat
- 10 holes tapped with a 1/4-20 thread for fastening to fixtures and clamping work to the angle plate



## 54 Hold-Downs

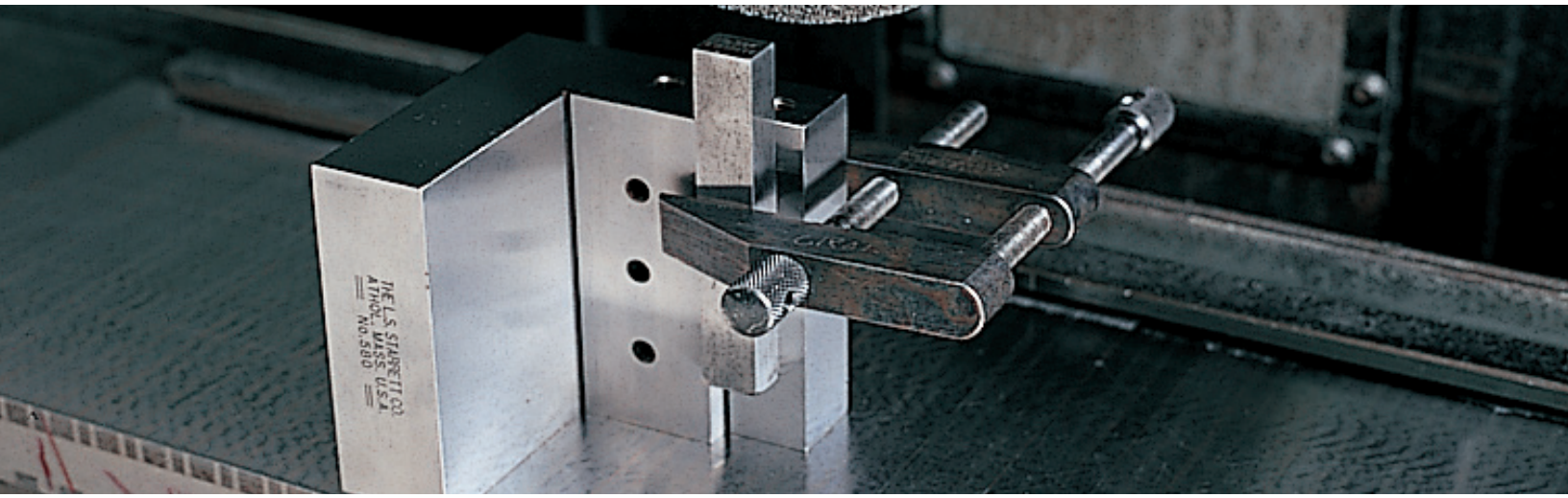
- Improved design firmly holds work flat on a machine bed or in a vise
- Contact edges are tapered to hold work securely and force it downward to the bed of the machine or against any parallel surface
- Especially useful for holding small work or thin materials without distortion
- Made of tool steel, hardened and ground




| 161 Toolmakers' Parallel Clamps | | | | | | |
|---|---|---|---|---|---|---|
| Capacity | | Approximate Throat Depth | | | | |
| Inch | mm | Inch | mm | Description | Cat. No. | EDP |
| 3/4" | 19mm | 21/32" | 16.5mm | Single Clamp | 161AA | 50593 |
| 1-1/4" | 32mm | 13/16" | 20.5mm | | 161A | 50594 |
| 1-3/4" | 44mm | 1" | 25mm | | 161B | 50595 |
| 2-1/4" | 57mm | 1-7/32" | 30mm | | 161C | 50596 |
| 2-3/4" | 70mm | 1-25/32" | 45mm | | 161D | 50597 |
| 3-1/2" | 89mm | 2-1/4" | 57mm | | 161E | 50598 |

| 54 Hold-Downs | | | | | |
|---|---|---|---|---|---|
| Length | | Width | | | |
| Inch | mm | Inch | mm | Cat. No. | EDP |
| 4" | 100mm | 27/32" | 21mm | 54A (Pair) | 50274 |

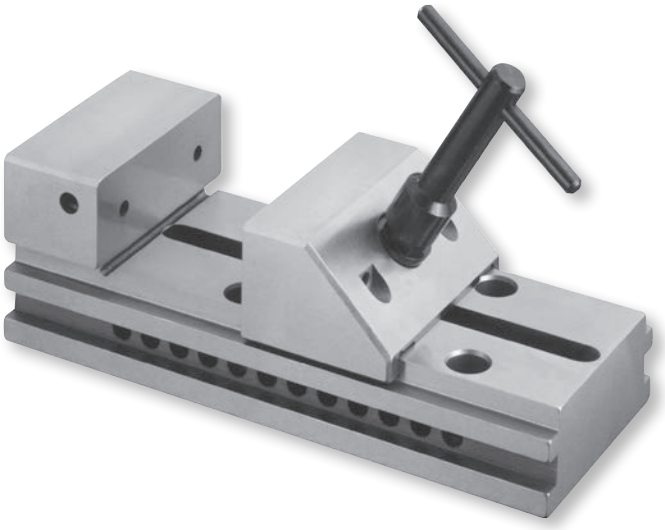
| 580 Precision Angle Plate | | |
|---|---|---|
| Size/Description | Cat. No. | EDP |
| 3" x 3" x 3" (75 x 75 x 75mm) Angle Plate | 580 | 64961 |



# Vises and Clamps

## 581 Precision Grinding Vise

- Extremely useful for accurate grinding
- Hardened steel construction
- Ground flat, square, and parallel within .0002" (0.005mm)
- Jaw pressure on workpiece is forward and downward for repeatable positioning and maximum holding power
- Jaw opening 4" (100mm), jaw depth 1-1/4" (32mm)
- Movable jaw is slightly narrower than the base, enabling the vise to be used on its side
- 1/4-20 tapped hole in each side of the solid jaw to allow the use of a stop for repetitive operations
- "T" handle wrench provided for tightening the movable jaw
- Four drilled and counterbored holes for 5/16 bolts in the base of the vise for bolting to a sine plate or the bed of a machine tool
- Angle blocks available on special order
- For attaching special jaw plates, two holes are drilled in both the solid and movable jaws



| 581 Precision Grinding Vise | | | | |
|---|---|---|---|---|
| | Capacity Jaw Opening x Depth | | | |
| Description | Inch | mm | Cat. No. | EDP |
| Grinding Vise with T-Handle Wrench | 4 x 1-1/4 | 100 x 32 | 581 | 64962 |

## 160 Toolmakers' Steel Clamps

These clamps are useful in layout work or for holding work securely in drilling and other similar operations. Each clamp is furnished with two take-up blocks that slip on the end of the screw. The blocks are held to allow a slight swivel action that conforms the angle of the block to the shape of the work being held.

There is a hole in the base of the clamps so they may be fastened to the bench and used as a small vise. Clamps are made of case-hardened steel and are smoothly finished.



| 160 Toolmakers' Steel Clamps | | | | |
|---|---|---|---|---|
| Capacity | | | | |
| Inch | mm | Description | Cat. No. | EDP |
| 2 | 50 | Pair of Clamps | 160 | 50592 |

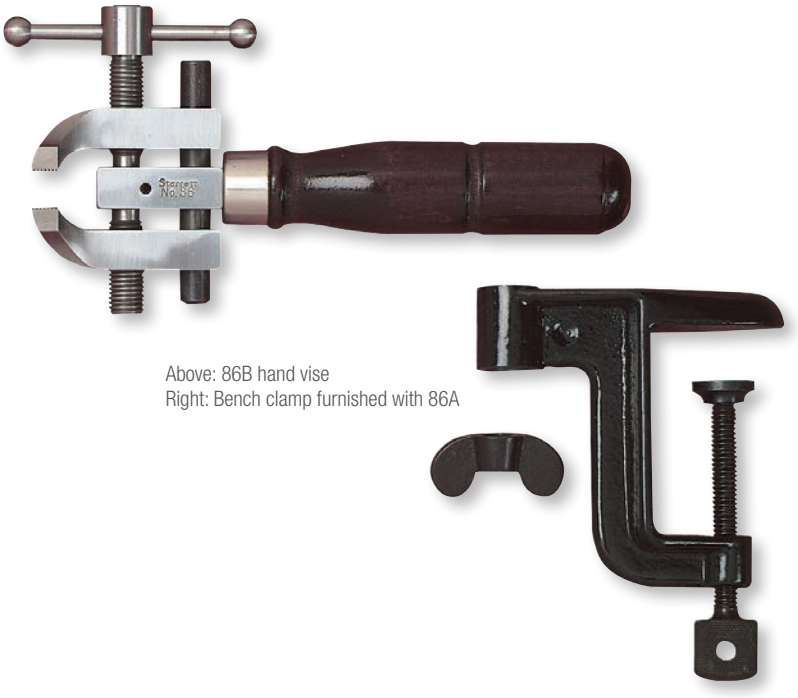
# Vises and Clamps

## 86 Combination Hand Vise

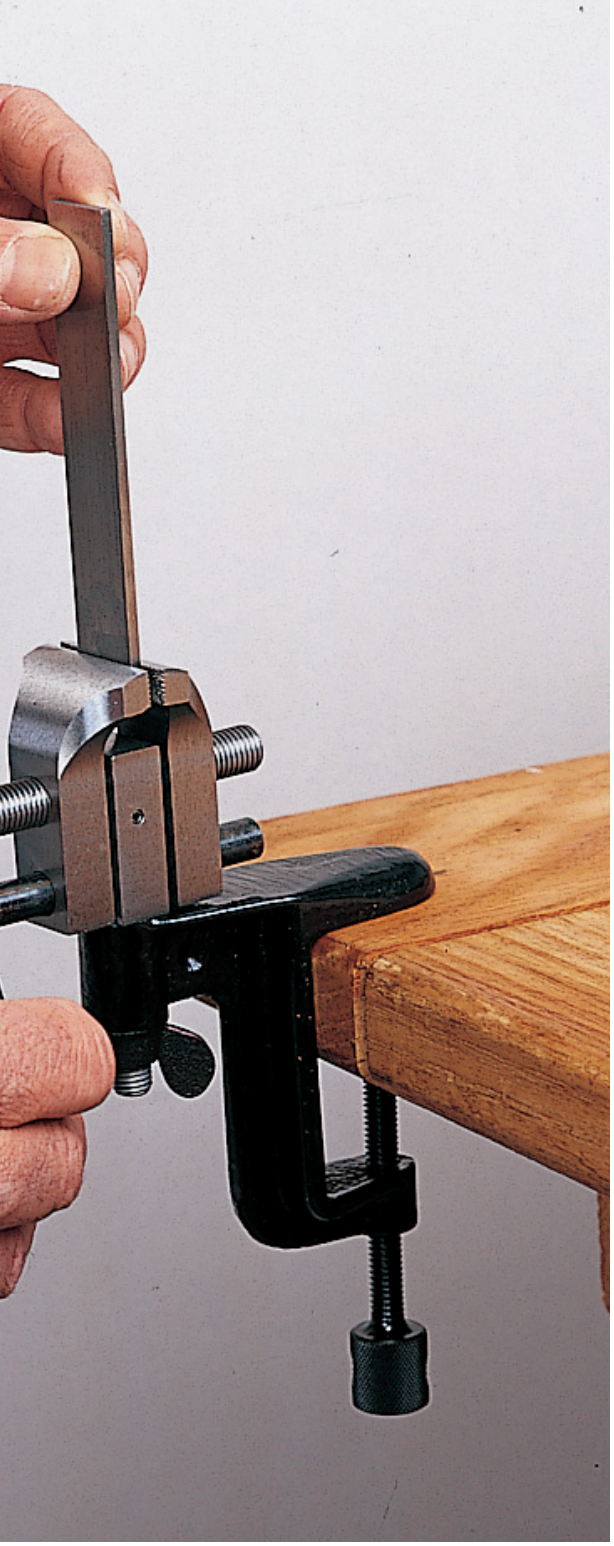
The 86 Combination Hand and Bench Vise has a wide range of uses for all toolmakers, mechanics, hobbyists and do-it-yourselfers. When a vise is needed at different locations for convenience, this tool is indispensable. By removing the handle and substituting the clamp, the tool may be fastened to benches, shelves, etc., approximately 1/2 - 2-1/8" (13-54mm) in thickness, and can be adjusted to different positions according to the user's preference.

When used as a hand vise, the leverage obtainable with the ball end lever will be appreciated in comparison with a wing nut commonly employed for this purpose. The jaws are made from forgings and are properly tempered.

| 86 Combination Hand Vise | | | | |
|---|---|---|---|---|
| Capacity | | | | |
| Inch | mm | Description | Cat. No. | EDP |
| 1-1/2" | 38mm | Hand Vise with Clamp | 86A | 50404 |



Above: 86B hand vise
Right: Bench clamp furnished with 86A



Using the hand vise with clamp mounted for benchwork applications

# Vises and Clamps

## 1620 Tool and Instrument Oil

Special high-refining process makes Starrett Tool and Instrument Oil colorless, ensures thorough lubrication of close-fitting parts at extreme temperatures and provides a strong, lasting film over all areas requiring protection against rust.

### Features

- This oil is made to our specifications and used in our factory to lubricate and protect our precision measuring tools and instruments
- General purpose lubricant for a wide range of applications
- Ideal for maximum protection and lubrication of measuring tools, precision instruments and light machinery
- Guards highly finished tools, parts and machine surfaces against rust
- Protects  firearms, fishing tackle and other sporting equipment and keeps working parts in perfect condition
- Cleans bright metals and polishes furniture
- Starrett oil can also be used for automobile generators, starters, hinges, locks, and springs




Lubricating the slide on a 123 Vernier Caliper assures maximum protection and lubrication of working parts

| 1620 Tool and Instrument Oil | | |
|---|---|---|
| **Description** | **Cat. No.** | **EDP** |
| 4 fl. oz. (0.1 liter) Plastic Bottle | 1620 | 53216 |

## 706 Inspection Blocks

**1" X 2" X 3"**

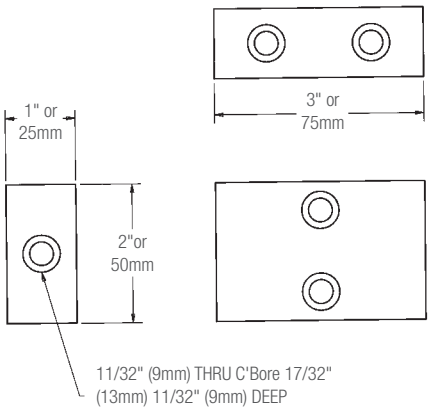
## 706M Inspection Blocks

**25 X 50 X 75MM**

These Inspection Blocks are manufactured to precision tolerances, and are of great value for all inspection laboratories and in-shop setups where positioning is important.

- High accuracy
- Hardened steel, ground and lapped
- Matched pair available

| Inch Blocks | | |
|---|---|---|
| **Description** | **Cat. No.** | **EDP** |
| Single 1 x 2 x 3" Block in Case | 706AZ | 57121 |
| Matched Pair in Case | 706BZ | 57122 |
| **Millimeter Blocks** | | |
| Single 25 x 50 x 75mm Block in Case | 706MAZ | 64968 |
| Matched Pair in Case | 706MBZ | 64969 |




| Specifications | |
|---|---|
| **Block Dimensions** | 1" x 2" x 3"<br>(25 x 50 x 75mm) |
| **Parallelism** | .0001" (0.003mm) |
| **Squareness** | .0001 in/in<br>(0.003mm/25mm) |
| **Hardness** | RC 63-65 |
| **Flatness** | .0001" (0.003mm) |






# Video Borescopes

NEW!

## 698 and 699 Video Borescopes

### POWERFUL AND ROBUST

The 698 and 699 Video Borescopes are ideal for inspection of inaccessible areas.

Applications include viewing hard-to-see areas during machining operations, inspection of internal parts of engines and machinery, A/C systems, and interior structures of walls.

### Features

- Robust design and construction
- Camera has a tempered glass lens and durable, corrosion resistant stainless steel body
- Flexible, water resistant conduit with high quality metal tip
- Detachable 1m (39.4") conduit (other lengths available by special order)
- Bright LED illumination
- High quality image
- Camera IP67 and body IP65 protection against water, dirt and dust
- Three available models




699-5.5 with mirror adaptor

| 698 and 699 Video Borescopes | | | |
|---|---|---|---|
| **Description** | **Probe** | **Cat. No.** | **EDP** |
| Video borescope, manual, video output cable, USB cable, 45° mirror, 2GB Micro SD card, case | 5.5mm | 699-5.5 | 62811 |
| Video borescope, manual, video output cable, USB cable, 2GB Micro SD card, case | 10mm | 699-10 | 62812 |
| Video borescope, manual, video output cable, case | 10mm | 698-10 | 62810 |
| **Video Borescope Accessories** | | | |
| **Description** | | **Cat. No.** | **EDP** |
| 45° mirror for 699-5.5 video borescope | | PT99559 | 74070 |
| Camera probes | | | |
| Camera probe, 10mm Dia. x 1m long | | CP10-1M | 50122 |
| Camera probe, 10mm Dia. x 3m long | | CP10-3M | 50123 |
| Camera probe, 5.5mm Dia. x 1m long | | CP5.5-1M | 50124 |
| **Transformer Wall Mounts** | | | |
| Transformer wall mount power supply 5VDC, 2A, 10W for the 698 borescope | | PT99557 | 72642 |
| Transformer wall mount 12VDC, 1A power supply for the 699-10 and 699-5.5 borescope | | PT99558 | 72643 |

# M1 oil

## M1® Industrial Quality All-Purpose Lubricant

M1 is the "modern one" – the superior alternative. It dries and will not attract dirt, dust or other contaminants as other leading lubricants do.

Starrett is a leader in precision measuring tools. We use M1 in our manufacturing areas and it works. M1 will work for you too. The best lubricant value for your money.

- M1 produces a micro-thin, airtight coating/film that simultaneously dries as it protects, avoiding dirt, grime, etc., that other "wet" lubricants actually attract
- The can will spray upside down in awkward places without losing propellant power




M1 Aerosol Cans spray upside down and in awkward places. Spray wand (shown) is included with each aerosol can.




12 oz. Aerosol Can

1 pt. Spray bottle sold empty for refilling from bulk container

**Penetrates:** Deep-down penetration works quickly to free frozen nuts, bolts, and metal parts. Actually gets under caked-on dirt to clean the metal for removal.

**Prevents Rust:** Protects metal against rust and corrosion damage by providing a molecular shield that locks to the metal.

**Cleans:** Actually removes grease, tar, and grime from metal parts and painted surfaces. Cleans and polishes for lasting protection.

**Stops Squeaks:** Has instant lubrication properties that spread into those hard-to-reach metal parts to stop squeaking and sticking.

**Displaces Moisture:** M1 is not soluble in water, so it gets under moisture to lift it away from the surface to be protected.

**Nonconductive:** Prevents short circuits in high moisture environments, halts electrical leakage from wet ignition wires.

## Industrial Applications

Applications for industry are endless. Protect working surfaces of machinery, use in dip tanks to protect production parts in process, or apply on tools when stored. M1 is also ideal in highly corrosive situations that destroy metal equipment like rollers, racks, conveyors, etc. used in marine environments.

## Universal Applications

Use to dry wet automotive ignition systems. Great on ski bindings and prevents snow from sticking to shovels. Ideal on sticky drawer slides and window frames. Removes tar from car bumpers and painted surfaces. Can also be easily removed to prepare surfaces for painting. Use on tools, hinges, appliances, guns, knives, bicycles, mowers, fishing gear, locks, and more.

## Bulk Containers

Larger size containers of M1 make economical sense. You can also use and refill the handy spray dispenser bottle that saves you money and prevents the unwanted waste and disposal of empty cans.

| M1 All-Purpose Lubricant | | |
|---|---|---|
| **Description** | **Cat. No.** | **EDP** |
| Case of 12/12 oz. (0.3 liter) Aerosol Cans | M1.95173 | 95173 |
| **Bulk Containers** | | |
| 4/1 Gal. (3.8 liter) Containers | M-1.01 | 93221 |
| 5 Gal. (19 liters) | M-1.05 | 93227 |
| 53 Gal. (200 liters) Drum | M-1.53 | 93233 |
| **Spray Dispenser** | | |
| Case of 4/1 Pint (0.5 liter) Empty Spray Bottles | M-1.15 | 93251 |




M1 is available in bulk for industrial applications in 1 Gallon Cans, 5 Gallon Pails, and 53 Gallon Drums.




1 Gallon (3.8 liters)




5 Gallon (19 liters)




53 Gallon Drum (200 liters)

| Specifications | |
|---|---|
| **Color** | Amber (clear) |
| **Odor** | Pleasant |
| **Specific Gravity** | .80 @ 60º F (15.5º C) |
| **Viscosity** | 2.2 cSt (centiStokes) converts to 10.5 SUS (seconds universal Saybolt) at 72º F (22.2º C) |
| **Lubrication** | 1500 lb (680.4 kg) of pressure (independent testing) |
| **Flash Point** | 174 °F (79 °C) T.C.C. |
| **VOC (wt%) CARB Method 310** | 9.2 |
| **Pour Point** | -100º F (-73º C) excellent low temperature stability |
| **Evaporation Rate** | .7 (water = 1) |
| **Coverage** | 3500 to 4000 sq. ft. (72-82 sq. meters) per U.S. Gal. (4.5 liters) |
| **Boiling Point, Initial** | 370 - 470º F (187.8 - 243.3º C) |
| **Weight, Applied Coating** | 1.7 x 10-3 lb per sq. ft. |
| **Film Thickness** | .0004" (0.010mm) average |
| **Dielectric Strength** | 18,000v with .100" (2.54mm) gap |
| **Humidity** | Meets and exceeds ASTM-D655 zero rust after 1000 hours |
| **Salt Spray** | Meets and exceeds ASTM-B117 zero rust after 48 hours<br>Indoor protection lasts up to a year.<br>Outdoor protection – reapply as needed. |
| **NSF registered 124332 Category Code H2** | Acceptable as a lubricant, release agent or anti-rust film on equipment and machinery parts in and around food processing areas where there is no possibility of direct food contact |



Kit includes tachometer, RCA, contact tips, 10cm linear contact wheel 5 feet of T-5 reflective tape, (2) "AA" batteries, and latching carrying case

# Digital Tachometer

## S7793Z Contact and Non-Contact Digital Tachometer

This Pocket Laser Tachometer (S7793Z) is a digital, battery-powered portable optical tachometer that can operate up to 25 feet from a reflective target using a laser light source. Its ergonomic design allows safe, direct line-of-sight viewing of both target and display at the same time, with a non-slip rubber surface for single hand operation.

### Multi-Function

This powerful 32 function Tachometer/Ratemeter, Totalizer/Counter and Timer (stopwatch) is programmable in both inch and metric rates. It has TTL compatible pulse output to trigger devices such as data collectors or stroboscopes.

The kit is supplied with a remote contact assembly including concave and convex tips, a 10cm linear speed wheel, and rugged carrying case.

### Features

- Operating range up to 25 feet* (Class 3R visible laser)
- Accepts remote contact assembly
- Accepts remote sensors (optional)
- TTL pulse output
- Auto ranging/fixed decimal (user selectable)
- English and metric rates
- Tripod mounting bushing
- On-target and low battery indicators
- Rugged rubberized housing
- NIST traceable certificate of calibration included

| 7793 Contact and Non-Contact Digital Tachometer | | |
|---|---|---|
| **Description** | **Cat. No.** | **EDP** |
| Tachometer, RCA, contact tips, 10cm linear contact wheel 5' of T-5 reflective tape, (2) "AA" batteries, latching carrying case | S7793Z | 68930 |

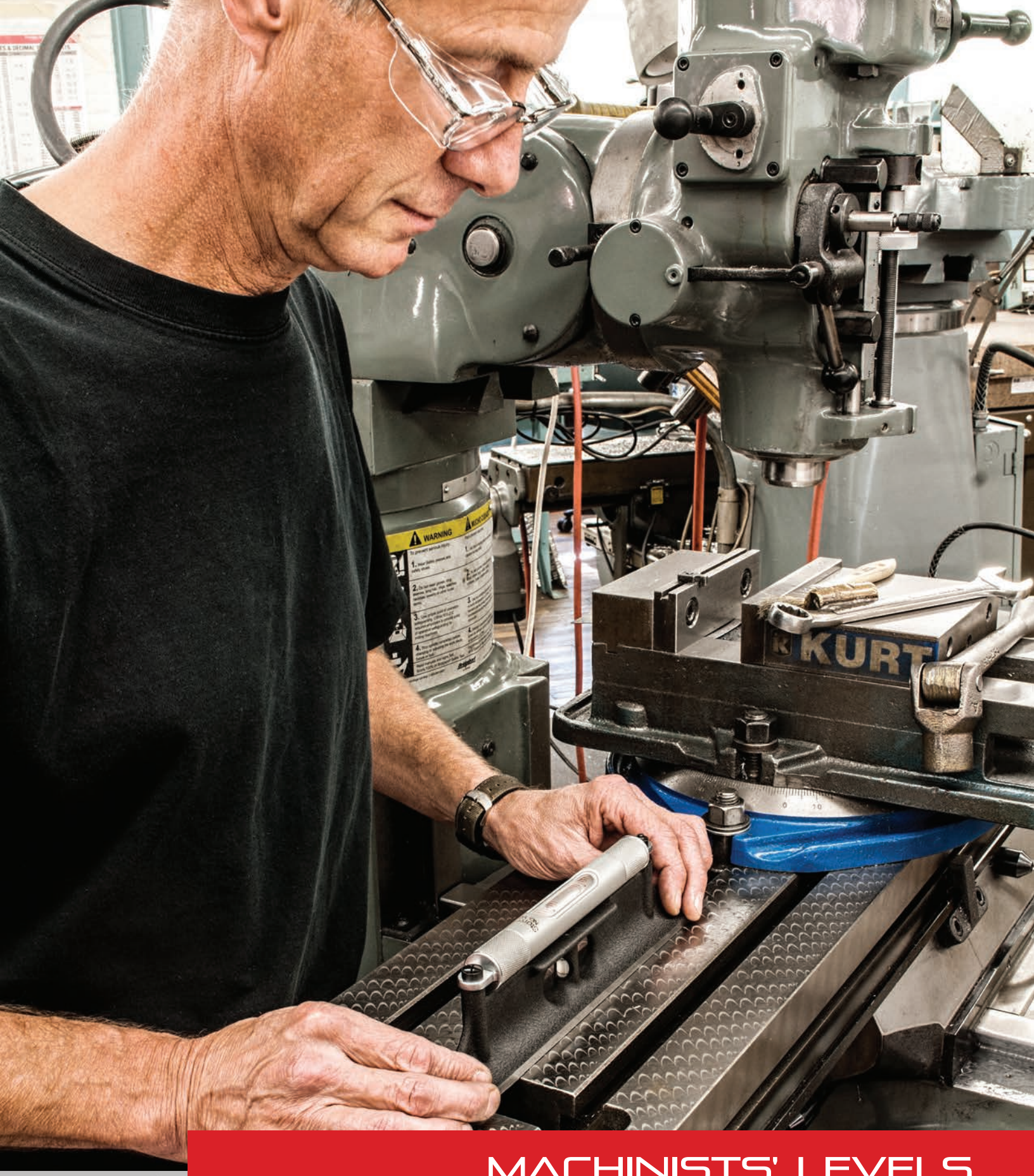
| Specifications | |
|---|---|
| **Display:** | 5 Alpha-Numeric LCD |
| **Ranges** | |
| Optical* | 5-200,000 RPM |
| Contact** | 0.5-20,000 RPM |
| **Rates 10cm Circumference Contact Wheel** | |
| Inches/Min | 1.969-78,740 |
| Feet/Min | 0.164-6,561.7 |
| Yards/Min | 0.055-2,187.2 |
| Centimeters/Min | 5.000-200,000 |
| Meters/Min | 0.050-2,000 |
| **Totalizer** | 1-200,000 |
| **Accuracy** | |
| Optical: | ±0.01% of reading |
| Contact: | ±0.05% of reading (rpm) |
| **Resolution** | 0.001-10 RPM |
| **Operating range:** | 2 Inches to 25 feet, ±70º |
| **Memory:** | Maximum, Minimum, and Last |
| **Power** | (2) "AA" 1.5 VDC Batteries (30 Hours) |
| **Environmental:** | 5º - 40ºC (0º - 100ºF) 80% RH up to 31ºC (88ºF) |
| **Size (H x W x D)** | 6.92 x 2.4 x 1.6" (176 x 61 x 41mm) |
| **Weight** | 7 oz. (210g) |

* Performance subject to intensity of ambient light irradiation

** Also reads units per second and per hour




The S7793Z Pocket Laser Tachometer can operate with the remote contact assembly (left) or up to 25 feet from a reflective target (right)




# MACHINISTS' LEVELS

## Level Use

To get a correct reading with a level, both ends of the bubble should be viewed. If the gaps between the ends of the bubble and the lines are unequal at any time, then they should be averaged out. The reason for this is temperature, which affects the size of the bubble. As a level is warmed the liquid expands, thereby reducing the size of the bubble so that at true-level there will be gaps at both ends between the bubble and the reading lines. Conversely, if the temperature is very cold, the bubble could expand and overlap the reading lines.

Excessive hand heat on the center of the level for an extended period of time could expand the center, causing the working surface to become slightly convex and also create a tendency to spin on flat surfaces. This is more noticeable on very precise levels.

Any level can be checked for accuracy on any flat surface regardless of whether it is level or not. Simply put the level on the surface and note the position of the bubble. Then reverse the level in the same spot. If the level is true, the bubble will be in the same relative position both ways.

Some models, like our 98 machinist levels with an adjustable system, have an adjustment that can be made on the job.

## Level Vial Information

The accuracy of a level is dependent on the proper machining of the working surface, the straightness, and rigidity of the construction and the sensitivity of the level vial. Accuracies are very often specified in parts of degrees such as 10-second accuracy or 43-minute accuracy. Technically, we are referring to the sensitivity of the level vial, but many interchange these terms. Since this means little to most people, we use the more practical definition of inches per foot of elevation. For instance, a 10-second vial accuracy means if the level is on an incline that is .0005" per foot, then the bubble on the vial will move .100" (slightly less than 1/8").

There are three general types of level vials. Ground vials are generally used in precision levels; bent glass and plastic vials are used in most other levels.

Most level vials have just two lines spanning the length of the bubble because most users just want to know if something is level or not.

The more precise levels have vials with a number of reading lines on each side of the bubble. All Inch reading vial graduations are .100" apart. This will show the machinist in a very precise manner how level the equipment is.

Metric reading levels have vial graduations 2mm apart and accuracies are usually described as millimeters per meter. This is an easy conversion to make, so we converted our Inch specifications to an understandable metric reading. Machinists only need to know how far they are out of level if the bubble moves to the next line.

### 199, 98 and 132 Precision Machinists' Levels

These are the finest levels available, used for precision work that is typically required in the industry. They all have these features:

- All level bases are made from the finest quality seasoned cast iron and are precision-machined on the reference surface
- Non-machined surfaces have an attractive, black wrinkle finish
- All models except the 199 have an involute longitudinal groove between the bearing flats for accurate seating on round work. This groove has a special involute design, permitting better centering and greater capacity to handle larger rounds
- Groove and bearing flats are machined together for maximum accuracy

# Master Precision Levels

## 199 Master Precision Level

### 15"/380MM

The efficiency of modern, high speed machinery depends to a large degree upon the levelness of the machine set-up.

- Specially designed to set up, check and test machinery of all types
- At-a-glance reading of the exact variation of machinery levelness
- Ground and graduated main vial of 10-second accuracy; one division equals 1/2 thousandth of an inch (0.0005") per foot, or 0.04mm per meter
- Main vials have seven graduations on each side of the bubble
- Auxiliary level vial shows lateral position and assists in horizontal setting
- Level vials are positioned so breakage is reduced to a minimum
- Special alloy iron used to obtain freedom from thermal effects
- Seasoned, machined castings
- Scraped reference surface
- Nonconductive top plate and black wrinkle finish on nonmachined surfaces
- Finished wood case




Builders' and Contractors' Levels can be found in our Jobsite and Workshop Tools Catalog

| 199 Master Precision Level | | | | | | | |
|---|---|---|---|---|---|---|---|
| Length Base | | Width Base | | Height Level | | | |
| Inch | mm | Inch | mm | Inch | mm | Cat. No. | EDP |
| 15 | 380 | 1-5/8 | 40 | 3 | 75 | 199Z<br>199Z W/SLC* | 50719<br>66932 |

* Includes redemption card for Standard Letter of Certification (SLC).



# MACHINISTS' LEVELS

## 98 MACHINISTS' LEVELS WITH GROUND AND GRADUATED VIALS

**4-18"/100-450MM**

These levels have ground and graduated main vials. All sizes have a cross test vial except the 4" (100mm) model.

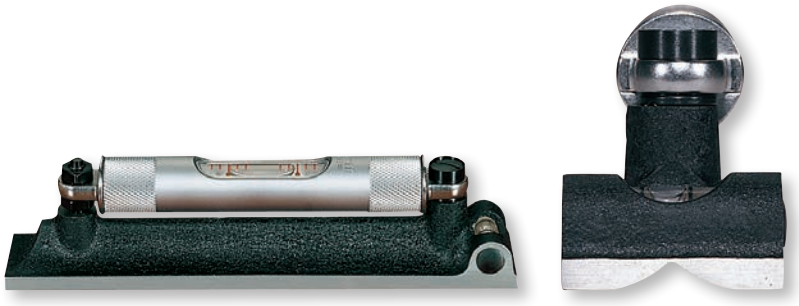
The 12" (300mm) model also has a plumb vial and the 18" (450mm) size has a double plumb vial.

These vials are adjustable to a positive setting and are housed in a satin chrome finished brass tube with a friction-fit closing cover to prevent breakage.

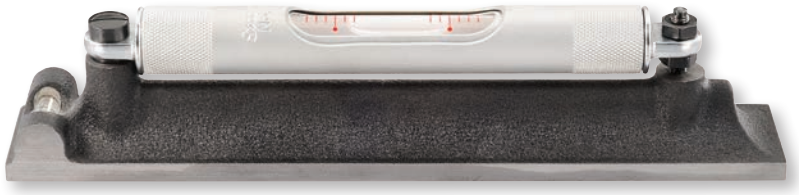
The base of the levels features an involute groove running the length of the base, which provides a reliable seat for round work such as pipes or shafting.

With the cross test vial, it is possible to simultaneously level in both directions. This prevents inaccuracies in the main vial reading caused by canting the level sidewise on round work.

The 6" through 18" (150-450mm) main level vials have graduations that are approximately 80-90 seconds or .005" per foot (0.42mm per meter). There are five, six, or seven lines on each side of the bubble, depending on the base length.



End view showing involute groove





| 98 Machinists' Levels with Ground and Graduated Vials | | | | | | | Tube and Plug Assemblies | |
|---|---|---|---|---|---|---|---|---|
| Size | | | Without Case | | In Finished Wood Case | | | |
| Inch | mm | Description | Cat. No. | EDP | Cat. No. | EDP | Part No. | EDP |
| 4 | 100 | Without Cross Test Vial | 98-4 | 50440 | | | | |
| 6 | 150 | With Cross Test Vial | 98-6 | 50441 | | | PT99430 | 64497 |
| | | With Cross Test Vial, Standard Letter of Certification* | 98-6 W/SLC | 66935 | | | | |
| 8 | 200 | With Cross Test Vial | 98-8 | 50442 | | | PT99431 | 64498 |
| 12 | 300 | With Single Plumb Vial and Cross Test Vial | 98-12 | 50443 | 98Z-12 | 50444 | PT99432 | 64499 |
| | | With Single Plumb Vial and Cross Test Vial Standard Letter of Certification* | 98-12 W/SLC | 66934 | 98Z-12 W/SLC | 66933 | | |
| 18 | 450 | With Double Plumb Vial and Cross Test Vial | 98-18 | 50445 | 98Z-18 | 50446 | | |

To guarantee extreme accuracy, the length of your level should not be longer than the work you are leveling.

* Includes redemption card for Standard Letter of Certification (SLC)

# Precision Bench Levels

## 132 Precision Bench Levels with Double Plumbs

### 6-24"/150-600MM

These are moderately priced levels designed for the all-around use of machinists, maintenance and set-up mechanics and carpenters. They are available in a wide range of sizes to suit every requirement.

- The attractive filigree design of these levels provides a lighter weight, and the curved design evenly dissipates excess heat
- The base of the levels has an involute groove running the full length, which provides a reliable seat for round work
- All sizes have a main vial and double plumb vials. Each vial has two graduated lines
- The main vials have approximately 19-minute sensitivity, meaning if the bubble moves 1/8" off the graduated lines, the out-of-level is approximately .080" per foot. If the bubble is off 2mm, then the out-of-level is approximately 4.4mm per meter.



End view showing involute groove

| 132 Precision Bench Levels | | | | |
|---|---|---|---|---|
| Size | | | | |
| Inch | mm | Description | Cat. No. | EDP |
| 6 | 150 | With Main Vial and Double Plumb Vial | 132-6 | 50562 |
| 9 | 225 | | 132-9 | 50563 |
| 12 | 300 | | 132-12 | 50564 |
| 24 | 600 | | 132-24 | 50566 |

To guarantee extreme accuracy, the length of your level should not be longer than the work you are leveling.



132-12

# Cross Test Levels

## 134 Cross Test Level and Plumb

### 2 X 3"/50 X 75MM

This is an especially useful little level, invaluable for plumbing, approximate squaring and leveling work. Made from brass with nickel finish, all working surfaces are flat and true. The level has two vials at right angles for cross test leveling without moving the tool and a plumb level at the top. An accurate, well-made and reliable tool, it is also very light and compact and can be easily carried in the pocket.

**134 Cross Test Level**

| Size | | | | |
|---|---|---|---|---|
| Inch | mm | Description | Cat. No. | EDP |
| 2 x 3 | 50 x 75 | With Cross Test Vials and Plumb Vial | 134 | 50569 |




## 136 Cross Test Level

### 2-3/4 X 2-3/4"/70 X 70MM

Similar to our 134 level, the 136 has two vials at right angles which permit leveling in both directions without moving the level from the work. The level is light and compact, with an attractive black wrinkle finish and a ground reference surface. Made from cast iron.

**136 Cross Test Levelww**

| Size | | | | |
|---|---|---|---|---|
| Inch | mm | Description | Cat. No. | EDP |
| 2-3/4 x 2-3/4 | 70 x 70 | With Cross Test Vials | 136 | 50572 |





# MACHINISTS' LEVELS

## 130 BENCH LEVEL

### 3-3/8"/85MM

This is a very handy, compact bench level with a sensitive and accurate single vial. The body is made of seasoned cast iron with black wrinkle finish and an accurately machined base leveling surface.



| 130 Bench Level | | | | |
|---|---|---|---|---|
| Size | | | | |
| Inch | mm | Description | Cat. No. | EDP |
| 3-3/8 | 85 | With Main Vial | 130 | 50560 |

## 135 POCKET LEVELS WITH SATIN NICKEL-PLATED FINISH

### 2-1/2 AND 3-1/2"/63 AND 88MM

Another extremely useful Starrett level that fits handily in the pocket with no sharp edges. Made from hexagonal stock with convex ends and satin nickel-plated finish.



| 135 Pocket Levels with Satin Nickel-Plated Finish | | | | |
|---|---|---|---|---|
| Size | | | | |
| Inch | mm | Description | Cat. No. | EDP |
| 2-1/2 | 63 | With Main Vial | 135A | 50570 |
| 3-1/2 | 88 | | 135B | 50571 |




# STARRETT-WEBBER GAGE BLOCKS

# Precision Gage Blocks, Standard Reference Bars

## Gage Blocks – Major Product Characteristics

Precision gage blocks are the primary standards vital to dimensional quality control in the manufacture of parts. The four major characteristics that are necessary for a precision gage block are accuracy, surface finish, wear resistance and dimensional stability. Other factors are corrosion resistance, hardness, thermal conductivity and coefficient of expansion.

The base material used for gage blocks is crucial in meeting the above criteria. While many materials have been tried, the major types available today are:

- **Traditional high-grade steel** gage blocks, which are generally used in shop floor environments
- **Tungsten Carbide** gage blocks, which have the advantage of being harder and longer wearing than steel (Not available from Starrett-Webber)
- **Ceramic** gage blocks will outwear regular steel and will not corrode
- **Chromium Carbide** gage blocks are considered the top of the line; the finest available. They outwear regular steel and ceramic. In addition, they will not corrode, are very stable and accurate, and have exceptional "wringing" qualities.

**croblox® Chromium Carbide** is the superior gage block material. The reason that our Webber Gage Division emphasizes gage blocks made from Chromium Carbide is because they are the most stable measuring devices ever developed.

No one in the world except Starrett-Webber has produced the accuracy and stability of our croblox Grand Masters. They were produced in 1955 of Chromium Carbide material to an accuracy within one millionth of an inch (.0000254mm) and have been checked periodically by the U.S. National Bureau of Standards and the U.S. National Institute of Standards and Technology (NIST) and have remained stable over this period.



## Other Characteristics

### Accuracy

All Starrett-Webber gage blocks meet or exceed all known specifications. The flatness, parallelism and surface finish necessary to achieve the required accuracies are the same as or better than government requirements.

### Stability

Starrett-Webber gage blocks do not change in size except through normal wear. Gage block stability is a characteristic that our Webber Gage Division has mastered with over eighty years of experience. Our gage blocks withstand the test of time.

### Hardness

Steel blocks have a Rockwell "C" hardness of approximately 64-65. Chromium Carbide blocks have a Rockwell "C" hardness of 71-73, with an unusually fine, hard grain structure, giving them exceptional resistance to wear and abrasion.

### Thermal Conductivity and Coefficient of Expansion

These are not important considerations when measurements are taken in temperature-controlled environments. This is primarily done when measuring to microinches or microns.

On the shop floor, where precision measurements are rarely finer than .0002" or 0.005mm, the coefficient of expansion of steel, chromium carbide and ceramic is so close as to be negligible.

Thermal conductivity is important on the shop floor. However, because it takes time for a gage block to move to the same temperature as the workpiece, we recommend setting the gage block on a heat sink such as a large mass of metal that is at the shop environment temperature.

# How To Order Starrett Precision Gage Blocks

## Gage Block Sets

1. Order by catalog number.
2. Please specify if you require a Commercial Calibration or Master Calibration. See the catalog page regarding our Accredited Gage Block Calibration Service near the end of this section. A certificate of calibration provides individual readings on each block and provides traceability to NIST. Webber gage block calibrations are NVLAP® accredited by NIST. (We require the end user's name and address to place on the certificate.)
3. Specify if you require special etched serial numbers. We can provide numbers up to a 6-digit maximum. (Our standard practice is to put the same etch number on each block in a set. Blocks are differentiated by their marked size.) If an etched serial number is not specified, we will assign a number that is a coded date.

The buyer of Webber products listed in this catalog agrees to the 100% Relaxed Acceptance Rule contained in ASME B89.7.3.1 (Guidelines for Decision Rules: Considering Measurement Uncertainty in Determining Conformance to Specifications). Products may not be rejected by the purchaser unless his measurements exceed the published tolerances by more than his uncertainty of measurement.

NVLAP® accreditation does not constitute an endorsement of any product by NVLAP® or any agency of the U.S. government.

NVLAP®

### NVLAP LAB CODE 200038-0

National Institute of Standards and Technology
National Voluntary Laboratory Accreditation Program

### Starrett-Webber Gage Division

24500 Detroit Road
Cleveland, OH 44145
Phone: 440-835-0001
Fax: 440-892-9555
E-mail: sales@starrett-webber.com
**DIMENSIONAL NVLAP Code:** 20/D03 Gage Blocks

## Individual Gage Blocks

1. **Specify Shape**, signified by the following symbols:
   - **Rectangular**
   - **Square**
   - **Heavy Duty**
2. **Specify Material** (croblox®, steel, or ceramic)
3. **Specify Unit of Measure** (inch or metric)
4. **Specify the Size**
5. **Specify Special Lengths**, if applicable (Rectangular Only)
   - Thin block sets (28 pc. inch and 17 pc. metric) are all 1.115" (28.3mm) long. Specify "SS" length.
   - .050", .100", and .150" blocks in inch 81-92 pc. sets are 1.380" long. Specify the Long length, "L".
   - .100" blocks contained in the 36, 38, and 43 pc. sets are 1.380" long. Specify the Long length, "L".
6. **Specify Accuracy Grade** (see next page)
7. **Specify if you require a Commercial, Master or Laboratory Calibration*.** See the catalog page regarding our Accredited Gage Block Calibration Service near the end of this section. A certificate of calibration provides individual readings on each block and provides traceability to NIST. Webber gage block calibrations are NVLAP® accredited by NIST. (We require the end user's name and address to place on the certificate.)

   * Commercial calibrations are included in the price of gage blocks. Master calibrations are done at extra cost. Laboratory calibrations are done at extra cost and are restricted to Webber croblox® rectangular style gage blocks of grades LM, AA, GGG grades 0.5 and 1, and B89 Grades 00 and K.
8. **Specify if you require special etched serial numbers.** We can provide up to a 6-digit maximum. If an etched serial number is not specified, we will assign a number that is a coded date.

# Gage Block Tolerances

## Gage Block Tolerances: B89.1.9

| | Inch System: Tolerances expressed in microinches (.000001") 1 millionth of an inch | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|
| | Order Webber Grade LM | | | Order Webber Grade AA B89.1.9 Grade 00 | | | Order Webber Grade A1 B89.1.9 Grade 0 | | |
| | Size Tolerance | Variation in Length Tolerance | Flatness Tolerance | Size Tolerance | Variation in Length Tolerance | Flatness Tolerance | Size Tolerance | Variation in Length Tolerance | Flatness Tolerance |
| Thru .050" | +1.2/-1.2 | 1.2 | 1.2 | +4/-4 | 2 | 2 | +6/-6 | 4 | 4 |
| Thru .400" | +1.2/-1.2 | 1.2 | 1.2 | +3/-3 | 2 | 2 | +5/-5 | 4 | 4 |
| Thru 1" | +1.2/-1.2 | 1.2 | 1.2 | +3/-3 | 2 | 2 | +6/-6 | 4 | 4 |
| Thru 2" | +2.0/-2.0 | 1.2 | 1.2 | +4/-4 | 2 | 2 | +8/-8 | 4 | 4 |
| Thru 3" | +3.0/-3.0 | 1.2 | 1.2 | +5/-5 | 3 | Rect.: 2, Sq.: 3 | +10/-10 | 4 | 4 |
| Thru 4" | +4.0/-4.0 | 1.2 | 1.2 | +6/-6 | 3 | Rect.: 2, Sq.: 3 | +12/-12 | 5 | 4 |
| Thru 5" | | | | +8/-8 | 3 | Rect.: 2, Sq.: 3 | +16/-16 | 5 | 4 |
| Thru 6" | | | | +8/-8 | 3 | Rect.: 2, Sq.: 3 | +16/-16 | 5 | 4 |
| Thru 7" | | | | +10/-10 | 4 | 4 | +20/-20 | 6 | 6 |
| Thru 8" | | | | +10/-10 | 4 | 4 | +20/-20 | 6 | 6 |
| Thru 10" | | | | +12/-12 | 4 | 4 | +24/-24 | 6 | 6 |
| Thru 12" | | | | +14/-14 | 4 | 4 | +28/-28 | 7 | 6 |
| Thru 16" | | | | +18/-18 | 5 | 4 | +36/-36 | 8 | 6 |
| Thru 28" | | | | +20/-20 | 6 | 4 | +44/-44 | 10 | 6 |

| | Not Available from Webber B89.1.9 Grade AS1 | | | Not Available from Webber B89.1.9 Grade AS2 | | |
|---|---|---|---|---|---|---|
| | Size Tolerance | Variation in Length Tolerance | Flatness Tolerance | Size Tolerance | Variation in Length Tolerance | Flatness Tolerance |
| Thru .050" | +12/-12 | 6 | 6 | +24/-24 | 12 | 10 |
| Thru .400" | +8/-8 | 6 | 6 | +18/-18 | 12 | 10 |
| Thru 1" | +12/-12 | 6 | 6 | +24/-24 | 12 | 10 |
| Thru 2" | +16/-16 | 6 | 6 | +32/-32 | 12 | 10 |
| Thru 3" | +20/-20 | 6 | 6 | +40/-40 | 14 | 10 |
| Thru 4" | +24/-24 | 8 | 6 | +48/-48 | 14 | 10 |
| Thru 5" | +32/-32 | 8 | 6 | +64/-64 | 16 | 10 |
| Thru 6" | +32/-32 | 8 | 6 | +64/-64 | 16 | 10 |
| Thru 7" | +40/-40 | 10 | 7 | +80/-80 | 16 | 10 |
| Thru 8" | +40/-40 | 10 | 7 | +80/-80 | 16 | 10 |
| Thru 10" | +48/-48 | 10 | 7 | +104/-104 | 18 | 10 |
| Thru 12" | +56/-56 | 10 | 7 | +112/-112 | 20 | 10 |
| Thru 16" | +72/-72 | 12 | 7 | +144/-144 | 20 | 10 |
| Thru 20" | +88/-88 | 14 | 7 | +176/-176 | 24 | 10 |

B89.1.9 Grade 00 exceeds DIN, ISO, BS Grades K

**Material Coefficients of Thermal Expansion are:**
**Chromium Carbide** 4.7 x 10-6 inch/ºF per inch
**SAE 52100 Steel** 6.4 x 10-6 inch/ºF per inch
**Ceramic** 5.5 x 10-6 inch/ºF per inch

| Suggested Replacement Grades for GGG-G-15C | | |
|---|---|---|
| GGG-G-15C Grade | Webber Grade | B89.1.9 Grade |
| 0.5 | LM | — |
| 1 | AA | 00 |
| 2 | A1 | 0 |
| 3 | A | AS1 |

The above replacement grades are suggested in B89.1.9. However, the tolerances specified in GGG-G-15C and B89.1.9 are not exactly the same. Gage blocks meeting B89.1.9 specifications may not meet GGG-G-15C requirements and vice versa.

| | Metric System: Tolerances expressed in micrometers (0.001mm) | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|
| | Order Webber Grade LM | | | Order Webber Grade AA B89.1.9 Grade 00 | | | Order Webber Grade A1 B89.1.9 Grade 0 | | |
| | Size Tolerance | Variation in Length Tolerance | Flatness Tolerance | Size Tolerance | Variation in Length Tolerance | Flatness Tolerance | Size Tolerance | Variation in Length Tolerance | Flatness Tolerance |
| Thru 0.5mm | +.03/-.03 | .03 | .03 | +.10/-.10 | .05 | .05 | +.14/-.14 | .10 | .10 |
| Thru 10mm | +.03/-.03 | .03 | .03 | +.07/-.07 | .05 | .05 | +.12/-.12 | .10 | .10 |
| Thru 25mm | +.04/-.04 | .03 | .03 | +.07/-.07 | .05 | .05 | +.14/-.14 | .10 | .10 |
| Thru 50mm | +.05/-.05 | .03 | .03 | +.10/-.10 | .06 | .05 | +.20/-.20 | .10 | .10 |
| Thru 75mm | +.08/-.08 | .03 | .03 | +.12/-.12 | .07 | Rect (.05), Sq. (.07) | +.25/-.25 | .12 | .10 |
| Thru 100mm | +.10/-.10 | .03 | .03 | +.15/-.15 | .07 | Rect (.05), Sq. (.07) | +.30/-.30 | .12 | .10 |
| Thru 125mm | | | | +.20/-.20 | .08 | Rect (.05), Sq. (.07) | +.40/-.40 | .14 | .10 |
| Thru 150mm | | | | +.20/-.20 | .08 | Rect (.05), Sq. (.07) | +.40/-.40 | .14 | .10 |
| Thru 175mm | | | | +.25/-.25 | .09 | .10 | +.50/-.50 | .16 | .15 |
| Thru 200mm | | | | +.25/-.25 | .09 | .10 | +.50/-.50 | .16 | .15 |
| Thru 250mm | | | | +.30/-.30 | .10 | .10 | +.60/-.60 | .16 | .15 |
| Thru 300mm | | | | +.35/-.35 | .10 | .10 | +.70/-.70 | .18 | .15 |
| Thru 400mm | | | | +.45/-.45 | .12 | .10 | +.90/-.90 | .20 | .15 |
| Thru 500mm | | | | +.50/-.50 | .14 | .10 | +1.1/-1.1 | .25 | .15 |

| | Not Available from Webber B89.1.9 Grade AS1 | | | Not Available from Webber B89.1.9 Grade AS2 | | |
|---|---|---|---|---|---|---|
| | Size Tolerance | Variation in Length Tolerance | Flatness Tolerance | Size Tolerance | Variation in Length Tolerance | Flatness Tolerance |
| Thru 0.5mm | +.30/-.30 | .16 | .15 | +.60/-.60 | .30 | .25 |
| Thru 10mm | +.20/-.20 | .16 | .15 | +.45/-.45 | .30 | .25 |
| Thru 25mm | +.30/-.30 | .16 | .15 | +.60/-.60 | .30 | .25 |
| Thru 50mm | +.40/-.40 | .18 | .15 | +.80/-.80 | .30 | .25 |
| Thru 75mm | +.50/-.50 | .18 | .15 | +1.0/-1.0 | .35 | .25 |
| Thru 100mm | +.60/-.60 | .20 | .15 | +1.2/-1.2 | .35 | .25 |
| Thru 125mm | +.80/-.80 | .20 | .15 | +1.6/-1.6 | .40 | .25 |
| Thru 150mm | +.80/-.80 | .20 | .15 | +1.6/-1.6 | .40 | .25 |
| Thru 175mm | +1.0/-1.0 | .25 | .18 | +2.0/-2.0 | .40 | .25 |
| Thru 200mm | +1.0/-1.0 | .25 | .18 | +2.0/-2.0 | .40 | .25 |
| Thru 250mm | +1.2/-1.2 | .25 | .18 | +2.4/-2.4 | .45 | .25 |
| Thru 300mm | +1.4/-1.4 | .25 | .18 | +2.8/-2.8 | .50 | .25 |
| Thru 400mm | +1.8/-1.8 | .30 | .18 | +3.6/-3.6 | .50 | .25 |
| Thru 500mm | +2.2/-2.2 | .35 | .18 | +4.4/-4.4 | .60 | .25 |

B89.1.9 Grade 00 exceeds DIN, ISO, BS Grades K

**Material Coefficients of Thermal Expansion are:**
**Chromium Carbide** 8.5 x 10-6 m/ºC per m
**SAE 52100 Steel** 11.5 x 10-6 m/ºC per m
**Ceramic** 9.9 x 10-6 m/ºC per m

| Suggested Replacement Grades for GGG-G-15C | | |
|---|---|---|
| GGG-G-15C Grade | Webber Grade | B89.1.9 Grade |
| 0.5 | LM | — |
| 1 | AA | 00 |
| 2 | A1 | 0 |
| 3 | A | AS1 |

The above replacement grades are suggested in B89.1.9. However, the tolerances specified in GGG-G-15C and B89.1.9 are not exactly the same. Gage blocks meeting B89.1.9 specifications may not meet GGG-G-15C requirements and vice versa.





# Gage Block Sets



All sets are furnished in a handsome, rugged wood case for lasting protection

## Rectangular Inch System Gage Block Sets, Individual Blocks and Accessories

INCH

**Rectangular croblox® Gage Block Sets in Case**

| Accuracy Grade* | Measuring Range | Blocks Per Set | Blocks Included In Sets | Cat. No. |
|---|---|---|---|---|
| B89.1.9 0<br>B89.1.9 00<br>Webber LM | .100-12.000 in Steps of .001<br>.200-12.000 in Steps of .0001 | 81 | 9 Blocks .1001 Through .1009 (Steps of .0001)<br>49 Blocks .101 Through .149 (Steps of .001)<br>19 Blocks .050 Through .950 (Steps of .050)<br>4 Blocks 1.000 Through 4.000 (Steps of 1") | RC 81.A1<br>RC 81.AA<br>RC 81.LM** |
| B89.1.9 0<br>B89.1.9 00<br>Webber LM | .100-12.000 in Steps of .001<br>.200-12.000 in Steps of .0001<br>.300-12.000 in Steps of .000025<br>1/16-12.000 in Steps of 1/64 | 88 | Same as in RC 81. Set, Plus<br>3 Blocks .100025, .10005, .100075<br>4 Blocks 1/16, 5/64, 3/32, 7/64 | RC 88.A1<br>RC 88.AA<br>RC 88.LM** |
| B89.1.9 0<br>B89.1.9 00<br>Webber LM | .200-8.000 in Steps of .001<br>.300-8.000 in Steps of .0001 | 34 | 9 Blocks .1001 Through .1009 (Steps of .0001)<br>9 Blocks .101 Through .109 (Steps of .001)<br>9 Blocks .110 Through .190 (Steps of .010)<br>3 Blocks .100 Through .300 (Steps of .100)<br>1 Block .500<br>3 Blocks 1.000, 2.000 and 4.000 | RC 34.A1<br>RC 34.AA<br>RC 34.LM** |
| B89.1.9 0<br>B89.1.9 00 | .020-.240 in Steps of .001<br>.040-.240 in Steps of .0001<br>.060-.240 in Steps of .00005 | 28 | 1 Block .02005<br>9 Blocks .0201 Through .0209 (Steps of .0001)<br>9 Blocks .021 Through .029 (Steps of .001)<br>9 Blocks .010 Through .090 (Steps of .010) | RC 28.A1<br>RC 28.AA |

For gage block accessories, order AC 11.A Accessory Set in Case. Sets include etched serial numbers and Commercial Calibration Certificate. A Master Calibration Certificate is available at extra cost.

* For complete accuracy specifications, see the beginning of this section.

** Available by special order only.

# Gage Block Sets

## Rectangular Inch System Gage Block Sets, Individual Blocks and Accessories

Our Ceramic Gage Blocks, offered in rectangular, inch and metric, fill the gap between steel and the universally accepted croblox®. While not as stable as croblox®, ceramic is an excellent alternative to steel because of its superior hardness, thermal expansion and wear characteristics.

INCH

| Rectangular Ceramic Gage Block Sets in Case | | | | |
|---|---|---|---|---|
| **Accuracy Grade*** | **Measuring Range** | **Blocks Per Set** | **Blocks Included In Sets** | **Cat. No.** |
| B89.1.9 0<br><br>B89.1.9 00 | .100-12.000 in Steps of .001<br>.200-12.000 in Steps of .0001 | 81 | 9 Blocks .1001 Through .1009 (Steps of .0001)<br>49 Blocks .101 Through .149 (Steps of .001)<br>19 Blocks .050 Through .950 (Steps of .050)<br>4 Blocks 1.000 Through 4.000 (Steps of 1") | RY 81.A1<br><br>RY 81.AA |
| B89.1.9 0<br><br>B89.1.9 00 | .100-12.000 in Steps of .001<br>.200-12.000 in Steps of .0001<br>.300-12.000 in Steps of .000025<br>1/16-12.000 in Steps of 1/64 | 88 | Same as in RY 81. Set, Plus<br>3 Blocks .100025, .10005, .100075<br>4 Blocks 1/16, 5/64, 3/32, 7/64 | RY 88.A1<br><br>RY 88.AA |
| B89.1.9 0<br><br>B89.1.9 00 | .200-8.000 in Steps of .001<br>.300-8.000 in Steps of .0001 | 34 | 9 Blocks .1001 Through .1009 (Steps of .0001)<br>9 Blocks .101 Through .109 (Steps of .001)<br>9 Blocks .110 Through .190 (Steps of .010)<br>3 Blocks .100 Through .300 (Steps of .100)<br>1 Block .500 3 Blocks 1.000, 2.000 and 4.000 | RY 34.A1<br><br>RY 34.AA |

Sets include etched serial number and Commercial Calibration Certificate. A Master Calibration Certificate is available at extra cost.

* For complete accuracy specifications, see the beginning of this section.

INCH

| Rectangular Steel Gage Block Sets in Case | | B89.1.9 Accuracy Grade 0* | |
|---|---|---|---|
| **Measuring Range** | **Blocks Per Set** | **Blocks Included In Sets** | **Cat. No.** |
| .100-12.000 in Steps of .001<br>.200-12.000 in Steps of .0001 | 81 | 9 Blocks .1001 Through .1009 (Steps of .0001)<br>49 Blocks .101 Through .149 (Steps of .001)<br>19 Blocks .050 Through .950 (Steps of .050)<br>4 Blocks 1.000 Through 4.000 (Steps of 1") | RS 81.A1 |
| .100-12.000 in Steps of .001<br>.200-12.000 in Steps of .0001<br>.300-12.000 in Steps of .000025<br>1/16-12.000 in Steps of 1/64 | 88 | Same as in RS 81.A1 Set, Plus<br>3 Blocks .100025, .10005, .100075<br>4 Blocks 1/16, 5/64, 3/32, 7/64 | RS 88.A1 |
| .100-12.000 in Steps of .001<br>.200-12.000 in Steps of .0001<br>.300-12.000 in Steps of .000025<br>1/16-12.000 in Steps of 1/64 | 92 | Same as in RS 88.A1 Set, Plus<br>2 Blocks .100" (croblox® Wear Blocks)<br>2 Blocks .050 (croblox® Wear Blocks) | RS 92.A1 |
| .100-4.000 in Steps of .001<br>.150-4.000 in Steps of .0001<br>.200-4.000 in Steps of .00005 | 38 | 2 Blocks .050 (croblox® Wear Blocks)<br>1 Block .05005<br>9 Blocks .0501 Through .0509 (Steps of .0001)<br>9 Blocks .051 Through .059 (Steps of .001)<br>11 Blocks .050 Through .150 (Steps of .010)<br>4 Blocks .200 Through .500 (Steps of .100)<br>2 Blocks 1.000 and 2.000 | RS 38.A1 |
| .200-8.000 in Steps of .001<br>.300-8.000 in Steps of .0001 | 34 | 9 Blocks .1001 Through .1009 (Steps of .0001)<br>9 Blocks .101 Through .109 (Steps of .001)<br>9 Blocks .110 Through .190 (Steps of .010)<br>4 Blocks .100, .200, .300, .500<br>3 Blocks 1.000, 2.000, 4.000 | RS 34.A1 |
| .020-.240 in Steps of .001<br>.040-.240 in Steps of .0001<br>.060-.240 in Steps of .00005 | 28 | 1 Block .02005<br>9 Blocks .0201 Through .0209 (Steps of .0001)<br>9 Blocks .021 Through .029 (Steps of .001)<br>9 Blocks .010 Through .090 (Steps of .010) | RS 28.A1 |
| .0625-4.000 in Steps of .0625<br>.100-4.000 in Steps of .100 | 9 | 1 Block .0625, .100, .125, .200, .250, .300, .500, 1.000, 2.000 | RS 9.A1 |
| **Micrometer Checking Set** | | **B89.1.9 Accuracy Grade AS1*** | |
| | 10 | 10 blocks .105, .210, .315, .420, .500, .605, .710, .815, .920, 1.000 | RS 10.A |

For gage block accessories, order AC 11.A Accessory Set in Case. See rectangular block accessories on the next page. Sets include etched serial numbers and Commercial Calibration Certificate. A Master Calibration Certificate is available at extra cost.

* For complete accuracy specifications, see the beginning of this section.

# Gage Block Sets

## MicroAccurate® B-Grade Rectangular Steel Gage Block Sets in Case

These B-Grade gage block sets are Starrett Global products. Their very affordable price makes them ideal for general shop floor use.

- Etched, unique serial numbers are included on each block. Custom numbers are not available.
- Sets available with a choice of two types of certificates of calibration as described below
- Inch System sets have a tolerance of ±50µin.
- Metric System sets have a tolerance of ±1.25µm.



RS 81.B

INCH AND METRIC

| MicroAccurate Inch System Sets | | | |
|---|---|---|---|
| **Measuring Range** | **Blocks Per Set** | **Blocks Included In Sets** | **Cat. No.** |
| .100-12.000 in Steps of .001<br>.200-12.000 in Steps of .0001 | 81 | 9 Blocks .1001 Through .1009 (Steps of .0001)<br>49 Blocks .101 Through .149 (Steps of .001)<br>19 Blocks .050 Through .950 (Steps of .050)<br>4 Blocks 1.000 Through 4.000 (Steps of 1) | RS 81.B<br>RS 81.W |
| **MicroAccurate Metric System Sets** | | | |
| 3.0 Through 450 in .0005 Steps<br>2.0 Through 450 in .001 Steps<br>1.0 Through 450 in .01 Steps<br>1.0 Through 450 in .1 Steps | 88 | 1 block .5<br>1 block 1.0005<br>9 blocks 1.001 Through 1.009 (Steps of .001)<br>49 blocks 1.01 Through 1.49mm (Steps of .01)<br>18 blocks 1 Through 9.5 (Steps of .5)<br>10 blocks 10 Through 100 (Steps of 10) | RS 88.MB<br>RS 88.MW |
| **MicroAccurate Metric System Sets** | | | |
| 3.0 Through 250 in .0005 Steps<br>2.0 Through 250 in .001 Steps<br>1.0 Through 250 in .01 Steps<br>1.0 Through 250 in .1 Steps | 112 | 1 block .5<br>1 block 1.0005<br>9 blocks 1.001 Through 1.009 (Steps of .001)<br>49 blocks 1.01 Through 1.49 (Steps of .01)<br>48 blocks 1 Through 24.5 (Steps of .5)<br>4 blocks 25 Through 100 (Steps of 25) | RS 112.MB<br>RS 112.MW |

| Specifications | |
|---|---|
| **Cat. No.** | **Features** |
| RS 81.B<br>RS 88.MB<br>RS 112.MB | Calibration performed at Webber Gage in Cleveland, OH. Certificate of Calibration with NVLAP® accreditation. Calibration in accordance with ISO 17025 with dated calibration certificate and NIST traceability number. The name and address of the user may be added to the calibration certificate.<br>**Inch System (RS 81.B)** uncertainty of measurement (k=2): U = 6 + L where L is in inches, but U not less than 7 min.<br>**Metric Systems (RS 88.MB & RS 112.MB)** uncertainty of measurement (k=2): U = 0.15 + .001L where L is in millimeters, but U not less than 0.18 µm. |
| RS 81.W<br>RS 88.MW<br>RS 112.MW | Calibration performed in China in partnership with Webber Gage. Webber Gage samples the measurements to monitor the calibration results. Calibrations are traceable to NIST, but no NIST traceability number or dates will be given. The name and addrress of the user will be left blank on the calibration certificate.<br>**Inch System (RS 81.W)** uncertainty of measurement (k=2): 10 µin.<br>**Metric Systems (RS 88.MW & RS 112.MW)** uncertainty of measurement (k=2): U = 0.25 µm. |

# GAGE BLOCK ACCESSORIES

INCH



| Rectangular croblox® Wear Blocks | |
|---|---|
| **Size** | **Cat. No.** |
| .020 | RC .020 WA1 |
| .050 | RC .050 WA1 |
| .100 | RC .100 WA1 |

| Rectangular Inch System Steel and croblox Accessories Individually or Sets as Stated Below | | | |
|---|---|---|---|
| **Individual Accessories** | | | **Steel Accessories Included** |
| | **Cat. No.** | | |
| **Description** | **Steel** | **croblox®** | **Set AC 11.A** |
| Half-Round Jaw*<br>.250 Radius | RA 1. | | 2 |
| Straight Jaw*<br>.250" Thick | RA 4. | RA 24. | 2** |
| Clamps<br>0" – 1-1/2" Capacity<br>1-1/2" – 4" Capacity<br>4" – 6-1/2" Capacity<br>0" – 12" Capacity | <br>RA 5.<br>RA 6.<br>RA 7.<br>RA 8. | | <br>1<br>1<br>1<br>1 |
| Scriber Point<br>Center Point, 100 C/L<br>Base Block 1" Thick | RA 11.<br>RA 12.<br>RA 13. | | 1<br>1<br>1 |
| Case (CS 9111.) | | | 1 |
| **Additional Accessories** | | | |
| Clamps<br>0-18" Capacity<br>0-24" Capacity<br>0-36" Capacity | <br>RA 9.<br>RA 10.<br>RA 14. | | |
| Half-Round Jaws<br>.200 Radius<br>.100 Radius | <br>RA 2.<br>RA 3. | | |

* croblox jaws available as an option at extra cost. Please specify.

** Jaws are normally used in pairs, but are ordered individually. Please order accordingly.

INCH

| Square croblox® – Inch System Gage Block Sets in Case | | | | |
|---|---|---|---|---|
| **Accuracy Grade*** | **Measuring Range** | **Blocks Per Set** | **Blocks Included In Sets** | **Cat. No.** |
| B89.1.9 0<br><br>B89.1.9 00 | .100-12.000 in Steps of .001<br>.200-12.000 in Steps of .0001 | 81 | 9 Blocks .1001 Through .1009 (Steps of .0001)<br>49 Blocks .101 Through .149 (Steps of .001)<br>19 Blocks .050 Through .950 (Steps of .050)<br>4 Blocks 1.000 Through 4.000 (Steps of 1) | SC 81.A1<br><br>SC 81.AA |
| B89.1.9 0<br><br>B89.1.9 00 | .100-12.000 in Steps of .001<br>.200-12.000 in Steps of .0001<br>.300-12.000 in Steps of .000025<br>1/16-12.000 in Steps of 1/64 | 88 | Same as in SC 81. Set, Plus<br>3 Blocks .100025, .10005, .100075<br>4 Blocks 1/16, 5/64, 3/32, 7/64 | SC 88.A1<br><br>SC 88.AA |
| B89.1.9 0<br><br><br>B89.1.9 00 | .200-8.000 in Steps of .001<br>.300-8.000 in Steps of .0001 | 36 | 1 Block .050<br>9 Blocks .1001 Through .1009 (Steps of .0001)<br>9 Blocks .101 Through .109 (Steps of .001)<br>9 Blocks .110 Through .190 (Steps of .010)<br>5 Blocks .100 Through .500 (Steps of .100)<br>3 Blocks 1.000, 2.000, 4.000 | SC 36.A1<br><br><br>SC 36.AA |

All Square croblox® sets above are available with accessories at extra cost. To order, add "X" to catalog number. Accessories are furnished in steel (see following pages). Sets include etched serial numbers and Commercial Calibration Certificate. A Master Calibration Certificate is available at extra cost.

* For complete accuracy specifications, see the beginning of this section.

# Gage Block Sets

## Inch System Individual Gage Block Sets in Case



INCH

| Square Steel Gage Block Sets in Case | | B89.1.9 Accuracy Grade 0* | |
|---|---|---|---|
| **Measuring Range** | **Blocks Per Set** | **Blocks Included In Sets** | **Cat. No.** |
| .100-12.000 in Steps of .001<br>.200-12.000 in Steps of .0001 | 81 | 9 Blocks .1001 Through .1009 (Steps of .0001)<br>49 Blocks .101 Through .149 (Steps of .001)<br>19 Blocks .050 Through .950 (Steps of .050)<br>4 Blocks 1.000 Through 4.000 (Steps of 1")<br>Above Set also Available with Accessories** (Extra) | SS 81.A1 |
| .100-12.000 in Steps of .001<br>.200-12.000 in Steps of .0001<br>.300-12.000 in Steps of .000025<br>1/16-12.000 in Steps of 1/64 | 88 | Same as in SS 81.A1 Set, Plus<br>3 Blocks .100025, .10005, .100075<br>4 Blocks 1/16, 5/64, 3/32, 7/64<br>Above Set also Available with Accessories** (Extra) | SS 88.A1 |
| .200-8.000 in Steps of .001<br>.300-8.000 in Steps of .0001 | 36 | 1 Block .050<br>9 Blocks .1001 Through .1009 (Steps of .0001)<br>9 Blocks .101 Through .109 (Steps of .001)<br>9 Blocks .110 Through .190 (Steps of .010)<br>5 Blocks .100 Through .500 (Steps of .100)<br>3 Blocks 1.000, 2.000 and 4.000<br>Above Set Also Available with Accessories** (Extra) | SS 36.A1 |
| .020-.240 in Steps of .001<br>.040-.240 in Steps of .0001<br>.060-.240 in Steps of .00005 | 28 | 1 Block .02005<br>9 Blocks .0201 Through .0209 (Steps of .0001)<br>9 Blocks .021 Through .029 (Steps of .001)<br>9 Blocks .010 Through .090 (Steps of .010) | SS 28.A1 |
| 5.000-84 in Steps of 1.000 | 8 | 8 Blocks 5, 6, 7, 8, 10, 12, 16, 20<br>Accessories Included:<br>6 Each SA 8. Studs<br>2 Each SA 9. Flat Head Screws (long)<br>2 Each SA 10. Flat Head Screws (short)<br>1 Each SA 16. 4-1/2 - 6" Tie Rod (adjustable)<br>1 Each SA 17. 6-9" Tie Rod (adjustable)<br>1 Each SA 18. 11-3/4" Tie Rod<br>1 Each SA 19. 15-3/4" Tie Rod<br>2 Each SA 20. 19-3/4" Tie Rods | SS 8.A1X |
| **Square Steel Gage Block Sets in Case** | | **B89.1.9 Accuracy Grade 00*** | |
| 5.000-84 in Steps of 1.000 | 8 | Same as above SS 8.A1X | SS 8.AAX |

* For complete accuracy specifications, see page at the beginning of this section.

** All square steel sets 34 through 88 are available with Accessories at extra cost. To order, add "X" to catalog number. Accessories are steel. See square block Accessories on the next page. Sets include etched serial numbers and Commercial Calibration Certificate. A Master Calibration Certificate is available at extra cost.






# Gage Block Accessories

## SA 707. Steel Internal Measuring Machine Jaws

Jaws are double-ended, self-proving, assuring parallelism and squareness. Designed for use with square style gage blocks. Jaws are made of hardened steel material, 2.000" long, 1.000" wide and .500" thick. Both side edges are lapped 90º square to the gaging faces within 30 seconds of arc and extend beyond the gage blocks in the combination, thus forming a square master.

Jaw and gage combination parallelism is quickly checked merely by turning the combination to the opposite side and rechecking the reading. Furnished in pairs.

| Additional Accessories | |
|---|---|
| **Description** | **Cat. No.** |
| Tie Rods | |
| 11-3/4" Solid | SA 18. |
| 15-3/4" Solid | SA 19. |
| 19-3/4" Solid | SA 20. |

## Square Gage Block Accessories Steel and croblox®

INCH

| Square Steel Accessories Individually or Sets as Stated Below | | | |
|---|---|---|---|
| **Individual Accessories** | | **Steel Accessories Included** | |
| **Description** | **Cat. No.** | **Set SA 25.A and 81 thru 88 Block Sets when Ordered with Accessories** | **34 and 36 Block Sets when Ordered with Accessories** |
| Half-Round Jaw* | | | |
| .125 Radius | SA 1. | 2 | |
| .250 Radius | SA 2. | 2 | 2 |
| Straight Jaw* | | | |
| .500" Thick | SA 3. | 2 | |
| Scriber Point | SA 4. | 1 | 1 |
| Center Point, .100 C/L | SA 5. | 1 | |
| Base Block .500 Thick | SA 6. | 1 | |
| Knurled Screw | SA 7. | 2 | 2 |
| Stud | SA 8. | 2 | 2 |
| Flat Head Screw | | | |
| Long | SA 9. | 2 | 2 |
| Short | SA 10. | 2 | 2 |
| Slotted Nut | SA 11. | 2 | 2 |
| Tie Rods | | | |
| 3/4" Solid | SA 12. | 1 | 1 |
| 1-1/2" Solid | SA 13. | 1 | 1 |
| 2-1/4" Solid | SA 14. | 1 | 1 |
| 3" Solid | SA 15. | 1 | 1 |
| 4-1/2-6" Adjust | SA 16. | 1 | 1 |
| 6-9" Adjust | SA 17. | 1 | |
| Case (CS9168) | | (For SA 25.A Only) | |

*Jaws are normally used in pairs, but are ordered individually. Please order accordingly.

# Gage Blocks

## Individual Rectangular Gage Blocks

INCH

| Specify in this Sequence: Shape, Material, Size and Accuracy Grade | | | |
|---|---|---|---|
| **Shape** | **Material** | **Size** | **Accuracy** |
| R=Rectangular<br>S=Square | S=Steel<br>C=croblox<br>Y=Ceramic | (listed in table) | |

Example: RS .250A1 = Rectangular Steel block, size .250, Grade A1 Accuracy

### HOW TO ORDER

#### Rectangular Block Sizes

- Width: all blocks are .352" wide
- Length: for blocks under .050", length is 1.115"
- For blocks with .050" through .190", length is 1.180"
- For blocks .200" and above, length is 1.380"

#### Exceptions

- 28 block sets with blocks to .090" are all 1.115" long.
  .050, .060, .070, .080, .090" blocks in this set are listed with the suffix "ss".
- .050, .100, .150" blocks contained in the 81–92-piece sets are 1.380" long. Specify "long length".
- .100" blocks contained in the 36, 38, and 43-block sets are 1.380" long. Specify "long length".

| croblox®, Ceramic and Steel Gage Blocks | croblox | | Ceramic | | Steel |
|---|---|---|---|---|---|
| | A1 | AA | A1 | AA | A1 |
| Grade | 0 | 00 | 0 | 00 | 0 |
| .010 | • | • | | | • |
| .01005 | | | | | • |
| .0101 Through .0109 in Steps of .0001 | | | | | • |
| .011 Through .019 in Steps of .001 | | | | | • |
| .020 (Wear Blocks) | • | | | | |
| .020 or .02005 | • | • | | | • |
| .0201 Through .0209 in Steps of .0001 | • | • | | | • |
| .021 Through .029 in Steps of .001 | • | • | | | • |
| .030 | • | • | | | • |
| .040 | • | • | | | • |
| .050 long* | • | • | • | • | • |
| .050 (Wear Blocks) | • | | | | |
| .050S or .050SS | • | • | | | • |
| .05005 | | | | | • |
| .0501 Through .0509 in Steps of .0001 | | | | | • |
| .051 Through .059 in Steps of .001 | | | | | • |
| .060 or .060SS | • | • | | | • |
| .0625 (1/16) | • | • | • | • | • |
| .070 or .070SS | • | • | | | • |
| .078125 (5/64) | • | • | • | • | • |
| .080 or .080SS | • | • | | | • |
| .090 or .090SS | • | • | | | • |
| .09375 (3/32) | • | • | • | • | • |
| .100 long* | • | • | • | • | • |
| .100 (Wear Blocks) | • | | | | |
| .100S | • | • | • | • | • |
| .100025 | • | • | • | • | • |
| .10005 | • | • | • | • | • |
| .100075 | • | • | • | • | • |
| .1001 Through .1009 in Steps of .0001 | • | • | • | • | • |
| .101 Through .109 in Steps of .001 | • | • | • | • | • |
| .109375 (7/64) | • | • | • | • | • |
| .110 Through .119 in Steps of .001 | • | • | • | • | • |
| .120 Through .129 in Steps of .001 | • | • | • | • | • |
| .130 Through .139 in Steps of .001 | • | • | • | • | • |
| .140 Through .149 in Steps of .001 | • | • | • | • | • |
| .150 Long* | • | • | • | • | • |
| .150 | • | • | • | • | • |
| .160 Through .190 in Steps of .010 | • | • | • | • | • |
| .200, .250, .300, .350 | • | • | • | • | • |
| .400, .450, .500, .550, .600 | • | • | • | • | • |
| .650, .700, .750 | • | • | • | • | • |
| .800, .850, .900, .950 | • | • | • | • | • |
| 1.000 | • | • | • | • | • |
| 2.000 | • | • | • | • | • |
| 3.000 | • | • | • | • | • |
| 4.000 | • | • | • | • | • |
| 5.000 | | | | | • |
| 6.000 | | | | | • |

* Order long length for Webber set replacements.

# Gage Blocks

## Individual Square Gage Blocks

INCH

| Specify in this sequence: Shape, Material, Size and Accuracy Grade | | | |
|---|---|---|---|
| **Shape** | **Material** | **Size** | **Accuracy** |
| R=Rectangular<br>S=Square | S=Steel<br>C=croblox | (listed in table) | |

Example: SS .125A1 = Square Steel block, size .125 with a Grade A1 accuracy

### HOW TO ORDER

#### Square Block Size

- All square blocks are .950" x .950"
- Blocks have a .265" hole in the center
- On blocks .200" thick and over, the hole is countersunk on both faces (croblox Wear Blocks are countersunk on one face only)

| croblox® and Steel Gage Blocks | croblox | | Steel | |
|---|---|---|---|---|
| | A1 | AA | A1 | AA |
| Grade | 0 | 00 | 0 | 00 |
| .010 | | | • | |
| .020 | | | • | |
| .02005 | | | • | |
| .0201 Through .0209 in Steps of .0001 | | | • | |
| .021 Through .029 in Steps of .001 | | | • | |
| .030 | | | • | |
| .040 | | | • | |
| .050 | • | • | • | |
| .060 | | | • | |
| .0625 (1/16) | • | • | • | |
| .070 | | | • | |
| .078125 (5/64) | • | • | • | |
| .080 | | | • | |
| .090 | | | • | |
| .09375 (3/32) | • | • | • | |
| .100 | • | • | • | |
| .100 (Wear with Chamfered Hole) | • | | | |
| .100025 | • | • | • | |
| .10005 | • | • | • | |
| .100075 | • | • | • | |
| .1001 Through .1009 in Steps of .0001 | • | • | • | |
| .101 Through .149 in Steps of .001 | • | • | • | |
| .109375 (7/64) | • | • | • | |
| .150 Through .190 in Steps of .010 | • | • | • | |
| .200 | • | • | • | |
| .250 | • | • | • | |
| .300 | • | • | • | |
| .350 | • | • | • | |
| .400, .450, .500, .550 | • | • | • | |
| .600, .650, .700, .750 | • | • | • | |
| .800, .850, .900, .950 | • | • | • | |
| 1.000 | • | • | • | |
| 2.000 | • | • | • | |
| 3.000 | • | • | • | |
| 4.000 | • | • | • | |
| 5.000 | | | • | • |
| 6.000 | | | • | • |
| 7.000 | | | • | • |
| 8.000 | | | • | • |
| 10.000 | | | • | • |
| 12.000 | | | • | • |
| 16.000 | | | • | • |
| 20.000 | | | • | • |

# Gage Blocks

## Heavy-Duty Steel Gage Block Sets and Accessories

### GAGING AREA 17/32 X 1-1/2"

These heavy-duty gage block sets are primarily used for assembling together into exclusive Webber fixtures.

Precision "yardsticks" and height gages can be built up to a required dimension by wringing blocks together and then by the use of eccentric clamps, locking them into place. All blocks over 1" long have 1/4" holes that accept eccentric clamps. All blocks 6" or larger have an insulated center grip to eliminate temperature variations caused by handling.

Precision scribers and dividers for tool layout can be created in a few seconds. The center point is on a .500" center line of a 1" block. The scriber point may be sharpened indefinitely without altering the original accuracy.

Snap gages with inside or outside calipers can be easily assembled using accessories like the eccentric clamps, a quick-acting clamp, and a pair of half-round or straight jaws.



INCH




Snap gage is used to check inside dimensions of ring gage still mounted in internal grinder



Building up blocks into precision "yardsticks"



Precision scribers, dividers and snap gages

# Accessory Sets

## Indicator Accessory Set

This heavy-duty accessory mounts on any build-up of heavy-duty blocks and measures the deviation of the work from nominal or desired size. (Indicator is set and checked for zero by placing blocks on any known flat surface.)

HDA 10 and HDA 12 Indicator Accessory Sets consist of a holding block, extension jaw and a precision Starrett indicator. See catalog description below for indicator ranges and graduations.




Indicator Accessory Set

Eccentric clamps are used for combining long blocks

INCH





Quick-acting clamps are used for combining fractional inch blocks with blocks 1" or longer

| Heavy-Duty Steel Accessories Individually or Sets as stated below | | |
|---|---|---|
| **Individual Accessories** | | **Steel Accessories Included in all** |
| **Description** | **Cat. No.** | **42 thru 46 Piece Sets or 84 Piece Set when ordered with Accessories** |
| Half-Round Jaw* .500 Radius | HDA 1. | 2 |
| Scriber Point | HDA 2. | 1 |
| Center Point .500 C/L | HDA 3. | 1 |
| Eccentric Clamp | HDA 4. | (See set description next page for qty.) |
| Quick-Acting Clamp | HDA 5. | 1 |
| Base Block 1.500" Thick | HDA 6. | 1 |
| **Additional Accessories** | | |
| Straight Jaw* 1.000 Thick | HDA 820. | |
| Indicator Set Consisting of:<br>Indicator Holding Block<br>Extension Jaw (1.000" Thick)<br>Indicator with ±.010" Range, .0005" Graduations<br>Case | HDA 10. | |
| Indicator Set As Above Except:<br>Indicator with ±.0015" Range, .00005" Graduations | HDA 12. | |

* Jaws are normally used in pairs, but are ordered individually. Please order accordingly.

## Wear Blocks

croblox® Wear Blocks in .050" and .100" sizes are available for use with heavy-duty blocks.




| croblox Wear Blocks | |
|---|---|
| **Size** | **Cat. No.** |
| .050" | HDC .050 WA1 |
| .100" | HDC .100 WA1 |

# Gage Block Sets and Accessories

## Heavy-Duty Steel

INCH

| Gage Block Sets and Accessories | | B89.1.9 Accuracy Grade 0* | |
|---|---|---|---|
| **Measuring Range** | **Blocks Per Set** | **Blocks Included In Sets** | **Cat. No.** |
| .100-12.000 in Steps of .001<br>.200-12.000 in Steps of .0001<br>.300-12.000 in Steps of .00005 | 84 | 2 Blocks .100 Wear croblox®<br>1 Block .10005<br>9 Blocks .1001 Through .1009 (Steps of .0001)<br>49 Blocks .101 Through .149 (Steps of .001)<br>19 Blocks .050 Through .950 (Steps of .050)<br>4 Blocks 1.000 Through 4.000 (Steps of 1)<br>3 Eccentric Clamps<br>Above Set Also Available With 2 Additional Eccentric Clamps and Accessories** (Extra) | HD 84.A1 |
| .200-48.000 in Steps of .001<br>.300-48.000 in Steps of .0001 | 46 | 9 Blocks .1001 Through .1009 (Steps of .0001)<br>9 Blocks .101 Through .109 (Steps of .001)<br>9 Blocks .110 Through .190 (Steps of .010)<br>9 Blocks .100 Through .900 (Steps of .100)<br>4 Blocks 1.000 Through 4.000 (Steps of 1)<br>6 Blocks 6.000<br>10 Eccentric Clamps and Accessories** (Included) | HD 46.A1X |
| .200-36.000 in Steps of .001<br>.300-36.000 in Steps of .0001 | 44 | 9 Blocks .1001 Through .1009 (Steps of .0001)<br>9 Blocks .101 Through .109 (Steps of .001)<br>9 Blocks .110 Through .190 (Steps of .010)<br>9 Blocks .100 Through .900 (Steps of .100)<br>4 Blocks 1.000 Through 4.000 (Steps of 1)<br>4 Blocks 6.000<br>8 Eccentric Clamps and Accessories** (Included) | HD 44.A1X |
| .200-24.000 in Steps of .001<br>.300-24.000 in Steps of .0001 | 42 | 9 Blocks .1001 Through .1009 (Steps of .0001)<br>9 Blocks .101 Through .109 (Steps of .001)<br>9 Blocks .110 Through .190 (Steps of .010)<br>9 Blocks .100 Through .900 (Steps of .100)<br>4 Blocks 1.000 Through 4.000 (Steps of 1)<br>2 Blocks 6.000<br>6 Eccentric Clamps and Accessories** (Included) | HD 42.A1X |

Sets include etched serial numbers and Commercial Calibration Certificate. A Master Calibration Certificate is available at extra cost.
Case for HD 84.A1 has space for accessories and six 6.000" heavy-duty blocks. To order with accessories, add "X" to catalog number.
* For complete accuracy specifications, see page at the beginning of this section.
** See previous page for accessories.

| Individual Heavy-Duty Gage Blocks – Steel Only |
|---|
| **Block Size** |
| .050 |
| .100, .100025, .10005, .100075 |
| .1001 Through .1009 In Steps of .0001 |
| .101 Through .149 In Steps of .001 |
| .150 Through .190 In Steps of .010 |
| .200 Through .950 In Steps of .050 |
| 1.000 |
| 2.000 |
| 3.000 |
| 4.000 |
| 6.000 |
| 10.000 |
| 20.000 |

To order individual blocks, specify HD followed by size and accuracy grade.
Example: HD .050 A1

# Gage Block Sets

## Metric System Gage Block Sets, Individual Blocks and Accessories

The following pages include these metric system items in the order shown:

Rectangular gage blocks and accessories

Square gage blocks and accessories



Metric rectangular 88 piece and square 112 sets are shown

## RS 9.MA1 Mini-Metric Rectangular Steel Gage Block Set

This mini-metric set of precision gage blocks calibrates micrometers, vernier gages and similar measuring tools. The gage blocks are also useful as setting masters for comparator-type dimensional gages and are useful in teaching the basics of metric measurement.

The set has a capacity of 61mm in 1, 0.5mm or 0.25mm steps. Its nine hardened steel blocks include these sizes: 1, 2, 2.25, 2.5, 3, 5, 10, 15 and 25mm. They are finished to B89.1.9 Accuracy Grade 0 and are furnished in a lined metal case.




Metric set RS 9.MA1

# Gage Block Sets

## Rectangular croblox® Gage Block Sets in Case

METRIC

**Rectangular croblox Gage Block Sets in Case, One Millimeter Base**

| Accuracy Grade* | Measuring Range | Blocks Per Set | Blocks Included In Sets | Cat. No. |
|---|---|---|---|---|
| B89.1.9 0 | 3.0 Through 450 (Steps of .001)<br>2.0 Through 450 (Steps of .01)<br>1.0 Through 450 (Steps of .1) | 45 | 9 Blocks 1.001mm Through 1.009mm (Steps of .001)<br>9 Blocks 1.01mm Through 1.09mm (Steps of .01)<br>9 Blocks 1.1mm Through 1.9mm (Steps of .1)<br>9 Blocks 1mm Through 9mm (Steps of 1)<br>9 Blocks 10mm Through 90mm (Steps of 10) | RC 45.MA1 |
| B89.1.9 00 | | | | RC 45.MAA |
| B89.1.9 0 | 3.0 Through 450 (Steps of .0005)<br>2.0 Through 450 (Steps of .001)<br>1.0 Through 450 (Steps of .01)<br>1.0 Through 450 (Steps of .1) | 88 | 1 Block .5<br>1 Block 1.0005<br>9 Blocks 1.001mm Through 1.009 (Steps of .001)<br>49 Blocks 1.01mm Through 1.49 (Steps of .01)<br>18 Blocks 1mm Through 9.5mm (Steps of .5)<br>10 Blocks 10mm Through 100mm (Steps of 10) | RC 88.MA1 |
| B89.1.9 00 | | | | RC 88.MAA |
| B89.1.9 0 | 3.0 Through 250 (Steps of .0005)<br>2.0 Through 250 (Steps of .001)<br>1.0 Through 250 (Steps of .01)<br>1.0 Through 250 (Steps of .1) | 112 | 1 Block .5<br>1 Block 1.0005<br>9 Blocks 1.001 Through 1.009 (Steps of .001)<br>49 Blocks 1.01 Through 1.49 (Steps of .01)<br>48 Blocks 1mm Through 24.5mm (Steps of .5)<br>4 Blocks 25mm Through 100mm (Steps of 25) | RC 112.MA1 |
| B89.1.9 00 | | | | RC 112.MAA |

Sets include etched serial numbers and Commercial Calibration Certificate. Metric croblox® Wear Blocks and/or Master Calibration Certificate are available at extra cost. For gage block accessories, order AC 11.MA Metric Accessory Set in Case.

* For complete accuracy specifications, see page at the beginning of this section.



Set RY 88.MA1

## Rectangular Ceramic

Now there's another addition to the famous Starrett-Webber line of precision gage blocks. Ceramic, offered in rectangular, inch and metric, fills the gap between steel and the universally accepted croblox®. While not as stable as croblox®, ceramic is an excellent alternative to steel because of its superior hardness, thermal expansion and wear characteristics.

METRIC

**Gage Block Sets in Case**

| Accuracy Grade* | Measuring Range | Blocks Per Set | Blocks Included In Sets | Cat. No. |
|---|---|---|---|---|
| B89.1.9 0 | 3.0 Through 450 in .001 Steps<br>2.0 Through 450 in .01 Steps<br>1.0 Through 450 in .1 Steps | 45 | 9 blocks 1.001 Through 1.009 (Steps of .001)<br>9 blocks 1.01 Through 1.09 (Steps of .01)<br>9 blocks 1.1 Through 1.9 (Steps of .1)<br>9 blocks 1 Through 9 (Steps of 1)<br>9 blocks 10 Through 90 (Steps of 10) | RY 45.MA1 |
| B89.1.9 00 | | | | RY 45.MAA |
| B89.1.9 0 | 3.0 Through 450 in .0005 Steps<br>2.0 Through 450 in .001 Steps<br>1.0 Through 450 in .01 Steps<br>1.0 Through 450 in .1 Steps | 88 | 1 block .5<br>1 block 1.0005<br>9 blocks 1.001 Through 1.009 (Steps of .001)<br>49 blocks 1.01 Through 1.49 (Steps of .01)<br>18 blocks 1 Through 9.5 (Steps of .5)<br>10 blocks 10 Through 100 (Steps of 10) | RY 88.MA1 |
| B89.1.9 00 | | | | RY 88.MAA |

Sets include etched serial numbers and Commercial Calibration Certificate. A Master Calibration Certificate is available at extra cost.

* For complete accuracy specifications, see page at the beginning of this section.

# Gage Block Sets

## Rectangular Steel – Metric System

METRIC

One Millimeter Base

| Gage Block Sets in Case | | B89.1.9 Accuracy Grade 0* | |
|---|---|---|---|
| Measuring Range | Blocks Per Set | Blocks Included In Sets | Cat. No. |
| 1.0 Through 61.0 in 1.0 Steps<br>2.0 Through 61.0 in .5 Steps<br>4.0 Through 61.0 in .25 Steps | 9 | 3 blocks 1.0, 2.0, 2.25<br>4 blocks 2.5, 3.0, 5.0, 10.0<br>2 blocks 15.0, 25.0 | RS 9.MA1 |
| 3.0 Through 450 in .001 Steps<br>2.0 Through 450 in .01 Steps<br>1.0 Through 450 in .1 Steps | 45 | 9 blocks 1.001 Through 1.009 (Steps of .001)<br>9 blocks 1.01 Through 1.09 (Steps of .01)<br>9 blocks 1.1 Through 1.9 (Steps of .1)<br>9 blocks 1 Through 9 (Steps of 1)<br>9 blocks 10 Through 90 (Steps of 10) | RS 45.MA1 |
| 3.0 Through 450 in .0005 Steps<br>2.0 Through 450 in .001 Steps<br>1.0 Through 450 in .01 Steps<br>1.0 Through 450 in .1 Steps | 88 | 1 block .5<br>1 block 1.0005<br>9 blocks 1.001 Through 1.009 (Steps of .001)<br>49 blocks 1.01 Through 1.49 (Steps of .01)<br>18 blocks 1 Through 9.5 (Steps of .5)<br>10 blocks 10 Through 100 (Steps of 10) | RS 88.MA1 |
| 3.0 Through 250 in .0005 Steps<br>2.0 Through 250 in .001 Steps<br>1.0 Through 250 in .01 Steps<br>1.0 Through 250 in .1 Steps | 112 | 1 block .5<br>1 block 1.0005<br>9 blocks 1.001 Through 1.009 (Steps of .001)<br>49 blocks 1.01 Through 1.49 (Steps of .01)<br>48 blocks 1 Through 24.5 (Steps of .5)<br>4 blocks 25 Through 100 (Steps of 25) | RS 112.MA1 |
| **Micrometer Checking Set** | | **B89.1.9 Accuracy Grade AS1*** | |
| | 10 | 10 blocks 2.5, 5.1, 7.7, 10.3, 12.9, 15.0, 17.6, 20.2, 22.8, 25.0 | RS 10.MA |

Sets include etched serial numbers and Commercial Calibration Certificate. Metric croblox® Wear Blocks and/or Master Calibration Certificate are available at extra cost.
For gage block accessories, order AC 11.MA Metric Accessory Set in Case.
See rectangular metric block accessories on the next page.
* For complete accuracy specifications, see page at the beginning of this section.



| Rectangular croblox Wear Blocks | |
|---|---|
| Size | Cat. No. |
| 1.0 | RCM 1.0 WA1 |
| 2.0 | RCM 2.0 WA1 |

## Rectangular Gage Block Accessories Steel and croblox®

| Rectangular Steel and croblox Accessories Individually or Sets as Stated Below | | | |
|---|---|---|---|
| Individual Accessories | | | Steel Accessories Included |
| | Cat. No. | | |
| Description | Steel | croblox® | Set AC 11.MA |
| Half-Round Jaw*<br>5mm Radius | RA 101. | | 2 |
| Straight Jaw*<br>5mm Thick | RA 104. | RA 204. | 2** |
| Clamps<br>0-38mm Capacity<br>38-100mm Capacity<br>100-165mm Capacity<br>0-300mm Capacity | <br>RA 5.<br>RA 6.<br>RA 7.<br>RA 8. | | <br>1<br>1<br>1<br>1 |
| Scriber Point<br>Center Point, 2mm C/L<br>Base Block, 25mm Thick | RA 11.<br>RA 112.<br>RA 113. | | 1<br>1<br>1 |
| Case (CS 9111.) | | | 1 |
| **Additional Accessories** | | | |
| Clamps<br>0-450mm Capacity<br>0-600mm Capacity<br>0-900mm Capacity | <br>RA 9.<br>RA 10.<br>RA 14. | | |

* croblox jaws available as an option at extra cost. Please specify.
** Jaws are normally used in pairs, but are ordered individually. Please order accordingly.

# Gage Block Sets

## Square Combination croblox® and Steel Metric System Gage Block Sets in Case

An ideal combination of value, price and convenience, these sets include a popular selection of croblox® and steel as listed.

METRIC

| Gage Block Sets in Case, Two Millimeter Base | | B89.1.9 Accuracy Grade 0* | |
|---|---|---|---|
| **Measuring Range** | **Blocks Per Set** | **Blocks** Included in Sets** | **Cat. No.** |
| 6.0 Through 450 in .001 Steps<br>4.0 Through 450 in .01 Steps<br>2.0 Through 450 in .1 Steps | 45 | 1 Block 1.0 - Steel<br>9 Blocks 2.001 Through 2.009 (Steps of .001)<br>9 Blocks 2.01 Through 2.09 (Steps of .01)<br>9 Blocks 2.1 Through 2.9 (Steps of .1mm)<br>9 Blocks 1.0 Through 9.0 (Steps of 1.0mm)<br>8 Blocks 10 Through 90 (Steps of 10mm) - Steel | S2CS 45.MA1 |
| 6.0 Through 450 in .0005 Steps<br>4.0 Through 450 in .001 Steps<br>2.0 Through 450 in .01 Steps<br>2.0 Through 450 in .1 Steps | 88 | 2 Blocks .5 and 1.0 - Steel<br>1 Block 2.0005<br>9 Blocks 2.001 Through 2.009 (Steps of .001)<br>49 Blocks 2.01 Through 2.49 (Steps of .01)<br>18 Blocks 1.5 Through 10.0 (Steps of .5)<br>9 Blocks 20 Through 100 (Steps of 10) - Steel | S2CS 88.MA1 |
| 6.0 Through 250 in .0005 Steps<br>4.0 Through 250 in .001 Steps<br>2.0 Through 250 in .01 Steps<br>2.0 Through 250 in .1 Steps | 112 | 2 Blocks .5 and 1.0 - Steel<br>1 Block 2.0005<br>9 Blocks 2.001 Through 2.009 (Steps of .001)<br>49 Blocks 2.01 Through 2.49 (Steps of .01)<br>18 Blocks 1.5 Through 10.0 (Steps of .5)<br>29 Blocks 10.5 Through 24.5 (Steps of .5) - Steel<br>4 Blocks 25m Through 100 (Steps of 25) - Steel | S2CS 112.MA1 |
| 6.0 Through 300 in .0005 Steps<br>4.0 Through 300 in .001 Steps<br>2.0 Through 300 in .01 Steps<br>2.0 Through 300 in .1 Steps | 77 | 5 Blocks .5, 1.0, 1.5, 2.0, 2.0005<br>9 Blocks 2.001 Through 2.009 (Steps of .001)<br>50 Blocks 2.01 Through 2.50 (Steps of .01)<br>5 Blocks 3.0, 3.5, 4.0, 4.5, 5.0<br>5 Blocks 10, 15, 20, 25, 30<br>3 Blocks 50, 75, 100 | S2C 77.MA1 |
| | | B89.1.9 Accuracy Grade 00* | |
| 6.0 Through 300 in .0005 Steps<br>4.0 Through 300 in .001 Steps<br>2.0 Through 300 in .01 Steps<br>2.0 Through 300 in .1 Steps | 77 | Same as Above S2C 77.MA1 | S2C 77.MAA |

Metric croblox Wear Blocks are available as option. Sets include etched serial numbers and Commercial Calibration Certificate. A Master Calibration Certificate is available at extra cost.

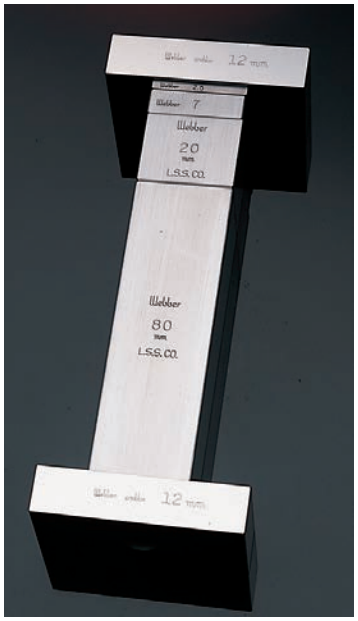
* For complete accuracy specifications, see page at the beginning of this section.

** All blocks are croblox, except as noted.

## Steel SA 711. Internal Measuring Machine Jaws

Double ended, self proving - assures parallelism and squareness. Designed for use with square style gage blocks, jaws are made of hardened steel 50.8mm long, 25.4mm wide and 12mm thick. Both side edges are lapped 90º square to the gaging faces within 30 seconds of arc and extend beyond the gage blocks in the combination, thus forming a square master.

Jaw and gage combination parallelism is checked merely by turning the combination to the opposite side and rechecking the reading. Furnished in pairs.



# Gage Block Sets

## Square Steel – Metric System Gage Block Sets in Case

METRIC

| Gage Block Sets in Case, Two Millimeter Base | | B89.1.9 Accuracy Grade 0* | |
|---|---|---|---|
| **Measuring Range** | **Blocks Per Set** | **Blocks Included in Sets** | **Cat. No.** |
| 6.0 Through 450 in .001 Steps<br>4.0 Through 450 in .01 Steps<br>2.0 Through 450 in .1 Steps | 45 | 1 Block 1.0<br>9 Blocks 2.001 Through 2.009 (Steps of .001)<br>9 Blocks 2.01 Through 2.09 (Steps of .01)<br>9 Blocks 2.1 Through 2.9 (Steps of .1)<br>9 Blocks 2.0 Through 10.0 (Steps of 1.0)<br>8 Blocks 20 Through 90 (Steps of 10) | S2S 45.MA1 |
| 6.0 Through 300 in .0005 Steps<br>4.0 Through 300 in .001 Steps<br>2.0 Through 300 in .01 Steps<br>2.0 Through 300 in .1 Steps | 77 | 5 Blocks .5, 1.0, 1.5, 2.0, 2.0005<br>9 Blocks 2.001 Through 2.009 (Steps of .001)<br>50 Blocks 2.01 Through 2.50 (Steps of .01)<br>5 Blocks 3.0, 3.5, 4.0, 4.5, 5.0<br>5 Blocks 10, 15, 20, 25, 30<br>3 Blocks 50, 75, 100 | S2S 77.MA1 |
| 6.0 Through 450 in .0005 Steps<br>4.0 Through 450 in .001 Steps<br>2.0 Through 450 in .01 Steps<br>2.0 Through 450 in .1 Steps | 88 | 2 Blocks .5, 1.0<br>1 Block 2.0005<br>9 Blocks 2.001 Through 2.009 (Steps of .001)<br>49 Blocks 2.01 Through 2.49 (Steps of .01)<br>18 Blocks 1.5 Through 10.0 (Steps of .5)<br>9 Blocks 20 Through 100 (Steps of 10) | S2S 88.MA1 |
| 6.0 Through 250 in .0005 Steps<br>4.0 Through 250 in .001 Steps<br>2.0 Through 250 in .01 Steps<br>2.0 Through 250 in .1 Steps | 112 | 1 Block .5<br>1 Block 2.0005<br>9 Blocks 2.001 Through 2.009 (Steps of .001)<br>49 Blocks 2.01 Through 2.49 (Steps of .01)<br>48 Blocks 1.0 Through 24.5 (Steps of .5)<br>4 Blocks 25 Through 100 (Steps of 25) | S2S 112.MA1 |
| 125 to 2100 | 8 | 8 Blocks 125, 150, 175, 200,<br>250, 300, 400, 500<br>Accessories Included:<br>6 Each SA 8. Studs<br>2 Each SA 9. Flat Head Screws (long)<br>2 Each SA 10. Flat Head Screws (short)<br>1 Each SA 16. 114-152 Tie Rod (adjustable)<br>1 Each SA 17. 152-228 Tie Rod (adjustable)<br>1 Each SA 18. 298 Tie Rod<br>1 Each SA 19. 400 Tie Rod<br>2 Each SA 20. 502 Tie Rods | SS 8.MA1X |
| | | B89.1.9 Accuracy Grade 00* | |
| 125 to 2100 | 8 | Same as Above SS 8.MA1X | SS 8.MAAX |

Sets include etched serial numbers and Commercial Calibration Certificate. A Master Calibration Certificate is available at extra cost.

* For complete accuracy specifications, see page at the beginning of this section.

# Gage Block Sets

## Square Steel or croblox® – Metric System Gage Block Accessories

METRIC

| Square Steel Accessories Individually or Sets as Stated Below | | |
|---|---|---|
| **Individual Accessories** | **Cat. No.** | **Steel Accessories Included** |
| Half-Round Jaw** | | |
| 3mm Radius | SA 101. | 2 |
| 6mm Radius | SA 102. | 2 |
| Straight Jaw** | | |
| 12mm Thick | SA 103. | 2 |
| Scriber Point | SA 4. | 1 |
| Center Point 2mm C/L | SA 105. | 1 |
| Base Block 12mm Thick | SA 106. | 1 |
| Knurled Screw | SA 7. | 2 |
| Stud | SA 8. | 2 |
| Flat Head Screw | | |
| Long | SA 9. | 2 |
| Short | SA 10. | 2 |
| Slotted Nut | SA 11. | 2 |
| Tie Rods | | |
| 19mm Solid | SA 12. | 1 |
| 38mm Solid | SA 13. | 1 |
| 57mm Solid | SA 14. | 1 |
| 76mm Solid | SA 15. | 1 |
| 114-152mm Adjustable | SA 16. | 1 |
| 152-228mm Adjustable | SA 17. | 1 |
| Case (CS 9168.) | | 1 |
| **Additional Accessories** | | |
| Tie Rods | | |
| 298mm | SA 18. | |
| 400mm | SA 19. | |
| 502mm | SA 20. | |

** croblox jaws available as an option at extra cost. Please specify.
** Jaws are normally used in pairs, but are ordered individually. Please order accordingly.




| Square croblox® Wear Blocks | |
|---|---|
| **Size** | **Cat. No.** |
| 2.0mm with 1 Side Countersunk | SCM 2.0 WA1 |

# Gage Block Sets

## Individual Rectangular and Square Gage Blocks - Metric System

croblox®, CERAMIC AND STEEL

| Individual Rectangular Gage Blocks | croblox® | | Ceramic | | Steel |
|---|---|---|---|---|---|
| | A1 | AA | A1 | AA | A1 |
| Size/Millimeters Grade | 0 | 00 | 0 | 00 | 0 |
| 0.3, 0.4* | | | | | • |
| 0.5** | • | • | • | • | • |
| 0.6 Through 0.9 in .1 Steps* | | | | | • |
| 1.0 or 1.0005 | • | • | • | • | • |
| 1.0 Wear Blocks | • | | | | |
| 1.001 Through 1.009 in Steps of .001 | • | • | • | • | • |
| 1.01 Through 1.14 in Steps of .01 | • | • | • | • | • |
| 1.15 Through 1.49 in Steps of .01 | • | • | • | • | • |
| 1.5 Through 1.9 in Steps of .1 | • | • | • | • | • |
| 2.0 | • | • | • | • | • |
| 2.0 Wear Blocks | • | | | | |
| 2.25 | | | | | • |
| 2.5 | • | • | • | • | • |
| 3.0 Through 4.5 in Steps of .5 | • | • | • | • | • |
| 5.0 Through 6.5 in Steps of .5 | • | • | • | • | • |
| 7.0 Through 10.0 in Steps of .5 | • | • | • | • | • |
| 10.5 Through 14.5 in Steps of .5 | • | • | | | • |
| 15.0 | • | • | • | • | • |
| 15.5 Through 19.5 in Steps of .5 | • | • | | | • |
| 20.0 | • | • | • | • | • |
| 20.5 Through 24.5 in Steps of .5 | • | • | | | • |
| 25.0 and 30.0 | • | • | • | • | • |
| 40.0 | • | • | • | • | • |
| 50.0 | • | • | • | • | • |
| 60.0 | • | • | • | • | • |
| 70.0 | • | • | • | • | • |
| 75.0 and 80.0 | • | • | • | • | • |
| 90.0 | • | • | • | • | • |
| 100.0 | • | • | • | • | • |

### Rectangular Block Sizes

- Width: all blocks are 9mm wide
- Length: For blocks 10mm thick and under, length is 30mm
  For blocks 10.5mm thick and above, length is 35mm

**Exceptions:**

*Blocks are 28.3mm long

** When ordering 0.5mm block, specify length (28.3 or 30mm)

### How To Order

| Specify in this sequence: Shape, Material, "M" for Metric, Size and Accuracy Grade | | | |
|---|---|---|---|
| **Shape** | **Material** | **Size** | **Accuracy** |
| R=Rectangular<br>S=Square | S=Steel<br>C=croblox®<br>Y = Ceramic | (listed in table) | |

Example: RSM 2.0.A1 = Rectangular Steel block, Metric size 2.0, Grade A1 Accuracy

| Individual Square Gage Blocks | croblox | | Steel |
|---|---|---|---|
| | A1 | AA | A1 |
| Size/Millimeters Grade | 0 | 00 | 0 |
| 0.5 mm | • | • | • |
| 1.0 | • | • | • |
| 1.5 | • | • | • |
| 2.0 Wear Blocks with 1 Side Countersunk | • | | |
| 2.0 or 2.0005 | • | • | • |
| 2.001 Through 2.009 in .001 Steps | • | • | • |
| 2.01 Through 2.49 in .01 Steps | • | • | • |
| 2.5 Through 2.9 in .1 Steps | • | • | • |
| 3.0 Through 10.0 in .5 Steps | • | • | • |
| 10.5 Through 14.5 in .5 Steps | | | • |
| 15mm | • | • | • |
| 15.5 Through 19.5 in .5 Steps | | | • |
| 20.0mm | • | • | • |
| 20.5 Through 24.5 in .5 Steps | | | • |
| 25.0 | • | • | • |
| 30.0 | • | • | • |
| 40.0 | | | • |
| 50.0 | • | • | • |
| 60.0 | | | • |
| 70.0 | | | • |
| 75.0 | • | • | • |
| 80.0 | | | • |
| 90.0 | | | • |
| 100.0 | • | • | • |

| Individual Square Gage Blocks | Steel Only | |
|---|---|---|
| | A1 | AA |
| Size/Millimeters Grade | 0 | 00 |
| 125.0 | • | • |
| 150.0 | • | • |
| 175.0 | • | • |
| 200.0 | • | • |
| 250.0 | • | • |
| 300.0 | • | • |
| 400.0 | • | • |
| 500.0 | • | • |

### Square Block Sizes

- All blocks are 24.1mm x 24.1mm
- Blocks have a 6.7mm hole in the center
- On blocks 5.0mm thick and over, the hole is countersunk on both faces. (croblox Wear Blocks are countersunk on one face only)

# Reference Bars

## Standard Reference Bars

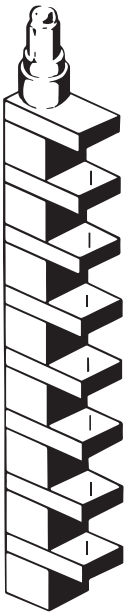
**12", 19", 25", 37", 49"/300, 500, 650, 950, 1250MM**

These Standard Reference Bars are invaluable for use in checking table movement of machine tools, accuracy of vernier height gages, surface plate transfer measurement, and for final inspection of precision machine tools and coordinate measuring machines.

The "channel design" places additional measuring pads at appropriate points over the length of the bar as reference points for x, y or z axis measurements. Channel design permits use of the bar on its base (vertical), or on its back, or either side (horizontal). The alternating gage block jaws and spacer blocks are permanently wrung and fastened together to form 1" increments for inch bars and 25mm increments for metric bars.

A special bushing arrangement allows the master stack to conform to thermal conditions prevailing during use, thus providing a true master even under less than perfect laboratory conditions. Mating surfaces are treated during assembly to prevent corrosion.

Non-standard lengths and measuring increments are available on special order. A Certificate of Calibration is included. All models are furnished with storage case.



**Specifications**

| Description | Inch System | Millimeter System |
|---|---|---|
| Tolerance (Stack) | expressed in µin. | expressed in µm |
| Maximum: | 2.5L + 10L in inches | .0025L + .25L in millimeters |
| Minimum: | - 10 | - .25 |
| Parallelism: Gage Surfaces to Base and Each Other | 15µin. | 0.4µm |
| Uncertainty of Calibration | 10 + 2.0L in inches expressed in µin. | .25 + .002L in millimeters expressed in µm. |

The accuracy of the surface that supports the gage must be taken into account when determining the accuracy of any measurements.

**With Channel Design**

| Inch System | | | Millimeter System | | |
|---|---|---|---|---|---|
| Size | Cat. No. | EDP | Size | Cat. No. | EDP |
| 12" | RBC 12. | 92626 | 300mm | RBCM 300. | 93642 |
| 19" | RBC 19. | 92627 | 500mm | RBCM 500. | 92617 |
| 25" | RBC 25. | 92628 | 650mm | RBCM 650. | 93053 |
| 37" | RBC 37. | 92629 | 950mm | RBCM 950. | 92619 |
| 49" | RBC 49. | 92630 | 1250mm | RBCM 1250. | 92620 |

**Free Standing Stack Without Channel Design – Vertical Position Only**

| Inch System | | | Millimeter System | | |
|---|---|---|---|---|---|
| Size | Cat. No. | EDP | Size | Cat. No. | EDP |
| 8" | RB 8. | 92616 | 200mm | RBM 200. | 93261 |
| 10" | RB 10. | 92623 | 250mm | RBM 250. | 93262 |
| 12" | RB 12. | 92624 | 300mm | RBM 300. | 93263 |
| 18" | RB 18. | 92625 | 450mm | RBM 450. | 93264 |

Standard Sizes are 12", 19", 25", 37" and 49" in the inch system and 300mm, 500mm, 650mm, 950mm and 1250mm in the millimeter system





AG 18.W



AG 16.R

# Gage Block Sets

## Angle Gage Block Sets

Angle Gage Blocks permit fast, simple and accurate measurements of any angle. They are far superior to sine bar measuring methods, that involve trigonometric formulae and complex stacks of gage blocks.

Angle gage blocks come in three accuracies: croblox® Reference Angle Blocks with a 1-second accuracy, steel Calibration Grade Angle Blocks with 2-second accuracy, and steel Working Grade Angle Blocks with 5-second accuracy. Each grade can be purchased in sets that will measure in steps of one-second, one-minute or one-degree to suit any need. (See angle block specification information on next two pages.)

- **Reference Angle Blocks croblox: 1-second accuracy.** Designed for optical or as reference standards for autocollimators, spectrometers, etc. They are unsurpassed for use in aerospace, optical, and precision instrument fields.
- **Calibration Angle Blocks Steel: 2-second accuracy.** The same high quality as the Reference Grade Angle Blocks.
- **Working Angle Blocks Steel: 5-second accuracy.** These angles are designed for shop or tool room. The longer gaging surfaces are made for use with an indicator. These blocks reduce set-up time and minimize error in grinding both simple and compound angles.

**Angle Gage Block Sets in Case**

| Cat. No. | Description/ Accuracy Grade | Blocks Per Set | Measuring Range | Blocks Included In Sets |
|---|---|---|---|---|
| AG 6.R<br>AG 6.C | Reference Grade ±1.0 Second<br>Calibration Grade ±2.0 Seconds | 6 | 0-99º in 1° Steps | 6 Blocks: 1°, 3°, 5°, 15°, 30°, 45° |
| AG 8.W | Working Grade ±5.0 Seconds | 8* | 0-99º in 1° Steps | 6 Blocks: 1°, 3°, 5°, 15°, 30°, 45° |
| AG 11.R<br>AG 11.C | Reference Grade ±1.0 Second<br>Calibration Grade ±2.0 Seconds | 11 | 0-99º in 1' Steps | 6 Blocks: 1°, 3°, 5°, 15°, 30°, 45°<br>5 Blocks: 1', 3', 5', 20', 30' |
| AG 13.W | Working Grade ±5.0 Seconds | 13* | 0-99º in 1' Steps | 6 Blocks: 1°, 3°, 5°, 15°, 30°, 45°<br>5 Blocks: 1', 3', 5', 20', 30' |
| AG 16.R<br>AG 16.C | Reference Grade ±1.0 Second<br>Calibration Grade ±2.0 Seconds | 16 | 0-99º in 1" Steps | 6 Blocks: 1°, 3°, 5°, 15°, 30°, 45°<br>5 Blocks: 1', 3', 5', 20', 30'<br>5 Blocks: 1", 3", 5", 20", 30" |
| AG 18.W | Working Grade ±5.0 Seconds | 18* | 0-99º in 1" Steps | 6 Blocks: 1°, 3°, 5°, 15°, 30°, 45°<br>5 Blocks: 1', 3', 5', 20', 30'<br>5 Blocks: 1", 3", 5", 20", 30" |

**Cases for Angle Gage Block Sets**

| | |
|---|---|
| CS 9135 | Calibration Set and Reference Case |
| CS 9134 | Working Case |

* One 6" (150mm) parallel and one 6" (150mm) knife edge are included with Working Grade Sets in addition to the listed sizes.

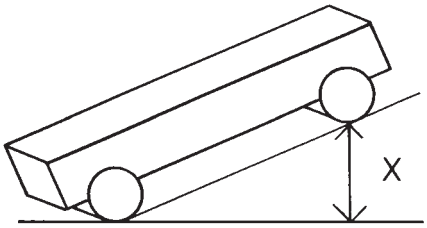
**To Order Individually, Specify in the Following Key Sequence:**

| AngleGage Prefix | Numeric Size of Angle | Angle Units (Degree, Min., Sec.) | Accuracy Grade R, C, or W |
|---|---|---|---|
| AG | 45 | D | R |

Example: AG 45.DR = a Reference 45º Angle Block
AG 30.MW = a Working 30' Angle Block

**NOTE:** The catalog numbers and specifications of our angle gage blocks have been changed in response to updated requirements concerning the application of the uncertainty of measurement. See the next two pages for information regarding the specifications of our angle blocks.

# Webber Gage Blocks




## Using Angle Gage Blocks

### SUPERIOR TO SINE BAR METHODS

A precision angle has always been difficult to set because of the involved trigonometric formula that is used with the sine bar.

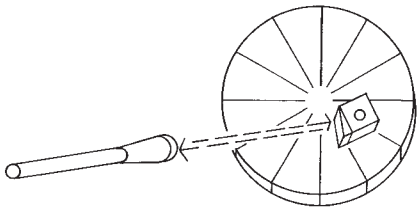
The main difficulty lies in the dimension X in diagram, which often results in a figure with many decimal places. Gage blocks can only approximate this value. For example, to measure 44º 30' using a 5" sine bar the following steps are required:

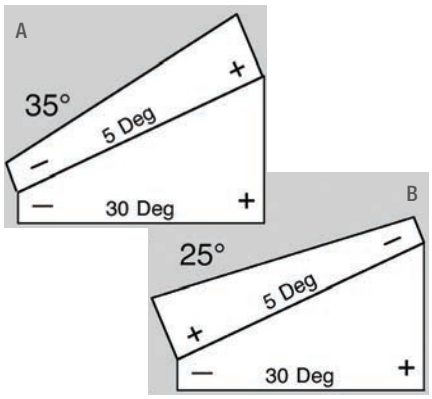
| | |
|---|---|
| Sine for 44º 30' angle | .7009093 |
| For dimension X multiply by 5 | 3.5045465 |
| | .1005 |
| Gage Blocks necessary to match this dimension | .104 |
| | .300 |
| | 3.000 |
| | 3.5045 |

3.5045465 – 3.5045 = Residual error .0000465

This error cannot be eliminated in sine bar procedure.

With angle gage blocks, you take a 45º block from the set, wring on a 30' block so that the plus end of 45º block contacts the minus end of 30' block, and you have an angle of 44º 30'. It is not only easy to accomplish, it is absolutely accurate.






## Ease and Versatility

A set consisting of only 16 blocks will measure 356,400 angles in steps of one second, to an accuracy of 1/5,000,000th of a circle! These micro-accurate blocks can be used in either plus or minus positions. In example **"A"**, take the 30º angle and add the 5º angle to obtain a measurement of 35º (making sure that both plus ends are together). In **"B"**, use the same two blocks but wring them together so that the minus end of the 5º block is over the plus end of the 30º block. This will subtract 5º from 30º, thus giving a 25º measurement.

## Indexing a Large Rotary Table

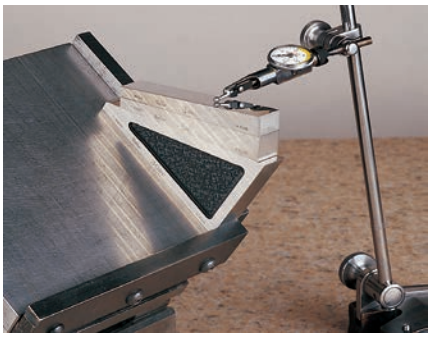
A Webber Angle Block or True Square is positioned on the work and a beam of light from an autocollimator is directed against the gaging surface. This becomes 0º, or the reference surface. Other angle blocks are then added in proper combination to measure each succeeding angle. The table is rotated and inspected at each position with reference to the light beam. This method indexes large workplaces quickly, with accuracy measured in fractional seconds.



## Inspecting a Simple Angle

The photo above shows a workpiece on which an angle of 30º is required. The workpiece is resting on a parallel* which is wrung to angle blocks forming 30º. The entire set-up is lined up vertically with an angle plate and then indicated across the top of the work to determine the correctness of the angle.

* Parallels are not necessary, but they are convenient because of their longer reference surface.



## Setting a Revolving Magnetic Chuck

A chuck is set for a 38º angle. Three blocks, +30º, +5º and +3º, are assembled and mounted with the parallel*. The indicator quickly tells if the setting is accurate. Adjustment is a matter of seconds. A revolving chuck teams up perfectly with angle blocks to make possible several applications in tool grinding that are more difficult with other methods.

| Angle Gage Block Specifications | Accuracy In Microinches (Microns) | | |
|---|---|---|---|
| Material | Reference Grade croblox® | Calibration Grade Steel | Working Grade Steel |
| Tolerances: Deviation From Nominal | ±1.0 second | ±2.0 second | ±5.0 second |
| Flatness of Gaging Surfaces | 6µin. (0.15µm) | 8µin. (0.20µm) | 14µin. (0.35µm)** |
| Flatness & Parallelism of Sides | 8µin. (0.20µm) | 8µin. (0.20µm) | 16µin. (0.40µm)** |
| Squareness of Sides to Gaging Surfaces | 6 seconds | 8 seconds | 12 seconds |
| Area of Gaging Surfaces† | 1" x 2" (25 x 50mm) | 1" x 2" (25 x 50mm) | 5/8" x 4" (16 x 100mm) |
| Surface Finish (Gage Surfaces Only) | 0.4µin. AA (.01µm AA) | 0.6µin. AA (.015µm AA) | 1.0µin. AA (.025µm AA) |
| Estimated Uncertainty of Measurement (k=2) | 0.6 seconds | 1.0 seconds | 3.5 seconds |

Flatness tolerances exclude 1.5mm from the edges on all angle blocks, except where marked with **. Then 3mm from the edge is excluded. † Dimension of gaging surfaces in millimeters is approximate.

# Webber Gage Blocks

## True Squares

True squares are designed for fast, precision indexing with angle gage blocks.

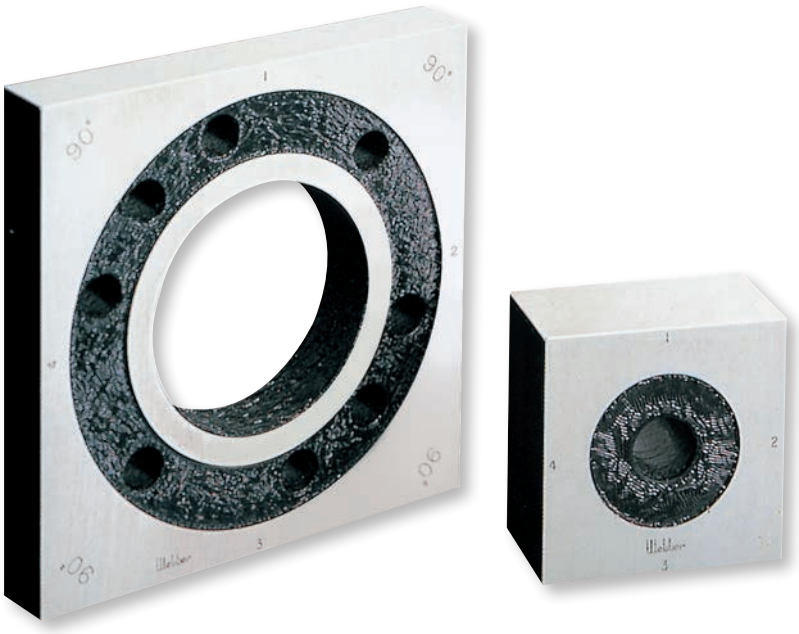
All faces of Webber True Squares are at precisely 90º to adjacent sides, with perfect optical flatness and parallelism to permit use with autocollimators.

Applications for fast precision indexing and setting of angular grinding fixtures are almost unlimited. For example: the work and the true square are mounted together on a revolving fixture. A notch is ground by two successive cuts, one at 90º with the true square, and the other at 2º with the addition of two angle blocks (+3º and –1º) mounted on square. An indicator reading is taken before each grind. This process is then repeated by turning the True Square to successive zero readings.

True Squares are designed for use as an accessory to our angle gage blocks to easily make angles greater than 45° and through 180°.

Webber True Squares also permit a fast, easy check of indexing tables. The gaging faces are at precise 90° angles with optical flatness and finishes that permit the use of autocollimators.

The catalog numbers and specifications of our True Squares have been changed in response to updated requirements concerning the application of the uncertainty of measurement.



**True Square Specifications**

| Cat. No.<br>Grade<br>Material | TS 21.R<br>Reference<br>croblox® | TS 21.C<br>Calibration<br>Steel | TS 44.W<br>Working<br>Steel | TS 66.W<br>Working<br>Steel |
|---|---|---|---|---|
| Tolerances:<br>Deviation From Nominal | ±1.0 second | ±2.0 second | ±5.0 second | ±5.0 second |
| Flatness of Gaging Surfaces | 6µin. (0.15µm) | 8µin. (0.20µm) | 14µin. (0.35µm)* | 14µin. (0.35µm)* |
| Flatness & Parallelism of Sides | 8µin. (0.20µm) | 8µin. (0.20µm) | 16µin. (0.40µm)* | 16µin. 0.40µm)* |
| Squareness of Sides to Gaging Surfaces | 6 seconds | 8 seconds | 12 seconds | 12 seconds |
| Area of Gaging Surfaces† | 1" x 2" (25 x 50mm) | 1" x 2" (25 x 50mm) | 5/8" x 4" (16 x 100mm) | 5/8" x 6" (16 x 150mm) |
| Surface Finish (Gage Surfaces Only) | 0.4µin. AA (0.01µm AA) | 0.6µin. AA (.015µm AA) | 1.0µin. AA (.025µm AA) | 1.0µin. AA (.025µm AA) |
| Estimated Uncertainty of Measurement (K=2) | 0.6 seconds | 1.0 seconds | 3.5 seconds | 4.0 seconds |

Flatness tolerances exclude 1.5mm from the edges on all angle blocks except where marked with *. Then, 3mm from the edge is excluded.
† Dimension of gaging surfaces in millimeters is approximate.

# CROBLOX®



## CROBLOX Reflecting Cubes

Stable and maintenance free, reflecting cubes are ideal for 90º indexing or alignment in optical tooling or inspection.

### To order, specify the following information:

1. The number and position of all finished sides, including the base:

   **NOTE:** for fixturing purposes during manufacturing, the bottom face must be one of the finished sides. The bottom face is etched with the Webber logo, a serial number, and face identifications as applicable.

2. Specify the manufacturing tolerances of the 90° angles, 1 second, 3 seconds, or other angular specification.

3. A certificate of calibration showing the deviation from 90° of the finished sides is available at extra cost. **NOTE:** Our uncertainty of measurement is estimated to be ±1.0 seconds. This uncertainty should be added to the manufacturing tolerance to give practical tolerance of the cube.

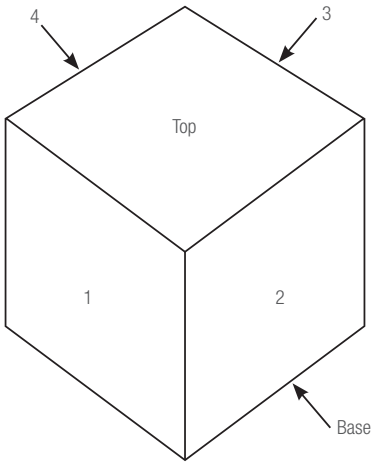
4. If requested, a copy of the material certificate from our supplier of chrome-carbide is available at no extra cost.

**To Order Webber Optical Cubes**

Specify all 6 parts to the part number

| Prefix | Size | Face Code | Hole Pattern | Hole Type | Accuracy |
|---|---|---|---|---|---|
| CUBE | .50<br>.75<br>1.0<br>1.5<br>2.0 | A thru K<br><br><br><br><br>(See Face Table) | (blank)<br>or<br>1 thru 4<br><br><br><br>(See Hole Pattern Chart) | (blank)<br>or<br>S=Fine Thrd<br>T=Coarse Thrd<br>U=Thru Hole<br>V=Thru Hole with C-Sink<br>Y=C'Bore thru hole<br><br>(See Hole Pattern Chart for available dimensions) | 1 SEC*<br>3 SEC*<br>5 SEC<br>10 SEC |

*Not Available In 0.50" Size




**Face Code Table**

| Face Code | No. of Finished Faces | Finished Faces |
|---|---|---|
| A | 6 | ALL |
| B | 5 | 1-2-3-4-Base |
| C | 5 | 1-2-3-Top-Base |
| D | 4 | 1-2-3-Base |
| E | 4 | 1-3-Top-Base |
| F | 4 | 1-2-Top-Base |
| G | 3 | 1-3-Base |
| H | 3 | 1-2-Base |
| J | 3 | 1-Top-Base |
| K | 2 | 1-Base |

Example: CUBE 1.0 A 3SEC
CUBE 1.0 = 1" Cube
A = finished 6 sides
1SEC = orthogonal to 3 second accuracy.
(No holes were specified in this example.)

Cubes are made to order from semifinished blanks in six standard sizes: 0.50" (12.7mm), 0.75" (19.0mm), 0.95" (24.1mm), 1.00" (25.4mm), 1.50" (38.1mm), and 2.00" (50.8mm). Also available is a .950" (24.1m) square with a 17/64" (6.7mm) countersunk center hole.

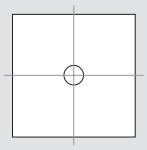
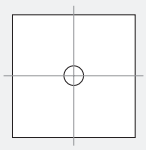
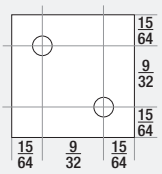
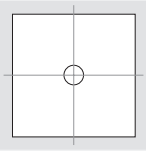
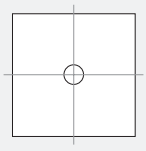
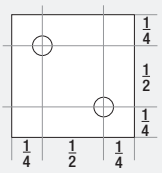
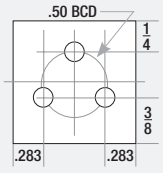
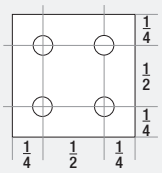
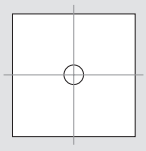
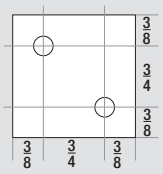
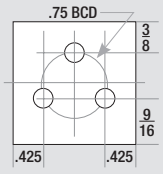
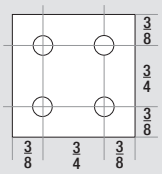
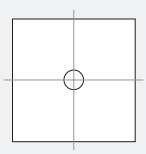
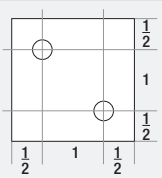
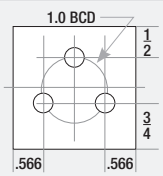
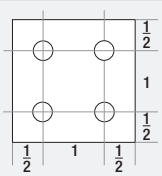
Reflectivity of finished faces is nominally:

| | |
|---|---|
| Visible Blue Light | (λ= 4200 Â) ≈ 50% |
| Visible Red Light | (λ= 6900 Â) ≈ 60% |
| Infrared | (λ= 10.6 µm) > 80% |

We are unable to measure or certify reflectivity. If reflectivity testing is required,the user must arrange for testing through a third party.

## Hole Pattern Dimensions and Hole Types

Dimensions are shown in Inches.

| | Hole Pattern-1 | Hole Pattern-2 | Hole Pattern-3 | Hole Pattern-4 |
|---|---|---|---|---|
| CUBE .50 |  <br>Min. Good Thread .28<br>T1 S1<br>T2 S2<br>U0 U1<br>U2 U3<br>V0 V1<br>C'Bore Depth = .20"<br>Y0 Y1<br>Y2 | | | |
| CUBE .75 |  <br>Min. Good Thread .40<br>T1 S1<br>T2 S2<br>U1 U2<br>U3 U4<br>V1 V2<br>V3 V4<br>C'Bore Depth = .38"<br>Y1 Y2<br>Y3 |  <br>15/64, 9/32, 15/64<br>Min. Good Thread .40<br>T1 S1<br>T2 S2<br>U1 U2<br>U3<br>C'Bore Depth = .38"<br>Y1 | | |
| CUBE .95 |  <br>.266 Dia. Thru Hole<br>72° C-Sink.<br>Min. 100" Deep for<br>#8 Flat Head Screw | | | |
| CUBE 1.0 |  <br>Min. Good Thread .50<br>T2 S2<br>T3 S3<br>T4 S4<br>U2 U3<br>U4<br>V2 V3<br>V4<br>C'Bore Depth = .50"<br>Y2 Y3<br>Y4 |  <br>1/4, 1/2, 1/4<br>Min. Good Thread .50<br>T2 S2<br>T3 S3<br>U2 U3<br>U4<br>C'Bore Depth = .50"<br>Y2 |  <br>.50 BCD<br>1/4, 3/8, .283, .283<br>Min. Good Thread .50<br>T2 S2<br>T3 S3<br>U2 U3<br>U4<br>C'Bore Depth = .50"<br>Y2 |  <br>1/4, 1/2, 1/4<br>Min. Good Thread .50<br>T2 S2<br>T3 S3<br>U2 U3<br>U4<br>C'Bore Depth = .50"<br>Y2 |
| CUBE 1.5 |  <br>Min. Good Thread .62<br>T3 S3<br>T4 S4<br>U3 U4<br>U5<br>V3 V4<br>V5<br>C'Bore Depth = .75"<br>Y3 Y4<br>Y5 |  <br>3/8, 3/4, 3/8<br>Min. Good Thread .62<br>T3 S3<br>T4 S4<br>U3 U4<br>U5<br>V3 V4<br>C'Bore Depth = .75"<br>Y3 Y4 |  <br>.75 BCD<br>3/8, 9/16, .425, .425<br>Min. Good Thread .62<br>T3 S3<br>T4 S4<br>U3 U4<br>U5<br>V3 V4<br>C'Bore Depth = .75"<br>Y3 Y4 |  <br>3/8, 3/4, 3/8<br>Min. Good Thread .62<br>T3 S3<br>T4 S4<br>U3 U4<br>U5<br>V3 V4<br>C'Bore Depth = .75"<br>Y3 Y4 |
| CUBE 2.0 |  <br>Min. Good Thread .75<br>T3 S3<br>T4 S4<br>U4 U5<br>U6<br>V3 V4<br>V5<br>C'Bore Depth = 1.25"<br>Y4 Y5 |  <br>1/2, 1, 1/2<br>Min. Good Thread .75<br>T3 S3<br>T4 S4<br>U4 U5<br>U6<br>V3 V4<br>V5<br>C'Bore Depth = 1.25"<br>Y4 Y5 |  <br>1.0 BCD<br>1/2, 3/4, .566, .566<br>Min. Good Thread .75<br>T3 S3<br>T4 S4<br>U4 U5<br>U6<br>V3 V4<br>V5<br>C'Bore Depth = 1.25"<br>Y4 Y5 |  <br>1/2, 1, 1/2<br>Min. Good Thread .75<br>T3 S3<br>T4 S4<br>U4 U5<br>U6<br>V3 V4<br>V5<br>C'Bore Depth = 1.25"<br>Y4 Y5 |

## Legend for Hole Types

| Threaded Hole | | Thru Hole | 72° Countersunk Hole | Counterbore Hole for Cap Head Screw |
|---|---|---|---|---|
| T1 = 6-32 | S1 = 6-40 | U0 = 0.128 Dia. for #4 Screw | V0 = 0.128 Dia. for #4 Screw | Y0 = for #4 Screw<br>0.128 Dia. Thru Hole 0.21 Dia. C'Bore |
| T2 = 8-32 | S2 = 8-36 | U1 = 0.156 Dia. for #6 Screw | V1 = 0.156 Dia. for #6 Screw | Y1 = for #6 Screw<br>0.180 Dia. Thru Hole 0.29 Dia. C'Bore |
| T3 = 10-24 | S3 = 10-32 | U2 = 0.180 Dia. for #8 Screw | V2 = 0.180 Dia. for #8 Screw | Y2 = for #8 Screw<br>0.180 Dia. Thru Hole 0.29 Dia. C'Bore |
| T4 = 1/4-20 | S4 = 1/4-28 | U3 = 0.206 Dia. for #10 Screw | V3 = 0.206 Dia. for #10 Screw | Y3 = for #10 Screw<br>0.206 Dia. Thru Hole 0.34 Dia. C'Bore |
| | | U4 = 0.266 Dia. for 1/4" Screw | V4 = 0.266 Dia. for 1/4" Screw | Y4 = for 1/4" Screw<br>0.266 Dia. Thru Hole 0.40 Dia. C'Bore |
| | | U5 = 0.328 Dia. for 5/16" Screw | V5 = 0.328 Dia. for 5/16" Screw | Y5 = for 5/16" Screw<br>0.332 Dia. Thru Hole 0.50 Dia. C'Bore |
| | | U6 = 0.391 Dia. for 3/8" Screw | | |

Tolerances are ± .010" except for Counterbore depth: ± .020"

Example: CUBE 1.5 D 2 Y4 1SEC
- CUBE 1.5 = 1-1/2" Cube
- D = finished front, right, and base
- 2 = two holes located in corners of the cube (See Pattern Table for hole location)
- Y4 = .266 Dia. thru hole with .40 Dia C'Bore for 1/4' cap screw
  For 1.5" cube, C'Bore depth = .75" (See Pattern Table)
- 1SEC = finished sides orthogonal to 1 second accuracy

# Optical

## Optical Polygons

Webber Optical Polygons provide an easy, accurate method of checking and calibrating angles. They are designed for use with autocollimators in measuring angle spacing.

The exclusive one-piece design provides compact, fixed master for precise angle spacing. Target faces are highly reflective and optically flat.

Chrome carbide polygons provide a hardness of Rockwell 71-73 C and a corrosion resistance 10-20 times that of 18-8 stainless steel, resulting in lifetime accuracy.

Maintenance problems are virtually eliminated due to their ruggedness and extreme stability.

A 1" mounting hole, flanged bushing, lapped washer and hold-down bolt, furnished with each unit, permit mounting the polygon in any desired attitude. Available in two accuracy grades. Furnished in case. Certificate of Calibration included.

To order polygons, specify number in the following key/sequence:

**Optical Polygon** OP
**No./Faces**
**Decimal**
**Accuracy Grade**

Example: OP 3.0 = A 3-sided optical polygon with a 0 Reference Accuracy




**Optical Polygon Specifications**

| No. of Sides | Angle Spacing Degrees | Diameter Across Corners Inch (mm) | Height Inch (mm) | Target Size Inch (mm) | Area Sq. In. | Area Sq. Cm. |
|---|---|---|---|---|---|---|
| 3 | 120 | 2.90" (73.6mm) | .880" (22.3mm) | .75" x .75" (19 x 19mm) | .56 | 3.60 |
| 4 | 90 | | | | | |
| 5 | 72 | | | | | |
| 6 | 60 | | | | | |
| 8 | 45 | | | | | |
| 9 | 40 | | | | | |
| 10 | 36 | | | | | |
| 12 | 30 | | | | | |

**Optical Polygon Specifications**

| Accuracy Grade | Target Area Flatness* | Accuracy of Calibration (Uncertainty) | Maximum Deviation of Faces from Nominal 3-12 |
|---|---|---|---|
| Reference: 0 | 4 µin. (.10 µm) | ±1.0 sec. | ±1.0 sec. |
| Calibration: 1 | | | ±2.0 sec. |

* Excludes .020" (0.5mm) from edges.
All sizes: Flatness and parallelism – top and bottom – .00005"; maximum pyramidal error ±15 seconds.

# Optical

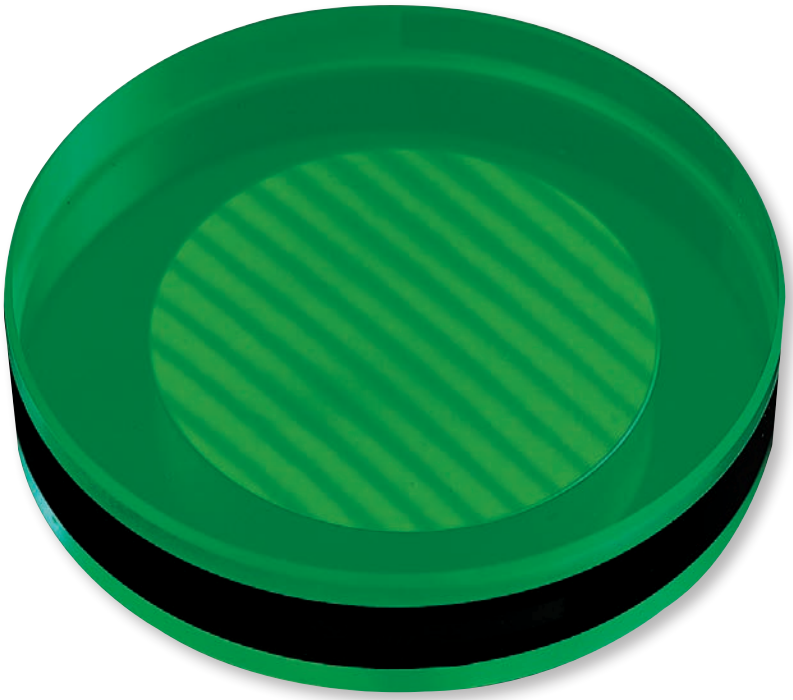
## Fused Quartz Optical Flats

For visually checking the flatness of seals, gages and mating surfaces. Through means of interpreting light interference patterns or bands, the optical flat provides a simple, accurate precision method for measuring surface flatness. Flats are crafted from high quality fused quartz and provide the maximum resistance to wear, damage and temperature variations.

Starrett-Webber optical flats are available in single or double surfaces and three accuracy grades. The double flat has both surfaces finished to tolerance but not necessarily parallel. Double flats provide longer service because wear is distributed over two surfaces. All are furnished with case.

Coating is available and it aids readability when applied to one surface. Coating is of value on single-sided flats only. Coating on a double surface will reduce the readability of the other surface.

When ordering, specify size, accuracy grade, single or double side, and coated or not.



| Fused Quartz Optical Flats, Accuracy Grades | |
|---|---|
| Reference Grade | 1 µin. (.03 µm) |
| Master Grade | 2 µin. (.05 µm) |
| Working Grade | 4 µin. (.10 µm) |

| Fused Quartz Optical Flats, Standard Sizes* | | |
|---|---|---|
| 1" x 1/2" (25 x 12.7mm) | 3" x 11/16" (75 x 17.5mm) | 5" x 7/8" (125 x 22mm) |
| 2" x 5/8" (50 x 16mm) | 4" x 3/4" (100 x 19mm) | 6" x 1" (150 x 25mm) |

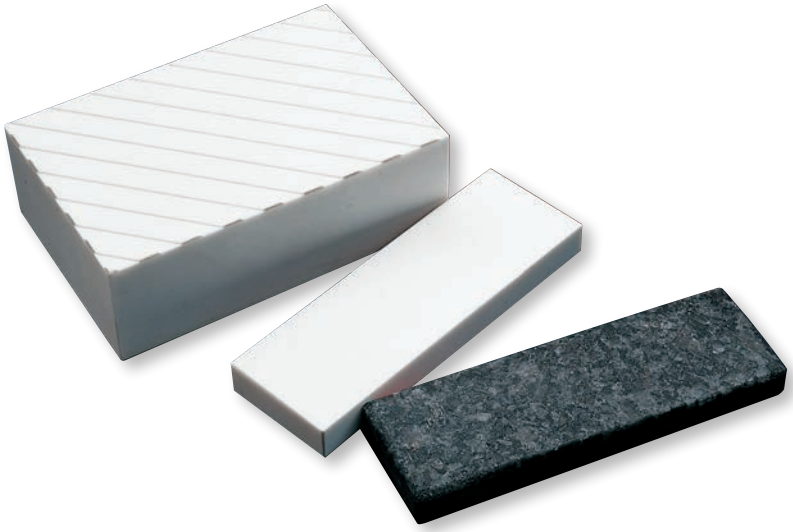
* Dimensions shown in millimeters are approximate.
Larger sizes available on special order.
Optical flats are made to U.S. Federal Specifications GG-O-635. Certificate of Calibration available at extra cost.
Accuracy of Calibration (uncertainty) 3µin. (0.08µm).

## Chamois

These Starrett-Webber synthetic chamois cloths, rather than natural chamois, are recommended for wiping gage surfaces. They can be used with solvents and oils, including Starrett M-1® All-Purpose Lubricant, and are washable in detergents.



| Chamois | |
|---|---|
| **Description** | **Cat. No.** |
| Dry | CH 1. |
| Lubricated | CH 2. |



## Gage Block Stones

If a block does not wring together with other blocks, it may be the result of nicks or other damage. Examine blocks carefully with a magnifying glass. If a small burr is found, it may be removed with a gage block stone.

Starrett-Webber stones, when used moderately, may be rubbed directly on the gaging surfaces without danger of decreasing the size of the gage block. Available in 3 styles/materials as listed.

**GS 13** is recommended for use with steel gage blocks

**SAO 13** is recommended for general use. Steel, ceramic, or carbide blocks

**SAO 23** is recommended for use with carbide and ceramic gage blocks

| Gage Block Stones | | |
|---|---|---|
| **For Block Material** | **Description** | **Cat. No.** |
| Steel | Black Granite Stone, 1/4 x 1 x 3" (6.3 x 25 x 75mm) | GS 13. |
| Steel or Carbide | Sintered Aluminum Oxide, 5/16 x 1 x 3" (8 x 25 x 75mm) | SAO 13. |
| | Serrated Aluminum Oxide with Case, 1 x 2 x 3" (25 x 50 x 75mm) | SAO 23. |

NVLAP®

NVLAP LAB CODE 200038-0

## Accredited Gage Block Calibration Service

In accordance with: ISO 17025
ANSI/NCSL Z540-1
ISO 10012-1
former MIL-STD-45662A

## Master Calibration

The calibration procedure is regarded as a process to be controlled and monitored using SPC techniques. Information that would enable the analysis of control data is to be recorded and can be made available to the user upon request (at extra cost). A second master, sometimes referred to as a control block, is used in the calibration. The purpose of the second master is to generate known difference reading which can be analyzed. The average of the known differences of several readings of the two masters and the range of their differences can be analyzed using statistical techniques. The calibration process can be demonstrably controlled.

Reported measurement uncertainties based upon a 95% confidence level (two standard deviations) are dynamic, reflecting the current performance of the specific equipment and operator. Other factors included in the stated uncertainty are derived from a detailed error analysis. The error analysis is based upon experimentation whenever possible or industry consensus from estimates derived from NIST publications. Experimental checks of the stated uncertainty levels are made using laboratory comparison techniques involving both internal repeatability studies and external comparisons with other calibration laboratories.

Our Reference Gage Blocks are calibrated directly by NIST. All other reference standards are periodically checked and calibrated either by NIST or NVLAP accredited laboratories. Documented histories are maintained. Statistical methods are used to control all of our master gages.

**NOTICE:** Webber Gage cannot recommend recalibration due dates on our calibration certificates or calibration stickers. Recalibration due dates must be provided to us at the time of order. If this information is not provided, the recalibration due date will be left blank for the user to add.

## Laboratory Calibration

Each block calibrated using our Laboratory Calibration procedure is calibrated three times using our Master Calibration procedure as described above - Using different transfer master blocks, operators and equipment when possible for all three measurements. The results are averaged together and reported. This results in the lowest possible uncertainty reported to the user as random errors in the measuring process are averaged out.

This calibration service is restricted to Webber rectangular croblox® gage blocks of Webber grades LM or AA, GGG grades 0.5 and 1, and B89 grades 00 and K.

## Commercial Calibration

Calibrations are performed using the same program as our Master calibrations except that the second master, the control block, is omitted. By omitting this control block some of the statistical tests are also omitted which results in larger uncertainty.

All necessary information to confirm the calibration is recorded. All raw data from the comparator, the temperature of the blocks, the temperature of the comparator, and the relative humidity of the surrounding environment is recorded for each measurement. Applied correction factors are broken down and are recorded, as well as the results of any calibrations.

Our Reference Gage Blocks are calibrated directly by the National Institute of Standards and Technology. All other reference standards are calibrated either by NIST or NVLAP accredited laboratories. Documented histories are maintained of our measuring and test equipment. Statistical methods are used to control our Master Gage Blocks.

Reported uncertainties are based on a 95% confidence level. Experimental checks of the uncertainty are made using laboratory comparison techniques involving repeatability studies and external comparisons with other calibration laboratories.

**Approximate Best Uncertainty (k=2) for blocks through 4" (100mm) in length**

| | Commercial Calibration | | Master Calibration | | Laboratory Calibration | |
|---|---|---|---|---|---|---|
| Grade | Uncertainty | Minimum | Uncertainty | Minimum | Uncertainty | Minimum |
| Webber LM<br>GGG 0.5 | | | | | 0.65 + 0.7L<br>.016 + .0007L | 1.4µin<br>.035µm |
| Webber AA<br>B89 Grade 00, K<br>GGG 1 | 1.6 + 1.0L<br>.04 + .001L | 2.4 µin<br>.060µm | 1.2 + 0.7L<br>.03 + .0007L | 1.7µin<br>.045µm | 0.65 + 0.7L<br>.016 + .0007L | 1.4µin<br>.035µm |
| Webber A1<br>B89 Grade 0<br>GGG 2 | 2.0 + 1.0L<br>.05 + .001L | 3.0 µin<br>.075µm | 1.8 + 0.7L<br>.045 + .0007L | 2.0µin<br>.050µm | | |
| B89 Grade AS1<br>GGG 3 | 2.0 + 1.0L<br>.05 + .001L | 3.0 µin<br>.075µm | 1.8 + 0.7L<br>.05 + .0007L | 2.0µin<br>.050µm | | |

NVLAP® accreditation does not constitute an endorsement of any product by NVLAP or any agency of the U.S. Government.

# Starrett-Webber Gage Calibration

## Gage Block Calibration Services

We offer expert and comprehensive gage block calibration and repair services for Starrett-Webber gage blocks.

Calibration will help you prevent production inaccuracies. It will identify a worn gage block before it can create a problem. Regular, periodic calibration of your gage blocks will ensure that your gage blocks are as accurate and dependable as when they were new.

### Comprehensive and Fast

Starrett-Webber gage block calibration is performed promptly – your gage blocks will be ready to be returned to you within a few days after we receive them.

The calibration process is as follows:

1. After receiving your gage blocks, we document their arrival, then clean each block to remove oil, grease and film. The case is also thoroughly cleaned.
2. Next, we lightly stone each block to remove small nicks and burrs. This does not guarantee that the blocks will wring if they are heavily nicked, scratched, or burred.
3. Your gage blocks are then individually compared with master blocks that are accurate to fractions of one millionth of an International Inch. Starrett-Webber Grand Master Blocks are Starrett-Webber croblox® (solid chrome carbide). Our exclusive Grand Master Gage Blocks are calibrated directly by the U.S. National Institute of Standards and Technology (NIST).
4. Our automated system generates a Certificate of Calibration to ensure complete accuracy in recording gage block size. This certificate shows the deviation from the marked size of each block and marks those sizes which need replacing.
5. We will then provide a quotation for recommended replacements in the original material and croblox, if applicable.
6. If replacements are not required, or if you have instructed us only to calibrate and return the set, the gage blocks are packed and returned to you with a Certificate of Calibration showing the "as found" readings.
7. If you authorize replacements, your Certificate of Calibration is marked to indicate which blocks were replaced and the date of replacement. At your request, we can issue an "as found" and an "as left" certificate for an additional fee.

### Please provide the following information:

When sending gage blocks to us for calibration, please specify whether you want us to:

A. Calibrate, issue a certificate and return only;

B. Calibrate, advise condition and hold for instructions; or

C. Calibrate, replace worn and missing blocks, then return.

If your order specifies replacement for worn and missing blocks and the cost of replacement approaches that of a new set, we will inform you, provide a quote price and wait for your instructions.

### Be sure to protect your valuable gage blocks by packaging them carefully

Gage block cases are made for immobile storage – not as shipping crates.

It is good practice to carefully follow these steps when preparing your gage blocks for shipment:

- Treat them with rust preventative. Starrett M1® Lubricant is an excellent choice for this job.
- Place wax paper over the blocks.
- If necessary, add cushioning inside lid to prevent excessive movement of blocks in the inserts. Do not overdo this – the lid should not have to be forced to close.
- Seal the closed case with reinforced heavy tape. Note that the case clasp alone is not adequate to ensure that the case remains closed during shipment.
- Use a strong, oversize outer shipping container. Carefully surround the case with a generous amount of firm cushioning material to ensure that your blocks withstand shock in transit.
- Be sure to mark the shipping box as "Fragile."

### As Good as New

When you receive your freshly calibrated gage block set with all necessary of the recommended repairs and/or replacements, you can rely on them to be essentially as good as new – that is, the most reliable and trusted gage blocks available – Starrett-Webber.




# GRANITE SURFACE PRODUCTS

# Granite Surface Plates and Accessories

In 2006, The L.S. Starrett Company acquired Tru-Stone Technologies in Waite Park, MN. With this acquisition, a broad variety of new capabilities are now available to Starrett customers.

## OEM Capabilities

Our Starrett Tru-Stone Granite Division continues to provide solutions to customers in precision granite, carbon fiber, ceramic, high precision vacuum chucks and other materials. We offer granite machine bases and surface plates to meet your requirements up to 55 feet long and weighing 72 tons.

Whether your application requires a simple standard surface plate or a large OEM assembly, the Starrett Granite Division will work with you to fulfill those requirements.

Every linear measurement depends on an accurate reference surface from which final dimensions are taken. Starrett Precision Granite Surface Plates provide this reference plane for work inspection and for work layout. Their high degree of flatness, overall quality and workmanship also make them ideal bases for mounting sophisticated mechanical, electronic and optical gaging systems.

## Material

The granite for Starrett surface plates has been selected for the best balance of physical properties, maximum resistance to wear and for deflection under load. Each plate has been lapped to a fine microinch finish to minimize tool wear and drag.

The most important element in the performance and life of granite surface plates is the percentage of quartz that is present in the stone. Quartz is more than twice as resistant to wear as the other minerals in granite. It provides bearing points that are of a hard, highly polished, smooth character which protect the accuracy and finish of both the surface plate and the tools and instruments used on it.

Starrett Crystal Pink® Granite has the highest percentage of quartz of any granite. Higher quartz content means greater wear resistance. The longer a surface plate holds its accuracy, the less often it will require resurfacing, ultimately providing better value.

## Selection

### Accuracy Under Load

Starrett Crystal Pink and Superior Black Granite plates have a thickness capable of supporting a total normal load equal to 50lb for each square foot (24kg for each 1,000 sq. cm) of surface area loaded in the center of the plate – without deflecting the plate along a diagonal of more than one-half the flatness tolerance. This is the accepted rating in the U.S. Federal Specification GGG-P-463c and ASME B89.3.7 2013.

In the situations where abnormal loading conditions are anticipated, Starrett can engineer and modify surface plate thickness to meet virtually any requirement.

### Ledges and Clamping

Surface plates without work clamping ledges are recommended for sustained accuracy and reliability. Ledges are for work clamping purposes only. If excessive torque is used when applying clamps to ledges, it can adversely affect measurements taken near the plate edges. If clamping is important, T-slots and threaded metal inserts may be installed in the surface.

## Accuracy

### Specifications

Starrett Granite Surface Plates meet or exceed U.S. Federal Specification GGG-P-463c and ASME B89.3.7 2013.

### Starrett Granite Surface Plate Calibration Services

- Calibration of granite surface plates, granite parallels (2 and 4-sided), granite straight edges, granite tri-squares, granite angle plates and granite squares
- Surface plate and granite metrology and accessory resurfacing
- Calibration Lab is accredited by A2LA to ISO/IEC 17025*

* The L.S. Starrett Company's accreditations are site-specific and tool-specific. The scope of accreditation is available upon request to each location.



# Technical Information

## Accuracy

Granite Surface Plates are manufactured in three grades of accuracy:

- **Grade AA – Laboratory Grade**
  This is typically specified for precision operations in constant temperature gaging rooms and metrology departments.
- **Grade A – Inspection Grade**
  This is typically specified for general work in quality control.
- **Grade B – Toolroom Grade**
  This is typically specified for production checking work throughout the shop.

### Unilateral Flatness Tolerance

Overall flatness tolerance is based on unilateral measurement. All points on the work surface shall be contained between two parallel planes separated at a distance no greater than the amount specified for each particular grade and size as shown in our listings.

### Repeat Reading Tolerance

Repeat reading tolerance is easily checked with a Repeat Reading Gage. This gage detects local areas, not overall flatness.

In addition to the overall flatness tolerance referred to above, Starrett provides repeat reading tolerances as follows:

| Diagonal Inches (mm) | Full Indicator Movement (F.I.M.) in Microinches and (Microns) | | | Obtained |
|---|---|---|---|---|
| | Grade AA | Grade A | Grade B | |
| Through 30" (750) | 35 (.9) | 60 (1.5) | 110 (2.8) | |
| Over 30-60" (750-1500) | 45 (1.1) | 70 (1.8) | 120 (3) | |
| Over 60-90" (1500-2250) | 60 (1.5) | 80 (2) | 160 (4) | When Not Specified |
| Over 90-120" (2250-3000) | 75 (1.9) | 100 (2.5) | 200 (5) | |
| Over 120-150" (3000-3800) | 90 (2.3) | 120 (3) | 240 (6) | |
| Over 150" (3800) | 100 (2.5) | 140 (3.6) | 280 (7) | |
| All Sizes | 25 (.6) | 50 (1.3) | 100 (2.5) | When Specified |

A repeat reading gage detects minute variations of the surface within the unilateral flatness tolerance of the whole surface.

### Certified Accuracy

Before shipment, each surface plate must pass a critical final inspection to prove that its entire surface is within the specified tolerance. The final inspection is done with an autocollimator in a controlled environment. This instrument is checked and certified against standards traceable to the U.S. National Institute of Standards and Technology (NIST). The instrument's certification is on file at the Starrett Tru-Stone Technologies Division in Waite Park, MN.

All shipments of Starrett precision granite products include a calibration certificate which verifies traceability to NIST as well as certifying that the inspection requirements of U.S. MIL-I-45208A and Federal Spec. GGG-P-463c and ASME B89.3.7 2013 have been met.

### Periodic Inspection

Every surface plate in use should be frequently inspected, especially when used in shop conditions where abrasion is common. An effective inspection program should include regular checks with an autocollimator. If tolerance variations are excessive, the plate can be transferred to work involving less accuracy or it can be resurfaced to restore its original level of accuracy.

### Resurfacing Services

Resurfacing for Starrett and other brands of granite surface plates are available in our plant or yours.

### Design Assistance

Starrett engineers will provide prompt assistance with any problem related to surface plate design, installation or use. Our staff is available to assist in your design of larger OEM projects.

To get the best service and value from any granite plate, contact Starrett Tru-Stone.



Inspecting a granite plate with an autocollimator

# Granite Solutions

## Custom Engineered Granite Solutions

### For Oversize Parts and Assembling

Starrett has unparalleled experience and expertise in building special, extra-large granite surface plates and custom products from granite to meet specific requirements.

All Starrett special surface plates are made from single, solid slabs of granite quarried in one piece, machined in one piece and finished to your specified dimensions and tolerances.

## Special Plates are Usually Requested in Two Categories:

### Inspecting oversize parts:

The first category is for inspecting oversize parts and assemblies such as diesel engine blocks and crankshafts, vehicle frames, missile components and ground support equipment.

Inquiries for granite surface plates to accommodate oversize parts and assemblies should indicate:

1. Type of part to be staged
2. Distribution of weight
3. Inspection accuracy required
4. Work holding requirements
5. Footing requirements, ceiling height and availability of heavy-duty work-handling equipment

### Modifying standard plates:

The second general category relates to modifying standard plates or building special surface plates for work-holding attachments of many different types.

Threaded and solid inserts, adaptor holes, T-slots, dovetails – almost anything added to conventional gaging fixtures can also be added to Starrett surface plates, extending their accuracy and versatility for numerous applications. Precision edges, made square with the top surface and adjacent edges, as well as precision graduated rules can also be added.

We can build and assemble this work-holding or special gaging equipment to very close tolerance in either fractional, decimal inch or metric dimensions. All special plates are quoted on an individual basis, based on complexity and tolerance requirements. We will work with you to give you the best, most economical solution for your application.

The uses of Starrett special granite surface plates are limited only by the imagination of the creative tool designer. Inquiries for special surface plates like the type shown will be studied and recommendations given without obligation.




We can build custom fixture plates that provide exceptional positional accuracy for one or several of your applications

## Tru-Vac Vacuum and Air-Lift Technology

Starrett provides both standard and custom solutions for vacuum chucking, positioning or air-lift part transfer. Our innovative Tru-Vac technology integrates the stability and precision flatness of granite with a porous medium, usually ceramic.

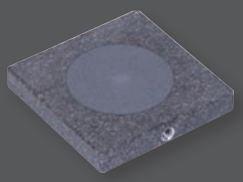
Tru-Vac can eliminate the need for mechanical clamping with its inherent part distortion or damage risk by utilizing vacuum draw at specific locations or distributed over the entire surface of your part.

Conversely, Tru-Vac technology can be utilized to provide positive pressure to allow delicate parts to glide on a cushion of air from which they can be safely lifted or transferred to the next operation.

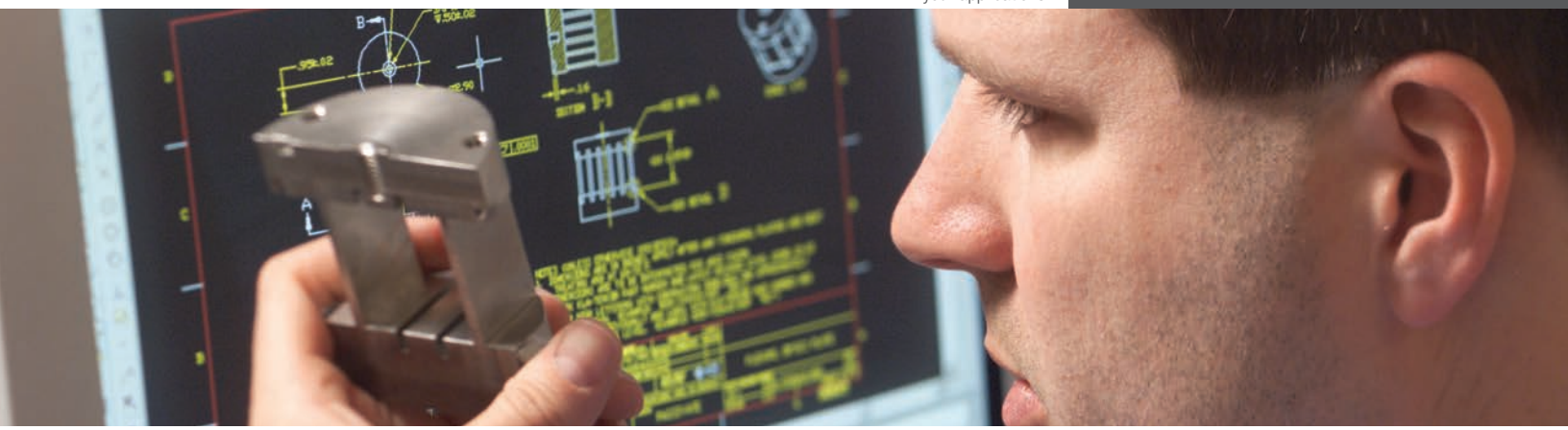
Starrett engineers will work with you to select the best porous medium for your application based on surface area, flatness, wear, and desired airflow characteristics.

Tru-Vac technology can be utilized in air chucks smaller than a hockey puck or larger than a conference room table. Vacuum zones can be of nearly any shape by virtue of our CNC milling capabilities.

Multiple zones can be utilized to accommodate a variety of part sizes or even to provide a combination of negative and positive pressure for controlled part movement.



Tru-Vac Vacuum Chuck



Starrett offers unparalleled design expertise and experience to work with your engineers to create the ideal custom solution for your application






## Technical Capabilities

Starrett has a variety of technical capabilities that, combined with our expertise, makes us the perfect choice for your custom granite requirements.

These capabilities include:

- Drilled and bored holes with precise size and location (right)
- Inserts turned and inspected in-house for quality control and custom options
- T-slots and inserts bonded using proprietary methods
- CNC milling of patterns of clearance areas
- Specialty slot milling capabilities
- Unsurpassed dimensional control of flat, square, and parallel surfaces



## Examples of Custom Applications Capabilities

Above Right: Multi-plane bases with precise insert accuracy.

Right: Laser verified geometric accuracy.

Left: Extremely large (or small) part capabilities.



## Assembly Integration

In addition to collaborating on the design and building of your machine foundation, Starrett technicians are skilled at value-added assembly.

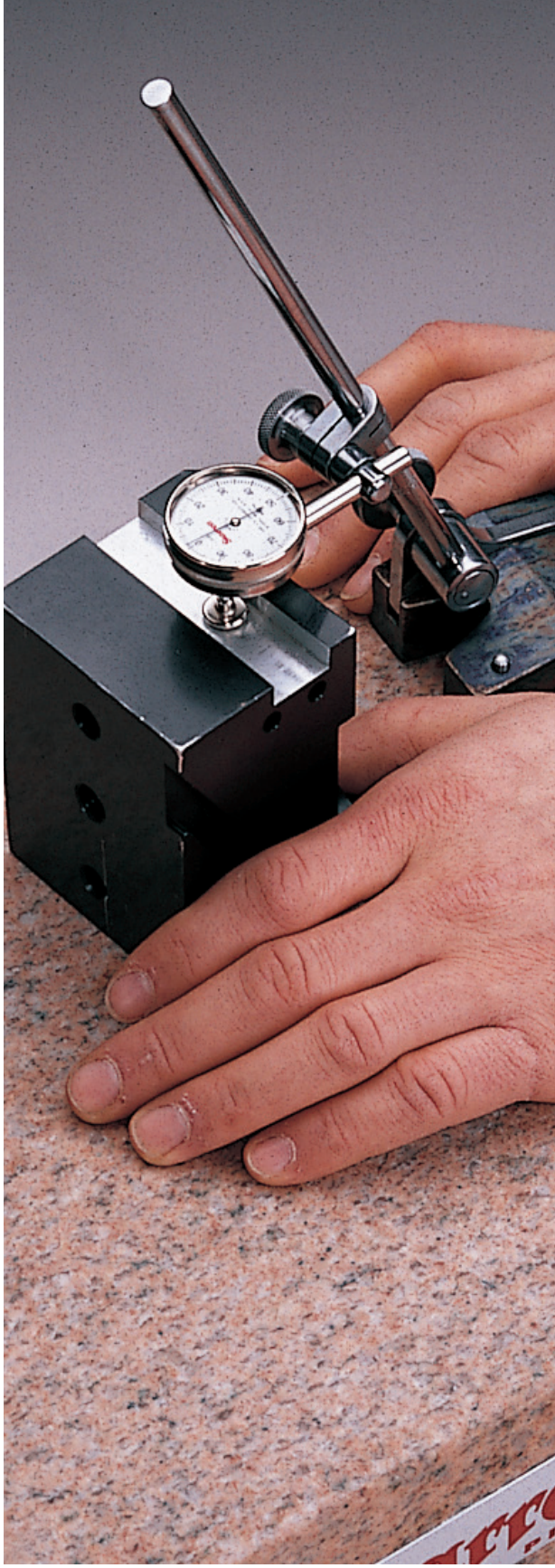
Using precision equipment in our assembly laboratories, we can provide you with the next level assembly, such as adding bearing rails, encoder rails, screw drives, stages, or vibration damping devices.

Having this assembly done at our factory provides accountability for accurate performance.



# Granite Surface Plates



## Crystal Pink®

- Accurate for use in metrology laboratories and wear resistant for use in abrasive shop environments
- The finest, most durable granite surface plate available to industry today
- The name is derived from the fact that it has the highest crystalline quartz content of any granite surface plate

### Surface Finish

- Even distribution of large quartz crystals provides a smooth finish, which significantly reduces wear on the surface plate and the instruments used on it
- Fine micro-finish, combined with the natural voids in the surface, prevents wringing and provides a velvety-smooth tool action

### Wear Life

- Non-quartz-bearing granite in average daily use requires resurfacing about once a year, while Crystal Pink plates used in these same plants have required resurfacing only once every three to five years, on average.

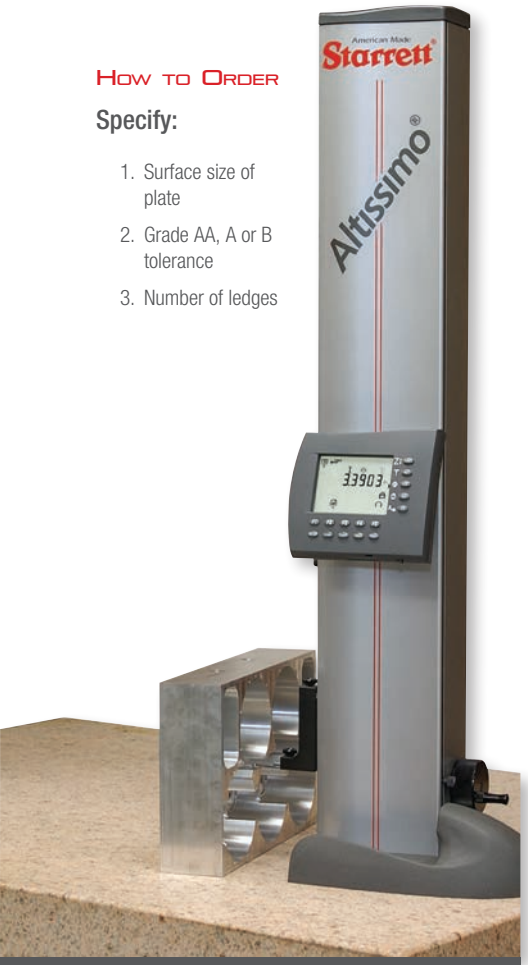
### Starrett Crystal Pink:

- Meets or exceeds U.S. Federal Specification GGG-P-463c and ASME B89.3.7 2013 for flatness
- Great surface hardness and wear resistance – the highest percentage of quartz crystals of any granite plate
- Smooth, jewel-like quartz bearing points protect accuracy and finish of both the surface and the tools used on it
- Quality and economy combined
- Comparable to black granite plates while outwearing them as much as 5 to 1
- Meets or exceeds 50 lb per square foot (24kg per 1,000 sq. cm) load bearing specifications. Available in 100 lb (45kg) test series.
- Standard-size plates are mounted on resilient support pads, providing isolation from normal vibration and a non-distorting 3-point suspension.
- Packed one per crate with skids for forklift handling.

## How to Order

**Specify:**

1. Surface size of plate
2. Grade AA, A or B tolerance
3. Number of ledges




## Special Requirements

Should your application require something other than a standard surface plate, we can provide you with custom options.

Starrett can produce your plate from pink, black or gray granite. Custom sizes and thicknesses are available upon request to meet your needs.

We can also add holes, counterbores, threaded or solid stainless steel inserts and t-slots to your surface plate.

Contact Starrett Tru-Stone for assistance.

| Grade AA Laboratory | | | | | | No Ledge | | | Two Ledge | | |
|---|---|---|---|---|---|---|---|---|---|---|---|
| Surface Size | | Thickness | | Flatness Unilateral Tolerance | | Weight | | | Weight | | |
| Inch | mm | Inch | mm | Inch | mm | Lb | kg | EDP | Lb | kg | EDP |
| 12 x 12 | 300 x 300 | | | | | 55 | 25 | 80601 | 50 | 23 | 80602 |
| 12 x 18 | 300 x 450 | 4 | 100 | .000050 | 0.0012 | 85 | 39 | 80610 | 78 | 35 | 80611 |
| 18 x 18 | 450 x 450 | | | | | 125 | 57 | 80619 | 120 | 54 | 80620 |
| 18 x 24 | 450 x 600 | 6 | 150 | .000075 | 0.0019 | 248 | 113 | 80628 | 224 | 102 | 80629 |
| 24 x 24 | 600 x 600 | | | | | 330 | 150 | 80646 | 306 | 139 | 80647 |
| 24 x 36 | 600 x 900 | 6 | 150 | .000100 | 0.0025 | 495 | 225 | 80655 | 460 | 209 | 80656 |
| 30 x 48 | 750 x 1200 | 10 | 250 | .000168 | 0.0043 | 1585 | 719 | 80883 | 1585 | 719 | 80884 |
| 36 x 36 | 900 x 900 | 6 | 150 | .000150 | 0.0038 | 745 | 338 | 80701 | 710 | 322 | 80702 |
| 36 x 48 | 900 x 1200 | 8 | 200 | .000200 | 0.0050 | 1320 | 599 | 80710 | 1250 | 567 | 80711 |
| 36 x 60 | 900 x 1500 | 10 | 250 | .000250 | 0.0063 | 2065 | 937 | 80719 | 1950 | 885 | 80720 |
| 36 x 72 | 900 x 1800 | 12 | 300 | .000300 | 0.0076 | 2970 | 1347 | 80728 | 2810 | 1275 | 80729 |
| 48 x 48 | 1200 x 1200 | 10 | 250 | .000200 | 0.0051 | 2535 | 1150 | 80889 | 2535 | 1150 | 80890 |
| 48 x 72 | 1200 x 1800 | 12 | 300 | .000350 | 0.0088 | 3960 | 1796 | 80755 | 3795 | 1721 | 80756 |
| 48 x 96 | 1200 x 2400 | 16 | 400 | .000500 | 0.0127 | 7040 | 3193 | 80773 | 6750 | 3062 | 80774 |
| **Grade A Inspection** | | | | | | **No Ledge** | | | **Two Ledge** | | |
| Surface Size | | Thickness | | Flatness Unilateral Tolerance | | Weight | | | Weight | | |
| Inch | mm | Inch | mm | Inch | mm | Lb | kg | EDP | Lb | kg | EDP |
| 12 x 12 | 300 x 300 | | | | | 55 | 25 | 80604 | 50 | 23 | 80605 |
| 12 x 18 | 300 x 450 | 4 | 100 | .000100 | 0.0025 | 85 | 39 | 80613 | 78 | 35 | 80614 |
| 18 x 18 | 450 x 450 | | | | | 125 | 57 | 80622 | 120 | 54 | 80623 |
| 18 x 24 | 450 x 600 | 6 | 150 | .000150 | 0.0038 | 248 | 113 | 80631 | 224 | 102 | 80632 |
| 24 x 24 | 600 x 600 | | | | | 330 | 150 | 80649 | 306 | 139 | 80650 |
| 24 x 36 | 600 x 900 | 6 | 150 | .000200 | 0.0050 | 495 | 225 | 80658 | 460 | 209 | 80659 |
| 30 x 48 | 750 x 1200 | 8 | 200 | .000400 | 0.0102 | 1270 | 576 | 80885 | 1270 | 576 | 80886 |
| 36 x 36 | 900 x 900 | 6 | 150 | .000300 | 0.0076 | 745 | 338 | 80704 | 710 | 322 | 80705 |
| 36 x 48 | 900 x 1200 | 8 | 200 | .000400 | 0.0102 | 1320 | 599 | 80713 | 1250 | 567 | 80714 |
| 36 x 60 | 900 x 1500 | 10 | 250 | .000500 | 0.0127 | 2065 | 937 | 80722 | 1950 | 885 | 80723 |
| 36 x 72 | 900 x 1800 | | | .000600 | 0.0152 | 2475 | 1123 | 80731 | 2340 | 1061 | 80732 |
| 48 x 48 | 1200 x 1200 | 8 | 200 | .000500 | 0.0130 | 2030 | 921 | 80891 | 2030 | 921 | 80892 |
| 48 x 72 | 1200 x 1800 | 10 | 250 | .000700 | 0.0177 | 3300 | 1497 | 80758 | 3165 | 1436 | 80759 |
| 48 x 96 | 1200 x 2400 | 12 | 300 | .001000 | 0.0254 | 5280 | 2395 | 80776 | 5060 | 2295 | 80777 |
| **Grade B Toolroom** | | | | | | **No Ledge** | | | **Two Ledge** | | |
| 12 x 12 | 300 x 300 | | | | | 55 | 25 | 80607 | 50 | 23 | 80608 |
| 12 x 18 | 300 x 450 | 4 | 100 | .000200 | 0.0050 | 83 | 38 | 80616 | 76 | 34 | 80617 |
| 18 x 18 | 450 x 450 | | | | | 125 | 57 | 80625 | 118 | 54 | 80626 |
| 18 x 24 | 450 x 600 | 4 | 100 | .000300 | 0.0076 | 165 | 75 | 80634 | 155 | 70 | 80635 |
| 24 x 24 | 600 x 600 | | | | | 220 | 100 | 80652 | 210 | 95 | 80653 |
| 24 x 36 | 600 x 900 | 6 | 150 | .000400 | 0.0102 | 495 | 225 | 80661 | 460 | 209 | 80662 |
| 30 x 48 | 750 x 1200 | | | .000700 | 0.0180 | 950 | 431 | 80887 | 950 | 431 | 80888 |
| 36 x 36 | 900 x 900 | | | .000600 | 0.0152 | 745 | 338 | 80707 | 710 | 322 | 80708 |
| 36 x 48 | 900 x 1200 | | | .000800 | 0.0203 | 990 | 449 | 80716 | 955 | 433 | 80717 |
| 36 x 60 | 900 x 1500 | 8 | 200 | .001000 | 0.0254 | 1650 | 749 | 80725 | 1560 | 708 | 80726 |
| 36 x 72 | 900 x 1800 | | | .001200 | 0.0304 | 1980 | 898 | 80734 | 1870 | 848 | 80735 |
| 48 x 48 | 1200 x 1200 | 6 | 150 | .000900 | 0.0229 | 1520 | 689 | 80893 | 1520 | 689 | 80894 |
| 48 x 72 | 1200 x 1800 | 8 | 200 | .001400 | 0.0355 | 2640 | 1198 | 80761 | 2530 | 1148 | 80762 |
| 48 x 96 | 1200 x 2400 | 10 | 250 | .002000 | 0.0508 | 4400 | 1996 | 80779 | 4215 | 1912 | 80780 |

Other sizes available by request. No ledge and two ledge plates listed, four ledge plates available by request.

# Granite Surface Plates

## Superior Black

Our superior black granite has low water absorption, thus minimizing the possibility of your precision gages rusting while setting on the plates.

This black granite creates little glare resulting in less eyestrain for individuals using the plates.

We have chosen our superior black granite with the specific intent of keeping thermal expansion to a minimum.




| Grade AA Laboratory | | | | | | | | No Ledge | Two Ledge |
|---|---|---|---|---|---|---|---|---|---|
| Surface Size | | Thickness | | Flatness Unilateral Tolerance | | Weight | | | |
| Inch | mm | Inch | mm | Inch | mm | Lb | kg | EDP | EDP |
| 12 x 12 | 300 x 300 | 4 | 100 | .000050 | 0.0012 | 61 | 28 | 85006 | 85007 |
| 12 x 18 | 300 x 450 | | | | | 92 | 42 | 85010 | 85011 |
| 18 x 24 | 450 x 600 | 4 | 100 | .000075 | 0.0019 | 183 | 83 | 85028 | 85029 |
| 24 x 24 | 600 x 600 | | | | | 244 | 111 | 85036 | 85037 |
| 24 x 36 | 600 x 900 | 6 | 150 | .000100 | 0.0025 | 549 | 249 | 85055 | 85056 |
| 30 x 48 | 750 x 1200 | 8 | 200 | .000168 | 0.0043 | 1220 | 553 | 85082 | 85083 |
| 36 x 36 | 900 x 900 | 6 | 150 | .000150 | 0.0038 | 824 | 374 | 85090 | 85091 |
| 36 x 48 | 900 x 1200 | 8 | 200 | .000200 | 0.0050 | 1464 | 664 | 85110 | 85111 |
| 36 x 60 | 900 x 1500 | 10 | 250 | .000250 | 0.0063 | 2288 | 1038 | 85118 | 85119 |
| 36 x 72 | 900 x 1800 | 12 | 300 | .000300 | 0.0076 | 3294 | 1494 | 85128 | 85129 |
| 48 x 48 | 1200 x 1200 | 8 | 200 | .000200 | 0.0051 | 1952 | 885 | 85136 | 85137 |
| 48 x 72 | 1200 x 1800 | 10 | 250 | .000350 | 0.0088 | 3660 | 1660 | 85155 | 85156 |
| 48 x 96 | 1200 x 2400 | 12 | 300 | .000500 | 0.0127 | 5856 | 2656 | 85173 | 85174 |
| Grade A Inspection | | | | | | | | No Ledge | Two Ledge |
| 12 x 12 | 300 x 300 | 4 | 100 | .000100 | 0.0025 | 61 | 28 | 85008 | 85009 |
| 12 x 18 | 300 x 450 | | | | | 92 | 42 | 85013 | 85014 |
| 18 x 24 | 450 x 600 | 4 | 100 | .000150 | 0.0038 | 183 | 83 | 85031 | 85032 |
| 24 x 24 | 600 x 600 | | | | | 844 | 111 | 85038 | 85039 |
| 24 x 36 | 600 x 900 | 6 | 150 | .000200 | 0.0050 | 549 | 249 | 85058 | 85059 |
| 30 x 48 | 750 x 1200 | | | .000400 | 0.0102 | 915 | 415 | 85085 | 85086 |
| 36 x 36 | 900 x 900 | | | .000300 | 0.0076 | 824 | 374 | 85092 | 95091 |
| 36 x 48 | 900 x 1200 | | | .000400 | 0.0102 | 1098 | 498 | 85113 | 85114 |
| 36 x 60 | 900 x 1500 | 8 | 200 | .000500 | 0.0127 | 1830 | 830 | 85120 | 85121 |
| 36 x 72 | 900 x 1800 | 10 | 250 | .000600 | 0.0152 | 2745 | 1245 | 85131 | 85132 |
| 48 x 48 | 1200 x 1200 | 6 | 150 | .000500 | 0.0130 | 1464 | 664 | 85138 | 85139 |
| 48 x 72 | 1200 x 1800 | 8 | 200 | .000700 | 0.0177 | 2928 | 1328 | 85158 | 85159 |
| 48 x 96 | 1200 x 2400 | 10 | 250 | .001000 | 0.0254 | 4880 | 2214 | 85176 | 85177 |
| Grade B Toolroom | | | | | | | | No Ledge | Two Ledge |
| 12 x 12 | 300 x 300 | 3 | 75 | .000200 | 0.0050 | 46 | 21 | 85012 | 85015 |
| 12 x 18 | 300 x 450 | | | | | 69 | 31 | 85016 | 85017 |
| 18 x 24 | 450 x 600 | 3 | 75 | .000300 | 0.0076 | 136 | 62 | 85034 | 85035 |
| 24 x 24 | 600 x 600 | 4 | 100 | .000300 | 0.0076 | 244 | 111 | 85040 | 85041 |
| 24 x 36 | 600 x 900 | | | .000400 | 0.0102 | 366 | 166 | 85061 | 85062 |
| 30 x 48 | 750 x 1200 | 6 | 150 | .000700 | 0.0180 | 915 | 415 | 85088 | 85089 |
| 36 x 36 | 900 x 900 | | | .000600 | 0.0152 | 824 | 374 | 85094 | 85095 |
| 36 x 48 | 900 x 1200 | | | .000800 | 0.0203 | 1098 | 498 | 85116 | 85117 |
| 36 x 60 | 900 x 1500 | | | .001000 | 0.0254 | 1373 | 623 | 85122 | 85123 |
| 36 x 72 | 900 x 1800 | 8 | 200 | .001200 | 0.0304 | 2196 | 996 | 85134 | 85135 |
| 48 x 48 | 1200 x 1200 | 6 | 150 | .000900 | 0.0229 | 1464 | 664 | 85140 | 85141 |
| 48 x 72 | 1200 x 1800 | 8 | 200 | .001400 | 0.0355 | 2196 | 996 | 85161 | 85162 |
| 48 x 96 | 1200 x 2400 | | | .002000 | 0.0508 | 3904 | 1771 | 85179 | 85180 |

Other sizes available by request. No ledge and two ledge plates listed, four ledge plates available by request.

## How to Order

**Specify:**

1. Surface size of plate
2. Grade AA, A or B tolerance
3. Number of ledges

### Special Requirements

Should your application require something other than a standard surface plate, we can provide you with custom options.

Starrett can produce your plate from pink, black or gray granite. Custom sizes and thicknesses are available upon request to meet your needs.

We can also add holes, counterbores, threaded or solid stainless steel inserts, and t-slots to your surface plate.

Contact Starrett Tru-Stone for assistance.

# Stands






## Surface Plate Stands

Our stands are constructed from welded square steel tubing to provide exceptional strength and durability. Steel crossbeams are located at the proper support points to ensure maximum surface plate accuracy.

Stands are supplied with a scratch and abrasion resistant industrial powder coated finish. In addition to our standard beige gray color, other colors are available upon request and at an additional charge.

Stationary stands come with leveling adjustors with the typical adjustment being 2". Rolling stands are fabricated with two stationary and two swivel casters.

Stands require no assembly. Order by surface plate size.

**Surface Plate Stands**

| Surface Plate Size (Length x Width) | Weight | Stationary with Leveling Screws EDP | Rolling with Casters EDP |
|---|---|---|---|
| 12 x 18" | 50lb | 82220 | 82221 |
| 12 x 18 - 2 Ledge | 50lb | 82250 | 82251 |
| 18 x 18" | 65lb | 82222 | 82223 |
| 18 x 18 - 2 Ledge | 65lb | 82252 | 82253 |
| 18 x 24" | 75lb | 82224 | 82225 |
| 18 x 24 - 2 Ledge | 75lb | 82254 | 82255 |
| 24 x 24" | 85lb | 82226 | 82227 |
| 24 x 24 - 2 Ledge | 85lb | 82256 | 82257 |
| 24 x 36" | 95lb | 82228 | 82229 |
| 24 x 36 - 2 Ledge | 95lb | 82258 | 82259 |
| 24 x 48" | 145lb | 82230 | 82231 |
| 24 x 48 - 2 Ledge | 145lb | 82260 | 82261 |
| 30 x 48" | 155lb | 82266 | 82268 |
| 30 x 48 - 2 Ledge | 155lb | 82267 | 82269 |
| 36 x 36" | 165lb | 82232 | 82233 |
| 36 x 36 - 2 Ledge | 165lb | 82262 | 82263 |
| 36 x 48" | 185lb | 82234 | 82235 |
| 36 x 48 - 2 Ledge | 185lb | 82264 | 82265 |
| 36 x 60" | 205lb | 82236 | 82237 |
| 36 x 72" | 235lb | 82238 | 82239 |
| 48 x 48" | 210lb | 82270 | 82272 |
| 48 x 60" | 250lb | 82240 | 82241 |
| 48 x 72" | 265lb | 82242 | 82243 |
| 48 x 96" | 345lb | 82244 | 82245 |

## Cabinet Type Surface Plate Stands

Cabinet stands provide a strong, rigid support for standard plates listed, plus a handy place to store frequently used inspection tools and accessories.

The standard height is 34-36" (900mm) from the floor to top of the surface plate.

All stands aremade from heavy-gage welded steel and have locking doors on the front. The 48" (1200mm) wide stands are equipped with doors front and back unless otherwise specified. Stands are supplied with leveling screws or casters as listed. Order by surface plate size and thickness.

**Cabinet Type Surface Plate Stands**

| Surface Plate Size | | Stand Weight | | Stationary Stand | Rolling Stand |
|---|---|---|---|---|---|
| Inch | mm | Lb | kg | EDP | EDP |
| 24 x 36 | 600 x 900 | 190 | 86 | 81504 | 81506 |
| 36 x 36 | 900 x 900 | 245 | 111 | 81516 | 81518 |
| 36 x 48 | 900 x 1200 | 300 | 136 | 81513 | 81515 |
| 36 x 60 | 900 x 1500 | 365 | 166 | 81519 | 81521 |
| 36 x 72 | 900 x 1800 | 440 | 200 | 81522 | 81524 |
| 48 x 72 | 1200 x 1800 | 660 | 299 | 81525 | 81527 |




# Granite Accessories

## Toolmakers' Flats

These handy flats are small precision surface plates that are ideal for many inspection and checking uses throughout the plant.

They are especially well suited for layout work and offer an easy, portable reference for gaging small parts.

Offered in Crystal Pink® or Black Granite, Starrett Toolmakers' Flats are 12" long x 8" wide x 2" thick (300 x 200 x 50mm) and finished to an overall tolerance of .0001" (0.0025mm).

The shipping weight without case is 20 lb (9kg).

| Toolmakers' Flats | |
|---|---|
| **Description** | **EDP** |
| Crystal Pink Granite | 81803 |
| Black Granite | 81802 |
| Sturdy Felt Lined Case for Toolmakers' Flat | 81804 |

## Three-Face Granite Tri-Squares

Three-Face Granite Tri-Squares provide an excellent, economical way for accurately checking the X-Y-Z axes on CNC machine tools and coordinate measuring machines.

Lying in the horizontal position, the X and Y axes can be checked for 90º squareness. With the square in the vertical position, tracing along the vertical edge of the square can check the perpendicularity of the Z axis.

Granite tri-squares may also be used in the same manner that steel squares would be used for the direct checking of squareness and straightness.

| Three-Face Granite Tri-Squares | | | | | |
|---|---|---|---|---|---|
| **Dimensions** | | | | **Accuracy Grade – EDP** | |
| **Length x Height x Thickness** | | **Weight** | | **AA Laboratory .000025"/6" TIR (0.0006/150mm)** | **A Inspection .000050"/6" TIR (0.0012/150mm)** |
| **Inch** | **mm** | **Lb** | **kg** | | |
| 6 x 9 x 3 | 150 x 225 x 75 | 18 | 8 | 81969 | 81970 |
| 9 x 12 x 3 | 225 x 300 x 75 | 23 | 10 | 81961 | 81962 |
| 12 x 18 x 4 | 300 x 450 x 100 | 60 | 27 | 81964 | 81965 |
| 18 x 24 x 4 | 450 x 600 x 100 | 120 | 54 | 81967 | 81968 |
| 24 x 36 x 6 | 600 x 900 x 150 | 570 | 259 | 81971 | 81972 |

Other sizes quoted on application.



# Granite Accessories

## Five-Face Master Squares

Five-Face Granite Master Squares are popular for accurately checking the X-Y-Z axes on CNC machine tools and coordinate measuring machines.

Lying in the horizontal position, the X and Y axes can be checked for 90º squareness. With the square in the vertical position, tracing along the vertical edge of the square can check the perpendicularity of the Z axis. By tracing along the top edge of the square while in the vertical position, it will check parallelism of the table in the X and Y axes.

Five-face master squares may also be used on any work that requires the checking of squareness or parallelism.




**Five-Face Master Squares**

| Dimensions Length x Height x Thickness | | Weight | | Accuracy Grade – EDP | |
|---|---|---|---|---|---|
| | | | | AA Laboratory .000025"/6" TIR (0.0006/150mm) | A Inspection .000050"/6" TIR (0.0012/150mm) |
| Inch | mm | Lb | kg | | |
| 12 x 12 x 3 | 300 x 300 x 75 | 41 | 19 | 81919 | 81920 |
| 14 x 14 x 3 | 350 x 350 x 75 | 56 | 25 | 81922 | 81923 |
| 16 x 16 x 4 | 400 x 400 x 100 | 98 | 44 | 81925 | 81926 |
| 24 x 24 x 4 | 600 x 600 x 100 | 220 | 100 | 81931 | 81932 |
| 36 x 36 x 6 | 900 x 900 x 150 | 855 | 388 | 81933 | 81934 |

24 x 24 and larger have a thru-hole for lifting with a sling.



## Granite Parallels

Produced in four standard sizes, Granite Parallels are useful in setting up work on surface plates and machine tables. They can also be used to elevate work above the surface of a plate to enable quick and easy inspection of piece parts with shoulders or steps.

Available in matched pairs, finished flat and parallel on two opposite narrow faces or all four faces. Parallels are sold in matched pairs. Single parallels available by request. Storage cases are available at extra cost.

**Granite Parallels**

| Length x Width x Thickness | | Grade AA Laboratory .000025"/6" TIR (0.0006/150mm) | | 2-Face | 4-Face | Grade A Inspection .000050"/6" TIR (0.0012/150mm) | | 2-Face | 4-Face | Weight Per Pair | | Case Only |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Inch | mm | Inch | mm | EDP | EDP | Inch | mm | EDP | EDP | Lb | kg | EDP |
| 6 x .75 x 1 | 150 x 19 x 25 | .000025 | 0.0012 | 81691 | 81692 | .000050 | 0.0025 | 81693 | 81694 | 1 | .5 | 81720 |
| 12 x 1 x 2 | 300 x 25 x 50 | | | 81695 | 81696 | | | 81697 | 81698 | 5 | 2.3 | 81721 |
| 18 x 1.5 x 3 | 450 x 37.5 x 75 | | | 81699 | 81700 | | | 81701 | 81702 | 18 | 8 | 81722 |
| 24 x 2 x 4 | 600 x 50 x 100 | | | 81703 | 81704 | | | 81705 | 81706 | 42 | 19 | 81723 |

# Granite Accessories

## Straight Edges

Our straight edges are produced from Crystal Pink® granite, as are all of our accessories. Straight edges have a single long, narrow face finished flat. Lifting holes are provided on sizes 48" or larger.



| Straight Edges | | | | | |
|---|---|---|---|---|---|
| Length x Width x Thickness | | Weight | | Grade AA Laboratory .000025"/6" TIR (0.0006/150mm) | Grade A Inspection .000050"/6" TIR (0.0012/150mm) |
| Inch | mm | Lb | kg | EDP | EDP |
| 2 x 4 x 24 | 50 x 100 x 600 | 22 | 10 | 81608 | 81648 |
| 2 x 6 x 36 | 50 x 150 x 900 | 48 | 22 | 81610 | 81650 |
| 3 x 8 x 48 | 75 x 200 x 1200 | 85 | 39 | 81612 | 81652 |
| 3 x 10 x 60 | 75 x 250 x 1500 | 198 | 90 | 81613 | 81653 |
| 3 x 12 x 72 | 75 x 300 x 1800 | 285 | 129 | 81614 | 81654 |

## Five-Face V-Blocks

V-Blocks are ideal for supporting or holding cylindrical pieces during manufacturing or inspection. They are provided in matched pairs and have 5 finished faces. V-blocks have a nominal 90-degree "V", centered with and parallel to the bottom and two sides and square to the ends.



| Five-Face V-Blocks | | | | | |
|---|---|---|---|---|---|
| Length x Width x Thickness | | Weight | | Grade AA Laboratory .000050"/6" TIR (0.0012/150mm) | Grade A Inspection .000100"/6" TIR (0.0024/150mm) |
| Inch | mm | Lb | kg | EDP | EDP |
| 3 x 3 x 3 | 75 x 75 x 75 | 6 | 3 | 81533 | 81530 |
| 4 x 4 x 4 | 100 x 100 x 100 | 15 | 7 | 81534 | 81531 |
| 6 x 6 x 6 | 150 x 150 x 150 | 48 | 22 | 81535 | 81532 |
| 9 x 9 x 9 | 225 x 225 x 225 | 160 | 73 | 81537 | 81536 |
| 12 x 12 x 12 | 300 x 300 x 300 | 380 | 172 | 81539 | 81538 |

## Six-Face Cubes

The granite cube has all six faces finished flat, perpendicular and parallel.



| Six-Face Cubes | | | | | |
|---|---|---|---|---|---|
| Length x Width x Thickness | | Weight | | Grade AA Laboratory .000025"/6" TIR (0.0006/150mm) | Grade A Inspection .000050"/6" TIR (0.0012/150mm) |
| Inch | mm | Lb | kg | EDP | EDP |
| 3 x 3 x 3 | 75 x 75 x 75 | 3 | 1 | 81980 | 81981 |
| 4 x 4 x 4 | 100 x 100 x 100 | 8 | 4 | 81982 | 81983 |
| 6 x 6 x 6 | 150 x 150 x 150 | 24 | 11 | 81984 | 81985 |

## Surface Plate Cleaner

To keep surface plates and other precision granite products in top condition, they should be cleaned frequently with Starrett Cleaner. This helps prevent abrasion of tools by dirt and other foreign particles.

The liquid cleaner, which also acts as a degreaser and rust inhibitor, should be used without water to minimize the risk of rusting tools.




| Surface Plate Cleaner | |
|---|---|
| Description | EDP |
| 55 Gal. (208 liter) Drum | 81820 |
| 1 Gal. (3.8 liter), Case of Four | 81822 |
| 1 Quart (1 liter), Case of 12 | 81824 |
| Waterless Cleaner, Case of 12 1lb jars | 81828 |

# Granite Accessories

## Angle Plates

Angle plates provide a convenient and practical means of clamping and holding work in a vertical position. Their excellent finish and flatness make them very compatible for use with granite surface plate accuracies. The angle plates are available with either 2 or 4 finished faces. The 2-face angle plate has the bottom and the adjacent square face finished flat and square to one another. The 4-face is similar to the 2-face, but has the two adjacent sides finished flat and square to the other two faces, as well as being parallel to each other.

## Four-Face Inserted Angle Plates

Inserted angle plates are available upon request. This product is the same as our standard angle plate, with the addition of metal discs inserted into one side. The inserted angle plates also have a main gauging face for magnetic chucking purposes and threaded inserts for clamping purposes.



| Angle Plates | | | | | | Four-Face Inserted Angle Plates | | | |
|---|---|---|---|---|---|---|---|---|---|
| Size Length x Width x Thickness | | Grade AA Laboratory .000025"/6" TIR (0.0006/150mm) | | Grade A Inspection .000050"/6" TIR (0.0012/150mm) | | Grade AA Laboratory .000025"/6" TIR (0.0006/150mm) | Grade A Inspection .000050"/6" TIR (0.0012/150mm) | Weight | |
| | | 2-Face | 4-Face | 2-Face | 4-Face | | | | |
| Inch | mm | EDP | EDP | EDP | EDP | EDP | EDP | Lb | kg |
| 4 x 4 x 4 | 100 x 100 x 100 | 81564 | 81565 | 81562 | 81563 | 81860 | 81861 | 8 | 4 |
| 6 x 6 x 6 | 150 x 150 x 150 | 81569 | 81568 | 81566 | 81567 | 81864 | 81865 | 24 | 11 |
| 6 x 9 x 12 | 150 x 225 x 300 | 81572 | 81573 | 81570 | 81571 | 81868 | 81869 | 72 | 33 |
| 9 x 9 x 9 | 225 x 225 x 225 | 81576 | 81577 | 81574 | 81575 | | | 80 | 36 |
| 12 x 12 x 12 | 300 x 300 x 300 | 81579 | 81578 | 81581 | 81580 | | | 190 | 86 |

## Surface Plate Covers

We highly recommend the use of surface plate covers to protect your precision granite investment. Prevent abrasive build up on your plates with our covers made from heavy gauge vinyl with a soft interior lining. Our covers provide a tough, durable, protective outside with a soft cushion inside.



| Vinyl Covers | | |
|---|---|---|
| For Surface Plate Size | | |
| Inch | mm | EDP |
| 12 x 12 | 300 x 300 | 83020 |
| 12 x 18 | 300 x 450 | 83021 |
| 18 x 18 | 450 x 450 | 83022 |
| 18 x 24 | 450 x 600 | 83023 |
| 24 x 24 | 600 x 600 | 83024 |
| 24 x 36 | 600 x 900 | 83025 |
| 24 x 48 | 600 x 1200 | 83026 |
| 30 x 48 | 750 x 1200 | 83034 |
| 36 x 36 | 900 x 900 | 83027 |
| 36 x 48 | 900 x 1200 | 83028 |
| 36 x 60 | 900 x 1500 | 83029 |
| 36 x 72 | 900 x 1800 | 83030 |
| 48 x 48 | 1200 x 1200 | 83035 |
| 48 x 60 | 1200 x 1500 | 83031 |
| 48 x 72 | 1200 x 1800 | 83032 |
| 48 x 96 | 1200 x 2400 | 83033 |

# Granite Surface Plates and Accessories



## Repeat Reading Gage

High-precision, fast checking of surface plate repeatability with readings taken with a dial indicator. Detects local error, not overall flatness. The base has an adjustment knob for zero-setting the cartridge-type gaging head, and all contact points resting on the granite, including the contact point of the gaging cartridge, are carbide and lapped to a fine finish.

The instrument also accommodates AGD indicators with .375" (9.5mm) diameter stems.

| Repeat Reading Gage | |
|---|---|
| **Description** | **EDP** |
| Gage Only | 81320 |
| Storage Case | 81321 |
| Travel Case | 81322 |
| 0.00002" Dial Indicator | 81850 |

## Granite Calibration Services

Starrett calibration and resurfacing services are available for all types and brands of granite surface plates. When certification of surface tolerance is required, recalibration service with an auto-collimator will be provided with accuracy traceable to the U.S. National Institute of Standards and Technology.

Calibration and resurfacing of surface plates, tri-squares, master squares, master angles, V-blocks, parallels and straight edges is available at our at Waite Park, MN location.

Resurfacing can also be done in your plant, saving crating and shipping costs as well as equipment down time. The cost is based on a square foot plate area with additional charge for travel. For a quotation, send us a list of plates, their sizes and the flatness tolerance required.

When resurfacing is done in your plant, tolerances for repeat reading of measurement will be per U.S. Federal Specification GGG-P-463c,and ASME B89.3.7-2013. Closer repeat reading tolerances of 25, 50 and 100 millionths can only be assured if the resurfacing is done at our facilities.

Recalibrations are provided by our Calibration Lab which is A2LA accredited.

| Tolerances for Repeat Reading of Measurement | | | | |
|---|---|---|---|---|
| | **Full Indicator Movement (F.I.M.) in Microinches and (Microns)** | | | |
| **Diagonal Inches (mm)** | **Grade AA** | **Grade A** | **Grade B** | **Obtained** |
| Through 30" (750) | 35 (.9) | 60 (1.5) | 110 (2.8) | |
| 30-60" (750-1500) | 45 (1.1) | 70 (1.8) | 120 (3) | |
| 60-90" (1500-2250) | 60 (1.5) | 80 (2) | 160 (4) | When not Specified |
| 90-120" (2250-3000) | 75 (1.9) | 100 (2.5) | 200 (5) | |
| 120-150" (3000-3800) | 90 (2.3) | 120 (3) | 240 (6) | |
| Over 150" (3800) | 100 (2.5) | 140 (3.6) | 280 (7) | |
| All Sizes | 25 (.6) | 50 (1.3) | 100 (2.5) | When Specified |

A repeat reading gage detects minute variations of the surface within the unilateral flatness tolerance of the whole surface.



# VISION SYSTEMS AND OPTICAL COMPARATORS

MV300, MV350
MVR200, MVR300
AV300, AV350
AVR200, AVR300
AV300+, AV350+, AV300+ Micro
LF303, LF463, LF713, LF963, LF1273
HDV300, HDV400
KineMic - KMR, KineScope
Specials
Specifications and Options
Software

# VISION

With the unbeatable combination of precision mechanics, powerful and intuitive software, and support from the most respected name in measurement, Starrett Metrology Systems take video-based and multi-sensor measuring systems to the next level.

Our broad range of metrology systems are ideal for use in QC labs, research, engineering, and manufacturing environments where small to large scale high-precision measurement is critical.

Many systems are available in either manual or CNC configurations.

The "Plus" and "LF" systems are multi-sensor instruments combining larger capacity with CNC and the capability to measure 2D or 3D geometry with powerful metrology software utilizing optional touch probes and laser sensors in addition to standard zoom optics.

Starrett vision systems combine high-resolution images with robust, precision mechanical metrology platforms to deliver superb accuracy and repeatable measurement results for a wide range of measurement applications. Systems are available with a choice of MetLogix™ or Quadra-Chek® software.

Starrett Metrology Systems provide quick Return-On-Investment through increased product quality, user time savings and alternative equipment reduction. Whether you are looking to solve a specific application or for a general purpose measurement tool, consider a system from Starrett!

# Manual Vision Metrology Systems

## MV

### MV300 AND MV350

MV metrology systems are easy-to-use, general purpose, and video-based with position control via hand wheels. Available with zoom optics, X and Y dimensions are measured by moving the stage horizontally. Z height is measured by moving an optical video probe vertically to maintain focus. A highly stable mechanical design and precision linear bearings achieve superb performance. The MV machines are ideal for QA, parts inspection, and short runs.

The operator interface is an M3-equipped PC. The part image, measuring marks, and readings are displayed on a color touch-screen. Video edge detection (VED), single and multi-point measurements of 2D geometries, and report generation are standard.




MV350

### Features

- Zoom optics 6.5:1
- MetLogix M3 control system software
- Video edge detection
- Easy manual X-Y-Z positioning
- Fiber Optic or LED illumination
- All in-one-PC with 21.5" (55cm) color touch-screen
- Windows® 7 Professional operating system
- Sub-stage bottom illumination and ring light surface illumination
- X-Y-Z travel for MV300: 12" x 6" x 5.5" (300 x 150 x 135 mm)
- X-Y-Z travel for MV350: 14" x 14" x 8" (350 x 350 x 200 mm)
- Manual X-Y-Z positioning via hand wheels on MV300, Motorized Z axis on MV350.
- Machine stand and control cart is standard with MV350

### Options

- Workstation
- 0.5x, 1.5x, and 2.0x auxiliary lenses for zoom optics
- Coaxial LED surface illumination
- Calibration standards
- DXF/FOV option pack for automatic comparison to CAD designs
- Modular workstation for MV300




MV300

### Weight and Dimensions

| | MV300 | MV350 |
|---|---|---|
| Net Weight | 115lbs<br>53kg | 900lbs<br>409kg |
| Shipping Weight | 345lbs<br>157kg | 1,275lbs<br>579kg |

For more information please see the Options and Specifications table at the end of this section.

# Manual Vision Metrology Systems

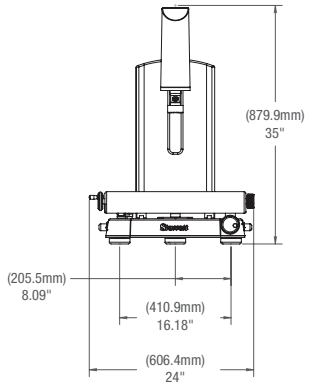
## MVR

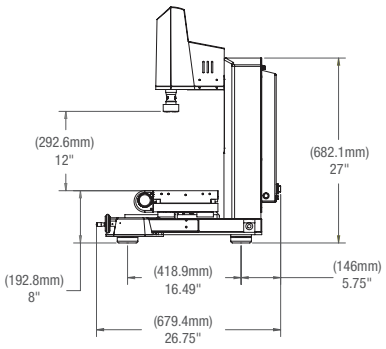
### MVR200 AND MVR300

The MVR manual vision metrology systems are ideal for individual measurements or short runs. They are available with dedicated 6.5:1 zoom optics or a quick-change bayonet lens mount which accepts zoom optics or telecentric lenses for micron-level resolution and optical distortion down to 0.001% for accurate field-of-view (FOV) measurements. These can encompass an entire small part up to 2.00" x 1.50" or a feature of a larger part and be seamlessly integrated with stage motion to measure parts with a length up to 8" (MVR200) or 12" (MVR300). The operator interface is a 21.5" all-in-one touch screen PC which runs MetLogix M3 FOV software under Windows® 7 Professional. The screen displays a live video image of the part plus geometry tools and digital readings. The image of the part can be resized using zoom, and measurements can be taken by simply tapping a feature on the screen.

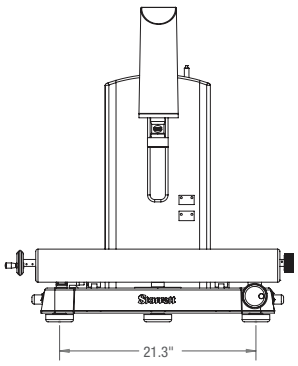
MVR hardware features include a granite base for maximum stability, recirculating ball linear guides for smooth and precise stage motion, and a motorized Z-axis with variable speed control.

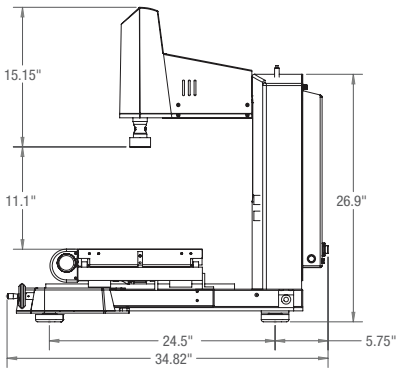
### MVR200




### MVR300




### Features

- X-Y travel for MVR200: 8" x 4" (200 x 100 mm)
- X-Y travel for MVR300: 12" x 8" (300 x 200 mm)
- Z travel: 8" (200 mm) with 2.0x auxiliary lens
- Manual X-Y positioning via hand wheels
- Motorized Z-axis positioning with variable speed control
- Windows® 7 Professional operating system for network connectivity
- MetLogix M3 metrology software with DXF/FOV option pack
- Video edge detection (VED)
- Field-of-view (FOV) measurements integrated with stage motion
- Renishaw scales for .00002" (0.5 µm) of X and Y resolution
- Accuracy: 2.5µm + 5L/1000 for X and Y, 2.5µm + 5L/1000 for Z
- Color digital video camera
- Collimated LED sub-stage illumination
- Ring light LED surface illumination
- Granite base

### Options

- Dedicated 6.5:1 zoom optics
- Quick-change bayonet lens mount
- Quadrant LED Ring Light
- Bayonet-mountable 6.5:1 zoom optics
- Bayonet mountable 0.30x, 0.50x, 0.80x, 1.0x, 2.0x, and 4.0x telecentric optics
- 0.5x, 1.5x, and 2.0x auxiliary lenses for zoom optics
- Calibration standards
- Coaxial LED surface illumination for zoom optics
- DXF/FOV option pack for automatic comparison to CAD designs
- Modular system workstation

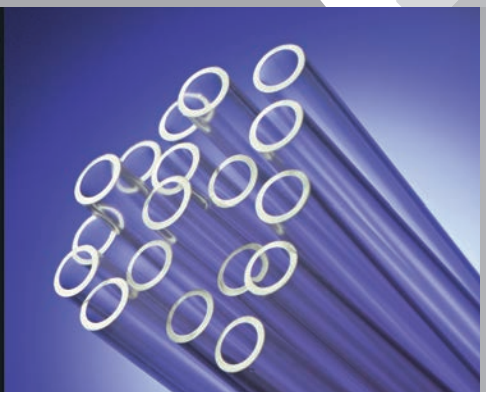
### Weight and Dimensions

| | MVR200 | MVR300 |
|---|---|---|
| Net Weight | 200lbs<br>90kg | 250lbs<br>113kg |
| Shipping Weight | 250lbs<br>115kg | 300lbs<br>135kg |

For more information please see the Options and Specifications table at the end of this section.

MVR200

# MVR MANUAL VISION SYSTEM







# Automatic Vision Metrology Systems

## AV

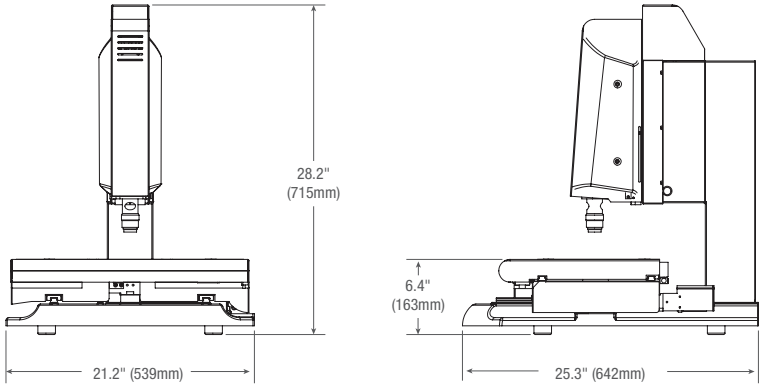
### AV300 AND AV350

The AV automatic vision (or video-based) metrology systems provide accurate 3-axis measurement capability (X-Y-Z) with hi-resolution video zoom optics. The systems can be pre-programmed (CNC) for repetitive part inspection, or driven manually via a joystick and trackball for individual measurements. Superb performance is achieved by a highly stable mechanical design, with precision linear bearings. Throughput is maximized with either QC5000 or Metlogix M3 software controlling all aspects of Video Edge Detection (VED) and multiple channel Fiber Optic or LED illumination.

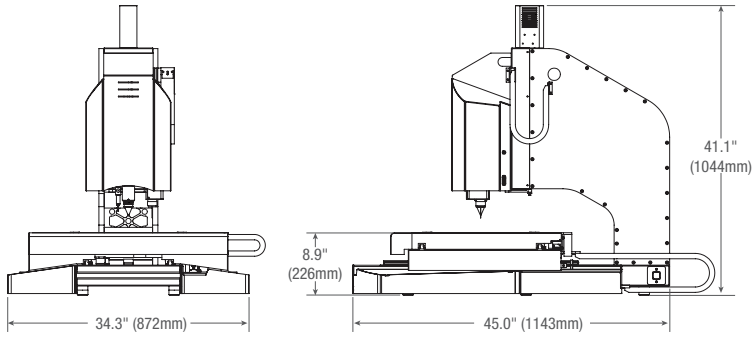
These automatic vision systems are ideal for quality assurance, inspection, and production runs. Flexible and powerful, the AV series allows users to cost effectively achieve maximum throughput of their inspection process. Measured data is effectively archived or networked to other devices.

Also see our AV+ multi-sensor metrology systems, which can provide vision metrology operation with travel up to 50" x 36" x 8" (1270 x 915 x 200mm).

### AV300




### AV350




### Features

- CNC operation or manual operation via joystick and trackball
- AV300 12" x 6" x 5.5" (300mm x 150mm x 140mm)
- AV350 14" x 14" x 8" (350mm x 350mm x 200mm)
- AV300, E2 = 1.9 µm + 5L/1000 accuracy for X and Y, E1 = 2.5 µm + 5L/1000 for Z
- AV350, E2 = 2.5 µm + 5L/1000 accuracy for X and Y, E1 = 2.5 µm + 5L/1000 for Z
- Reading resolution 4µin (0.1µm)
- Magnification on 24" monitor, 1:1 pixel setting: 37x to 240x with 6.5:1 zoom, 25x to 240x with 12:1 zoom
- Multiple channel Fiber Optic or LED Illumination
- Cast aluminum base for AV300. Granite base on AV350
- 1.3 megapixel color camera

### Lens Options

- 6.5:1 or 12:1 zoom optics
- Optional 0.5x, 1.5x and 2.0x auxiliary lenses

### Options

- Ergonomic workstation (standard with AV350)
- Calibration standards
- 0.5x, 1.5x and 2.0x auxiliary lenses for zoom optics
- LED darkfield quadrant illuminator

### Weight and Dimensions

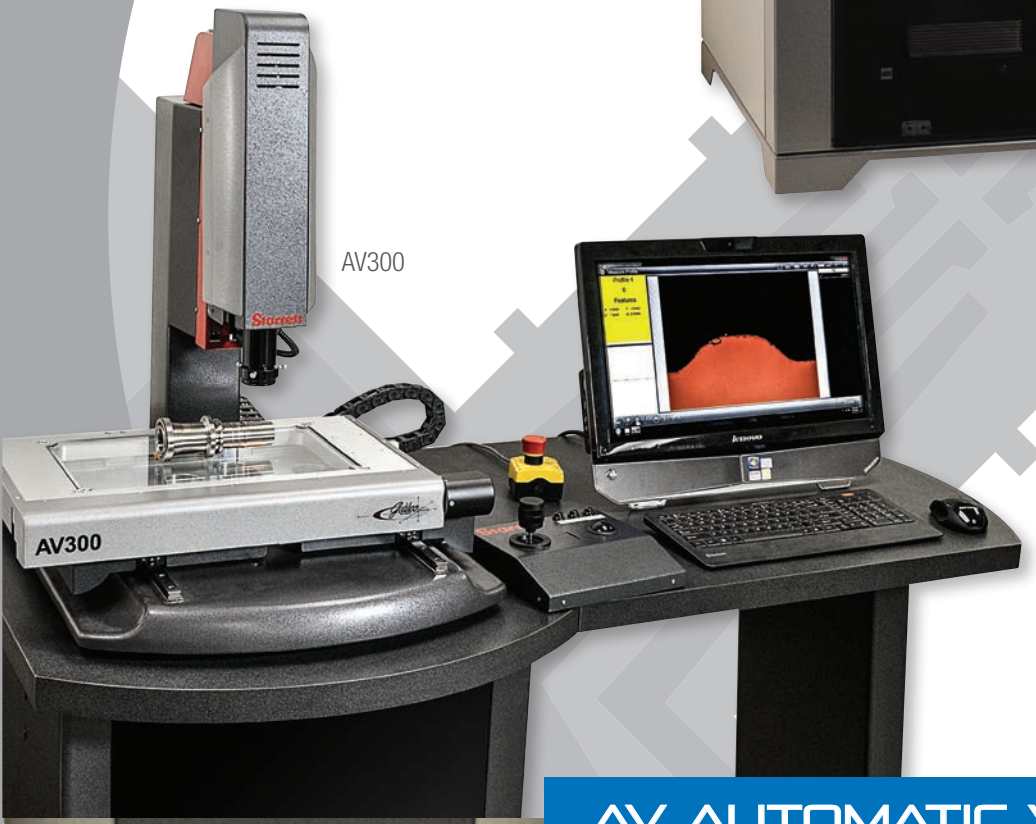
| | AV300 | AV350 |
|---|---|---|
| Net Weight | 115lbs<br>53kg | 900lbs<br>409kg |
| Shipping Weight | 345lbs<br>157kg | 1,275lbs<br>579kg |

For more information please see the Options and Specifications table at the end of this section.

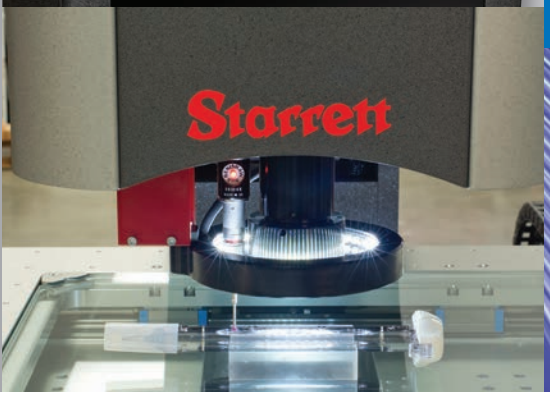
AV350




AV300




# AV AUTOMATIC VISION SYSTEM








# Automatic Vision Metrology Systems

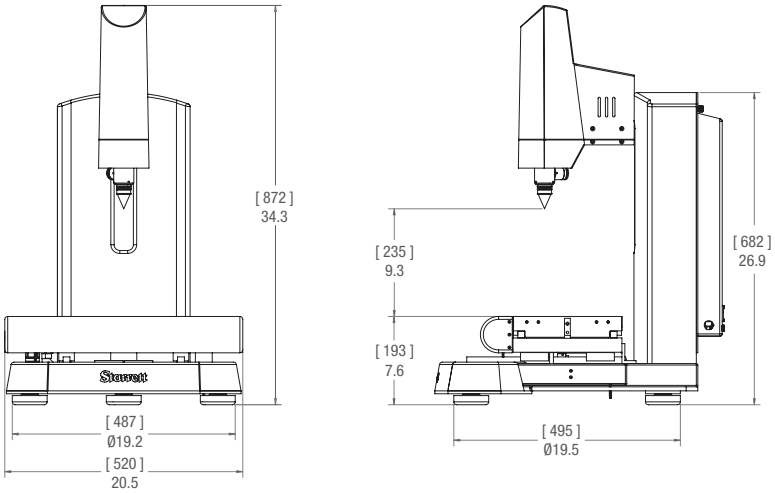
## AVR

### AVR200 AND AVR300

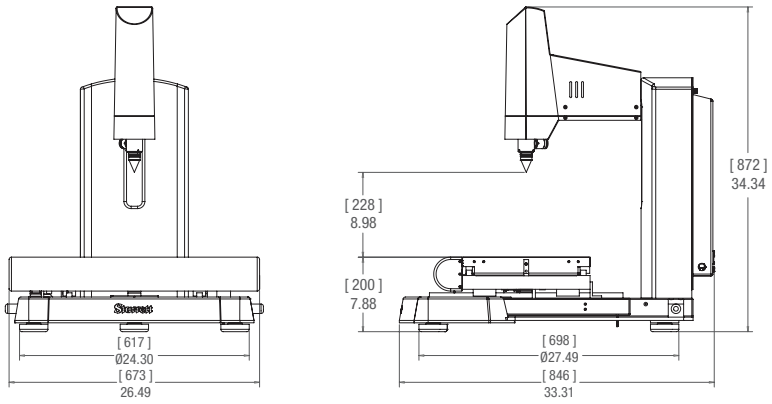
The AVR CNC automatic vision metrology systems are ideal for repetitive measurements and automatic comparison to CAD files. They are available with dedicated zoom optics or a quick-change bayonet lens mount which accepts a choice of telecentric lenses for micron-level resolution and optical distortion down to 0.001% for accurate field-of-view (FOV) measurements. These can encompass an entire small part up to 2.00" x 1.50" or a feature of a larger part and be seamlessly integrated with stage motion to measure parts with a length up to 8" (AVR200) or 12" (AVR300).

AVR hardware features a granite base for maximum stability, recirculating ball linear guides for smooth and precise stage motion, and full CNC control for high throughput. The AVR line is built around a 21" all-in-one touch screen PC which runs MetLogix M3-CNC software under Windows® 7. M3 software capabilities include 3-axis measurements and 2D geometrical constructs (points, lines, angles, rectangles).

### AVR200




### AV300




For more information please see the Options and Specifications table at the end of this section.

### Features

- X-Y travel for AVR200: 8" x 4" (200 x 100 mm)
- X-Y travel for AVR300: 12" x 8" (300 x 200 mm)
- Z travel: 8" (200 mm) with 2.0x auxiliary lens
- Full CNC X-Y-Z positioning or motorized manual positioning using a pendant with joystick and trackball
- Windows® 7 Professional operating system for network connectivity
- MetLogix M3 CNC metrology software
- Video edge detection (VED)
- Field-of-view (FOV) measurements integrated with stage motion
- Renishaw scales for .00002" (0.1µm) of X,Y and Z axis
- Accuracy: 2.5µm + 5L/1000 for X and Y, 3.5µm + 5L/1000 for Z
- Color digital video camera
- Collimated LED sub-stage illumination
- Ring Light LED surface illumination
- Granite base
- AVR200 H x W x D: 34" x 20.5" x 27" (863 x 520 x 685mm)
- AVR300 H x W x D: 34" x 29.2"x 35" (865 x 740 x 890mm)

### Options

- Dedicated 6.5:1 or 12:1 CNC zoom optics
- Quick-change bayonet lens mount for telecentric optics
- Bayonet mountable 0.30x, 0.50x, 0.80x, 1.0x, 2.0x, 4.0x telecentric optics
- 0.5x, 1.5x and 2.0x auxiliary lenses for zoom optics
- Quadrant LED surface illumination for zoom optics
- DXF/FOV option pack for automatic comparison to CAD designs
- Modular system workstation
- Calibration standards

### Weight and Dimensions

| | AVR200 | AVR300 |
|---|---|---|
| Net Weight | 200lbs<br>90kg | 250lbs<br>113kg |
| Shipping Weight | 250lbs<br>115kg | 300lbs<br>135kg |

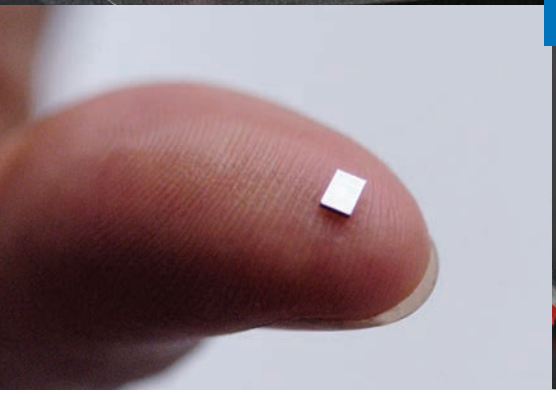
AVR300

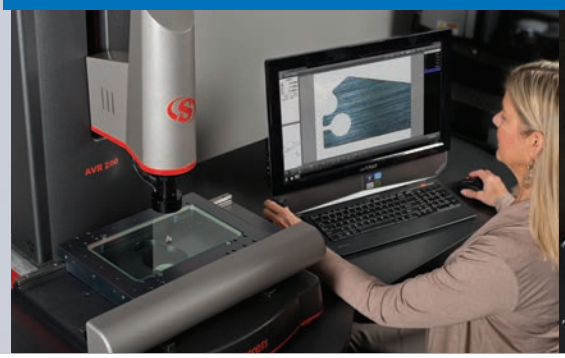


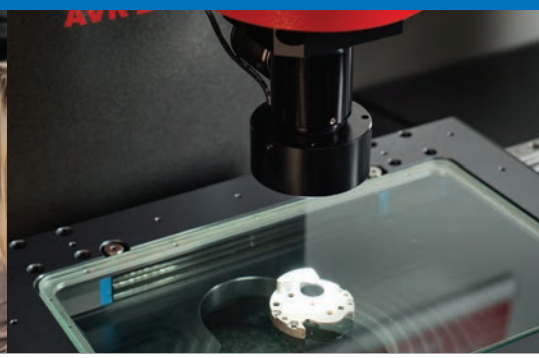
AVR200




# AVR AUTOMATIC VISION SYSTEM







# Automatic Vision Metrology Systems

## AV+
### MULTI-SENSOR

### AV300+

An enhanced version of the popular AV300 CNC video-based measurement system. The AV300+ system improves measuring performance by utilizing a precision granite base along with an extended travel Z column, delivering 12" x 6" x 8" (300 x 150 x 200mm) X-Y-Z measuring range. The system is a servo driven motion platform for enhanced performance and includes a 12:1 zoom lens, hi-resolution digital color camera and your choice of fiber optic or LED Illumination. Complete with vibration isolation and integrated machine stand, the AV300+ delivers more capability for multi-sensor requirements. The AV300+ is powered by QC5300 software to handle a variety of measuring applications.

### AV350+

Offering similar attributes and performance to the AV300+ with an expanded measurement envelope of 14" x 14" x 8" (350 x 350 x 200mm) X-Y-Z measuring range for those larger part and payload measurement requirements.

#### Features

- 12:1 Zoom Optics with co-axial illumination
- Precision Granite base construction
- System stand and control cart standard
- Windows® 7 Professional operating system for network connectivity
- Touch probe and laser compatible
- Touch probe change rack compatible

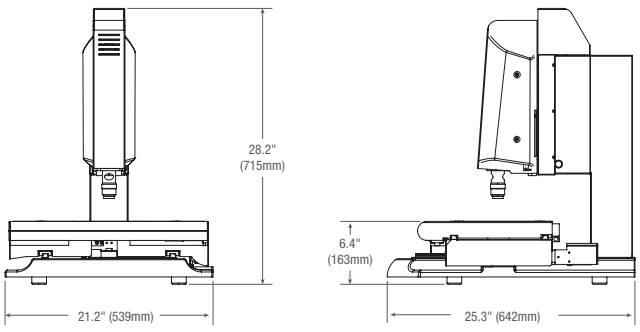
## AV300+ Micro
### MICROSCOPE-BASED OPTICS

The AV300+ Micro is a CNC system that offers a granite base and column, 12" x 6" x 4" (300 x 150 x 100mm) travel, microscope optics, a lens turret which accepts up to Five Olympus M plan objectives, a choice of powerful QC5300 or PAXIT software control systems, video edge detection (VED), LED or fiber optic illumination options, standard machine pedestal and computer cart. With PAX-it imaging software, an operator can measure, image analysis software is available to detect objects by shape, size, color and other criteria. PAX-it can measure, annotate, and analyze the images, and then create a written report that includes the images. Processing options include image stitching, fusion, blending, and background subtraction. These systems are ideal for automated measurements of microscopic features, such as semiconductors, microelectronic and biomedical components.

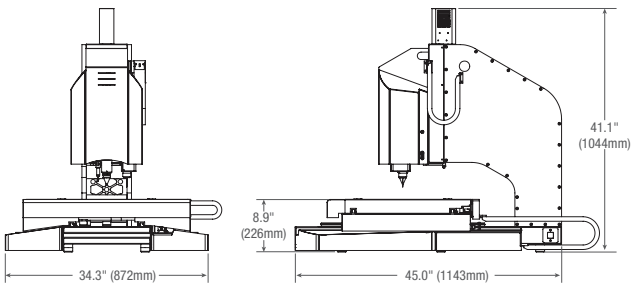
#### Features

- QC5000 or PAXIT software
- X travel of 12" (300mm), Y 6" (150mm), Z 4" (100mm)
- Turrett holds up to 5 Olympus lenses
- Scale resolution up to 5nm
- Adaptable to your applications

### AV300+




### AV350+




#### Weight and Dimensions

| | AV300+ | AV350+ | AV300+ MICRO |
|---|---|---|---|
| Net Weight | 115lbs<br>53kg | 900lbs<br>409kg | 115lbs<br>53kg |
| Shipping Weight | 345lbs<br>157kg | 1,275lbs<br>579kg | 345lbs<br>157kg |

For more information please see the Options and Specifications table at the end of this section.

AV350+




AV300+ MICRO




AV300+




# AV+ VISION SYSTEMS








# Large Format Premier

## LF

Our LF Premier machines offer X-Y travel from 12" (305mm) to a generous 50" (1273mm). Z travel is 8" (200mm). Increased accuracy helps you verify critical dimensions. Ideal for use in QC labs, research, engineering, or manufacturing environments.

### Features

- Transports are driven by hi-speed (up to 30" per second), zero maintenance, balanced linear motors which are close-looped to precision hi-resolution scales in all three axes
- Adjustable ergonomic workstation including a compact control panel and standard keyboard maximizes operator performance
- Massive granite base, bridge and air-bearing ways for superior machine stability and precision
- QC5300 or MetLogix M3 Software
- 21.5" touchscreen with M3 software
- 24" monitor with QC5300

### Options

- Optional Renishaw contact probe and laser scanner allows these systems to be configured to meet a variety of measurement needs (with QC5300)
- Optional touch probe spotter camera for viewing critical placement of touch probe points as well as a touch probe changing rack
- LED Surface Ring Illumination
- LED Transmitted Illumination
- LED Coaxial Illumination
- Digital Video Color Camera: 1.2 MP, 1/3" SXVGA sensor

1. **User Programmability**. Over-movement, focus, magnification, lighting, data acquisition tools, and reporting. Automating these tasks eliminates operator error and speeds throughput.
2. **Accurate Positioning** of samples obtained from high acceleration, linear motors, and high accuracy scales to determine position. Path optimization may improve throughput.
3. **Non-Linear Error Correction (NLEC)** software feature allows any errors detected in the measurement system to be corrected automatically. The entire measurement area is mapped and compensated for inherent mechanical errors.
4. **Video Edge Detection (VED)** is user programmable feature, which allows the choice of how the software sees a feature. Setting the threshold strength and the VED method provides great flexibility in the types of features that can be measured.
5. **Powerful software choices**. QC5300 provides a flexible solution that allows a user to run up to 3 sensors on the system; video, touch probe and laser. MetLogix M3 software offers powerful simplicity with a touchscreen operator interface and a wide range of software measuring functionality.

These five concepts, combined with other principles, make the LF Vision Line a teachable, automatic, and accurate measuring device.

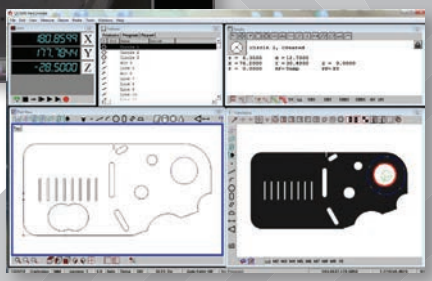
### Weight and Dimensions

| Model | | LF313 | LF463 | LF713 | LF963 | LF1273 |
|---|---|---|---|---|---|---|
| Dimensions (W x D x H) | | 34" x 40" x 68" (87 x 102 x 173cm) | 40" x 40" x 68" (102 x 102 x 173cm) | 50" x 64" x 68" (127 x 163 x 173cm) | 69" x 80" x 71" (176 x 204 x 180cm) | 85" x 93" x 71" (217 x 235 x 180cm) |
| Weight | gross | 1950lb (885kg) | 2300lb (1043kg) | 3600lb (1630kg) | 4600lb (2087kg) | 6600lb (2994kg) |
| | net | 1300lb (590kg) | 1500lb (726kg) | 2700lb (1225kg) | 3500lb (1588kg) | 5400lb (2450kg) |

For more information please see the Options and Specifications table at the end of this section.



M3 Software display



QC5000 display




## LARGE FORMAT PREMIER







# Horizontal Digital Video Projector

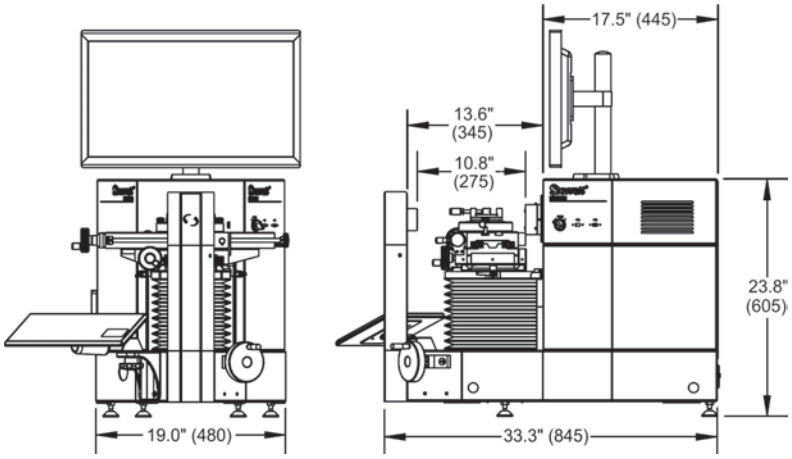
## HDV

### HDV300 AND HDV400

### HDV300 CNC AND HDV400 CNC

The HDV horizontal digital video comparators combine the best features of a horizontal optical comparator and a vision metrology system. With a rigid steel design, they are configured like a traditional horizontal comparator. The workstage is the same as the Starrett field-proven HB400 and HD400 comparators, with a 110lb (50kg) load capacity. The heart of the system centers on a uniquely designed interchangeable lens mounting system coupled to a hi-resolution color digital video camera (patent pending). The system is available with a choice of seven telecentric lenses for micron-level resolution and optical distortion as low as 0.001% for accurate field-of-view (FOV) measurements. Lenses provide a maximun FOV of up to 2.44" x 1.85" (62mm x 47mm). Stage movement can be related to the imported file allowing part comparison up to 16" (400mm) long.

The HDV systems house a powerful 64-bit PC, which runs MetLogix M3 Metrology software. With this software, DXF CAD files can be imported and 2D Go/No-Go gages can be developed directly from the CAD files. Video edge detection (VED), allows real-time interaction of the imported file with the video image of the part being inspected. Productivity, speed and accuracy are all enhanced. Systems are available in manual or CNC control.







For more information please see the Options and Specifications table at the end of this section.

### Features

- Steel construction with hard anodized X Y stage
- 12" x 6" (300mm x 150mm) of stage travel for HDV300
- 16" x 6" (400mm x 150mm) of stage travel for HDV400
- 21.3" x 5.1" (540mm x 130mm) workstage
- 110lb (50kg) maximum load capacity
- 2" (51mm) of focus travel
- Helix angle adjustment with ±15° Vernier scale
- Manual X-Y and focus positioning via hand wheels or CNC with joystick and trackball positioning
- Heidenhain glass scales for 0.5µm (.00002") X and Y resolution
- LED illumination for surface and profile lighting
- 5 megapixel color camera (2448 x 2058 pixels)
- Ultra-low distortion to 0.001% for telecentric FOV measurements
- 64-bit Intel® Processor
- Windows® 7 Professional operating system
- MetLogix M3 software with DXF/FOV option pack
- Parts displayed on 24" (60cm) touch-screen color monitor (1920 x 1080 pixels)

### Options

- 7 interchangeable telecentric lenses for fields of view from 2.36" x 1.77" to 0.09" x 0.07" (patent pending)
- 6.5:1 zoom optics
- 23" or 32" high cabinet stands
- Calibration standards

### Weight and Dimensions

| | HDV300 | HDV400 |
|---|---|---|
| Net Weight | 220lbs<br>100kg | 230lbs<br>105kg |
| Shipping Weight | 300lbs<br>100kg | 440lbs<br>200kg |



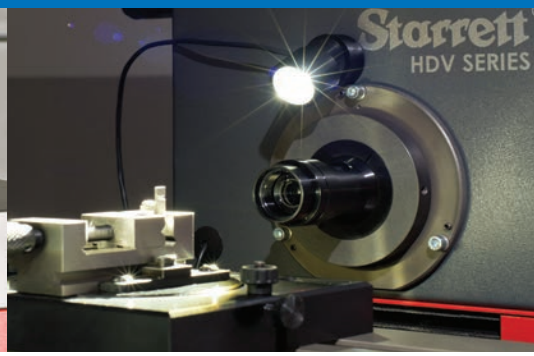

HDV300

## HORIZONTAL DIGITAL VIDEO PROJECTOR









# Video Inspection Systems

## KineMic™

### KMR

KineMic video microscopes are a family of seven versatile and affordable inspection and vision metrology systems. They are ideal for receiving inspection, quality assurance, training, manufacturing assembly, research, and documentation – wherever easy setup and a range of magnifications are required. Depending on the size of the parts to be measured, measurements can be all electronic within the field of view, or be integrated with stage motion for parts up to 8" (200mm).



KMR-200 with M3

### Features

- XGA models set the standard for quick setup and ease of use by not requiring a computer
- D1 and M3 models offer the power of a 21.5" color touch-screen PC with MetLogix D1 or M3 inspection and metrology software
- LED surface and transmitted illumination
- Small footprint takes up minimal space

Our KMR systems line provide high performance for low cost. These machines are simple to operate without compromising performance.

Lighting options, either manually or through the software, target less eye strain and neck fatigue for the operator. With seven models to choose from, we can customize to your specific needs.

Call for an exact quote.

| | KineMic XGA Zoom, Basic | KineMic XGA Zoom, 2 x 2 Stage | KineMic D1 Zoom | KineMic D1 Zoom, 2 x 2 Stage | KineMic M3 Zoom, 4 x 8 Stage | KineMic M3 Zoom, FOV | KineMic M3 Telecentric, FOV |
|---|---|---|---|---|---|---|---|
| **Part Number** | KMR-XGA | KMR-50-XGA | KMR-D1 | KMR-50-D1 | KMR-200-M3 | KMR-M3 | KMR-TFOV-M3 |
| **Optics** | 6.5:1 zoom | 6.5:1 zoom | 6.5:1 zoom | 6.5:1 zoom | 6.5:1 zoom | 6.5:1 zoom | 6 telecentric lenses |
| **CCD Sensor** | 0.83 MPixel | 0.83 MPixel | 1.33 MPixel | 1.33 MPixel | 1.33 MPixel | 1.33 MPixel | 2.02 MPixel |
| **Camera Interface** | VGA cable | VGA cable | USB cable | USB cable | USB cable | USB cable | USB cable |
| **Computer** | N/A | N/A | All-in-one PC | All-in-one PC | All-in-one PC | All-in-one PC | All-in-one PC |
| **Software** | N/A | N/A | MetLogix D1 | MetLogix D1 | MetLogix M3 | MetLogix M3 | MetLogix M3 |
| **Video Screen** | 19" XGA monitor | 19" XGA monitor | 21.5" all-in-one PC | 21.5" all-in-one PC | 21.5" all-in-one PC | 21.5" all-in-one PC | 21.5" all-in-one PC |
| **Screen Resolution** | 1024 x 768 | 1024 x 768 | 1920 x 1080 | 1920 x 1080 | 1920 x 1080 | 1920 x 1080 | 1920 x 1080 |
| **Lens Magnification** | 0.7x to 4.5x | 0.7x to 4.5x | 0.7x to 4.5x | 0.7x to 4.5x | 0.7x to 4.5x | 0.7x to 4.5x | 0.30x, 0.50x, 0.80x, 1.0x, 2.0x, 4.0x |
| **Screen Magnification** | 31x to 200x | 31x to 200x | 31x to 200x | 31x to 200x | 31x to 200x | 31x to 200x | 13x to 178x |
| **Auxiliary lenses** | 0.5x, 0.75x, 1.5x, 2x | 0.5x, 0.75x, 1.5x, 2x | 0.5x, 0.75x, 1.5x, 2x | 0.5x, 0.75x, 1.5x, 2x | 0.5x, 0.75x, 1.5x, 2x | 0.5x, 0.75x, 1.5x, 2x | N/A |
| **Field of view (X-axis)** | 1.4 to 9.0mm | 1.4 to 9.0mm | 1.4 to 9.0mm | 1.4 to 9.0mm | 1.4 to 9.0mm | 1.4 to 9.0mm | 1.8 to 24mm |
| **X-Y Stage Motion** | None | 50 x 50 mm | None | 50 x 50 mm | 200 x 100 mm | None | None |
| **Metrology Means** | None | Micrometers | D1 software** | D1 software** | X and Y encoders | M3 FOV software | M3 FOV software |
| **Measurement Resolution** | N/A | 1µm (.00005") | Up to 2µm* | 1µm (.00005") | 0.5µm (0.00002") | Up to 2µm* | Up to 2µm* |
| **Meas. Accuracy** | N/A | 3µm per 25mm | Up to ±2.5µm* | 3µm per 25mm | 2.5µm + 5L/1000 | Up to ±2.5µm* | Up to ±2.5µm* |
| **Basic Stand** | Standard | Standard | Standard | Standard | Standard | Standard | Standard |
| **Boom Stand** | Optional | N/A | Optional | N/A | N/A | Optional | N/A |
| **LED Back Light** | Standard | Standard | Standard | Standard | Standard | Standard | Standard |
| **LED Ring Light** | Standard | Standard | Standard | Standard | Standard | Standard | Standard |
| **Lighting Control** | Adjustment knobs | Adjustment knobs | Adjustment knobs | Adjustment knobs | Via M3 software | Via M3 software | Via M3 software |

* These are best values. Actual values will depend on the zoom lens setting or selected telecentric lens.

**D1 software basic measurements are taken by manually positioning a crosshair on the screen.

Disclaimer: Due to continual product improvements, specifications may change without notice.





KMR 50-D1



KMR-XGA



KMR-D1



KMR-FOV wtih M3

| | KineMic XGA Zoom, Basic | KineMic XGA Zoom, 2 x 2 Stage | KineMic D1 Zoom | KineMic D1 Zoom, 2 x 2 Stage | KineMic M3 Zoom, 4 x 8 Stage | KineMic M3 Zoom, FOV | KineMic M3 Telecentric, FOV |
|---|---|---|---|---|---|---|---|
| **Model Number** | KMR-XGA | KMR-50-XGA | KMR-D1 | KMR-50-D1 | KMR-200-M3 | KMR-M3 | KMR-TFOV-M3 |
| **Video Inspection** | Yes | Yes | Yes | Yes | Yes | Yes | Yes |
| **Basic Dimensions** | No | Manual LCD Micrometer | Yes - Manual | Manual LCD Micrometer | Yes | VED | VED |
| **Geometric Constructs** | No | No | No | No | Yes | Yes | Yes |
| **Image Annotation** | No | No | Yes | Yes | Yes | Yes | Yes |
| **Image Archiving** | No | No | Yes | Yes | Yes | Yes | Yes |
| **Video Edge Detection** | No | No | No | No | Yes | Yes | Yes |




# Video Inspection Systems

## KineScope

A digital video camera with precision optics and LED lighting, in a microscope that fits in the palm of your hand. The KineScope has 40-140x magnification, which lets you zoom in on the fine details of electronics, product parts, or anything else too small to see.

Place the KineScope over the object and view the image on your computer screen instead of looking into a small eyepiece. Capture images or video and easily add labels, make measurements, and draw on the live image. The KineScope connects to your computer's USB port and includes VLink imaging software.




## Features

- View live and captured images on a computer screen (or use a computer projector for large groups)
- 40-140x magnification
- Completely portable with your laptop computer
- Save still images, movies and time lapse
- Apply labels, markers, time stamps and measurement
- Draw directly on the live image
- Includes VLink imaging software

## Specifications

- Image Sensor: 1/4" CMOS
- Pixel Resolution: 640 x 480
- Power Req. USB Port, 2.0 or greater
- Minimum Operating System Requirements: Windows® 2000, XP or Vista with DirectX 8.1 and Pentium III 500MHz (also compatible with Windows® 7 and 8 in either 32 or 64 bit. MAC versions are also available)
- Illumination: Super-Bright LED

| | |
|---|---|
| **System Type** | Hand Held |
| **Illumination - Standard** | LED and IR |
| **Magnification Range** | 40x and 140x |
| **Field of View at Low Magnification** | 7.5mm x 10mm |
| **Field of View at High Magnification** | 1.8mm x 2.5mm |
| **Video Camera** | 2 MP Digital |
| **Control System/Software** | VLink |
| **Display PC and Monitor** | Required (not included) |
| **Image Capture** | Standard |
| **Resolution** | 4 microns (at High Magnification) |
| **Base Stand** | Optional |
| **Boom Stand** | Optional |
| **Power Requirement** | USB |
| **Calibration Standards** | Optional |

# Accessories

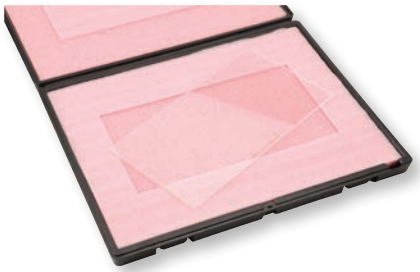
Starrett offers a wide variety of accessories to customize our products for your applications. Contact us for details.



Fiber Optic Lighting



Rotary Head with choice of collet kit



Calibration Standards



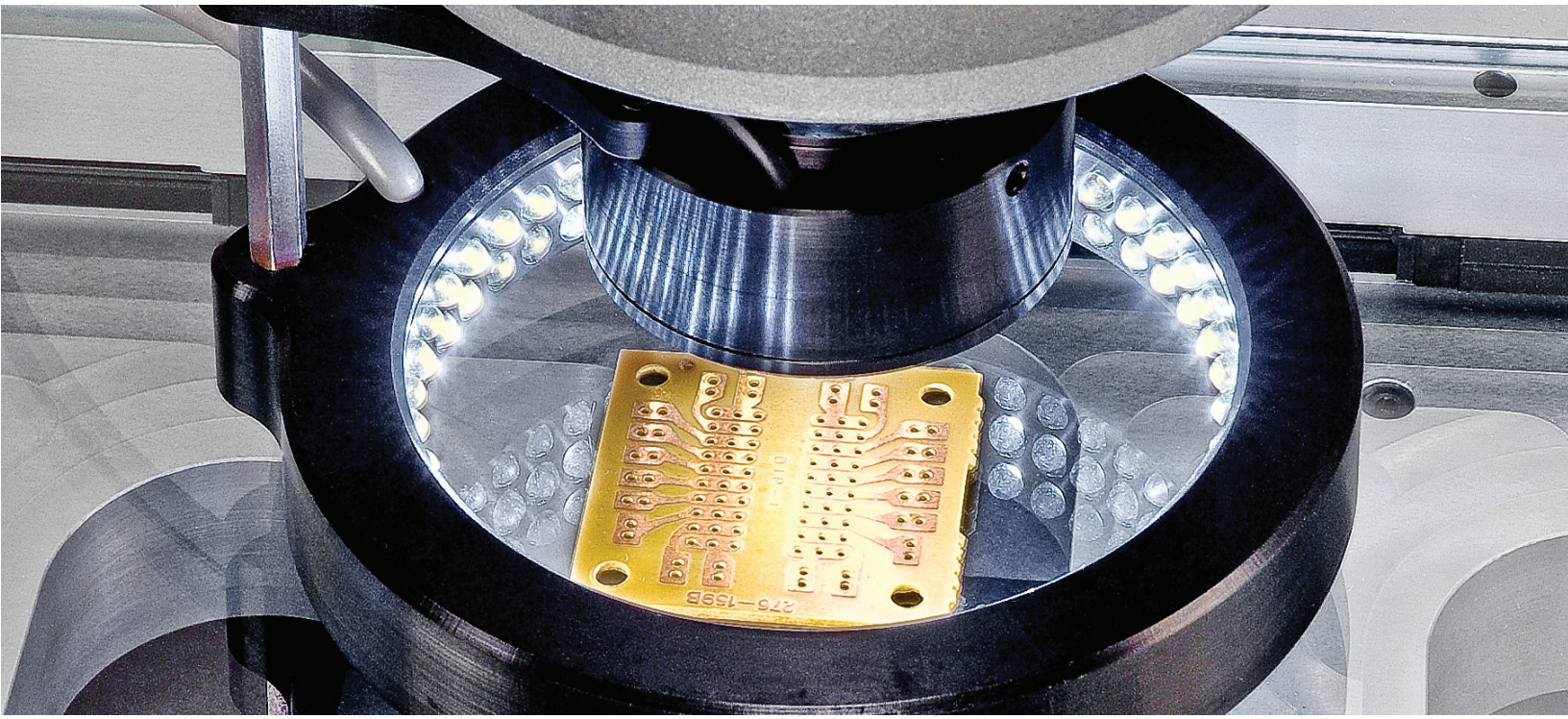
Renishaw Touch Probe Kit



Workstation Pedestal - Extension can be mounted left or right



Workstation Monitor Mount and Keyboard Swing Arm



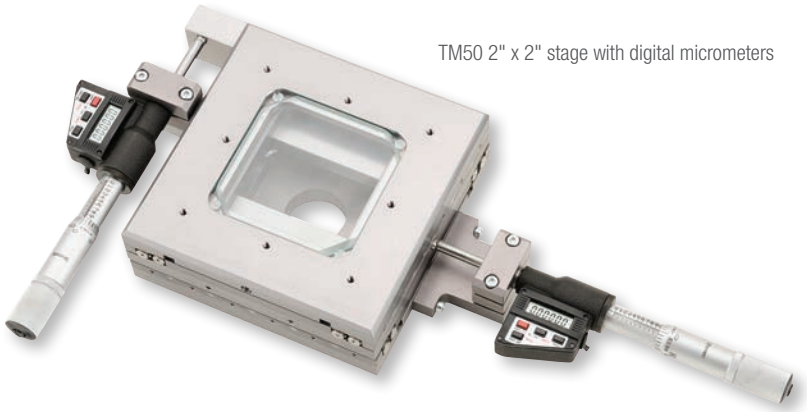
# Motion Stages

## TM X-Y stages

TM X-Y stages are designed for use in a variety of applications such as measurement, microscopy, inspection, and automation. TM stages adapt to existing microscopes from Nikon and Mitutoyo and are available in manual and motorized configurations. Custom sizes and configurations are also available.




TM200 4" x 8" stage



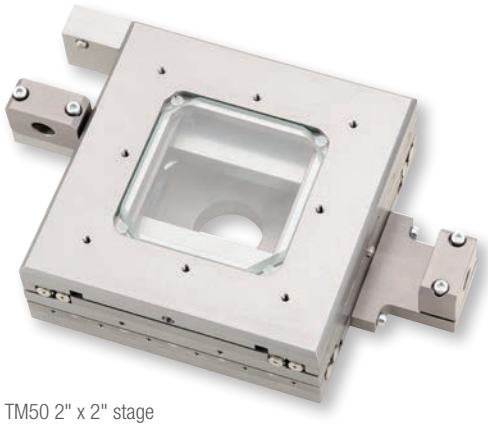
TM50 2" x 2" stage with digital micrometers

### Specifications

- Measurement Area (X-Y):
  TM200: 4" x 8" (200mm x 100mm)
  TM50: 2" x 2" (50mm x 50mm)
- Accuracy: E1=3.5+5L/1000
  (with computer enhancement)
- Resolution:
  TM200: 20µin (0.5µm)
  TM50: 100µin
- X-Y Squareness: Within 100µin/1"
  (2.5µm/25mm)
- Top Tooling Plate Overall Size:
  TM200: 14" x 8" (350mm x 200mm)
  TM50: 6" x 6" (150mm x 150mm)
- Repeatability: within 2.5mm

### Features

- Manual Drives are hand wheels with leadscrews on the TM200 or 2" (50mm) micrometer heads on the TM50
- Precision machined from heat treated, billet aluminum, with dark gray anodized finish
- Open frame (with removable stage glass) standard
- Precision cross-roller bearings
- Top plate has 4mm threaded holes for custom tooling



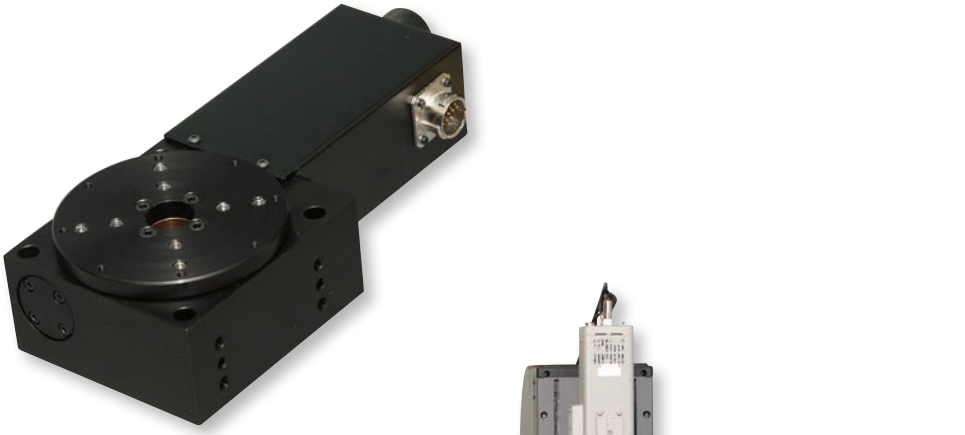
TM50 2" x 2" stage

## Rotary Stages

The 100mm and 150mm Rotary Stages from Starrett come complete with stepper motor, bidirectional limits, tooling plate, enclosure and connectors. Each stage is certified to meet or exceed application standards.

### Features

- Weight: 100mm, 4lbs; 150mm, 13.5lbs
- Pre-loaded Worm and Gear Assembly
- Maximum Output Speed: 30 rpm
- Main Spindle Run-out, TIR: .0002"
- Tooling Plate Run-out, (flatness) TIR: .0004"
- Positioning Accuracy: 0.09˚ peak to peak, 0.05˚ goal
- Limit Switches: 2 normally closed switches provide ±160˚ of rotation (170˚ of rotation on 150mm Rotary Stage)
- Motion control: Compatible with common controllers






CP7K custom solution with X-Y-Z platform

## Metrology Frames and Components

Looking for a custom solution? Starrett offers a selection of standard and custom solutions from Z-axis columns and granite bases that work in conjunction with our TM stages as well as complete X-Y-Z metrology and precision positioning platforms. Please consult us for more information.

# Specifications and Options

| Model | MV300 | MV350 | MVR200 | MVR300 | AV300 | AV350 | AVR200 |
|---|---|---|---|---|---|---|---|
| Bench-Top System | X | X | X | X | X | – | X |
| Floor-Standing System | – | – | – | – | – | X | – |
| Part View Orientation | Vertical | Vertical | Vertical | Vertical | Vertical | Vertical | Vertical |
| X-Y-Z Travel (in) | 12" x 6" x 5.5" | 14" x 14" x 8" | 8" x 4" x 8" | 12" x 8" x 8" | 12" x 6" x 5.5" | 14" x 14" x 8" | 8" x 4" x 8" |
| X-Y-Z Travel (mm) | 300 x 150 x 135mm | 350 x 350 x 200mm | 200 x 100 x 200mm | 300 x 200 x 200mm | 300 x 150 x 135mm | 350 x 350 x 200mm | 200 x 100 x 200mm |
| Z Axis Measuring | Optional | Optional | Optional | Optional | Standard | Standard | Standard |
| CNC | – | – | – | – | Standard | Standard | Standard |
| X-Y Accuracy (µm) | E2 = 2.5µm + 5L/1000 | E2 = 2.5µm + 5L/1000 | E2 = 2.5µm + 5L/1000 | E2 = 2.5µm + 5L/1000 | E2 = 1.9µm + 5L/1000 | E2 = 2.5µm + 5L/1000 | E2 = 1.9µm + 5L/1000 |
| Z Accuracy (µm) | E1 = 2.5µm + 5L/1000 | E1 = 2.5µm + 5L/1000 | E1 = 2.5µm + 5L/1000 | E1 = 2.5µm + 5L/1000 | E1 = 2.5µm + 5L/1000 | E1 = 2.5µm + 5L/1000 | E1 = 2.5µm + 5L/1000 |
| Scale Resolution | 0.5µm | 0.5µm | 0.5µm | 0.5µm | 0.1µm | 0.1µm | 0.1µm |
| Multi-Sensor Compatible | – | – | – | – | – | – | – |
| Base | Cast Aluminum | Granite | Granite | Granite | Cast Aluminum | Granite | Granite |
| Control System/Software | M3 | M3 | M3 | M3 | M3 or QC5300 | M3 | M3 |
| Display | 21" Touchscreen PC | 21" Touchscreen PC | 21" Touchscreen PC | 21" Touchscreen PC | 21" Touchscreen PC or 24"Monitor | 21" Touchscreen PC | 21" Touchscreen PC |
| Zoom Optics - Standard | 6.5:1 | 6.5:1 | 6.5:1 | 6.5:1 | 6.5:1 | 12:1 | 6.5:1 – 2 LED<br>12:1 – 3 LED |
| Zoom Optics - Optional | – | – | – | – | – | – | – |
| Optics | – | – | – | – | – | – | – |
| Microscope Optics | – | – | – | – | – | – | – |
| Digital Video Camera | 1.3 MP Color | 1.3 MP Color | 1.3 or 2.0 MP Color with Telecentric | 1.3 or 2.0 MP Color with Telecentric | 1.3 MP Color | 1.3 MP Color | 1.3 MP Color Standard; 2 MP wtih Telecentric |
| Surface Ring Illumination | LED or FO | LED or FO | LED | LED | LED or FO | LED or FO | LED |
| Transmitted Illumination | LED or FO | LED or FO | LED | LED | LED or FO | LED or FO | LED |
| Coaxial Illumination - Optional | LED or FO | LED or FO | LED | LED | LED or FO | LED or FO | LED |

| AVR300 | AV300+ | AV350+ | AV300+ MICRO | LF Premier | HDV300 | HDV400 |
|---|---|---|---|---|---|---|
| X | – | – | – | – | X | X |
| – | X | X | X | – | – | – |
| Vertical | Vertical | Vertical | Vertical | – | Horizontal | Horizontal |
| 12" x 8" x 8" | 12" x 6" x 8" | 14" x 14" x 8" | 12" x 6" x 4" | 12" x 12" x 8"<br>18" x 12" x 8"<br>28" x 24" x 8"<br>38" x 30" x 8"<br>50" x 36" x 8" | 12" x 6" | 16" x 6" |
| 300 x 200 x 200mm | 300 x 150 x 200mm | 350 x 350 x 200mm | 300 x 150 x 100mm | 305 x 305 x 200mm<br>460 x 305 x 200mm<br>711 x 610 x 200mm<br>965 x 760 x 200mm<br>1270 x 915 x 200mm | 300 x 150mm | 400 x 150mm |
| Standard | Standard | Standard | Standard | – | – | – |
| Standard | Standard | Standard | Standard | – | – | – |
| E2 = 1.9µm + 5L/1000 | E2 = 1.9µm + 5L/1000 | E2 = 2.5µm + 5L/1000 | E2 = 1.5µm + 5L/1000 | E2 = 1.5 + 5L/1000 | E1 = 3.0µm + L33 | E1 = 3.0µm + L/33 |
| E1 = 2.5µm + 5L/1000 | E1 = 2.5µm + 5L/1000 | E1 = 2.5µm + 5L/1000 | E1 = 2.0µm + 5L/1000 | E1 = 1.9 + 5L/1000 (Z) | – | – |
| 0.1µm | 0.1µm | 0.1µm | 5nm | 0.1µm | 0.5µm | 0.5µm |
| – | Yes | Yes | – | – | – | – |
| Granite | Granite | Granite | Granite | – | Steel | Steel |
| M3 | QC5300 | QC5300 | QC5300 or PAX–it | QC5300 or M3 | M3 | M3 |
| 21" Touchscreen PC | 24" Monitor | 24" Monitor | 24" Monitor | 24" Monitor or<br>21.5" Touchscreen | 24" Touchscreen Monitor | 24" Touchscreen Monitor |
| 6.5:1 – 2 LED<br>12:1 – 3 LED | 12:1 | 12:1 | – | 12:1 | – | – |
| – | – | – | – | – | 6.5:1 | 6.5:1 |
| – | – | – | – | – | Choice of 4.0x, 2.0x, 1.0x, 0.80x, 0.50x and 0.30x interchangeable Telecentric Lenses Optional- 0.14X fixed | Choice of 4.0x, 2.0x, 1.0x, 0.80x, 0.50x and 0.30x interchangeable Telecentric Lenses Optional- 0.14X Fixed |
| – | – | – | Standard | Optional | – | – |
| 1.3 MP Color Standard; 2 MP with Telecentric | 1.3 MP Color | 1.3 MP Color | 1.3 MP Color | 1.3 MP Color | 5 MP Color | 5 MP Color |
| LED or FO | LED or FO | LED or FO | – | – | LED | LED |
| LED or FO | LED or FO | LED or FO | LED or FO | – | LED | LED |
| LED or FO | LED or FO | LED or FO | LED or FO | – | – | – |

# Specifications and Options

(CONTINUED)

| Model | MV300 | MV350 | MVR200 | MVR300 | AV300 | AV350 | AVR200 |
|---|---|---|---|---|---|---|---|
| Microscope Objectives (required on MICRO) | – | – | – | – | – | – | – |
| Auxiliary Lenses - Optional | 0.5x, 1.5x, 2.0x | 0.5x, 1.5x, 2.0x | 0.5x, 1.5x, 2.0x | 0.5x, 1.5x, 2.0x | 0.5x, 1.5x, 2.0x | 0.5x, 1.5x, 2.0x | 0.5x, 1.5x, 2.0x |
| Rotary Fixture | – | – | – | – | Optional | Optional | Optional |
| Renishaw Touch Probe | – | – | – | – | – | – | – |
| Renishaw Touch Probe Change Rack | – | – | – | – | – | – | – |
| Multi-Part Touch Probe Change Rack | – | – | – | – | – | – | –– |
| Touch Probe Spotter Camera | – | – | – | – | – | – | – |
| Optimet Laser | – | – | – | – | – | – | – |
| Machine Pedestal and Point of Control Cart/Arm | – | Standard | – | – | – | Standard | – |
| Cabinet Stand | – | – | – | – | – | – | – |
| Workstation Base, Extension and Swing Arm | Optional | – | Optional | Optional | Optional | – | Optional |
| Part Fixturing | Optional | Optional | Optional | Optional | Optional | Optional | Optional |
| Dark Field Quadrant Illumination (LED only) | – | – | – | – | Optional | Optional | Optional |
| Video Pixel Calibration Standard | Optional | Optional | Optional | Optional | Optional | Optional | Optional |
| Calibration Standards | Optional | Optional | Optional | Optional | Optional | Optional | Optional |
| FOV, Linear and 2D Calibration Standards | Optional | Optional | Optional | Optional | Optional | Optional | Optional |

| AVR300 | AV300+ | AV350+ | AV300+ MICRO | LF Premier | HDV300 | HDV400 |
|---|---|---|---|---|---|---|
| – | – | – | 5x, 10x, 20x, 50x, 100x | – | – | – |
| 0.5x, 1.5x, 2.0x | 0.5x, 1.5x, 2.0x | 0.5x, 1.5x, 2.0x | – | 0.5x, 1.5X, 2.0x | – | – |
| Optional | Optional | Optional | Optional | Optional | – | – |
| – | Optional | Optional | – | Optional | – | – |
| – | Optional | Optional | – | – | – | – |
| – | – | – | – | Optional | – | – |
| – | – | – | – | Optional | – | – |
| – | Optional | Optional | – | Optional | – | – |
| – | Standard | Standard | Standard | – | – | – |
| – | – | – | – | – | Optional | Optional |
| Optional | – | – | – | – | – | – |
| Optional | Optional | Optional | Optional | Optional | Optinoal | Optional |
| Optional | Optional | Optional | Optional | Optional | – | – |
| Optional | Standard | Standard | Standard | Standard | Optional | Optional |
| Optional | Optional | Optional | Optional | Optional | Optional | Optional |
| Optional | Optional | Optional | Optional | Optional | Optional | Optional |

# Quadra-Chek® Software

Modern metrology is a complex sequence of measuring, recording, analyzing and reporting dimensional data. The conceptual model underlying the Quadra-Chek digital readout design organizes the workflow to support operators at every stage of the measurement process

## QC100

- Perform 2 and 3 axis measurements at very high levels of precision and accuracy
- Measurements viewed on the front panel LCD can be transmitted to a PC over a standard serial port connection, or to a printer over a parallel or serial port




QC100

## QC200

Metrology DRO requires a video monitor display and crosshair generator in vision configuration. QC200 is a time-saving measurement tool with patented Measure Magic® technology. Ideal for measuring 2D features on Optical Comparators and Manual Vision Machines.

- Inch/metric conversion, toggle between incremental/ absolute and simple zero reset
- Skew function for ease of part alignment
- Integrated geometric tolerancing allowing for pass/ fail measurements
- Simple part programming with measure guide
- USB and RS232 Interface
- Linear and segmented linear error correction
- Intuitive displays
- Crisp, clear, bright black and white LCD display
- Optional optical edge for comparators

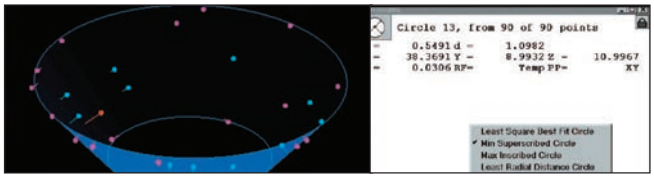


## QC5200

Metrology software is a Windows® 7 Professional 32-bit based PC inspection system for video measuring machines.

The QC5200 supports a wide range of industries that require precise measurement and inspection of 2D parts using a single sensor. This product features an intuitive user interface and simple, meaningful visual displays. The design reflects a deep understanding of the user's needs along with a process model that supports the operator at every stage in the measurement process.

- Powerful yet intuitive video edge detection tools
- Auto-Focus
- "XY" 2D measurements with optional "Z" axis for height measurements
- Image capture with drag and drop data reporting
- Image processing tools
- Continuous edge mode
- Patented Measure Magic
- Alternative algorithms
- Auto program from CAD files
- Pattern recognition
- Integrated runs database
- Geometric tolerancing
- Advanced calculation
- Data cloud analysis

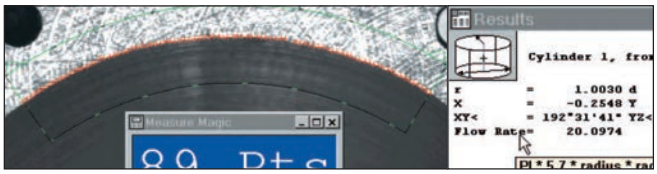



Data Cloud Alternate fits

## QC5300

Metrology software picks up where the QC5200 leaves off. This product offers multi-axis dimensional measurement of 2D and 3D parts. The QC5300 integrates an innovative user interface, state of the art ergonomics, powerful data import, export and data analysis tools.

- 3D measurement set
- 3D offset alignments
- Customizable screen layouts
- Multiple reference frames
- 3D part view
- Renishaw touch probe interface
- Optional laser sensor
- Vector probing
- Multiple language support
- 3D Measure Magic
- Advanced calculations
- 3D data clouds
- Alternate algorithms
- Drag and drop report generator
- Data export to a wide variety of applications




Measure Magic

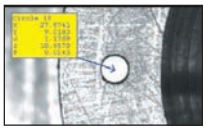
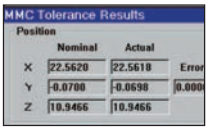
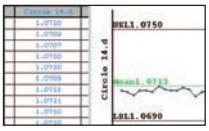


Image View




Tolerance



Integrated Database

| Color Key | QC-5200 | | | | | | | | QC-5300 | |
|---|---|---|---|---|---|---|---|---|---|---|
| **Configurations** | **5200** | **5205** | **5210** | **5215** | **5230** | **5235** | **5240** | **5245** | **5300** | **5310** |
| 2D Measurement | | | | | | | | | | |
| 3D Measurement | | | | | | | | | | |
| X-axis | | | | | | | | | | |
| Y-axis | | | | | | | | | | |
| Z-axis | | | | | | | | | | |
| Q-axis (Electronic Protractor) | | | | | | | | | | |
| Optical edge detection (optional) | | | | | | | | | | |
| **Options** | | | | | | | | | | |
| Motion control system | | | | | | | | | | |
| Video edge detection (color or b/w) | | | | | | | | | | |
| Programmable light control | | | | | | | | | | |
| Auto-focus (Z-axis only) | | | | | | | | | | |
| Programmable zoom | | | | | | | | | | |
| Non-linear error correction | | | | | | | | | | |

2D Measurement
3D Measurement

# MetLogix™ Software

## M1 and M2

### FOR OPTICAL COMPARATORS

Graphics rich display, large icon buttons, and intuitive operation. Coordinate display for X and Y linear axes and Q radius values for screen rotation. Easy part alignment and datum function.

#### Features

- Clean and simple touchscreen interface with large icon buttons and intuitive operation
- Graphics-rich display providing instant information on feature form, tolerances, and measurement data
- Coordinate display for X and Y linear axes and Q radius values for screen rotation
- Easy part alignment and datum functions
- Measure and tolerance these geometric features: point, line, angle, distance, radius, diameter
- As you measure, a part view is created in the feature view. Constructions between features such as distances and bolt hole pattern can been done by simple selections from the part view.
- For repetitive part measurement, create a part program that will visually guide operators through part measurement
- Available optical edge detection provides better throughput and removes operator subjectivity
- Four different report forms can be printed or exported to Microsoft Excel, text files, or to an SPC program
- Mounts and displays in either vertical or horizontal postition
- M2 utilizes a Windows® 7 Professional-based operating system enables flexible data export and interface capability with Windows
- Fast, easy connection to printers and networks
- M1 utilizes an Android operating system and a Bluetooth connection to the host Optical Comparator



M1 shown on HE400

## M3

### FOR VISION SYSTEMS

Multi-touch software control that can pan and zoom with pinch, swipe, or touch. Works with active part views and live video feeds (or use the conventional mouse interface). Custom "Eye Measure" probe captures complex edges generated by a finger path drawn on the touch screen. Measure Logic probe intelligence provides instant feature determination and measurement with a single touch.

#### Features

- DXF CAD file import for comparing parts being inspected to the actual design file; no need for cumbersome Mylar overlays
- "Vtouch" Probe has video touch probe functionality – just click for simple acquisition of points on a feature's edge
- Part View can generate distance and tangent lines from within the graphical part view. The "Gesture Menu" can be used for feature creation and manipulation tools.
- "Quick Annotate" allows data on several features to be displayed simultaneously with smart marquee feature selection
- Application of universal tolerance value entry according to feature resolution groupings
- Feature Detail Graphics: Individual feature views display point cloud distributions, nominal deviations, and tolerance results. Scroll through Actual, Nominal, Tolerance, Deviation and Data Fit Type information.
- Simple machine/camera calibration with popular machine and video correction methods
- Windows® 7 Professional-based, globally recognized OS for flexible data exporting and interface with Windows applications

### M1, M2 and M3

MetLogix control software provides a broad range of powerful, user-friendly functions on a compact, icon-based touchscreen interface in place of the traditional control.

| | MetLogix M1 | MetLogix M2 | MetLogix M3 |
|---|---|---|---|
| Mounted to comparator arm | x | x | |
| Color graphics | x | x | x |
| Touch-screen operation | x | x | x |
| MS Windows® operating system | | x | x |
| X-Y-Q (angle) measurements | x | x | x |
| 2D geometry software with skew | x | x | x |
| Optical edge detection option | x | x | x |
| Video edge detection option | | | x |
| CAD file import and export option | | x | x |
| CNC drive option | | x | x |




M3

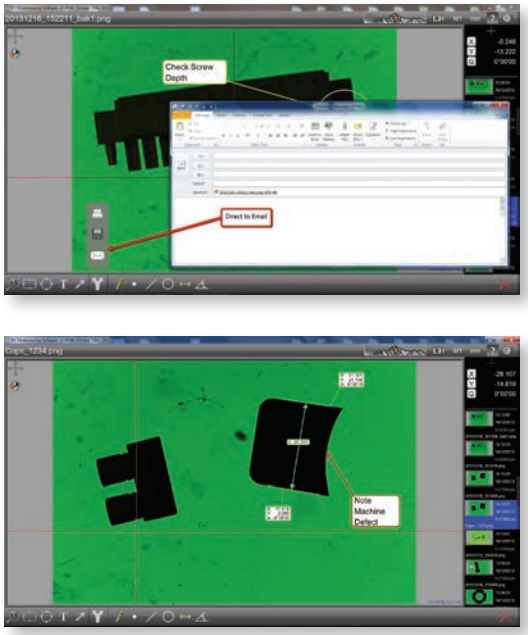
# M1, M2 AND M3 SOFTWARE

NEW!

# D1 Dimensioning Software

## Features

- View and manipulate live and static images from a variety of inspection devices on any Windows® 7 or Windows® 8 PC. Mouse/Keyboard and touchscreen systems are supported.
- A simplified operating interface requires only a few quick clicks to capture, mark up, export, print and email images directly from your inspection equipment
- Zoom and Pan the camera feed until the desired image is displayed. Add custom text, and graphic elements to generate detailed image capture for defect reporting and to improve overall visual communication of parts and component characteristics.
- Perform basic calculations of feature size, position, and orientation using a simple crosshair tool. Translate or rotate the crosshair tool within the image window to probe circle, line, point, and angle features within the field of view.
- Add feature annotation directly to selected features to display size, position and orientation results on either the video frame or within a blank part view space
- Access previously stored images easily in the thumbnail image list. Convenient date and time stamps are added to help sort and review collections of images.




D1 Software display




KineMic - KMR with D1 software



Starrett

HE400

HB400, HD400

VB400, VF600

HF600, HF750

HS600, HS750

Options and Accessories

# OPTICAL COMPARATORS

Optical comparators provide a time tested cost effective, solution for non-contact measurement. They are found in lab and shop environments, often near product manufacturing activity. Optical comparators are used for an exceptionally wide range of dimensional inspection applications. In recent years, Starrett's enhanced mechanical designs have combined with an advancement in microprocessor capability to make our current products even more accurate, repeatable, efficient and easy to use.

At the heart of these systems are precision optics, superb lighting and a highly accurate workstage. They combine to ensure bright, sharp images and exceptional accuracy.

Generally, horizontal models work well with parts that need to be fixtured, held in a vise, or on centers. Vertical models provide comparable accuracy and are ideal for parts that are placed on the glass insert of the workstage.

Vertical systems work well when the parts to be measured are flexible or soft (i.e., plastic, thin stampings or electrical components).

The versatile Starrett line includes optical systems from 16", 30" (400-750mm) screen diameters, horizontal and vertical models and a wide range of special machines.

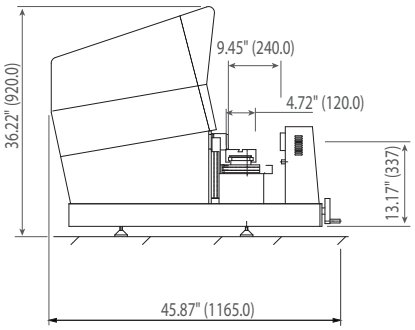
We offer many choices of optical magnification, manual, motor-driven or CNC workstage travel, with PC or LCD metrology readouts.

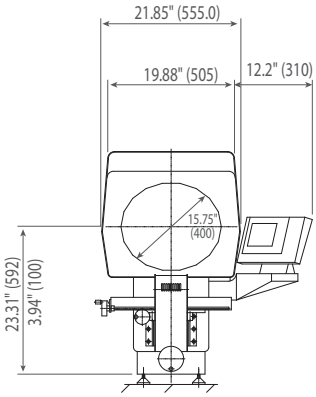
# Optical Comparators

## HE400

The most economical of our benchtop horizontal comparators, this machine offers a 16" (400mm) screen, 10 x 4" (250 x 100mm), bayonet fitting lenses and Q-axis angular readout; all to improve capacity and performance. These latest horizontal projectors are fitted with either Quadra-Chek® digital readout systems or MetLogix™ M1 or M2 software as standard, making them simple to use, but having the power to satisfy the most complex measuring requirements.

The HE400 comes with a bayonet socket that can accommodate six interchangeable projection lenses to convert system operation from profile projector to video metrology system.




### Features and Specifications

- All metal construction
- Digital protractor for accurate angle measurements: 1' resolution
- Lamphouse-mounted helix adjustment for accurate thread form inspection
- Available with MetLogix M1 tablet, M2 PC-based touch screen software or Quadra-Chek readout system
- 10" (250mm) horizontal travel
- 4" (100mm) vertical travel
- Fine adjustment on all axes, plus zero backlash, fast traverse mechanism on the X-axis
- Measurement by means of a linear encoder (glass scale) on both X and Y axes
- Fully retractable duplex fiber optic surface illumination
- Optional automatic edge detection




### Weight and Dimensions

| HE400 | |
|---|---|
| Net Weight | 230lbs<br>105kg |
| Gross Weight | 300lbs<br>135kg |

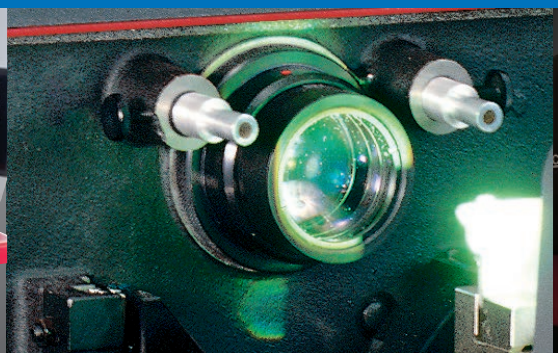
For more information please see the Options and Specifications table at the end of this section.




HE400

# HE HORIZONTAL BENCHTOP



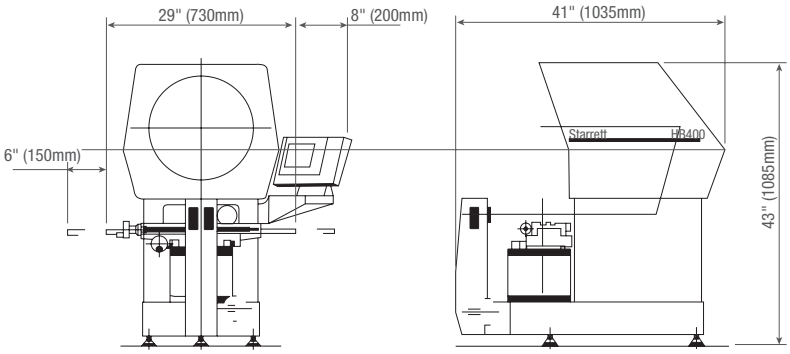





# Optical Comparators

## HB400

The HB400 horizontal optical comparator provides exceptional performance with a fully-usable 16" (400mm) diameter viewing screen, a 21" x 5" (530 x 125mm) workstage, 12" x 6" (300 x 150mm) of stage travel, and high 110lb workload capacity. Linear glass scales provide .00002" (0.5µm) of resolution. A bayonet lens socket accepts a choice of seven lenses or an OV2 Video Adapter for video edge detection (VED). Optional optical edge detection removes operator subjectivity in locating edges.




### Features and Specifications

- Digital protractor for accurate angular measurements (1' resolution) via Q-axis on readout
- Hard anodized aluminum top plate with cast iron intermediate and base plates
- 12" (300mm) horizontal travel by manual fine adjustment with quick release mechanism and 15° workstage helix adjustment
- 6" (150mm) vertical travel
- 24V, 150W profile illumination
- 24V, 250W fiber optic surface illumination
- Single lens mount with quick action lens change (lens not included); interchangeable and fixed 5x versions are available, call for quote
- Collimating condenser with yellow/green filter and provision to mount further accessories
- Measurement by means of a linear encoder (glass scale) on both X and Y axes
- Available with MetLogix™ M1 tablet, M2 PC-based touch screen software or Quadra-Chek® readout system
- Fixed retractable fiber optic surface illumination
- Extended workstage option



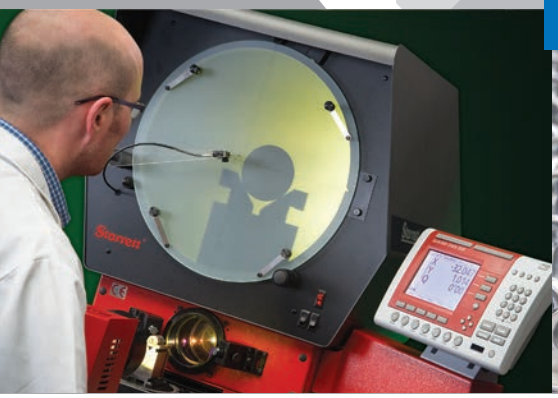

### Weight and Dimensions

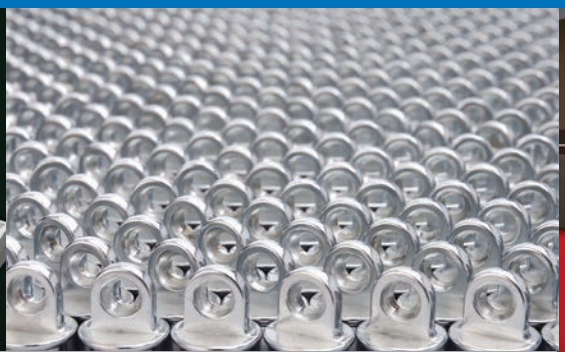
| | HB400 |
|---|---|
| Net Weight | 320lbs<br>145kg |
| Gross Weight | 385lbs<br>175kg |

For more information please see the Options and Specifications table at the end of this section.




# HB HORIZONTAL BENCHTOP







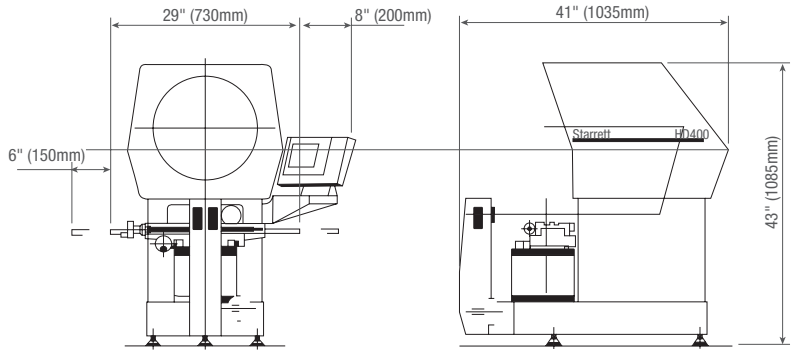


# Optical Comparators

## HD400

### DUAL LENS

The HD400 is a dual lens benchtop horizontal projection comparator, with a 16" (400mm) diameter screen, a vertically correct image, 16" x 6" (400 x 150mm) of stage travel, a high 110lb workload capacity, and ultra-bright lighting. A two-lens slide allows instant switching between two magnifications. Available with fiber-optic or video edge detection, this comparator provides performance previously only available with floor-standing models.




### Features and Specifications

- Dual lens system
- Digital protractor for accurate angular measurements (1' resolution) via Q-axis on readout
- Hard anodized aluminum top plate with cast iron intermediate and base plates
- 16" (400mm) horizontal travel by manual fine adjustment with quick release mechanism and 15° workstage helix adjustment
- 6" (150mm) vertical travel
- 24V, 150W profile illumination
- 24V, 250W fiber optic surface illumination
- Single lens mount with quick action lens change (lens not included); interchangeable and fixed 5x versions are available, call for quote
- Collimating condenser with yellow/green filter and provision to mount further accessories
- Measurement by means of a linear encoder (glass scale) on both X and Y axes
- Available with MetLogix™ M1 tablet, M2 PC-based touch screen software or Quadra-Chek® readout system
- Fixed retractable fiber optic surface illumination
- Extended workstage option

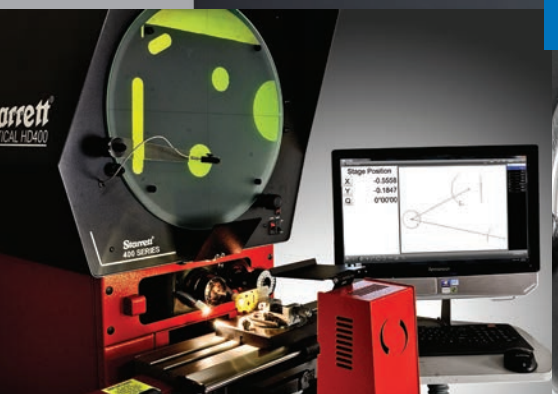
### Weight and Dimensions

| | HD400 |
|---|---|
| Net Weight | 320lbs<br>145kg |
| Gross Weight | 375lbs<br>170kg |

For more information please see the Options and Specifications table at the end of this section.

HD400

# HD HORIZONTAL BENCHTOP







# Optical Comparators

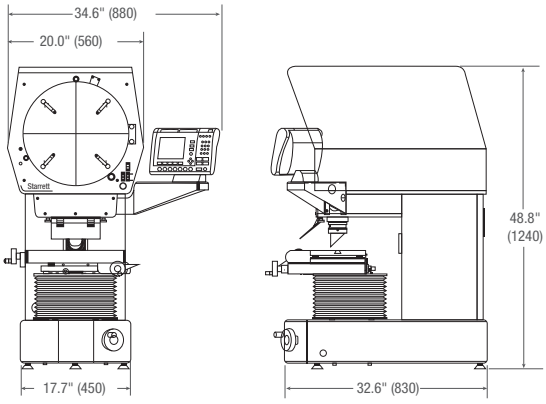
## VB400

### VERTICAL BENCHTOP

The VB400 vertical projection comparator allows flat parts to be simply laid on a glass insert in the workstage. Features include a 16" diameter vertical screen, ultra-bright LEDs for long-life illumination, linear encoder scales for .00002" (0.5µm) resolution, and angular readout to better than 1' resolution. Available with stages with 8" x 4" (200 x 100mm) of XY travel. Options include six projection lenses from 10x to 100x and a choice of digital interfaces.

### Features and Specifications

- Exceptionally stable, all metal, design and construction for optimum performance and accuracy
- High precision workstage with 16" x 9" top plate, with machine slot for easy fixturing
- Available systems with of Quadra-Chek® readout, MetLogix™ M1 tablet or M2 software with touchscreen PC
- Digital protractor for accurate angle measurements, 1' resolution
- Fine adjustment on all axes, plus zero backlash, fast traverse mechanism on the X and Y axis
- Automatic edge detection option
- Variable LED surface illumination




## VF600

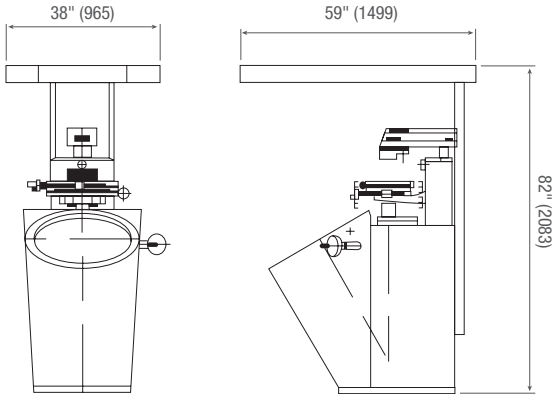
### VERTICAL FLOOR STANDING

If your measuring requirements demand the use of a large screen vertical axis projector, then look no further than the Starrett VF600. A design based on 35 years of knowledge in the manufacture of high performing optical projectors, the VF600 is ideal for the larger components found in the electronics, pressings and extrusion industries.

With its helix facility, single or multiple lens turret, choice of workstages and large range of digital readout options, the VF600 is the ultimate in vertical axis profile projectors.

### Features and Specifications

- Available systems with of Quadra-Chek® readout, MetLogix™ M1 tablet or M2 software with touchscreen PC
- Screen is angled 30° from horizontal for clear, easy viewing
- Glass insert is 9-1/4" x 5-1/2"
- 8" horizontal travel
- 4" vertical travel
- Projection lens turret with three lens capacity (lenses not included)
- Turret mounted condenser system complete with two lenses and yellow/green filter with provision to mount further accessories
- Erect image
- Full canopy and curtains
- Measurement by means of a linear encoder (glass scale) on both X and Y axes
- Optional two-axis motorized drive via joystick and variable speed controls for fine adjustment
- Optional fully automatic CNC control available
- Interchangeable and fixed 5x versions available




### Weight and Dimensions

| | VB400 |
|---|---|
| Net Weight | 423lbs<br>192kg |
| Shipping Weight | 443lbs<br>201kg |

For more information please see the Options and Specifications table at the end of this section.

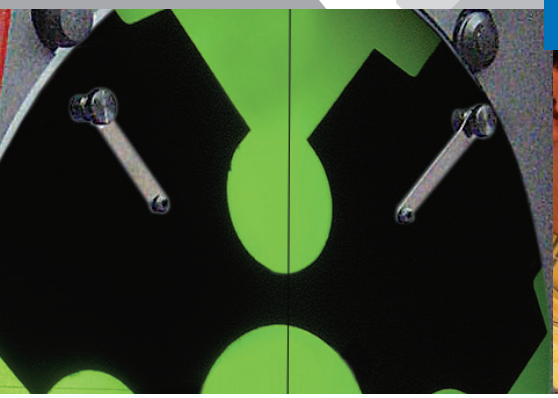


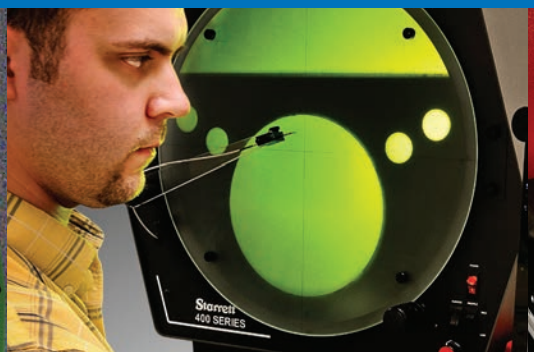

VB400

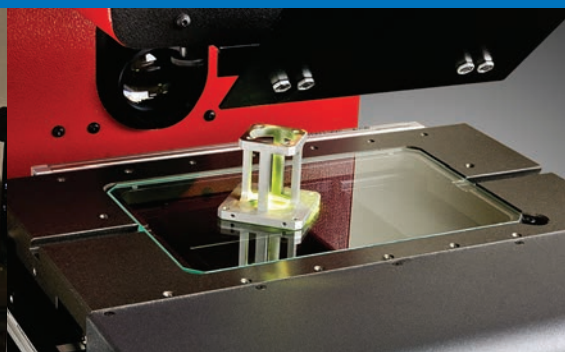


VF600

## VERTICAL COMPARATOR SYSTEMS





# Optical Comparators

## HF600

Well known throughout the world for superior value and exceptional measuring performance across the full measuring range and at all magnifications. The HF600 sets the standard in all applications from the QC lab to the production floor, the HF600 floor-standing horizontal projection comparator features a fully usable 24" (600mm) screen and a heavy-duty workstage with 330 lb (150 kg) load capacity. It comes with a four-position lens turret for instant selection of magnification. Inserting the optional "OV2.doc" OV2 Video Adapter in place of a projection lens converts the comparator and using a readout device with video edge detection (VED) capability converts the comparator into a video metrology system.

Ideal for use over a broad spectrum of industries and applications, the HF600 and HF750 projectors are designed and built to satisfy the requirements of measuring small to large workpieces with total precision, ruggedness, and efficiency.

The HF600 runs 2D software for geometries like diameters, radius, angles, lines and points, and for skew correction. It also provides many advanced software tools such as CAD file import, CAD data export for reverse engineering, standard and custom reports, and Ethernet networking.

### Features and Specifications

- Available with MetLogix™ M1 tablet, M2 PC-based touch screen software or Quadra-Chek® readout systems
- Heavy-duty corrosion and scratch-proof nickel plated precision work stage with 25" x 9" (625 x 225mm) top plate
- Two-axis power drive via joystick and variable speed control for fine adjust
- 12" (300mm) horizontal travel
- 8" (200mm) vertical travel
- 3" (75mm) focus travel
- 12V, 100W surface illumination
- 24V, 150W profile illumination
- Projection lens turret with four lens capacity (lenses not included)
- Turrett mounted condenser system complete with two lenses and yellow/green filter with provision to mount further accessories
- Erect image
- Full canopy and curtains
- Measurement by means of a linear encoder (glass scale) on both X and Y axes
- Optional fully automatic CNC control
- Extended workstage available

## HF750

The same exemplary build standards as the HF600, the HF750 super capacity optical comparator delivers benefits from an even larger 30" (762mm) screen. This large, fully usable screen sets a new standard for clarity and brightness.

Ideal for use over a broad spectrum of industries and applications, the HF750 projector is designed and built to satisfy the requirements of measuring small to large workpieces with total precision, ruggedness, and efficiency.

The geometric software handles diameter, radius, angle, line and point features, plus parts skewing for faster setup. The HF750 includes optical edge (E) detection and video edge detection.

Side bed models, HS600 and HS750 are also available.

### Features and Specifications

- Available with MetLogix™ M1 tablet, M2 PC-based touch screen software or Quadra-Chek® readout systems
- Heavy-duty corrosion and scratch proof nickel plated precision work stage with 25" x 9" (625 x 225mm) top plate
- Two-axis power drive via joystick and variable speed controls for fine adjust
- 12" (300mm) horizontal travel
- 8" (200mm) vertical travel
- 3" (75mm) focus travel
- 12V, 100W surface illumination
- 24V, 150W profile illumination
- Projection lens turrett with three lens capacity (lenses not included)
- Turret mounted condenser system complete with two lenses and yellow/green filter with provision to mount further accessories.
- Erect image
- Full canopy and curtains
- Measurement by means of a linear encoder (glass scale) on both X and Y axes
- Optional fully automatic CNC control
- Extended workstage available.

For more information please see the Options and Specifications table at the end of this section.



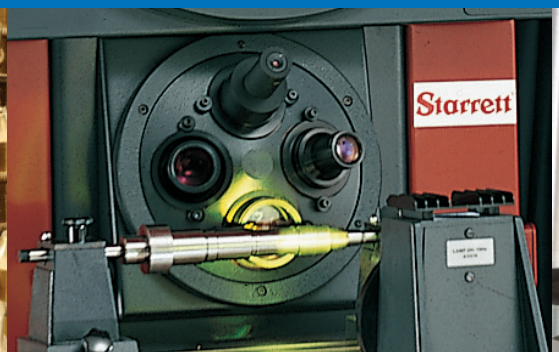

HF600




HF750

## HORIZONTAL FLOOR STANDING SYSTEMS








# Side Bed Optical Comparators

## HS600

The HS600 floor-standing horizontal optical comparator has all the same features as the HF600, except it has the screen position set to the side of the workstage area allowing close, comfortable and unrestricted access to the viewing and control area. It has a 12" (300mm) X-axis (16" [400mm] optional) and 8" (200mm) Y-Axis motorized travel (CNC control optional), Q-axis digital protractor with angular measurements to 1' resolution, and your choice of powerful Quadra-Chek® or MetLogix™ software control systems. A time tested, cost-effective solution for non-contact measurement. They are simple to use, yet have excellent capacity and performance to satisfy an exceptionally wide range of dimensional inspection applications and complex measuring requirements. At the heart of these systems are precision optics, superb lighting, and a highly accurate workstage that combine to ensure bright, sharp images and exceptional accuracy.

### Features and Specifications

- Accommodates components up to 330lbs (150kg)
- 24" (600mm) diameter screen
- 4 lens capacity
- Canopy and curtains standard
- Automatic edge detection option
- 20" (500mm) extended workstage available

## HS750

The HS750 floor-standing horizontal optical comparator has all the same features as the HF750, except it has the screen position set to the side of the workstage area allowing close, comfortable and unrestricted access to the viewing and control area. It has an extra large 30" (762mm) screen, 12" (300mm) X-axis (16" [400mm] optional) and 8" (200mm) Y-Axis motorized travel (CNC control optional), lens turret with 3 lens capacity, Q-axis digital protractor with angular measurements to 1' resolution, powerful Quadra-Chek® or MetLogix™ software control systems, canopy and curtains. A time tested, cost-effective solution for non-contact measurement. They are simple to use, yet have excellent capacity and performance to satisfy an exceptionally wide range of dimensional inspection applications and complex measuring requirements. At the heart of these systems are precision optics, superb lighting and a highly accurate workstage that combine to ensure bright, sharp images and exceptional accuracy.

### Features and Specifications

- Very rigid and inherently stable metal construction ensures optimum performance and accuracy
- Large diameter screens provide extensive field of view giving the user more component detail on the screen
- Side screen design gives the operator uninterrupted access to the screen and working area
- Large workstage, power driven on both axes, with high load capacity
- CNC workstage option
- 20" (500mm) extended travel workstage available
- Available with the full range of Quadra-Chek® or MetLogix™readout systems
- Canopy and curtains standard
- Wide range of ancilliaries and options allows specification tailoring and easy upgrading
- Accessories include alternative workstage, precision centers, vees, vices etc.

For more information please see the Options and Specifications table at the end of this section.

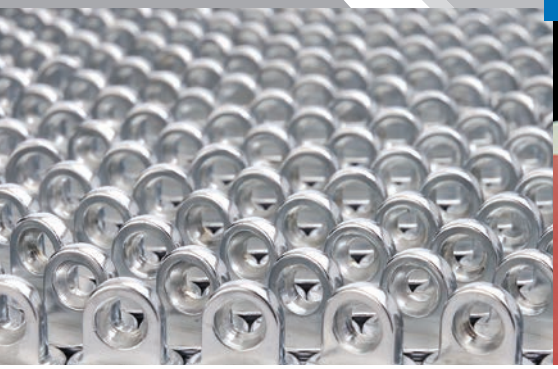


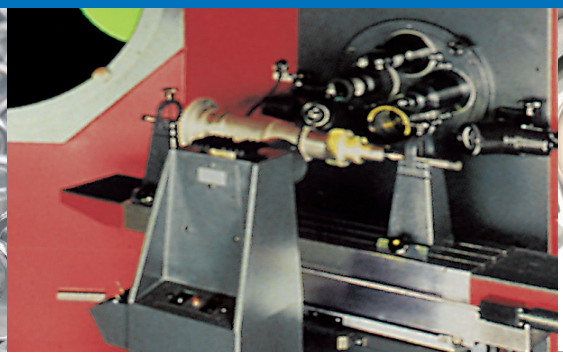

HS600




HS750

## SIDE BED COMPARATOR SYSTEMS







# OV2™ Optical Comparator Video Adaptor

The OV2 is a special zoom lens and video camera that can be interchanged with the lens on Starrett Optical comparators. Combined with M3 software and touchscreen PC, the result is a low cost video measuring system, expanding the versatility of your Optical Comparator!

The OV2 is available as an option with new Starrett comparators and as an easy-to-install field retrofit.

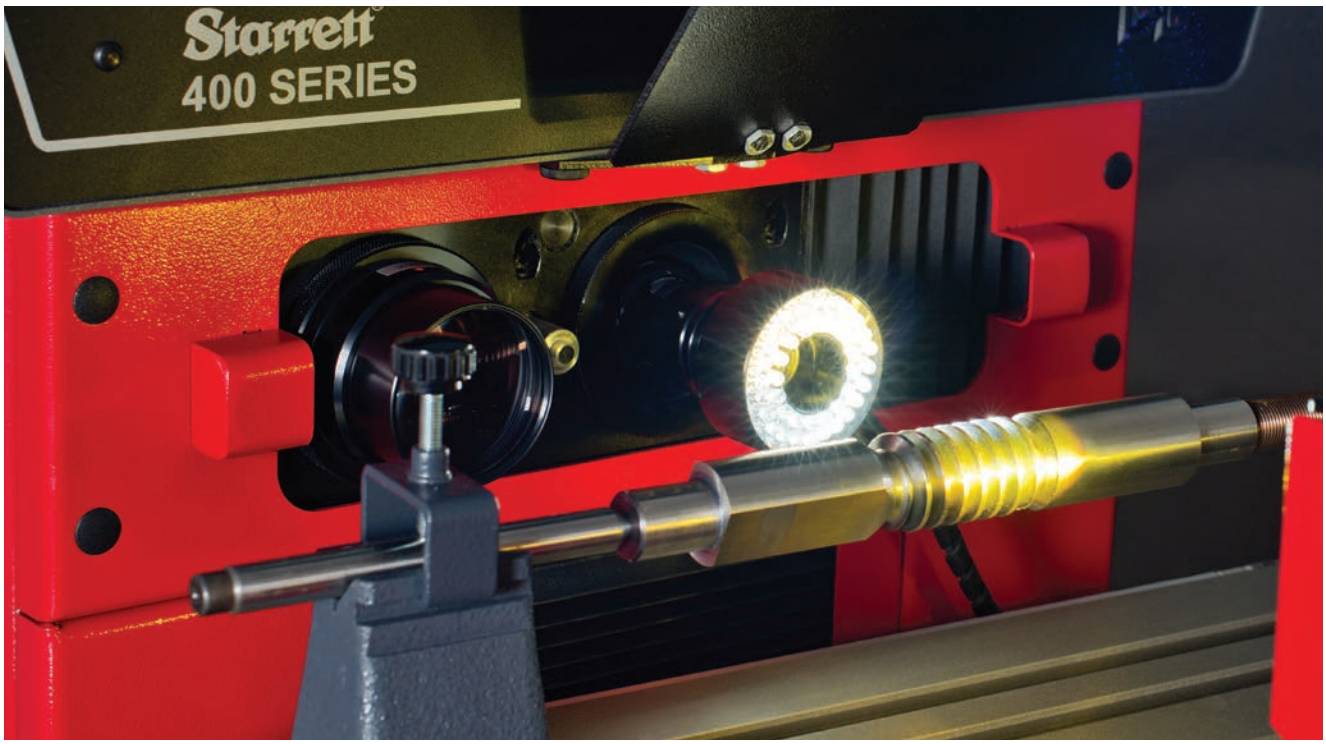
When used with the dual lens Starrett HD400, the OV2 allows immediate access to both Video and Optical measurement without changing the part setup.



Easily interchangable between normal optical mode and OV2 video

## Features

- Replaces bayonet mount comparator lens with video camera to create a video measuring system
- Changeover between normal optical mode and OV2 is easy and fast
- Lens locks into projector body and is prealigned for linear accuracy
- 6.5:1 zoom lens with up to 1.25" (32mm) of working distance allows maximum stage travel utilization
- Video magnifications up to 240x
- Utilizes M3 software and a PC for video display and touch screen control
- Maximizes existing investment to provide a low cost entry into video measurement technology
- Also available for other makes of optical comparators, please call for availability



# Accessories

Starrett offers a full range of accessories and stands designed for our Optical Systems to ensure efficient system setup and changeover for a broad range of applications.







| Photo Key | Part No. | Description | For Models |
|---|---|---|---|
| A<br>B | OCN8<br>ORV2 | Large and Centers Vees<br>2-1/32" Capacity Rotary Vise | HF600, HF750 |
| C | 4U000<br>OGH1<br>OGH2 | Magnification Checking Graticule | HE/HB/HD400 and VB400<br>HF600<br>HF750 |
| D | OCN7 | Small Centers and Vees | HF600, HF750 |
| E | 4G000<br>7P000 | Centers and Vees | HB350<br>HE/HB/HD400 |
| F | 9W000<br>3V000 | Helix Center Support Fixture | VB300 |
| G | 6H000 | Centers and Vees | VB400, VF600 |
| H | OVH1 | Vertical Glass Plate Holder | HF600, HF750 |
| J | 7U000 | Vertical Glass Plate Holder | HE/HB/HD400 |
| K | 4H003 | Rotary Vise with 1-1/4" Capacity | HE/HB/HD400 (also larger horizontal projectors) |
| M | 6U003 | Rotary Workstage | VB400, VF600 for use on 200mm x 100mm workstage |
| N<br>P | 4H002<br>4H004 | Fixed Position Vise with 1-1/4" Capacity<br>Universal Vee Block on Rotary Base | HE/HB/HD400 (also larger horizontal projectors) |
| S | P-10095<br>P-10102 | 32" Cabinet Base<br>23" Cabinet Base | HE400, HB400, HD400, VB400 |

# Specifications and Options

| Model | HE400 | HB400 | HD400 | VB400 |
|---|---|---|---|---|
| Bench Top System | X | X | X | X |
| Floor-Standing System | - | - | - | - |
| Part View Orientation | Horizontal | Horizontal | Horizontal | Vertical |
| Side Bed Version | - | - | - | - |
| Screen Diameter (in) | 16" | 16" | 16" | 16" |
| Screen Diameter (mm) | 400mm | 400mm | 400mm | 400mm |
| X-Y Measuring Range (in) | 10" x 4" | 12" (16" optional) x 6" | 16" x 6" | 8" x 4" |
| X-Y Measuring Range (mm) | 250 x 100mm | 300 (400mm optional) x 150mm | 400 x 150mm | 200 x 100mm |
| Linear Glass Scale Encoder on X and Y Axis | Standard | Standard | Standard | Standard |
| Motorized X-Y Axis | - | Optional | Optional | - |
| CNC Control | - | Optional | Optional | - |
| Focus Range (in) | 1.125" | 2" | 2" | 4" |
| Focus Range (mm) | 30mm | 50mm | 50mm | 100mm |
| Work Stage (in) | 18.75" x 4.75" | 21.25" x 5" | 21.25" x 5" | 16" x 19" |
| Work Stage (mm) | 475 x 120mm | 540 x 130mm | 540 x 130mm | 400 x 225mm |
| Load Capacity with Negligible Deflection (lbs) | 15lbs | 22lbs | 22lbs | 22lbs |
| Load Capacity Maximum (lbs) | 55lbs | 110lbs | 110lbs | 50lbs |
| Angular Measurement Resolution | 1' | 1' | 1' | 1' |
| Profile Illumination | Standard | Standard | Standard | Standard |
| Surface Illumination | Standard | Standard | Standard | Standard |
| Quick Change Lens Mount (lenses not included) | Single | Single | Single | Single |
| Collimating Condenser with Yellow/ Green Filter | Standard | Standard | Standard | Standard |
| Control System Software | QC100, QC200, M1, M2 | QC100/QC200, QC5200, M1, M2, M3 | QC200, QC5200, M1, M2, M3 | QC100, QC200, M1, M2 |

| VF600 | HF600 | HF750 | HS600 | HS750 |
|---|---|---|---|---|
| - | - | - | - | - |
| X | X | X | X | X |
| Vertical | Horizontal | Horizontal | Horizontal | Horizontal |
| - | - | - | Standard | Standard |
| 24" | 24" | 30" | 24" | 30" |
| 600mm | 600mm | 750mm | 600mm | 750mm |
| 8" x 4" | 12" (16" optional) x 8" | 12" (16" optional) x 8" | 12" (16" optional) x 8" | 12" (16" optional) x 8" |
| 200 x 100mm | 300 (400mm optional) x 200mm | 300 (400mm) x 200mm | 300 ( 400mm) x 200mm | 300 (400mm optional) x 200mm |
| Standard | Standard | Standard | Standard | Standard |
| - | Standard | Standard | Standard | Standard |
| - | Optional | Optional | Optional | Standard |
| 4" | 3" | 3" | 3" | 3" |
| 100mm | 75mm | 75mm | 75" | 75mm |
| 16" x 9" | 25" x 9" | 25" x 9" | 25" x 9" | 25" x 9" |
| 400 x 225mm | 630 x 230mm | 630 x 230mm | 630 x 230mm | 630 x 230mm |
| 22lbs | 110lbs | 110lbs | 110lbs | 110lbs |
| 66lbs | 330lbs | 330lbs | 330lbs | 330lbs |
| 1' | 1' | 1' | 1' | 1' |
| Standard | Standard | Standard | Standard | Standard |
| Standard | Standard | Standard | Standard | Standard |
| 3 Lens Turret | 4 Lens Turret | 3 Lens Turret | 4 Lens Turret | 3 Lens Turret |
| Standard | Standard | Standard | Standard | Standard |
| QC200, QC5200, M1, M2, M3 | QC200, QC5200, M1, M2, M3 | QC200, QC5200, M1, M2, M3 | QC200, QC5200, M1, M2, M3 | ND1120/5200, M1, M2, M3 |

# Specifications and Options

(CONTINUED)

| Model | HE400 | HB400 | HD400 | VB400 |
|---|---|---|---|---|
| Display (control system dependent) | QC DRO or 15.6" Touchscreen PC, M1 with 7" tablet | QC DRO, 15.6" or 21" Touchscreen PC or 24" Monitor, M1 with 7" tablet | QC DRO, 15.6" or 21" Touchscreen PC or 24" Monitor, M1 with 7" tablet | QC DRO or 15.6" Touchscreen PC, M1 with 7" tablet |
| Optical Edge Detection | Optional | Optional | Optional | Optional |
| Digital Video Camera System | - | Optional | Optional | - |
| Lenses - Screen Magnification (one required, not included) | 10x, 20x, 25x, 31.25x, 50x, 100x | 10x, 20x, 25x, 31.25x, 50x, 100x | 10x, 20x, 25x, 31.25x, 50x, 100x | 10x , 20x, 25x, 50x |
| Iris Diaphragm | Optional | Optional | Optional | - |
| Precision Rotary Vise | Optional | Optional | Optional | - |
| Vee Block on Rotary Base | Optional | Optional | Optional | - |
| Precision Fixed Vise | Optional | Optional | Optional | - |
| Precision Centers and Vees | Optional | Optional | Optional | Optional |
| Helix Center Support System | - | - | - | Optional |
| Precision Rotary Work Stage | - | - | - | Optional |
| Glass Plate Work Holder | Optional | Optional | Optional | - |
| Field of View Diameter (in) | 1.57", 0.79", 0.63", 0.50", 0.31", 0.16" | - | - | - |
| Field of View Diameter (mm) | 40mm, 20mm, 16mm, 13mm, 8mm, 4mm | - | - | - |
| Working Distance (in) | .15", 2.60", 2.44", 2.28", 1.97", 1.61" | - | - | - |
| Working Distance (mm) | 0mm, 66mm, 62mm, 58mm, 50mm, 41mm | - | - | - |
| Cabinet Stand 32" | Optional | Optional | Optional | - |
| Cabinet Stand 23" | Optional | Optional | Optional | Optional |
| Canopy and Curtains | Optional | Optional | Optional | Optional |

| VF600 | HF600 | HF750 | HS600 | HS750 |
|---|---|---|---|---|
| QC DRO, 15.6" or 21" Touchscreen PC or 24"Monitor, M1 with 7" tablet | QC DRO, 15.6" or 21" Touchscreen PC or 24" Monitor, M1 with 7" tablet | QC DRO, 15.6" or 21" PC Touchscreen or 24" Monitor, M1 with 7" tablet | QC DRO, 15.6" or 21" Touchscreen PC or 24" Monitor, M1 with 7" tablet | QC DRO, 15.6" or 21" Touchscreen PC or 24" Monitor, M1 with 7" tablet |
| Optional | Optional | Optional | Optional | Optional |
| - | Optional | Optional | Optional | Optional |
| 10x, 20x, 25x, 50x, 100x | 10x, 20x, 25x, 31.25x, 50x, 100x | 10x, 20x, 25x, 31.25x, 50x, 100x | 10x, 20x, 25x, 31.25x, 50x, 100x | 10x, 20x, 25x, 31.25x, 50x, 100x |
| - | Optional | Optional | Optional | Optional |
| - | Optional | Optional | Optional | Optional |
| - | Optional | Optional | Optional | Optional |
| - | Optional | Optional | Optional | Optional |
| Optional | Optional | Optional | Optional | Optional |
| Optional | - | - | - | - |
| Optional | - | - | - | - |
| - | Optional | Optional | Optional | Optional |
| - | - | - | - | - |
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| - | - | - | - | - |
| Optional | Standard | Standard | Standard | Standard |

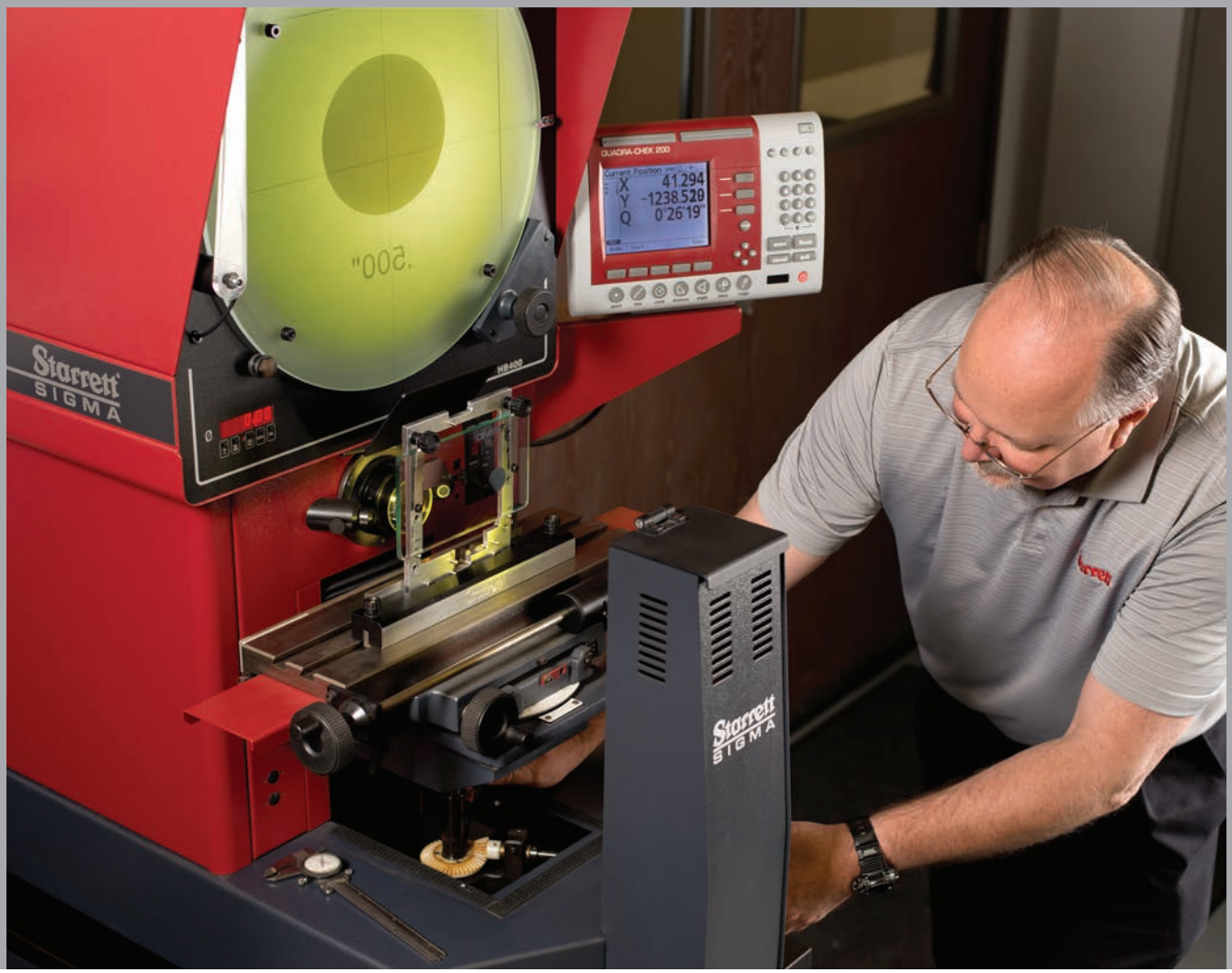
# Metrology Services

## Total Solution Provider

With Starrett Metrology products, the system is only a part of the whole package. From application analysis, system specification, installation, and training to post-installation field services, the excellence of our products is matched by the quality and comprehensive range of our services.

We recognize that reliable operation and dependable accuracy are essential to your quality and manufacturing operations. As part of our commitment to quality, we have established first generation NIST traceable documentation for all calibration artifacts and standards. Our metrology professionals are available to assist you with whatever you need to keep your system on the job.

Our factory trained experts are available to perform calibration, preventive maintenance, repairs, upgrades and system retrofits. We offer in-house training, custom programming and measurement process development. Our field technicians are trained on both Optical Comparator and Vision Systems to assure that the same calibration and validation methods utilized in the factory are used in the field.



# Custom Solutions

Starrett stands out from other precision tool providers through our willingness to work directly with customers to design and manufacture custom tools for applications where standard products cannot perform.

For metrology products, system specification many times involves customization. We approach each application with a wide range of excellent products, accessories and expertise. If necessary, we will take the additional step to developing original, customized solutions. Whatever it takes, we will work with you to configure a system that is just right for your requirements.

As a company, Starrett has provided solutions to industries including energy, aerospace, automotive, food packaging, high-technology, plastics, medical components, and to NASA and other government agencies.

Through design, testing, product specification and system development, we will find a solution to meet your requirements to your full satisfaction.

- From Problem
- To Innovation
- To Solution

At the conclusion of the process, a difficult problem is transformed into an innovative, often elegant solution.





# Training Services

Expert knowledge of software and metrology readout systems is essential to get the most from your measurement and inspection system. We offer training on our industry-standard leading MetLogix and Quadra-Chek® software and metrology readouts. Classes can be held at your facility, in our training room or online. Our expert instructors have extensive experience with these products as well as in the measurement sciences. They will show you how to get the best return on your investment.

We also offer custom training. Let us work with your engineering/metrology personnel to meet your specific needs and establish solutions for your challenging measurement applications. Starrett Metrology wants to become your one stop metrology headquarters, both for new machine sales and to support your current metrology equipment.

Give us a call to see what we can accomplish together! 1-949-348-1213 or training@starrettkinemetric.com






# MATERIAL TEST AND FORCE MEASUREMENT

# Systems

## S2 Systems

### COMPATIBLE WITH FMS AND FMD TEST FRAMES

Accurately determine spring constants, spring rate, initial tension, free length and more with our S2 System. This application-specific L2 System is ideal for measuring critical spring characteristics on the production floor or in the lab. Test templates are included for testing compression and extension springs. Tests can be created in seconds. Add the optional L2 Test Builder to create custom spring test methods. S2 Systems operate using a Windows®-based tablet PC. Load, distance, height and time-based results are displayed in a large format for easy interpretation. Graphical representation of each test can be displayed. Data tables display results with tolerance and statistical calculations. Standard reports are included, or export .csv data for use with other applications. S2 Systems utilize FMS and FMD test frames and any Starrett load cell sensor. System communication is USB. Capacities range from 500N (112lbf) to 50kN (11,250lbf).

#### Features

- Ideal for compression and extension springs
- Single- and two-point load vs height methods
- Precondition using scragging and load set
- Auto-datuming feature for accurate height measurements
- Measure and calculate results:
  - Spring Rate and Spring Constant
  - Free Length
  - Initial Tension
- Options for creating multi-steps tests using L2 Test Builder
- Options for digital I/O and Control Logic
- Options for arithmetic calculations




Intuitive Test setups with easy-to-understand prompts, menus and combo box options. Setups can be performed in seconds by operators with no previous programming experience.

# Systems

## L2 Systems

### COMPATIBLE WITH FMS AND FMD TEST FRAMES

Whether your application is high-volume in situ production, incoming inspection and validation, or just basic force measurement, the L2 System is a cost-effective and easy-to-use solution. L2 Systems feature a small footprint, making them ideal for lean manufacturing environments. Create test setups in seconds using templates or create complex multi-stage test setups using the L2 Test Builder. No programming experience required. L2 Systems operate using a Windows®-based tablet PC. Load, distance and time-based results are displayed in a large format for easy interpretation. Graphical representation of each test can be displayed. Data tables display results with tolerance and statistical calculations. Standard reports are included, or export .csv data for use with other applications. L2 Systems utilize FMS and FMD test frames and any Starrett load cell sensor. System communication is USB. System capacities range from 500N (112lbf) to 50kN (11,250lbf).

#### Features

- Ideal for tension, compression, flexural, cyclic, shear, and friction applications
- Create test setups using internationally accepted testing standards from ASTM, ISO, DIN, TAPPI and more, or create your own custom test methods
- Measure and calculate results:
  - Min/Max/Avg
  - Breaks
- Options for digital I/O and Control Logic
- Options for arithmetic calculation







Our L2 controller is a tablet computer featuring a 10-inch (254mm) color, touchscreen display. The controller is both WiFi® and Bluetooth® compatible with USB 2.0 port(s).

# Systems

## L2 Plus Systems

### COMPATIBLE WITH MMS, MMD, FMS AND FMD TEST FRAMES

Designed for advanced force measurement and analysis, L2 Plus Systems are optimized for quality and engineering personnel. Test setup is intuitive, efficient and non-compromising. Measurements and analysis are performed graphically using our Windows®-based, all-in-one computer. Results are displayed on graphs, in data tables or combinations based on load, distance or time. You may include tolerances and display statistical calculations. Standard reports are included, or export .csv data for use with other applications. L2 Plus Systems utilize FMS and FMD test frames and any Starrett load cell sensor. System communication is USB. System capacities range from 500N (112lbf) to 50kN (11,250lbf).

### Features

- Ideal for tension, compression, flexural, cyclic, shear, and friction applications
- Create test setups using internationally accepted testing standards from ASTM, ISO, DIN, TAPPI and more, or create your own custom test methods
- Measure and calculate results graphically:
  - Points
  - Slopes and Intercepts
  - Min/Max/Avg
  - Breaks
  - Peaks & Valleys
  - Deltas
  - Rates
  - Work/Energy
- Options for digital and analog I/O and Control Logic
- Options for arithmetic, trigonometric and logarithmic calculations






# Systems

## L3 Systems

### COMPATIBLE WITH MMS, MMD, FMS AND FMD TEST FRAMES

Ideal for material testing and characterization and advanced force analysis, L3 Systems represent a new and easier solution for creating a test, performing a test, analyzing your test results, and managing test data. Measurements and analysis are performed graphically using our Windows®-based, all-in-one computer. Results are displayed on graphs, in data tables or combinations based on stress, strain, load, distance or time. Include tolerances and display statistical calculations. Create calculations using arithmetic, trigonometric and logarithmic functions. Standard reports are included, or export .csv data for use with other applications. L3 Systems utilize MMS and MMD test frames and any Starrett load cell sensor. Support for two extensometers is standard. System communication is USB. System capacities range from 500N (112lbf) to 50kN (11,250lbf).

#### Features

- Determine stress, strain, load, extension, and time results using tension, compression, flexural, cyclic, shear, and friction applications
- Create test setups using internationally accepted testing standards from ASTM, ISO, DIN, TAPPI and more, or create your own custom test methods
- Measure and calculate results graphically:
  - Points
  - Elastic Modulus (Automatic, Chord, Tangent)
  - Offset Yield
  - Min/Max/Avg
  - Breaks
  - Peaks and Valleys
  - Deltas
  - Rates
  - Hysteresis
  - Work/Energy
- Options for digital and analog I/O and Control Logic



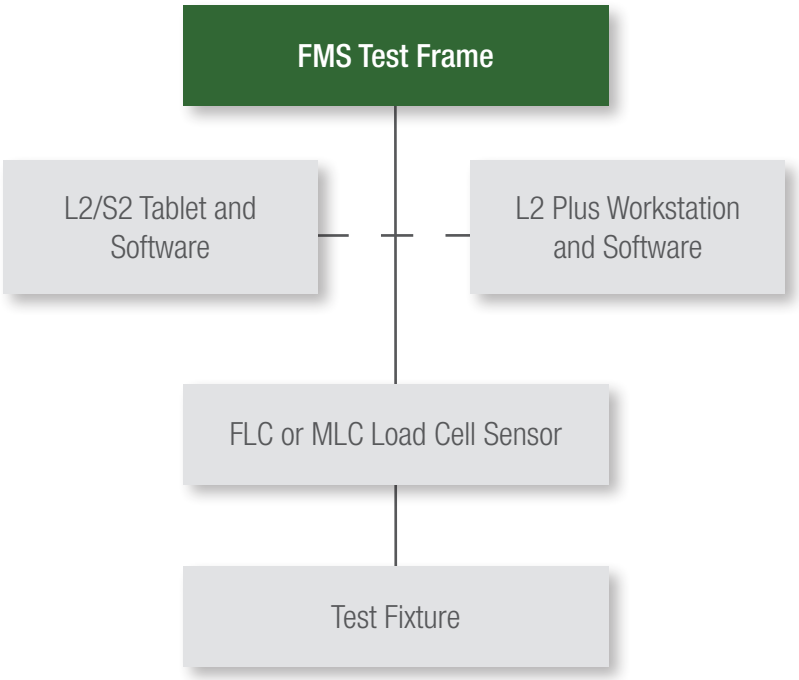
# Test Frames

## FMS

### SINGLE COLUMN

FMS single-column test frames are designed for force measurement and analysis applications. Available in four load capacities, FMS test frames are optimized for repetitive, high-volume testing applications conducted in production or laboratory environments. FMS frames feature a granite base and extruded aluminum column for inherent stiffness. The drive system includes a pre-loaded ball screw matched to a precision linear rail for unprecedented motion control, accuracy and repeatability. Magnetic travel limits protect against over-travel. Push-button controls for crosshead movement, test control and emergency stopping are easily accessible and rugged. Communication is USB. Quick-connect clevis is supplied for securing test fixtures. The FMS features a small footprint, ideal for lean manufacturing applications. Use with L2, S2 and L2 Plus software. Compatible with all Starrett load cell sensors. Options include digital I/O and safety shield with interlocks. CE compliant.

## System Diagram







FMS-1000 with L2 software and tablet PC for force measurement applications

| FMS Force Measurement Frames | | | | | |
|---|---|---|---|---|---|
| **Model Number** | | **FMS-500** | **FMS-1000** | **FMS-2500** | **FMS-5000** |
| Load Capacity | N | 500 | 1000 | 2500 | 5000 |
| | kgf | 50 | 100 | 250 | 500 |
| | lbf | 112 | 225 | 562 | 1124 |
| Minimum Speed | mm/min | 0.05 | 0.05 | 0.05 | 0.05 |
| | in/min | .002 | .002 | .002 | .002 |
| Maximum Speed | mm/min | 1525 | 1525 | 1525 | 1525 |
| | in/min | 60 | 60 | 60 | 60 |
| Position Control Resolution | µm | 0.250 | 0.250 | 0.250 | 0.250 |
| | µin | 9.8 | 9.8 | 9.8 | 9.8 |
| Vertical Test Space[1] | mm | 559 | 953 | 1257 | 1257 |
| | in | 22 | 37.5 | 49.5 | 49.5 |
| Total Crosshead Travel | mm | 381 | 762 | 1016 | 1016 |
| | in | 15 | 30 | 40 | 40 |
| Throat | mm | 100 | 100 | 100 | 100 |
| | in | 4 | 4 | 4 | 4 |
| Accuracy Load Measurement | | Load Cell Sensor Dependent (See Notes) | | | |
| Accuracy Position Measurement[2] | | ±.001" (±20 µm) | | | |
| Accuracy Crosshead Speed | | ±0.1% of set speed | | | |
| Data Sampling | Hz | 5 to 1000 | | | |
| Digital I/O | | 8 channels @ 1-5V | | | |
| Electrical Phase | | 1 | 1 | 1 | 1 |
| Power Requirements | | 100, 120, 220, 230, 240VAC 10%; 47-63Hz Self-identifying | | | |
| Operating Temperature | °C | 10° to 38 °C | | | |
| | °F | 50° to 100 °F | | | |
| Storage Temperature | °C | -40° to 66 °C | | | |
| | °F | -40° to 150 °F | | | |
| Humidity | | +10% to +90%, non-condensing | | | |
| Total Height | mm | 813 | 1270 | 1575 | 1575 |
| | in | 32 | 50 | 62 | 62 |
| Total Width | mm | 381 | 381 | 381 | 381 |
| | in | 15 | 15 | 15 | 15 |
| Total Depth | mm | 514 | 514 | 514 | 514 |
| | in | 20.25 | 20.25 | 20.25 | 20.25 |
| Weight | kg | 61 | 77 | 88 | 88 |
| | lb | 135 | 170 | 195 | 195 |

**NOTES**

1. Total vertical space is the distance from the top surface of the base plate to the bottom surface of the crosshead, excluding load cell sensor, test fixtures, and clevis adapter.
2. Assumes Linear Error Correction and Deflection Compensation has been performed on test frame.



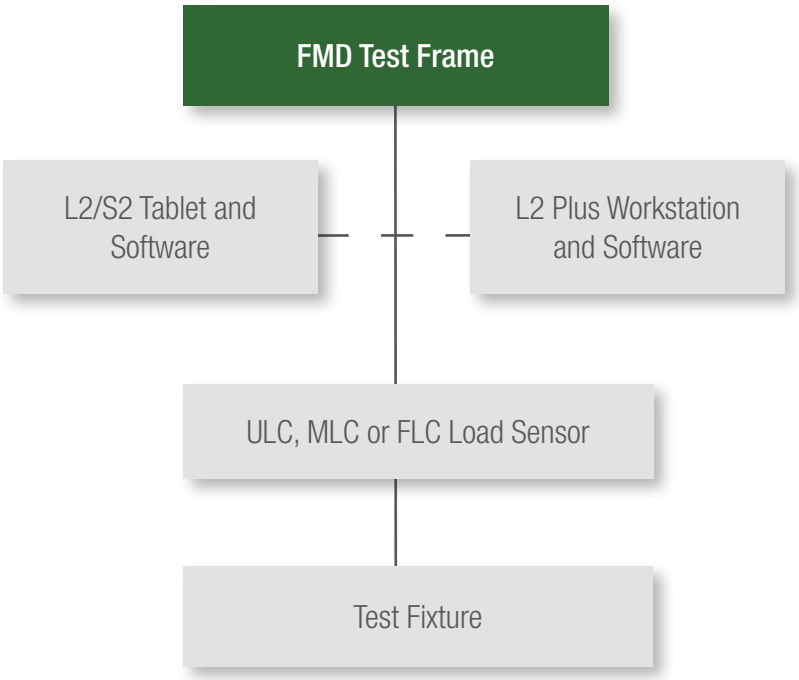
# Test Frames

## FMD

### DUAL COLUMN

FMD dual-column, bench top test frames are designed for force measurement and analysis applications. Available in three load capacities, FMD test frames are optimized for high-volume production and laboratory testing. FMD frames feature a granite base and extruded aluminum columns for inherent stiffness. The drive system includes synchronized pre-loaded ball screws matched to precision linear guides for precise motion control, accuracy and repeatability. Magnetic travel limits protect against over-travel. Push button controls for crosshead movement, test control and emergency stopping are easily accessible and rugged. Communication is USB. Quick-connect clevis is supplied for securing test fixtures. Use with L2, S2 and L2 Plus software. Compatible with all Starrett load cell sensors. Options include digital I/O and safety shield with interlocks. CE compliant.

## System Diagram







FMD-50K Test Frame
Shown with optional test fixture and load cell sensor

| FMD Force Measurement Frames | | | | |
|---|---|---|---|---|
| **Model Number** | | **FMD-10K** | **FMD-30K** | **FMD-50K** |
| Load Capacity | kN | 10 | 30 | 50 |
| | kgf | 1000 | 3000 | 5000 |
| | lbf | 2250 | 6750 | 11,250 |
| Minimum Speed | mm/min | 0.05 | 0.05 | 0.05 |
| | in/min | 0.002 | 0.002 | 0.002 |
| Maximum Speed | mm/min | 1525 | 1525 | 752 |
| | in/min | 60 | 60 | 30 |
| Position Control Resolution | µm | 0.05 | 0.025 | 0.025 |
| | µin | 1.9 | 0.9 | 0.9 |
| Frame Axial Stiffness | kN/mm | 72 | 150 | 161 |
| | lb/in | 412,844 | 855,513 | 918,367 |
| Vertical Test Space[1] | mm | 1270 | 1245 | 1220 |
| | in | 50 | 49 | 48 |
| Column Space | mm | 424 | 424 | 424 |
| | in | 16.7 | 16.7 | 16.7 |
| Total Crosshead Travel | mm | 1162 | 1137 | 1111 |
| | in | 45.75 | 44.75 | 43.75 |
| Accuracy Load Measurement | | Load Cell Sensor Dependent (See Notes) | | |
| Accuracy Position Measurement[2] | | .001" (±20 µm) | | |
| Accuracy Crosshead Speed | | ±0.1% of set speed | | |
| Data Sampling | Hz | 5 to 2000 | | |
| Digital I/O (optional) | | 12 total channels<br>Channel 1 and 2 for Power (5-24V)<br>Channels 3 thru 10 for either digital inputs or outputs<br>Channels 11 and 12 for Ground | | |
| Analog Inputs (optional) | | 1 channel @ ±10V | | |
| Analog Outputs (optional) | | 2 channels @ 0-10V | | |
| Electrical Phase | | 1 | 1 | 1 |
| Power Requirements | | 100, 120, 220, 230, 240Vac 10% | Single Phase Voltage (Vac) ±10% 220-240V (see Note) | Single Phase Voltage (Vac) ±10% 220-240V (see Note) |
| Maximum Power (VA) | Watts | 900 | 1250 | 1250 |
| Frequency | Hz | 50/60 | | |
| Operating Temperature | °C | 10° to 38 °C | | |
| | °F | 50° to 100 °F | | |
| Storage Temperature | °C | -40° to +66 °C | | |
| | °F | -40° to 150 °F | | |
| Humidity | | +10% to +90%, non-condensing | | |
| Total Height | mm | 1626 | 1626 | 1626 |
| | in | 64 | 64 | 64 |
| Total Width | mm | 787 | 787 | 787 |
| | in | 31 | 31 | 31 |
| Total Depth | mm | 736 | 736 | 736 |
| | in | 29 | 29 | 29 |
| Weight | kg | 136 | 192 | 225 |
| | lb | 300 | 425 | 500 |

**Notes**

1. Total vertical space is the distance from the top surface of the base plate to the bottom surface of the crosshead, excluding load cell sensor, test fixtures, and clevis adapter.
2. Assumes Linear Error Correction and Deflection Compensation has been performed on test frame.



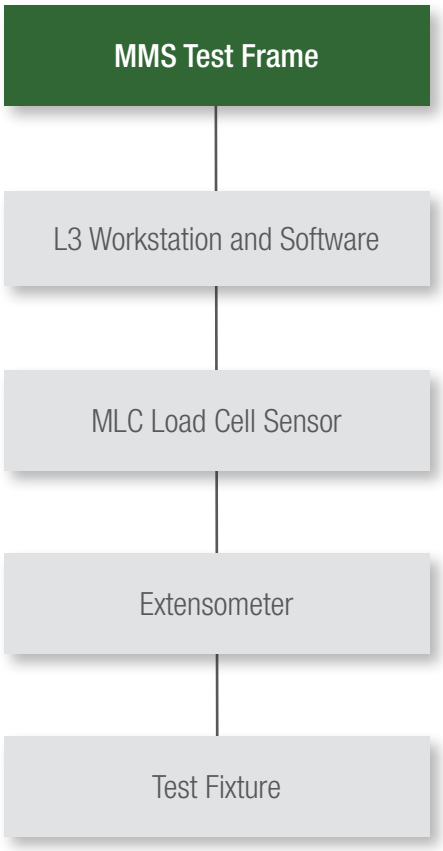
# Test Frames

## MMS

### SINGLE COLUMN

MMS single-column test frames are designed for material testing applications. Available in four load capacities, MMS test frames are optimized for laboratory and research and development testing. MMS frames feature a granite base and extruded aluminum column for inherent stiffness. The drive system includes a pre-loaded ball screw matched to a precision linear guide and high resolution encoder for unprecedented motion control, accuracy and repeatability. Magnetic travel limits protect against over-travel. Push button controls for crosshead movement, test control and emergency stopping are easily accessible and rugged. Communication is USB. Quick-connect clevis is supplied for securing test fixtures. Use with L3 software. Compatible with all Starrett load cell sensors. Connections for two extensometers. Includes digital I/O with optional analog I/O and safety shield with interlocks. CE compliant.

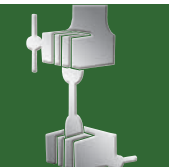
## System Diagram







MMS-500 shown with optional load cell sensor and platens.



| MMS Material Test Frames | | | | | |
|---|---|---|---|---|---|
| **Model Number** | | **MMS-500** | **MMS-1000** | **MMS-2500** | **MMS-5000** |
| Load Capacity | N | 500 | 1000 | 2500 | 5000 |
| | kgf | 50 | 100 | 250 | 500 |
| | lbf | 112 | 225 | 562 | 1124 |
| Minimum Speed | mm/min | 0.001 | 0.001 | 0.001 | 0.001 |
| | in/min | .00004 | .00004 | .00004 | .00004 |
| Maximum Speed | mm/min | 1525 | 1525 | 1525 | 1525 |
| | in/min | 60 | 60 | 60 | 60 |
| Position Control Resolution | µm | 0.0625 | 0.0625 | 0.0625 | 0.0625 |
| | µin | 2.4 | 2.4 | 2.4 | 2.4 |
| Vertical Test Space[1] | mm | 559 | 953 | 1257 | 1257 |
| | in | 22 | 37.5 | 49.5 | 49.5 |
| Total Crosshead Travel | mm | 381 | 762 | 1016 | 1016 |
| | in | 15 | 30 | 40 | 40 |
| Throat | mm | 100 | 100 | 100 | 100 |
| | in | 4 | 4 | 4 | 4 |
| Accuracy Load Measurement | | Load Cell Sensor Dependent | | | |
| Accuracy Position Measurement[2] | | ±0.0002" (±5 µm) | | | |
| Accuracy Strain Measurement | | ±0.5% of reading down to 1/50 of full scale with ASTM E83 class B or ISO 9513 class 0.5 extensometer | | | |
| Accuracy Crosshead Speed | | ±0.1% of set speed | | | |
| Data Sampling | Hz | 1 to 2000 | | | |
| Extensometer Connections | | 2 channels available for 0-10V extensometers | | | |
| Digital I/O | | 8 channels @ 1-5V | | | |
| Analog Inputs | | 1 channel @ ±10V | | | |
| Analog Outputs | | 2 channels @ 0-10V | | | |
| Electrical Phase | | 1 | 1 | 1 | 1 |
| Power Requirements | | 100, 120, 220, 230, 240VAC 10%; 47-63Hz Self-identifying | | | |
| Operating Temperature | °C | 10° to 38 °C | | | |
| | °F | 50° to 100 °F | | | |
| Storage Temperature | °C | -40° to 66 °C | | | |
| | °F | -40° to 150 °F | | | |
| Humidity | | +10% to +90%, non-condensing | | | |
| Total Height | mm | 813 | 1270 | 1575 | 1575 |
| | in | 32 | 50 | 62 | 62 |
| Total Width | mm | 381 | 381 | 381 | 381 |
| | in | 15 | 15 | 15 | 15 |
| Total Depth | mm | 514 | 514 | 514 | 514 |
| | in | 20.25 | 20.25 | 20.25 | 20.25 |
| Weight | kg | 61 | 77 | 88 | 88 |
| | lb | 135 | 170 | 195 | 195 |

**NOTES**

Total vertical space is the distance from the top surface of the base plate to the bottom surface of the crosshead, excluding load cell sensor, test fixtures, and clevis adapter.
Assumes Linear Error Correction and Deflection Compensation has been performed on test frame.



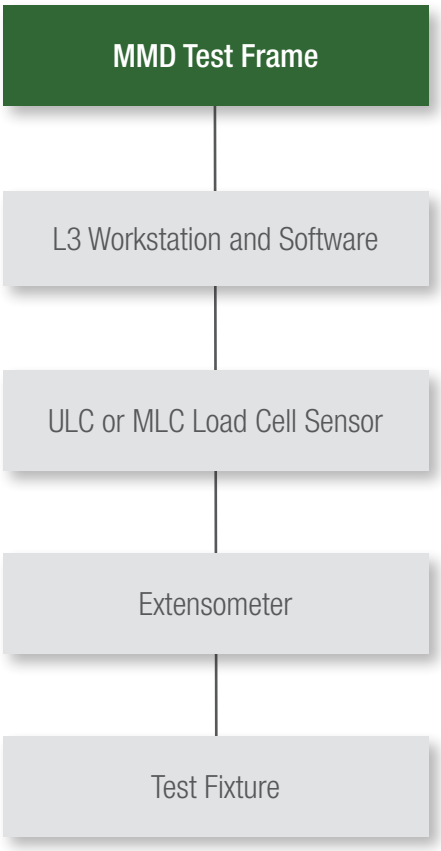
# Test Frames

## MMD

### DUAL COLUMN

MMD dual-column, bench top test frames are designed for high capacity material testing applications. Available in three load capacities, MMD test frames are optimized for laboratory and research and development testing. MMD frames feature a granite base and extruded aluminum columns for inherent stiffness. The drive system includes synchronized pre-loaded ball screws matched to precision linear guides and high resolution encoder for unprecedented motion control, accuracy and repeatability. Magnetic travel limits protect against over-travel. Push button controls for crosshead movement, test control and emergency stopping are easily accessible and rugged. Communication is USB. Quick-connect clevis is supplied for securing test fixtures. Use with L3 software. Compatible with all Starrett load cell sensors. Includes digital I/O with optional analog I/O and safety shield with interlocks. Connections for two extensometers. CE compliant.

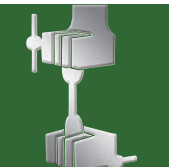
## System Diagram







MMD-50K Test Frame
Shown with optional test fixture and load cell sensor



| MMD Material Test Frames | | | | |
|---|---|---|---|---|
| **Model Number** | | **MMD-10K** | **MMD-30K** | **MMD-50K** |
| Load Capacity | kN | 10 | 30 | 50 |
| | kgf | 1000 | 3000 | 5000 |
| | lbf | 2250 | 6750 | 11,250 |
| Minimum Speed | mm/min | 0.001 | 0.001 | 0.001 |
| | in/min | .00004 | .00004 | .00004 |
| Maximum Speed | mm/min | 1525 | 1525 | 752 |
| | in/min | 60 | 60 | 30 |
| Position Control Resolution | µm | 0.05 | 0.025 | 0.025 |
| | µin | 1.9 | .9 | .9 |
| Frame Axial Stiffness | kN/mm | 72 | 150 | 161 |
| | lb/in | 412,844 | 855,513 | 918,367 |
| Vertical Test Space[1] | mm | 1270 | 1245 | 1220 |
| | in | 50 | 49 | 48 |
| Column Space | mm | 424 | 424 | 424 |
| | in | 16.7 | 16.7 | 16.7 |
| Total Crosshead Travel | mm | 1162 | 1137 | 1111 |
| | in | 45.75 | 44.75 | 43.75 |
| Accuracy Load Measurement | | Load Cell Sensor Dependent | | |
| Accuracy Position Measurement | | ±.0002" (±5 µm) | | |
| Accuracy Strain Measurement | | ±0.5% of reading down to 1/50 of full scale with ASTM E83 class B or ISO 9513 class 0.5 extensometer | | |
| Accuracy Crosshead Speed | | ±0.1% of set speed | | |
| Data Sampling | Hz | 1 to 2000 | | |
| Extensometer Connections | | 2 channels for 0-10V extensometers | | |
| Digital I/O | | 12 total channels<br>Channel 1 and 2 for Power (5-24V)<br>Channels 3 thru 10 for either digital inputs or outputs<br>Channels 11 and 12 for Ground | | |
| Analog Inputs | | 1 channel @ ±10V | | |
| Analog Outputs | | 2 channels @ 0-10V | | |
| Electrical Phase | | 1 | 1 | 1 |
| Power Requirements | | 100, 120, 220, 230, 240Vac 10% | Single Phase Voltage (Vac) ±10% 220-240V (see Note) | Single Phase Voltage (Vac) ±10% 220-240V (see Note) |
| Maximum Power (VA) | Watts | 900 | 1250 | 1250 |
| Frequency | Hz | 50/60 | | |
| Operating Temperature | °C | 10° to 38 °C | | |
| | °F | 50° to 100 °F | | |
| Storage Temperature | °C | -40° to 66 °C | | |
| | °F | -40° to 150 °F | | |
| Humidity | | +10% to +90%, non-condensing | | |
| Total Height | mm | 1626 | 1626 | 1626 |
| | in | 64 | 64 | 64 |
| Total Width | mm | 787 | 787 | 787 |
| | in | 31 | 31 | 31 |
| Total Depth | mm | 736 | 736 | 736 |
| | in | 29 | 29 | 29 |
| Weight | kg | 136 | 192 | 225 |
| | lb | 300 | 425 | 500 |

**NOTES**

1. Total vertical space is the distance from the top surface of the base plate to the bottom surface of the crosshead, excluding load cell sensor, test fixtures, and clevis adapter.
2. Assumes Linear Error Correction and Deflection Compensation has been performed on test frame.



# Load Cells

## ULC, MLC and FLC Load Cells Sensors

Starrett offers a full range of precision load cell sensors for material testing, force analysis and force measurement applications. Starrett load cells are compliant with IEEE 1451.4 and meet or exceed ASTM E4, BS 1610, ISO 7500-1 and EN 10002-2. Measurement accuracies of ±0.5% of reading down to 1/100 of sensor capacity may be achieved. Sensors are supplied with a NIST-traceable Certificate of Calibration. Sensors may be used on L2, S2, L2 Plus or L3 Systems.

## ULC and MLC Load Cell Sensors

Starrett ULC and MLC load cell sensors are full-bridge, temperature compensated, strain gage instruments designed and optimized for material testing applications. These low profile sensors feature high axial stiffness and minimal deflection at full capacity which leads to improved measurement accuracy.

ULC sensors provide ultimate measurement performance and are supplied with a standard base plate adapter. Available in capacities from 1.5kN to 50kN.

The MLC are general purpose sensors available in capacities from 125N to 50kN.




MLC low-profile load cell sensor
Load measurement accuracy of ±0.5% of reading down to 1/100 of sensor capacity may be achieved.

**Material Test Load Cell Sensors - Ultra Low Profile**

| Model | Load Capacity N | kgf | lbf | Full Scale Deflection mm | in | Safe Overload % | Height mm | in | Width mm | in | Thread |
|---|---|---|---|---|---|---|---|---|---|---|---|
| ULC-1500 | 1500 | 150 | 337 | 0.05 | .002 | 150 | 63.5[1] | 2.51[1] | 104.8 | 4.13 | M16 x 2-4H |
| ULC-2500 | 2500 | 250 | 562 | 0.05 | .002 | 150 | 63.5[1] | 2.51[1] | 104.8 | 4.13 | M16 x 2-4H |
| ULC-5K | 5000 | 500 | 1124 | 0.05 | .002 | 150 | 63.5[1] | 2.51[1] | 104.8 | 4.13 | M16 x 2-4H |
| ULC-10K | 10,000 | 1000 | 2248 | 0.05 | .002 | 150 | 63.5[1] | 2.51[1] | 104.8 | 4.13 | M16 x 2-4H |
| ULC-25K | 25,000 | 2500 | 5620 | 0.10 | .004 | 150 | 63.5[1] | 2.51[1] | 104.8 | 4.13 | M16 x 2-4H |
| ULC-50K | 50,000 | 5000 | 11,240 | 0.10 | .004 | 150 | 63.5[1] | 2.51[1] | 104.8 | 4.13 | M16 x 2-4H |

**NOTES**

[1] Dimension includes the base adapter. These sensors are supplied with the base adapter standard.
Load measurement accuracy is ±0.5% of reading down to 1/100 of load cell capacity. Display resolution is 10,000:1.
Starrett recommends on-site verification of accuracy during installation. Sensor calibration should be performed at least annually.

**Material Test Load Cell Sensors - Standard Low Profile**

| Model | Load Capacity N | kgf | lbf | Full Scale Deflection mm | in | Safe Overload % | Height mm | in | Width mm | in | Thread |
|---|---|---|---|---|---|---|---|---|---|---|---|
| MLC-125 | 125 | 12.5 | 28 | 0.08 | .003 | 150 | 38.1 | 1.5 | 69.8 | 2.75 | M6 x 1-6H |
| MLC-250 | 250 | 25 | 56 | 0.08 | .003 | 150 | 38.1 | 1.5 | 69.8 | 2.75 | M6 x 1-6H |
| MLC-500 | 500 | 50 | 112 | 0.08 | .003 | 150 | 38.1 | 1.5 | 69.8 | 2.75 | M6 x 1-6H |
| MLC-1000 | 1000 | 100 | 225 | 0.08 | .003 | 150 | 38.1 | 1.5 | 69.8 | 2.75 | M6 x 1-6H |
| MLC-1500 | 1500 | 150 | 337 | 0.03 | .001 | 150 | 63.51 | 2.51[1] | 104.8 | 4.13 | M16 x 2-4H |
| MLC-2500 | 2500 | 250 | 562 | 0.03 | .001 | 150 | 63.51 | 2.51[1] | 104.8 | 4.13 | M16 x 2-4H |
| MLC-5K | 5000 | 500 | 1124 | 0.03 | .001 | 150 | 63.51 | 2.51[1] | 104.8 | 4.13 | M16 x 2-4H |
| MLC-10K | 10,000 | 1000 | 2248 | 0.03 | .001 | 150 | 63.51 | 2.51[1] | 104.8 | 4.13 | M16 x 2-4H |
| MLC-25K | 25,000 | 2500 | 5620 | 0.05 | .002 | 150 | 63.51 | 2.51[1] | 104.8 | 4.13 | M16 x 2-4H |
| MLC-50K | 50,000 | 5000 | 11,240 | 0.05 | .002 | 150 | 63.51 | 2.51[1] | 104.8 | 4.13 | M16 x 2-4H |

**NOTES**

[1] Dimension includes the base adapter. Starrett recommends including the base adapter on these model sensors to ensure proper alignment.
Load measurement accuracy is ±0.5% of reading down to 1/100 of load cell capacity. Display resolution is 10,000:1.
Starrett recommends on-site verification of accuracy during installation. Sensor calibration should be performed at least annually.

# Load Cells

## FLC Load Cell Sensors

Three models of s-beam load cell sensors are also available. These are all full-bridge, temperature compensated strain gage instruments, designed for force measurement applications, but suitable for some material testing applications.

### Premium Models

Ideal for low load applications, these sensors have a safe overload rating of 1000% of the sensor's load capacity.

### Economy Models

When price is an issue, these general purpose load cell sensors are economical and suitable for most general purpose force measurement applications.

### Sealed Models

These models are suitable for applications in non-laboratory environments where dirt, oil, dust and debris may be present.




Load measurement accuracy is ±0.1% of load cell capacity.

**S-Beam Force Measurement Load Cell Sensors - Premium**

| Model | Load Capacity N | kgf | lbf | Full Scale Deflection mm | in | Safe Overload % | Height mm | in | Width mm | in | Thread |
|---|---|---|---|---|---|---|---|---|---|---|---|
| FLC-5P | 5 | 0.5 | 1 | 0.4 | .014 | 1000 | 63.0 | 2.48 | 59.2 | 2.33 | M6 x 1-6H |
| FLC-10P | 10 | 1 | 2 | 0.3 | .012 | 1000 | 63.0 | 2.48 | 59.2 | 2.33 | M6 x 1-6H |
| FLC-25P | 25 | 2.5 | 5 | 0.3 | .011 | 1000 | 63.0 | 2.48 | 59.2 | 2.33 | M6 x 1-6H |
| FLC-50P | 50 | 5 | 11 | 0.2 | .009 | 1000 | 63.0 | 2.48 | 59.2 | 2.33 | M6 x 1-6H |
| FLC-100P | 100 | 10 | 22 | 0.2 | .007 | 1000 | 63.0 | 2.48 | 59.2 | 2.33 | M6 x 1-6H |
| FLC-250P | 250 | 25 | 56 | 0.2 | .006 | 1000 | 63.0 | 2.48 | 59.2 | 2.33 | M6 x 1-6H |

Load measurement accuracy is ±0.1% of load cell capacity. Display resolution is 10,000:1.
Starrett recommends on-site verification of accuracy during installation. Sensor calibration should be performed at least annually.

**S-Beam Force Measurement Load Cell Sensors - Economy**

| Model | Load Capacity N | kgf | lbf | Full Scale Deflection mm | in | Safe Overload % | Height mm | in | Width mm | in | Thread |
|---|---|---|---|---|---|---|---|---|---|---|---|
| FLC-50E | 50 | 5 | 11 | 0.08 | .003 | 150 | 63.5 | 2.5 | 50.8 | 2.0 | M6 x 1-6H |
| FLC-100E | 100 | 10 | 22 | 0.08 | .003 | 150 | 63.5 | 2.5 | 50.8 | 2.0 | M6 x 1-6H |
| FLC-200E | 200 | 20 | 45 | 0.08 | .003 | 150 | 63.5 | 2.5 | 50.8 | 2.0 | M6 x 1-6H |
| FLC-500E | 500 | 50 | 112 | 0.10 | .004 | 150 | 63.5 | 2.5 | 50.8 | 2.0 | M6 x 1-6H |
| FLC-1000E | 1000 | 100 | 225 | 0.15 | .006 | 150 | 63.5 | 2.5 | 50.8 | 2.0 | M6 x 1-6H |
| FLC-2000E | 2000 | 200 | 450 | 0.15 | .006 | 150 | 76.2 | 3.0 | 50.8 | 2.0 | M12 x 1.75-5H |
| FLC-2500E | 2500 | 250 | 562 | 0.13 | .005 | 150 | 76.2 | 3.0 | 50.8 | 2.0 | M12 x 1.75-5H |
| FLC-5000E | 10,000 | 1000 | 2248 | 0.13 | .005 | 150 | 76.2 | 3.0 | 50.8 | 2.0 | M12 x 1.75-5H |

Load measurement accuracy is ±0.1% of load cell capacity. Display resolution is 10,000:1.
Starrett recommends on-site verification of accuracy during installation. Sensor calibration should be performed at least annually.

**S-beam Force Measurement Load Cell Sensors - Sealed**

| Model | Load Capacity N | kgf | lbf | Full Scale Deflection mm | in | Safe Overload % | Height mm | in | Width mm | in | Thread |
|---|---|---|---|---|---|---|---|---|---|---|---|
| FLC-500 | 500 | 50 | 112 | 0.004 | .10 | 150 | 63.5 | 2.5 | 50.8 | 2.0 | M6 x 1-6H |
| FLC-1000 | 1000 | 100 | 225 | 0.006 | .15 | 150 | 63.5 | 2.5 | 50.8 | 2.0 | M6 x 1-6H |
| FLC-2000 | 1500 | 150 | 337 | 0.005 | .13 | 150 | 76.2 | 3.0 | 50.8 | 2.0 | M12 x 1.75-5H |
| FLC-2500 | 2500 | 250 | 562 | 0.005 | .13 | 150 | 76.2 | 3.0 | 50.8 | 2.0 | M12 x 1.75-5H |
| FLC-5K | 5000 | 500 | 1124 | 0.005 | .13 | 150 | 76.2 | 3.0 | 50.8 | 2.0 | M12 x 1.75-5H |
| FLC-10K | 10,000 | 1000 | 2248 | 0.005 | .13 | 150 | 76.2 | 3.0 | 50.8 | 2.0 | M12 x 1.75-5H |
| FLC-20K | 20,000 | 2000 | 4500 | 0.005 | .13 | 150 | 88.9 | 3.5 | 63.5 | 2.5 | M16 x 2-4H |

Load measurement accuracy is ±0.1% of load cell capacity. Display resolution is 10,000:1.
Starrett recommends on-site verification of accuracy during installation. Sensor calibration should be performed at least annually.

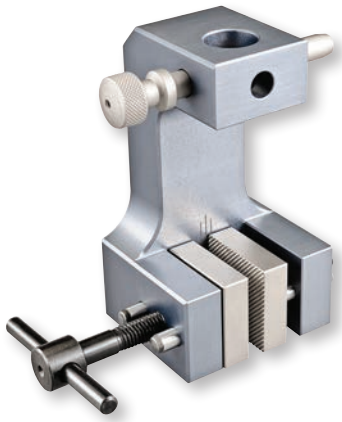


# Test Fixtures

Starrett offers a full range of test fixtures, grips and accessories. Test fixtures are compatible with all Starrett systems and test frames. Starrett can also engineer and supply custom test fixtures to your exact requirements.



Wedge-Action



Vise-Action



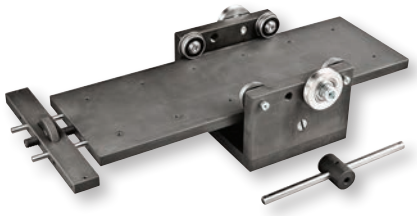
Scissor-Type



Pneumatic



Roller-Type



Peel and Friction



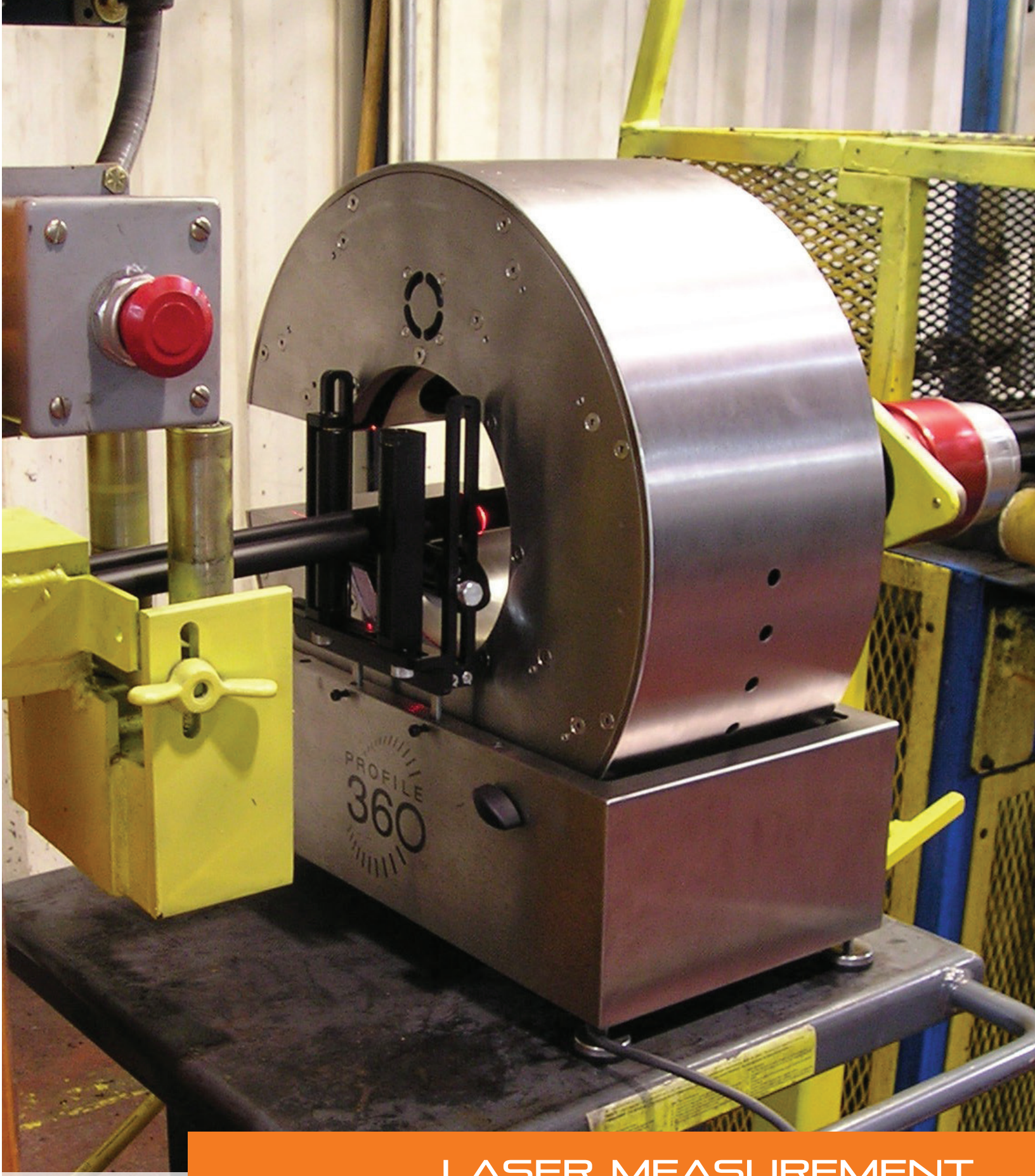
Rope



Terminal



Platens




# LASER MEASUREMENT

# Laser Measurement

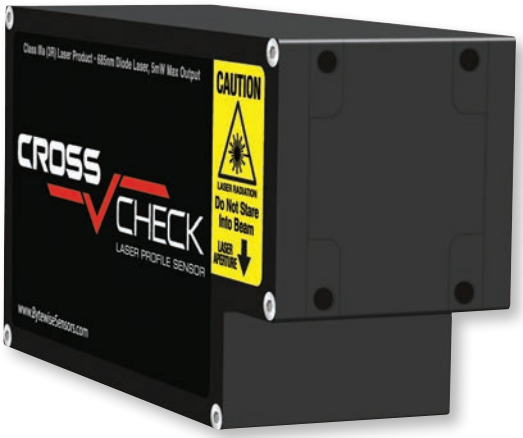
Profile360 is an in-line, real-time, non-contact measurement system for continuously monitoring key profile dimensions in complex shapes such as rubber, ceramic, plastic, and wood-plastic composite extrusions, roll-formed metal profiles, and profiled wire. Profile360 employs CrossCheck Line Laser Sensors to digitize the profile, compare it to a CAD template, and continuously monitor key dimensions. Dimension changes often indicate a change in material, equipment, or process, resulting in poor quality or high scrap or reclaim cost.

Profile360 continuously monitors the size and shape of complex profiles in order to assure quality and avoid the high cost of defects. The system acquires thousands of data points around the profile and matches them to a CAD template, where key measurement parameters such as width, thickness, gap, radius, and angle are extracted. Measurement parameters are compared to allowable control limits and displayed on the operator's terminal with a pass/caution/fail status indicator. Profile360 runs at rates up to 14 profiles per second. The system is available in standard sizes and can be custom-built for almost any size and shape.

### In-Line monitoring is displacing off-line checking methods:

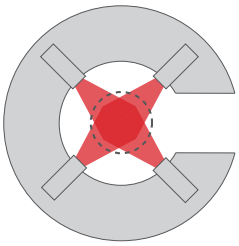
- Alarms immediately when the dimensions change so that operators can intervene to correct the process, resulting in improved quality, improved production yield, and reduced cost of scrap and rework
- Provides instant measurements, so the operator can immediately see the results of all line adjustments
- Provides 100% inspection of the entire run compared to periodic off-line checking, which can miss many disturbances
- Used by many to decrease start-up time, resulting in higher production yield and lower scrap cost



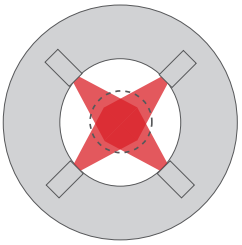

## The Profile360

Unlike oscillating measurement systems, Profile360 has no moving parts – no slides, motors, controllers, or encoders to require maintenance and calibration. The system is sealed and temperature controlled to assure a constant internal temperature. This results in a greatly reduced thermal drift for the system and assures a long laser diode life, even in tough environments.



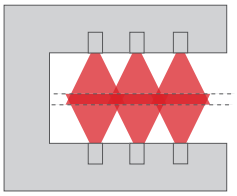
## C-Frame Systems

- Available in 10, 25, 50, 75, and 100mm diameter fields-of-view
- Available in 2, 3, 4, 5, or 6 sensor configurations
- Available with the Industrial Mobility Package, including a lift cart, junction box, panel PC, and alarm tower assembled into an "all-in-one" package
- An alarm beacon signals when control limits are exceeded



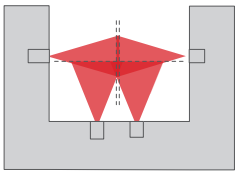
## O-Frame Systems

- Available in 150mm diameter field-of-view
- Available in 2, 3, 4, 5, 6, 7, or 8 sensor configurations
- Available with the Industrial Mobility Package



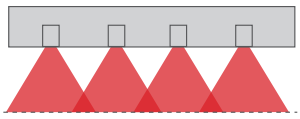
## Two-Sided Systems

- Available using any sensor size, in overlapping and non-overlapping sensor orientations



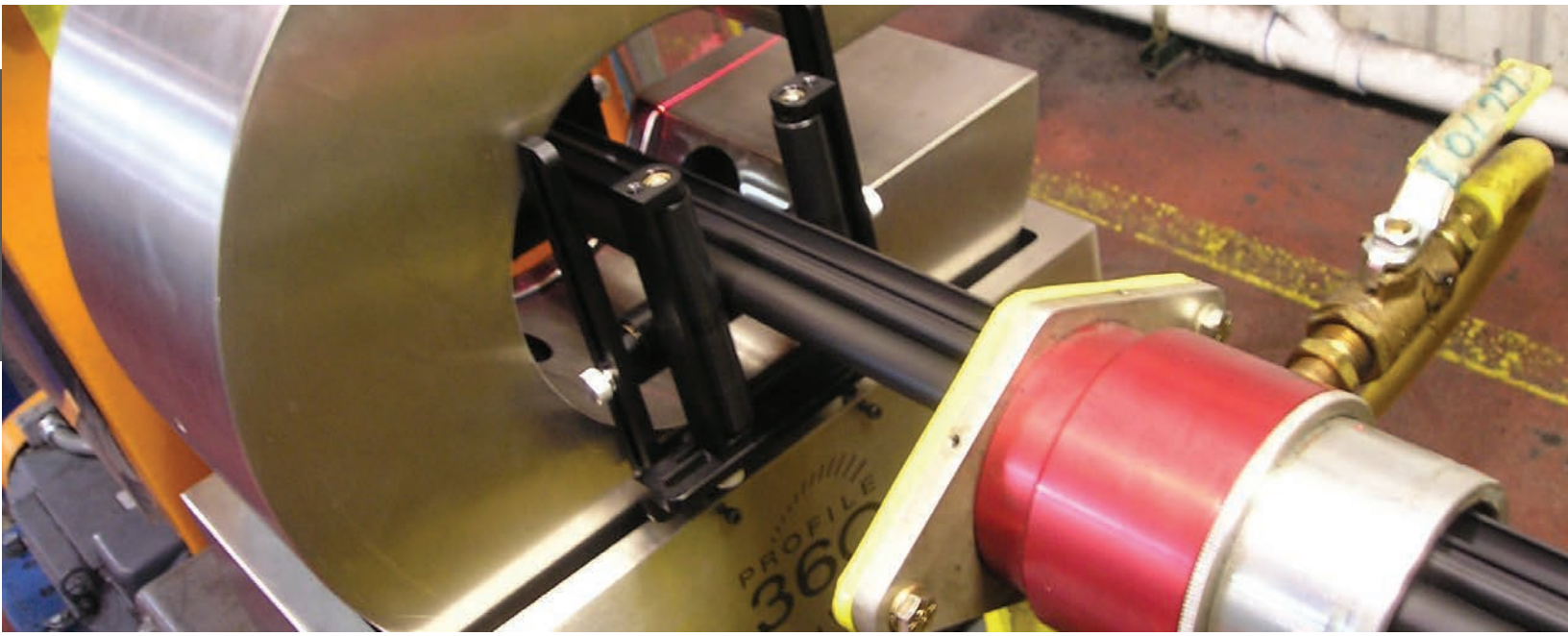
## Three-Sided Systems

- Available using any size sensor, in overlapping and non-overlapping sensor orientations



## Single-Sided Systems

- Available using any sensor size, in overlapping and non-overlapping sensor orientations



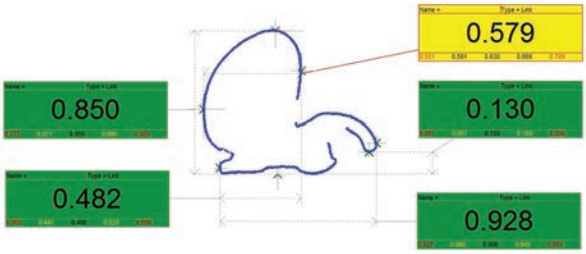
# Auto Seals

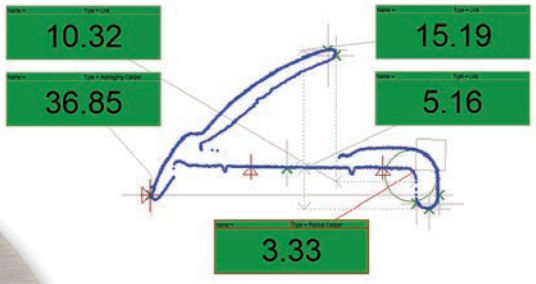
When auto sealing extrusion lines go out of specification, they produce about $1,400 per hour in scrap. The scrap is not recyclable because the rubber is vulcanized, and often is cured over metal reinforcement. The result is a loss in raw materials, labor, energy, landfill cost, and production time.

Profile360 alarms any time dimensions change so the operator can act to correct the process, save scrap, and improve production. The Profile360 investment payback period is achieved in only 32 hours of scrap savings. If you can avoid 1 hour's worth of scrap per week, your Profile360 investment is realized in 32 weeks.

| Savings with Profile360* | | |
|---|---|---|
| **Compound Cost** | 2.97 | $/kg |
| **Profile Weight** | 0.37 | kg/m |
| **Line Speed** | 21.3 | m/min |
| **Compound Cost/hr** | 1,404 | $/hr |
| **Profile360 Investment** | 45,000 | $ |
| **Payback Period** | 32 | hrs |

* If you can reduce scrap by 1 hour per week, you can achieve a payback in 32 weeks based on raw materials cost avoidance alone, not to mention the cost of customer returns.






# PVC Extrusion

PVC profiles can distort during calibration and cooling, resulting in non-usable profiles.

In-line checking with Profile360 assures that the operator will be alerted any time there is a change in size, shape, or squareness. This helps reduce the time and cost of rework and improves yield.

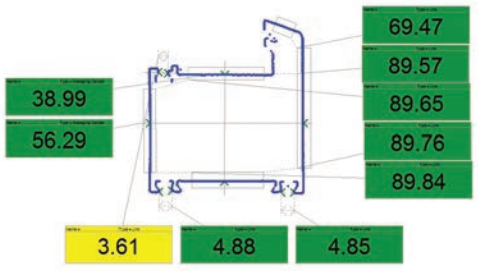
Since Profile360 provides real-time measurement, there is no need to cut samples, de-burr the cut edges, and walk to a central off-line inspection station in order to check dimensions. Profile360 greatly reduces the cost of dimension checking, and provides a much faster result.

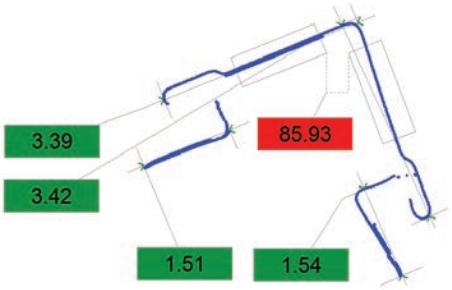
| Which of These is the Most Efficient Way to Start Up Your Extrusion Line? | |
|---|---|
| **Profile360** | **Off Line Methods** |
| View Real-Time Profile Dimensions In-Line | Cut Part |
| Adjust Extruder Immediately | Walk to Metrology Lab |
| Allow Adjustment to Stabilize and Pass Through Profile360 | Cut Sliver |
| Repeat | Clean and Prep Sliver |
| Time Required: 5 min per adjustment | Put Sliver in Queue for Measurement |
| | Upload File/Find Mylar<br>Place Sample On Scanner/10x |
| | Complete Measurement Routine |
| | Print Report |
| | File Report |
| | Walk Back to Extruder |
| | Adjust Extruder |
| | Wait for Adjustment to Stabilize |
| | Repeat Entire Process |
| | Time Required: 30 to 60 min per adjustment |

## Features

- Monitor angles, squareness, gaps, grooves, and other key dimensions in real-time with on-screen optical comparator and trend graph displays
- Alarm immediately when any dimensions change
- View real-time profile geometry from any PC on your network
- Report complete dimensional statistics for each run
- Available with industrial mobility package



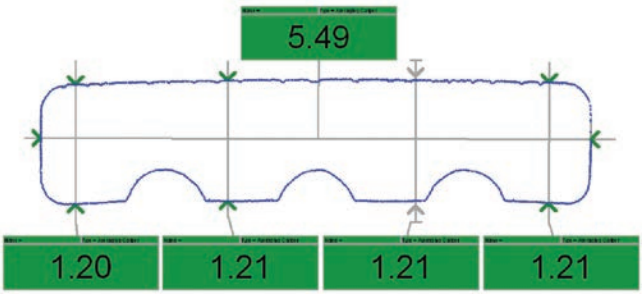



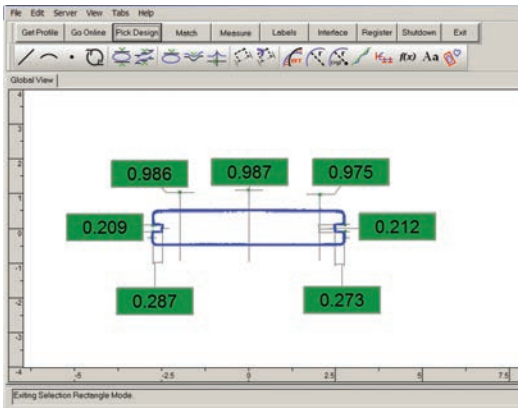



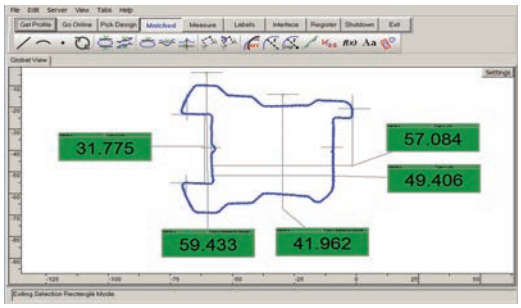
# Wood-Plastic Composite

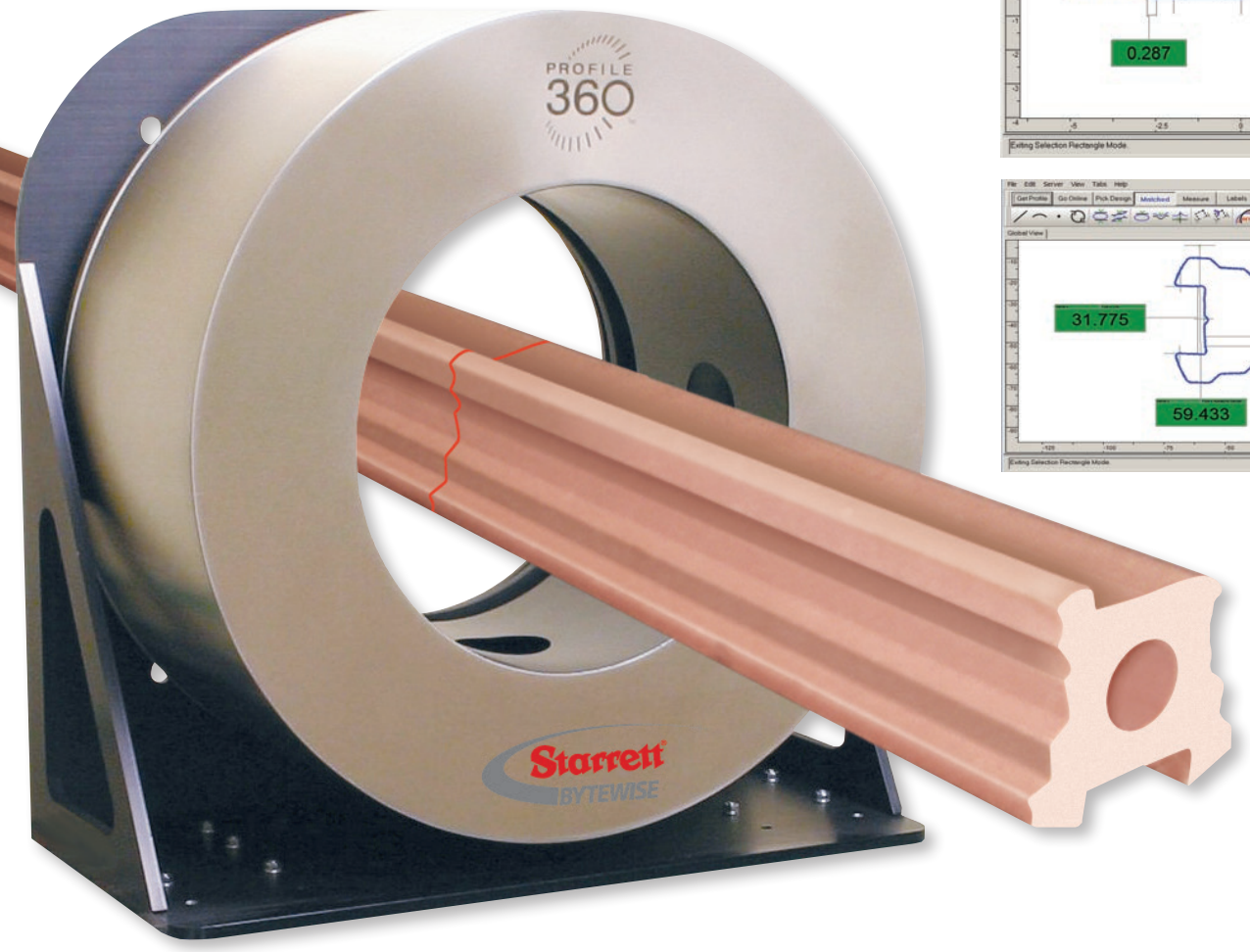
Wood-plastic composites have variations in raw material properties, humidity, and barrel temperature, and these variations can result in profiles that swell or sag, resulting in defective boards. Profile360 is employed to continuously monitor profiles coming out of the die to assure the process is under control and the size and shape is correct. Profile360 can measure boards to the lower end of the allowable tolerance range in order to reduce the raw material cost per board, resulting in payback within 100 days.

| Cost Savings | |
|---|---|
| Nominal Board Size | 5.5in$^2$ |
| Target Area Reduction | .1in$^2$ (1.8%) |
| Material Cost | $.60/lb |
| Density | .04lb/in$^3$ |
| Line Speed | 144in/min |
| Target Savings | 14.4in$^3$/min |
| Cost Savings | $477/day |
| Payback Period | 100 days |



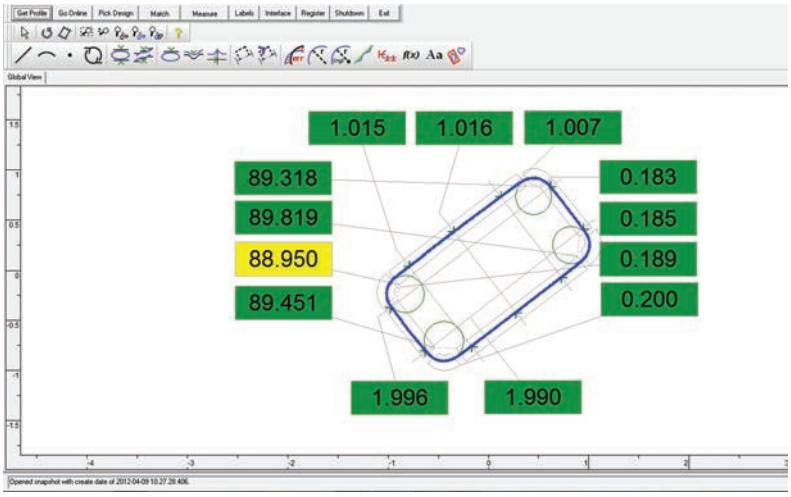



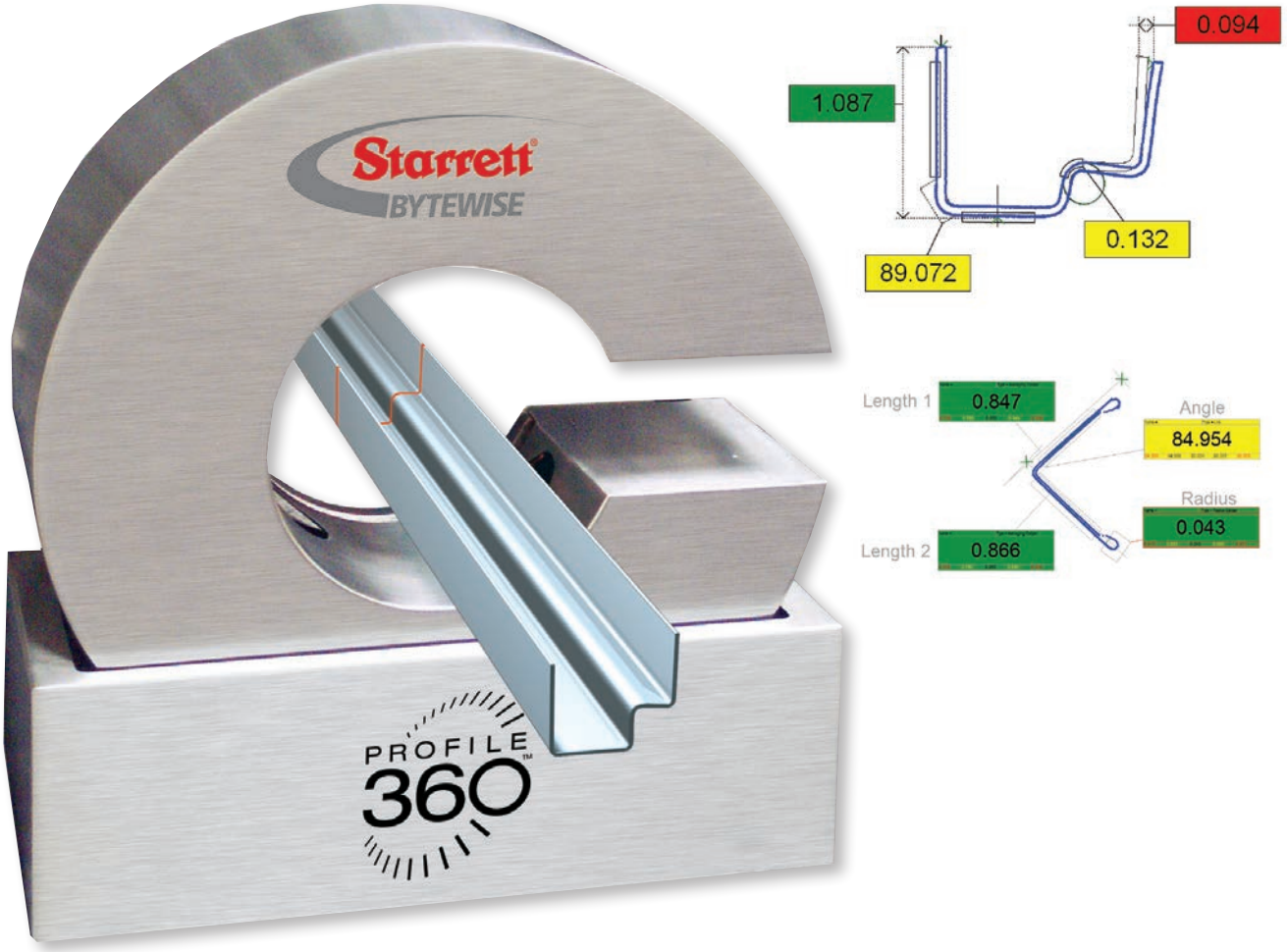
# Metal Profiles

Roll-formed profiles often go out of specification during a run because the incoming coils have lot-to-lot variations in width, thickness, crown, camber, and physical properties. Requiring the setup technician to adjust for the material changes. Pending manual inspection, to isolate the out-of-specification material, a long run can produce materials not to specification.




## Profile360 Advantages

- Quickly validate the roll stand setup
- Make progressively small roll adjustments and immediately see the result
- Decrease the set-up time by eliminating off-line checking process
- Assist in reducing the time required to reach stability
- Continuously monitor the dimensional quality of any profile, and alarm the operator when any problem occurs
- Produce data histories that can be used to compare any run with its historical performance
- Quantify quality improvement initiatives
- Assist tooling development
- Export DXF point files that can be opened in the die design CAD application and compared to the intended design



# Pipe and Tube

The system in final inspection produces an automated dimensional inspection report for the OD and OOR of the pipe ends and body to assure compliance with API and other standards. When installed prior to cutting, the measurements can be used to fine-tune the tooling during a set up change, and then alarm whenever OD or OOR values approach the allowable limits so that an operator can intervene before a quality fault occurs.

Sensors are mounted on a precision space-frame and aligned via patented software techniques. Data sets from each sensor are internally transformed into a global coordinate system to render the complete cross-sectional profile image. Software measurement tools can be configured to display and record up to 180 OD values, one per degree, as well as maximum and minimum OD and OOR for the pipe ends and body.

## Features

- Reliable due to its simple design
- Automatically measures pipe OD and OOR from 6" up to 24" (150 to 600mm) at two locations: in-line before cutting, and in final inspection
- Utilizes CrossCheck™ Line-Laser Sensors to achieve the range and accuracy required for pipe mills
- A single measurement cycle instantaneously acquires about 5,000 data points (for a 24" pipe) in a precise cross-sectional plane in 1 millisecond



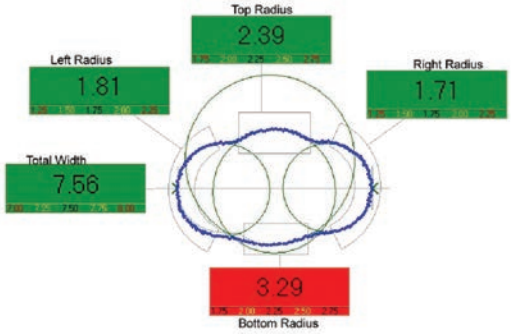


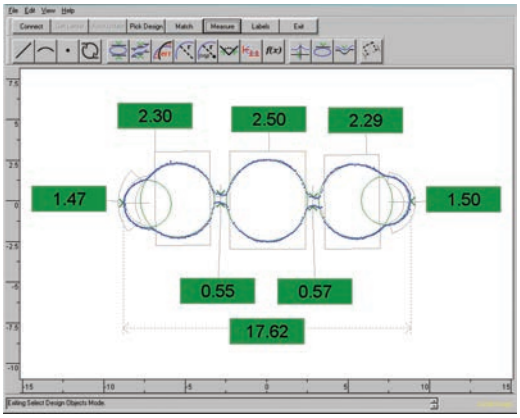

# Wire and Cable

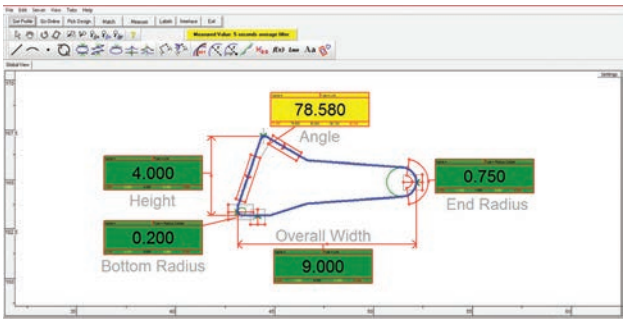
Multi-conductor cables, sub-sea cables, and fiber optic cables rely on the cover extrusion to isolate the conductors from the environment to assure safe and reliable power and data transmission. Profile360 is employed on the line for 100% inspection of the cover geometry.

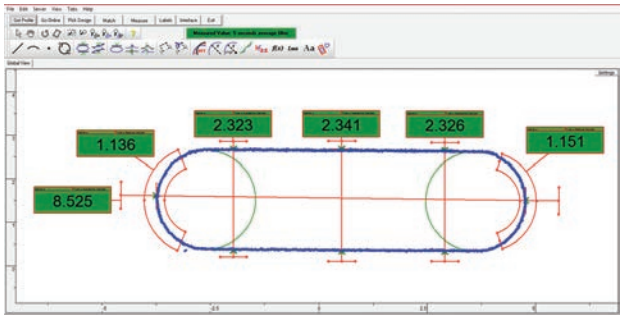
Profile360 is also used to monitor shaped wire profiles such as magnet wire for size and shape uniformity.



# Specifications and Accessories

| Field of View (FoV) Diameter | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|
| | | Inches | | | | | Millimeters | | | | |
| | All[2] | 1 | 2 | 3 | 4 | 6 | 25 | 50 | 75 | 100 | 150 |
| Repeatability[1] | 0.03% FoV | 0.0003" | 0.0006" | 0.0009" | 0.0012" | 0.0018" | 0.0075mm | 0.0150mm | 0.0225mm | 0.0300mm | 0.0450mm |
| Accuracy[1] | 0.06% FoV | 0.0006" | 0.0012" | 0.0018" | 0.0024" | 0.0036" | 0.015mm | 0.030mm | 0.045mm | 0.060mm | 0.090mm |

| Specifications | |
|---|---|
| Measurement Rate | Selectable up to 14 profiles/second |
| Communication Interface | Analog and Digital Outputs; Ethernet |
| Run Modes | Clock Frequency or Encoder |
| Data Output | Modbus TCP or OPC Server native; conversion to other platforms available |
| Operating Temperature | 32 to 113 °F (0 to 45 °C); cooling systems available |
| Profile360 conforms to the Machinery Safety, Electromagnetic Compatibility, and Low Voltage directives of the EC | |
| Laser safety class by the CDRH standard is Class 3A, and the IEC 60825-1 classification is Class 3R | |

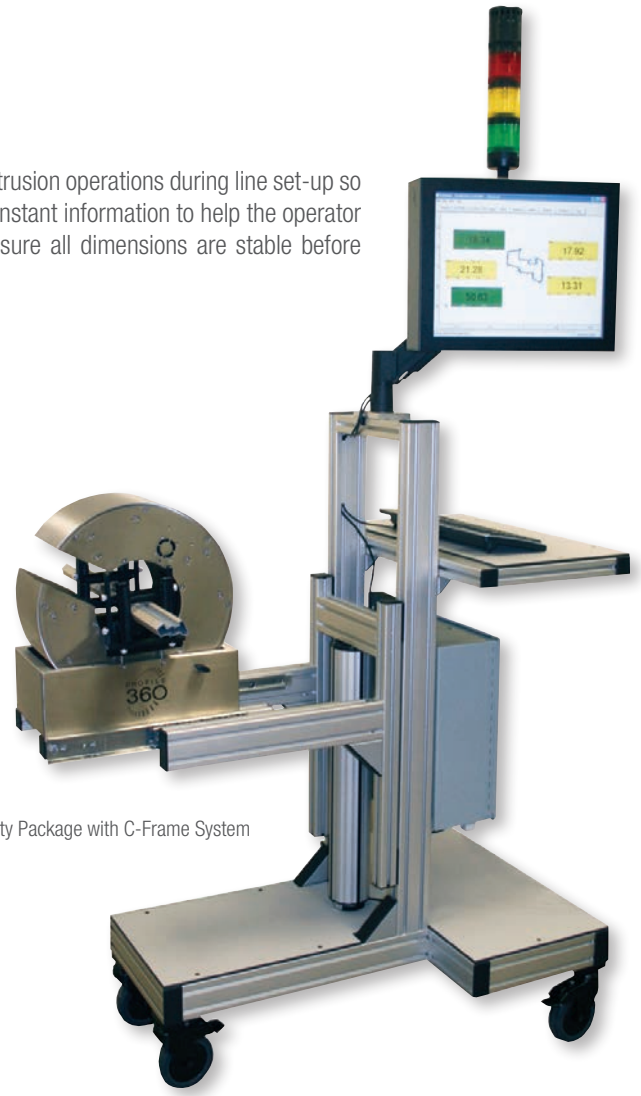
1. Repeatability is representative of the system's ability to monitor process variation. It is expressed as the three-sigma standard deviation in a series of measurements of a known gage block. Accuracy is representative of the system's error in measuring a known value. It is expressed as the Bias in a series of measurements of a certified gage block. Repeatability and Accuracy are based on 2012 standardized test procedure. Field results may be better or worse depending on caliper type, size and placement.

   2012 Test Procedure includes thickness measurements of an independently certified test block. 20 measurements are taken at each of 10 different locations throughout the system field of view. Repeatability (3σ) and Accuracy (bias) are calculated at each position. The Repeatability and Accuracy at each of the 10 positions must be less than the specification.

2. All measurements are taken at one update per second.

## Industrial Mobility Package

The Profile360 Industrial Mobility Package has been employed by large extrusion operations during line set-up so that one unit can serve multiple lines. The in-line measurement provides instant information to help the operator tune-in the extruder, calibrator, and down-stream equipment, and to assure all dimensions are stable before moving on to the next line.



Industrial Mobility Package with C-Frame System

# Software

## Profile360 Software provides:

- Test plan management for all profile designs
- Matching and comparison of measured profile to a CAD template
- Caliper-based utilities to program each profile design for specific measurements
- Display of all real-time measurement data
- Display of trend data
- Data logging for all measurement results
- Standard report printing
- Installation of software on any network PC and connection to the instrument to view real-time data

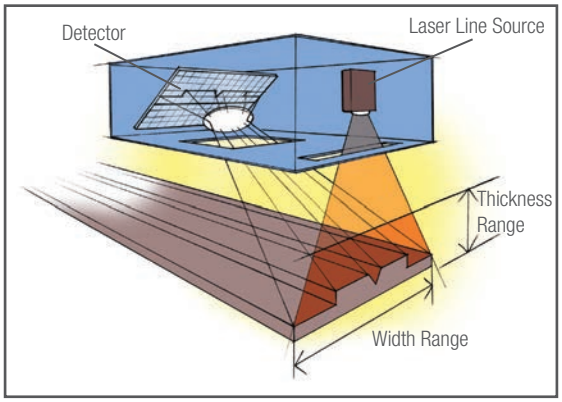
| Software Features | | | |
|---|---|---|---|
| **Data Matching** | Match profile to CAD template | **Calipers** | Averaging caliper |
| | Anchor profile to multiple datums | | Half caliper |
| | Match to user-defined sub-regions | | Integrating caliper |
| | Match multiple profiles independently | | Bump caliper |
| **Display** | Measured values with pass/fail/warning status | | Area caliper |
| | Error values | | Link multiple calipers |
| | Cp and Cpk | | Link to fixed position |
| | Standard deviation | | Radius and XY centerpoint |
| | Trend charts | | Line regression fit |
| | Histograms | | Formula caliper |
| | Optical comparator | | Angle caliper |
| | Error vectors | | |
| | Mean over a user-defined time period | | |
| | Display actual profile | | |
| | Display thickness profile | **Alignment Check** | Automatic software alignment |
| **Report Writer** | Print trend graph | **Data Logging** | Log caliper values to history file |
| | Print histogram | | Save point cloud to .txt |
| | Print exceptions | | Save snapshots to history file |

# Tire Industry

## Guide to Technology

At Starrett-Bytewise, we employ three types of sensor technologies: fixed point laser, displacement sensors, CrossCheck low-speed laser line sensors, and CrossCheckHD high-speed laser line sensors. All laser line sensors are designed and built by Starrett-Bytewise.

CrossCheck Sensors project a laser line across a profile, digitize the image, and transform the image into a geometric coordinate system. Multi-sensor systems acquire thousands of data points around the profile and match them to a CAD template, where key measurement parameters are extracted.




| Component Preparation | | |
|---|---|---|
| **Tread and Sidewall Extrusion** | **Calendar** | **Apex Extrusion** |
| On-Line Profilometer | Gum Calendar Monitor | Profile360 On-Line Profile Measurement System |
| Off-Line Profilometer | Overlapping Ply Splice Monitor | |
| Off-Line Profilometer SL | CrossCheck Width | |
| **Tire Building** | | |
| **Carcass Drum** | **Belt/Tread Drum** | **Shaping Drum** |
| Overlapping Inner Liner and Body Ply Splice Monitor | CrossCheck Belt Edge and Dog-Ear Splice Monitor | GTU Radial Runout and Lateral Runout Monitor |
| GTU Diagnostic System | GTU Diagnostic System | GTU Diagnostic System |
| **Tire Development & Testing** | | |
| **Tread Wear** | **Tire Profile** | **Sidewall Profile** |
| CTWIST - Circumferential Tread Wear Imaging System | Bead-to-Bead Tire Profile Measurement System | CrossCheck Laser Line Sensor |




## CrossCheck Special Applications

Easy to use CrossCheck "shape tools" measure radius/diameter, height, width, angle, and location. Master Profile Comparison provides Pass/Fail testing for contours, and makes small variations easily visible. All for less than the price of a single point laser sensor. CrossCheck is ideal for OEMs who need a fully designed, calibrated, and environmentally sealed 3D laser machine vision solution.

- CrossCheck's affordability and simplicity bring profile measurement to the entire organization
- R&D: Reverse Engineering
- Engineering: Design Validation
- Production: Monitor and control
- Quality: Process Studies
- Maintenance: Set Up and Adjustment

| Real Time Shape Measurements for | |
|---|---|
| **Process Control** | **Robotic Guidance** |
| Pultrusion | Weld Steam |
| Extrusion | Glue Bead |
| Calendering | Pick and Place |
| Roll Forming | Chassis Location |
| **Part Inspection** | **Shape Check** |
| Forging | Crimp Validation |
| Casting | Flush and Gap |
| Machining | Embossing Depth |
| Injection Molding | Blade and Vane Rework |

# On-Line Profilometer

Tread profile geometry has a strong influence on the cured tire uniformity. Treads that are non-symmetrical produce cured tires with uniformity and balance problems. Over-sized treads are a waste of materials. In order to assure the most precise tread and sidewall extrusion quality, tire makers worldwide have adopted the On-Line Profilometer (OLP) as their standard for extrusion monitoring. The On-Line Profilometer (OLP) provides automatic, high speed, non-contact measurement of tread and sidewall extrusions. OLP outperforms scanning systems by collecting an instantaneous cross-section profile rather than measuring in a zigzag pattern.

OLP can be installed after the die exit to monitor and alarm when key dimensions exceed the allowable tolerances. Dimension changes at the die often indicate changes in rubber visco-elastic properties or changes in the equipment set-up. When dimensions change, the operator is alerted to intervene. Early intervention can lead to faster startup, reduced rework, better production rates, and better tread uniformity.

OLP can also be installed after cooling to make 100% quality inspection of all treads before they are released to the tire building operation. This enables the QC organization to compare the current run to the historical standards, to pass or fail each run, and to maintain an audit trail for each lot.

## Uses

- Use OLP at the die during the startup of any run to assist in reducing the time required to reach stability
- Use OLP at the die to continuously monitor the dimensional quality of any profile, and alarm the operator when any problem occurs
- Use OLP at the die to immediately recognize changes in die swell associated with batch change so that the operator can adjust the extruder settings
- Use OLP after cooling to produce data histories to compare any run with its historical performance and verify the effect of quality improvement initiatives
- Use OLP after cooling to check for die wear
- Use OLP data alongside other process data such as material theology, extruder die head pressure, screw RPM, screw power, and various temperatures to develop better knowledge of the complex interactions between materials, process set-points, and profile geometry




High-Resolution System OLP-HR with Operator's Terminal and Extend/Retract Slide



## Specifications

| | Measurement Range Inches | | | | Millimeters | | | |
|---|---|---|---|---|---|---|---|---|
| | Thickness | Width | | | Thickness | Width | | |
| | 2.36" | 11.81" | 17.72" | 23.62" | 60 | 300mm | 450mm | 600mm |
| Absolute Accuracy[1] | .003" | .012" | | | ±0.075mm | 0.30mm | | |
| Relative Accuracy[2] | .001" | .004" | | | 0.0225mm | 0.09mm | | |
| Gage Repeatability[3] | .001" (0.025mm) | | | | | | | |
| Resolution[4] | .00004" (0.001mm) | | | | | | | |
| Measurement Rate | Selectable up to 7.5 profiles/second | | | | | | | |
| Outputs | Analog and Digital I/O; Ethernet (Modbus TCP, Text over TCP); tab-delimited .txt measure log | | | | | | | |
| Laser Classification | IIIa CDRH, 3R IEC | | | | | | | |

1. Absolute Accuracy: The average error of all dimensions of a certified gage block using the mean of 75 consecutive measurements. Error is defined as the difference between the OLP measured value and the certified target value.
2. Relative Accuracy: The maximum amount of error present when comparing successive measurements of a target with changing dimensions and located at a fixed position within the field of view (This also can be considered as "accuracy in measuring product variation.").
3. Gage Repeatability: An offline assessment calculating the standard deviation of the thickness of a certified gage block over 75 measurements.
4. Resolution: The smallest meaningful unit of measurement that is reported by the system.

# Off-Line Profilometer

Tread and sidewall extrusions can be no more precise than the dies used to make them. When a new die is cut it should be well-centered, so the Operator has the flexibility to optimize the extruder set-up. After some time in service, die wear can be uneven so that certain areas along the profile get excessive rubber flow. This is a very costly waste of raw materials. Unbalanced flow can also disrupt the symmetry of the tread - a factor that influences cured tire uniformity and balance.

The Profilometer was developed as an automated, non-contact measurement system to displace checking with hand tools. The Profilometer is used to verify the accuracy of newly-cut dies. Its accuracy and speed helps reduce the number of die trials needed to approve a new die for production. Once in production, the Profilometer is used to check each run for overall quality, and to monitor for die wear.

| Specifications | | |
|---|---|---|
| **Measurement Parameter** | **Car Tire Model** | **Truck Tire Model** |
| Thickness Measurement Range | 30mm | 60mm |
| Width Measurement Range | 600mm | 900mm |
| Gage Repeatability on Flat Surfaces | <0.0125mm | <0.025mm |
| Gage Accuracy on Flat Surface | <0.060mm | <0.060mm |
| Area Calculation Repeatability | <.25% | <.25% |
| Area Calculation Accuracy | <.25% | <.25% |
| Sample Interval (Width Resolution) | 0.1mm | 0.1mm |
| Measurement Spot Size | 0.3mm | 0.3mm |
| Dimensions (W x D x H) | 1225 x 775 x 1400mm | 1524 x 775 x 1400mm |

## Features and Specifications

- Visual display overlays the measurement onto the specified design
- Point and gage analysis measures the thickness and width of each breakpoint
- Conicity analysis compares the right and left extrusion halves
- Regional analysis reports the area and center of gravity for each region
- Statistical analysis allows export of data for analysis in spreadsheet applications
- Experienced users report that fewer die trials are needed, conserving time and raw materials
- Dies can be designed to increasingly tighter tolerances for materials that are more difficult to extrude uniformly



# Off-Line Profilometer SL

The Profilometer SL (PSL) combines the CrossCheck Line Laser Sensor technology with our proven Profilometer software platform to produce a low cost, reliable, and accurate tread and sidewall extrusion measurement system. PSL is an all-in-one package, with C-Frame, PC, and electronics combined into a mobile cart. PSL is non-contacting and has no moving parts, so reliability is uncommonly high. The measurement is instantaneous, so there is no waiting for results. With this new instant-scan capability and portability, geometry checks on tire components can be performed quickly at any location in the factory.

| Specifications | |
|---|---|
| **Measurement Parameter** | |
| Thickness Measurement Range | 60mm |
| Width Measurement Range | 300mm (4 sensors<br>450mm (6 sensors) |
| Gage Repeatability of Flat Surfaces | <0.025mm |
| Gage Accuracy on Flat Surfaces | 0.075mm |
| Area Calculation Repeatability | <0.25% |
| Area Calculation Accuracy | <0.25% |
| Sample Interval (Width Resolution) | 0.1mm |
| Scan Speed | Instantaneous |
| Dimensions (W x L x H) | 77cm x 110cm x 104cm (excluding LCD monitor) |
| Laser Classification | IIIa CDRH, 3R IEC |

## Features and Specifications

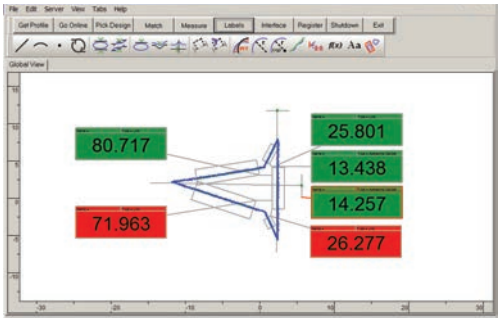
- No moving parts
- Instantaneous cycle time
- Portable
- Visual display overlays the measurement onto the specified design
- Point and gauge analysis measures the thickness and width of each breakpoint
- Conicity analysis compares the right and left extrusion halves
- Regional analysis reports the area and center of gravity for each region
- Statistical analysis allows export of data for analysis in spreadsheet applications
- Experienced users report that fewer die trials are needed, conserving time and raw materials
- Dies can be designed to increasingly tighter tolerances for materials that are more difficult to extrude uniformly



# Profile360 for Apex Extrusion

Profile360 is an in-line, real-time measurement system for continuously monitoring key profile dimensions in complex profile extrusions. Profile360 employs CrossCheck Line Laser Sensors manufactured by Starrett-Bytewise. These multi-sensor systems acquire thousands of data points around the profile and match them to a CAD template, where key measurement parameters such as width, thickness, radius, and angle are extracted. Measurement parameters are compared to allowable control limits and displayed on the operator's terminal with a green/yellow/red (pass/caution/fail) status indicator. Profile360 runs at rates up to 14 profiles per second.

| Specifications | |
|---|---|
| Measurement Rate | Selectable up to 14 profiles/second |
| Communication Interface | Analog and Digital Outputs; Ethernet |
| Run Modes | Clock Frequency or Encoder |
| Data Output | Modbus TCP or OPC Server native; conversion to other platforms available |
| Operating Temperature | 32 to 113 °F (0 to 45 °C); cooling systems available |
| Profile360 conforms to the Machinery Safety, Electromagnetic Compatibility, and Low Voltage directives of the EC | |
| Laser safety class by the CDRH standard is Class 3A, and the IEC 60825-1 classification is Class 3R | |






# Ply Splice Monitor

The In-Line Splice Width Monitor enables continuous, real-time product and process quality feedback for both automatic and manual fabric ply splicing operations. This effectively minimizes finished tire sidewall bulges and depressions caused by out-of-tolerance splice widths created during material preparation.

| Specifications | |
|---|---|
| Encoder Resolution | 0.10mm (0.004") |
| Splice Width Accuracy | ±0.15mm (0.006") |
| Splice Width Repeatability (1 Sigma) | 0.15mm (0.006") |

The above measurement specifications are based on material line speed of 1 meter/second (3 feet/second). A faster laser (32kHz sampling frequency) may be required if line speeds are much greater than 1m/second.

## Features

- High-speed, non-contact laser sensors.
- In-line configuration
- Splice width trend and variation analysis software.
- Multi-channel systems measure at several locations across the product width
- Enables repeatable detection of leading and trailing splice edges resulting in a more accurate splice width measurement
- Enables splice width to be measured without affecting cycle time
- Provides immediate product and process feedback
- Provides real-time data output to a PLC for automatic process control in automatic splicing operations
- Provides instant feedback to the operator of a manual splicing operation, thereby enabling immediate corrective actions to be made
- Enables width tolerances to be confidently reduced, eliminating heavy splices and saving material
- Improves splice width consistency across the entire product, minimizing open splices and improving tire radial uniformity



# Green Tire Uniformity System

Tire building is the most complex operation in the tire factory. Multiple components are centered, applied, spliced, turned-up, inflated, and stitched. Component stock variations combine with machine variations to produce green tires with variations in radial runout, tread snaking, lateral runout, and splice quality. Green tires with the largest variations invariably produce tires with the worst cured tire uniformity and balance performance.

The Green Tire Uniformity System (GTU) utilizes the CrossCheckHD Line Laser Sensor to scan green tires at any stage of production. The GTU Software has a suite of viewing and analysis tools for assessing all aspects of the green tire uniformity. The system is available in either configuration - portable or fixed.

The portable tripod-mounted version can be moved from drum-to-drum, and from machine-to-machine. This provides a way to thoroughly study the carcass, belt/tread package, and final shaped green tire for radial and lateral runout, tread snaking, and splice quality. This can be used by the Set-Up Technician to verify the TBM set-up, and can be used by the Uniformity Engineer to troubleshoot tires with uniformity problems.

The fix-mounted version provides a means to perform 100% inspection at any drum for any parameter. This is useful for understanding the population characteristics of green tire runouts and to alarm when limits are exceeded.

## Features

- Start scan from keyboard or relay contact
- Scan with encoder count
- Scan number of profiles
- Scan from encoder start/stop
- View runout color map
- View 3D image
- View circumferential or lateral waveform
- View harmonics
- Filter, rotate and crop data
- Radial and lateral runout caliper
- Tread splice caliper
- Width caliper
- Set pass/fail limits
- Subtract layers
- Export caliper waveform as .csv
- Export point cloud as .csv
- Portable system includes sensor, notebook PC, and carry case
- Fix-Mounted System includes sensor, PC, and PLC interface module



| | |
|---|---|
| **Radial Runout** | 0.23mm |
| **Lateral Runout** | 0.42mm |
| **Splice Bump** | 0.33mm |

| Specifications | |
|---|---|
| **Input Voltage** | 110-240 VAC |
| **Power Usage** | 50 W |
| **Operating Temperature** | 32 - 104 °F (0 - 40 °C) |
| **Sensor Sample Rate** | 700 Hz |
| **Laser Classification** | 660 nm Wavelength; IIIa (CDRH); 3R (IEC) |
| **Interfaces** | Telnet<br>PLC Input for Triggering<br>Incremental Encoder Input |

# Tread Wear Measurement System (CTWIST)

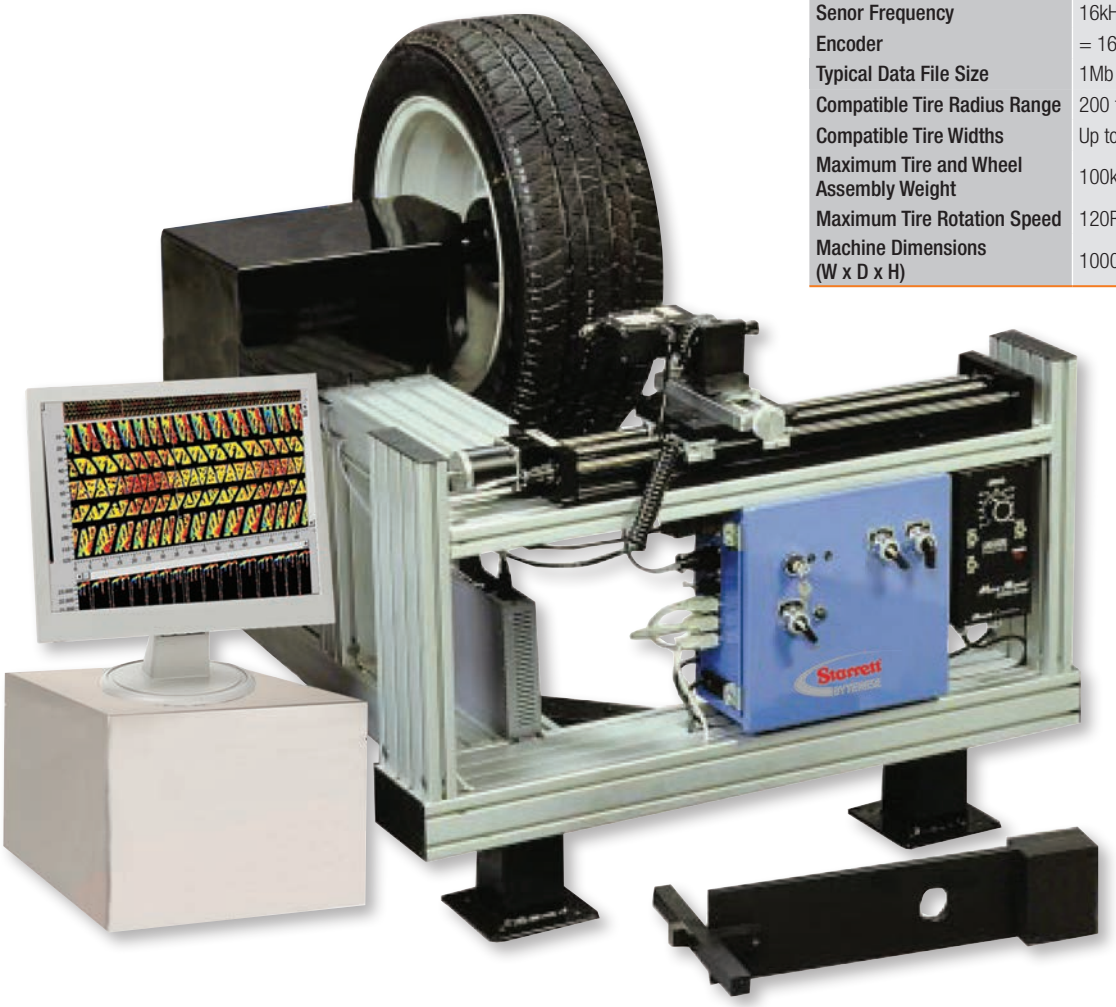
Tire designers are challenged to develop new tread patterns and compounds that deliver longer tread life and more uniform tread wear. Starrett-Bytewise partnered with Ford Motor Company and several leading OEM tire makers to develop CTWIST as a way to measure and characterize tread wear so the designers could better understand wear behavior. With the CTWIST process, new tires are scanned after break-in, then periodically scanned during the wear cycles. CTWIST predicts the tread life for each rib, and produces several tread wear reports to help the designer understand where improvements are needed.

CTWIST utilizes a non-contacting high-speed laser sensor to collect about 1,000,000 measuring points in less than 5 minutes.

## Features

- Tread Depth Profile Report shows the tread depth profile for each wear cycle
- Heel/Toe Wear Report shows the heel-toe wear profile across the tread
- Irregular Wear Report shows a 3D color map of the tread loss
- Tread Loss Report shows the tread loss profile across the tread
- Tread Life Mileage Projection shows the predicted tread life of each rib

| System Specifications | |
|---|---|
| **Typical Measurement Time** | 5 minutes |
| **Measurement Technology** | Scanned Laser Triangulation |
| **Measurement Range** | 32mm |
| **Laser Standoff** | 180mm |
| **Measurement Spot Diameter** | 0.1mm |
| **Laser Classification** | Class IIIb Gallium Arsenide |
| **Laser Resolution** | < 0.008mm |
| **Data Signal** | Digital with Invalid Data Signal |
| **Data Points per Scan Line** | 4096 |
| **Senor Frequency** | 16kHz |
| **Encoder** | = 16,000 PPR |
| **Typical Data File Size** | 1Mb |
| **Compatible Tire Radius Range** | 200 to 625mm |
| **Compatible Tire Widths** | Up to 400mm |
| **Maximum Tire and Wheel Assembly Weight** | 100kg |
| **Maximum Tire Rotation Speed** | 120RPM |
| **Machine Dimensions (W x D x H)** | 1000mm x 1150mm x 900mm |



# Bead-to-Bead Profile Measurement System

Tire and mold designers are tasked with creating new tire designs that meet strict dimensional requirements when the tire is inflated. The inflated growth is predicted using powerful CAD modeling software. The inflated tire is traditionally measured with hand tools to check compliance to the design target. Checking with hand tools is time consuming, imprecise, and operator dependant.

The Starrett-Bytewise Bead-to-Bead Measurement System (B2B) is a non-contact scanning system that provides instantaneous acquisition for tire profiles from one bead to the other, across both sidewalls and the tread. Data is rendered in a visual display. Drag and drop caliper tools enable easy measurement. The CAD model can be imported into the Bead-to-Bead software so that the actual profile can be overlaid to the design. Data can be exported back to the CAD system for further analysis.

Bead-to-Bead can scan tires rotating at high speed to measure centrifugal growth and deformation.

## Features

- Acquires 4,000 or more data points per profile
- Acquires complete profiles in less than one second
- Profiles are rendered in a visual display and matched to a CAD template
- Profiles are analyzed with easy-to-use tools for section width, crown radius, and other parameters
- Data points are output in .dxf and .txt formats

| Specifications | |
|---|---|
| **Tire Size Capability** | Various configurations to accommodate tire sizes ranging from passenger to truck and bus |
| **Sensor Accuracy** | 0.15mm (based on standard sensors) |
| **Measurement Accuracy*** | 0.15mm or 0.3mm |
| **Triggering** | Keyboard |
| **Point Data Output Formats** | DXF, TXT |
| **Communication Interface** | Digital and Analog I/O, Ethernet (Modbus TCP) |
| **Laser Classification** | IIIa |

* Measurement accuracy will depend on whether the data required to complete the desired measurement comes from one or two sensors.





# FLAT STOCK AND DRILL ROD

# Precision Flat Stock and Drill Rod



Cut costs and save time - make your own parts like these from Flat Stock

## Precision Ground Flat Stock and Drill Rod

### STANDARD AND OVERSIZE

Starrett Precision Ground Flat Stock and Drill Rod can save time in your shop … no more time hunting lost stock … no more slow, costly grinding to size. Just lay it out and saw it out and save valuable machinery, downtime and man hours.

- Machine parts
- Fixtures
- Parallels
- Dies
- Test gages
- Shims
- Stamps
- Templates
- Jigs
- Test tools
- Flat gages
- Punches
- Cutters
- Buttons

**Six types of material** in a complete range of sizes is available to meet your specific needs:

**495 and 496** are (AISI 01) oil hardening tool steels. These steels are dimensionally stable and can be used for all intricate work, including work with thin sections, with a minimum danger of cracking.

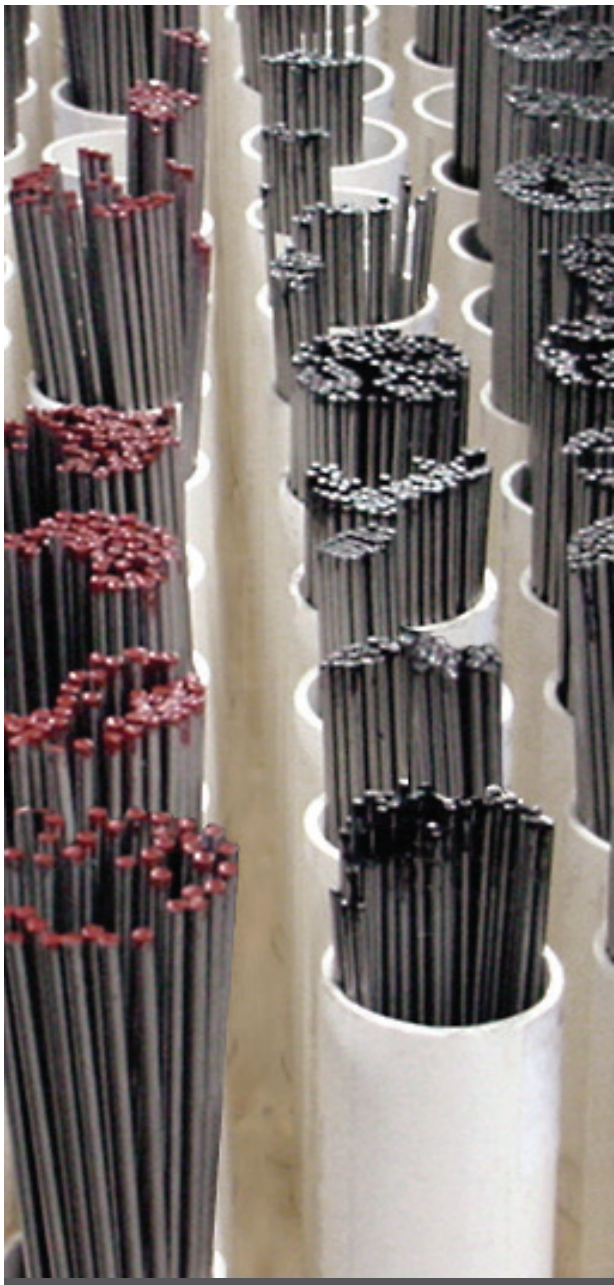
**497 and 499** are (AISI A2) 5% chromium air-hardening steel. These steels have high wear and abrasion resistance.

**498** Low carbon steel is used where deep hardening is not necessary, although it can be carburized or case hardened.

**344** is (AISI A6) a medium alloyed air hardening tool steel that provides an excellent balance of machinability, toughness and wear resistance.

**W1 Carbon** (Available only in Drill Rod) is (AISI/SAE W1) a versatile and less expensive carbon steel with excellent machinability, good wear resistance and toughness.

**401 and 402** are (AISI D2) high chromium steel. These steels are for the highest wear resistance applications.



### Packaging

Starrett Precision Ground Flat Stock is individually wrapped in brown paper and clearly marked with size dimensions, analysis and correct hardening and tempering information. Drill rods are bundled together and tagged with a description that includes the size and EDP number. Color coding by grade on the ends of each piece allows for easy identification.



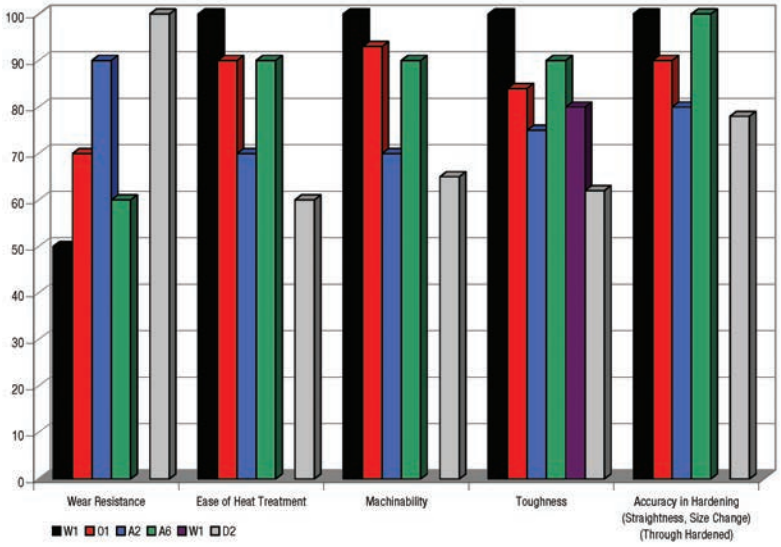


Cut costs and save time - make your own parts like these from Drill Rod

| Flat Stock Tolerances | |
|---|---|
| **Standard:** | Thickness ±.001"<br>Widths<br>Up through 8", +.000/.005"<br>9" and Over, +.000/.015"<br>Squares, ±.001" |
| **Oversize:** | Thickness, +.010/.015"<br>Width, +.010/.015"<br>Squares, +.010/.015" |
| **Length:**<br>Saw Cut Oversize to Allow for Finish Cutting | 18", +1/4"<br>24", +1/2"<br>36", +5/8" |
| **Squareness Edge All:** | .003" Per Inch |
| **Finish:** | 35 Microinch or Finer |

| Drill Rod Tolerances | | |
|---|---|---|
| **Size Range** | **Diameter Tolerance** | **Length Tolerance** |
| .124" round and less | ±.0003" | |
| .125" to .499" | ±.0005" | +1/8" - 0 |
| .500" to 2" | ±.0010" | |

## Comparative Feature Properties



# Precision Ground Flat Stock

## 496 Oil Hardening Precision Ground Flat Stock

### STANDARD

## 495 Oil Hardening Precision Ground Flat Stock

### OVERSIZE

- Stock is dimensionally stable – use it for the most intricate work
- Deep hardening characteristics and fine grain structure
- Machines freely – fully spheroidized, annealed
- Full length identification – eliminates confusion with other steels
- Starrett uses its own ground flat stock and die stock for many of its fine precision tool parts




Furnished in 18" and 36" lengths, ground straight and parallel.

### Specifications

#### Nominal Analysis (AISI O1)

| | |
|---|---|
| Carbon | .90 |
| Chromium | .50 |
| Manganese | 1.20 |
| Tungsten | .50 |
| Vanadium | .20 |

| Size | Temperature | Quench | Rockwell C |
|---|---|---|---|
| All Sizes | 1450º-1500º F | Oil | 63-65 |

### Hardening

It is recommended that stock be heated uniformly to 1450º-1500º F and quenched in oil. Temperature of the quenching oil should be 120º-140º F for best results. Do not quench in water because this is an oil hardening steel.

### Tempering

For maximum toughness, a tempering time of one hour at temperature is recommended. Use chart for selecting desired Rockwell C hardness and corresponding tempering temperature. The following may also be used as a guide depending on type of work.

#### Cutting Tools

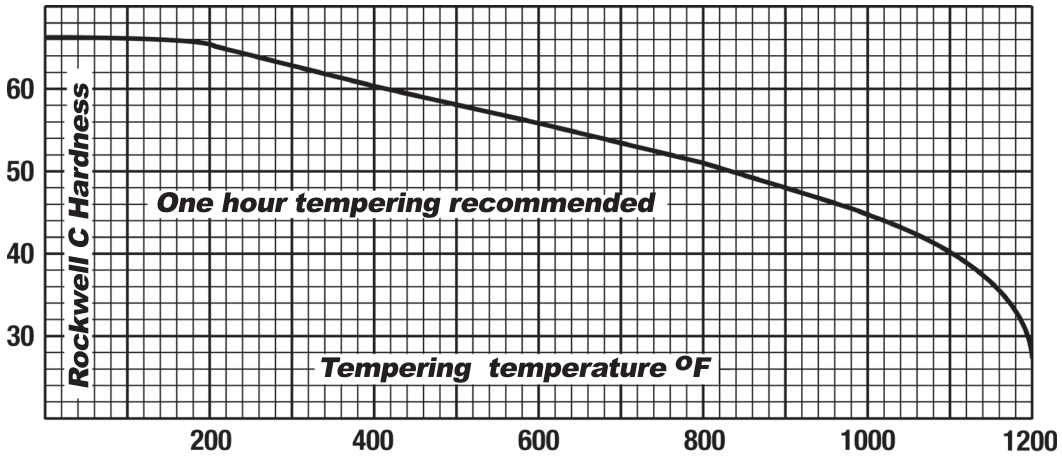
- 300º-350º F (Light Straw)

#### Solid Punches and Dies

- 400º-450º F (Straw)

#### Spring Temper

- 750º-800º F (Blue)




**NOTE:** Lengths, widths and thicknesses other than listed can also be quoted by request



# Precision Ground Flat Stock

## 496 Oil Hardening Precision Ground Flat Stock

### STANDARD TOLERANCE

| 496 Oil Hardening Precision Ground Flat Stock | | | |
|---|---|---|---|
| Thickness | Width | 18" Length | 36" Length |
| 1/64" | 1/2" | 53924 | 59139 |
| | 3/4" | 53925 | |
| | 1" | 53926 | |
| | 1-1/4" | 53927 | |
| | 1-1/2" | 53928 | |
| | 2" | 53929 | 59140 |
| | 2-1/2" | 53930 | |
| | 3" | 53931 | |
| | 4" | 53932 | 59141 |
| 1/32" | 1/2" | 53933 | 58895 |
| | 3/4" | 53934 | 59143 |
| | 1" | 53935 | 59144 |
| | 1-1/4" | 53936 | |
| | 1-1/2" | 53937 | 59145 |
| | 2" | 53938 | 58901 |
| | 2-1/2" | 53939 | |
| | 3" | 53940 | 59147 |
| | 4" | 53941 | 59148 |
| | 6" | 53942 | |
| 3/64" | 1/2" | 53943 | 59149 |
| | 3/4" | 53944 | 59150 |
| | 1" | 53945 | 58902 |
| | 1-1/4" | 53946 | 59171 |
| | 1-1/2" | 53947 | 57685 |
| | 2" | 53948 | 59152 |
| | 2-1/2" | 53949 | |
| | 3" | 53950 | |
| | 3-1/2" | 53951 | |
| | 4" | 53952 | 59153 |
| | 6" | 53953 | |
| 1/16" | 1/4" | 57226 | 58891 |
| | 3/8" | 57227 | |
| | 1/2" | 53954 | 54257 |
| | 3/4" | 53955 | 54258 |
| | 1" | 53956 | 54259 |
| | 1-1/4" | 53957 | 54260 |
| | 1-1/2" | 53958 | 54261 |
| | 1-3/4" | 53959 | 54262 |
| | 2" | 53960 | 54263 |
| | 2-1/2" | 53961 | 54264 |
| | 3" | 53962 | 54265 |
| | 3-1/2" | 53963 | 54266 |
| | 4" | 53964 | 54267 |
| | 5" | 53965 | 54268 |
| | 6" | 53966 | 54269 |
| | 8" | 53967 | 57236 |
| | 10" | 53968 | 57237 |
| 5/64" | 1/2" | 53969 | 54270 |
| | 3/4" | 53970 | 58905 |
| | 1" | 53971 | 58890 |
| | 1-1/2" | 53972 | |
| | 2" | 53973 | |
| | 2-1/2" | 53974 | |
| | 3" | 53975 | |
| | 4" | 53976 | |
| | 6" | 53977 | |

| 496 Oil Hardening Precision Ground Flat Stock | | | |
|---|---|---|---|
| Thickness | Width | 18" Length | 36" Length |
| 3/32" | 1/4" | | 58899 |
| | 3/8 | 58903 | |
| | 1/2" | 53978 | 54279 |
| | 3/4" | 53979 | 54280 |
| | 1" | 53980 | 54281 |
| | 1-1/4" | 53981 | 54282 |
| | 1-1/2" | 53982 | 54283 |
| | 2" | 53983 | 54284 |
| | 2-1/2" | 53984 | 54285 |
| | 3" | 53985 | 54286 |
| | 4" | 53986 | 54287 |
| | 5" | 53987 | 54288 |
| | 6" | 53988 | 54289 |
| | 8" | 53989 | 57682 |
| 7/64" | 1/2" | 53990 | |
| | 3/4" | 53991 | |
| | 1" | 53992 | |
| | 1-1/4" | 53993 | |
| | 1-1/2" | 53994 | |
| | 2" | 53995 | |
| | 3" | 53996 | |
| | 4" | 53997 | |
| 1/8" | 1/8" | 53998 | 59154 |
| | 1/4" | 57228 | 58894 |
| | 5/16" | 59127 | 58897 |
| | 3/8" | 57229 | 58892 |
| | 1/2" | 53999 | 54298 |
| | 5/8" | 54000 | 54299 |
| | 3/4" | 54001 | 54300 |
| | 1" | 54002 | 54301 |
| | 1-1/4" | 54003 | 54302 |
| | 1-1/2" | 54004 | 54303 |
| | 1-3/4" | 54005 | 54304 |
| | 2" | 54006 | 54305 |
| | 2-1/2" | 54007 | 54306 |
| | 3" | 54008 | 54307 |
| | 3-1/2" | 54009 | 54308 |
| | 4" | 54010 | 54309 |
| | 4-1/2" | 54011 | 54310 |
| | 5" | 54012 | 54311 |
| | 6" | 54013 | 54312 |
| | 7" | 54014 | 54313 |
| | 8" | 54015 | 54314 |
| | 10" | 54016 | 54315 |
| | 12" | 54017 | 54316 |
| | 14" | 54018 | 57238 |
| 9/64" | 9/64" | 54019 | |
| | 1/2" | 54020 | |
| | 3/4" | 54021 | |
| | 1" | 54022 | |
| | 1-1/2" | 54023 | |
| | 2" | 54024 | |
| | 3" | 54025 | |
| | 4" | 54026 | |
| 5/32" | 5/32" | 54027 | |
| | 1/2" | 54028 | 54324 |
| | 3/4" | 54029 | 54325 |
| | 1" | 54030 | 54326 |
| | 1-1/4" | 54031 | 54327 |
| | 1-1/2" | 54032 | 54328 |

| 496 Oil Hardening Precision Ground Flat Stock | | | |
|---|---|---|---|
| Thickness | Width | 18" Length | 36" Length |
| 5/32" | 1-3/4" | 54033 | 54329 |
| | 2" | 54034 | 54330 |
| | 2-1/2" | 54035 | 54331 |
| | 3" | 54036 | 54332 |
| | 3-1/2" | 54037 | 54333 |
| | 4" | 54038 | 54334 |
| | 5" | 54039 | 54335 |
| | 6" | 54040 | 54336 |
| | 8" | 54041 | 54337 |
| 3/16" | 3/16" | 54042 | 59157 |
| | 1/4" | 57230 | |
| | 3/8" | 57231 | |
| | 1/2" | 54043 | 54338 |
| | 3/4" | 54044 | 54339 |
| | 1" | 54045 | 54340 |
| | 1-1/4" | 54046 | 54341 |
| | 1-1/2" | 54047 | 54342 |
| | 1-3/4" | 54048 | 54343 |
| | 2" | 54049 | 54344 |
| | 2-1/2" | 54050 | 54345 |
| | 3" | 54051 | 54346 |
| | 3-1/2" | 54052 | 54347 |
| | 4" | 54053 | 54348 |
| | 5" | 54054 | 54349 |
| | 6" | 54055 | 54350 |
| | 8" | 54056 | 54351 |
| | 10" | 54057 | 54352 |
| 7/32" | 7/32" | 54058 | |
| | 1/2" | 54059 | 54353 |
| | 3/4" | 54060 | 54354 |
| | 1" | 54061 | 54355 |
| | 1-1/4" | 54062 | 54356 |
| | 1-1/2" | 54063 | 54357 |
| | 2" | 54064 | 54358 |
| | 3" | 54065 | 54359 |
| | 4" | 54066 | 54360 |
| | 6" | 54067 | |
| 1/4" | 1/4" | 54068 | 56517 |
| | 3/8" | 54069 | 58900 |
| | 1/2" | 54070 | 54362 |
| | 5/8" | 58904 | 58893 |
| | 3/4" | 54071 | 54363 |
| | 1" | 54072 | 54364 |
| | 1-1/4" | 54073 | 54365 |
| | 1-1/2" | 54074 | 54366 |
| | 1-3/4" | 54075 | 54367 |
| | 2" | 54076 | 54368 |
| | 2-1/2" | 54077 | 54369 |
| | 3" | 54078 | 54370 |
| | 3-1/2" | 54079 | 54371 |
| | 4" | 54080 | 54372 |
| | 4-1/2" | 54081 | 54373 |
| | 5" | 54082 | 54374 |
| | 5-1/2" | 54083 | 54375 |
| | 6" | 54084 | 54376 |
| | 7" | 54085 | 54377 |
| | 8" | 54086 | 54378 |
| | 10" | 54087 | 54379 |
| | 12" | 54088 | 54380 |
| | 14" | 54089 | 57239 |

Sizes other than listed priced on application



# Precision Ground Flat Stock

## 496 Oil Hardening Precision Ground Flat Stock

### STANDARD TOLERANCE

| 496 Oil Hardening Precision Ground Flat Stock | | | |
|---|---|---|---|
| Thickness | Width | 18" Length | 36" Length |
| 9/32" | 9/32" | 54090 | |
| | 1/2" | 54091 | |
| | 3/4" | 54092 | |
| | 1" | 54093 | |
| | 1-1/4" | 54094 | |
| | 1-1/2" | 54095 | |
| | 2" | 54096 | |
| | 2-1/2" | 54097 | |
| | 3" | 54098 | |
| | 4" | 54099 | |
| | 6" | 54100 | 54390 |
| 5/16" | 5/16" | 54101 | 54391 |
| | 3/8" | 57232 | |
| | 1/2" | 54102 | 54392 |
| | 5/8" | | 58896 |
| | 3/4" | 54103 | 54393 |
| | 1" | 54104 | 54394 |
| | 1-1/4" | 54105 | 54395 |
| | 1-1/2" | 54106 | 54396 |
| | 1-3/4" | 57233 | 57240 |
| | 2" | 54107 | 54397 |
| | 2-1/2" | 54108 | 54398 |
| | 3" | 54109 | 54399 |
| | 3-1/2" | 54110 | 54400 |
| | 4" | 54111 | 54401 |
| | 4-1/2" | 54112 | 54402 |
| | 5" | 54113 | 54403 |
| | 6" | 54114 | 54404 |
| | 8" | 54115 | 54405 |
| 3/8" | 3/8" | 54116 | 54406 |
| | 1/2" | 54117 | 54407 |
| | 5/8" | | 58898 |
| | 3/4" | 54118 | 54408 |
| | 1" | 54119 | 54409 |
| | 1-1/4" | 54120 | 54410 |
| | 1-1/2" | 54121 | 54411 |
| | 1-3/4" | 54122 | 54412 |
| | 2" | 54123 | 54413 |
| | 2-1/2" | 54124 | 54414 |
| | 3" | 54125 | 54415 |
| | 3-1/2" | 54126 | 54416 |
| | 4" | 54127 | 54417 |
| | 4-1/2" | 54128 | 54418 |
| | 5" | 54129 | 54419 |
| | 5-1/2" | 54130 | 54420 |
| | 6" | 54131 | 54421 |
| | 7" | 54132 | 54422 |
| | 8" | 54133 | 54423 |
| | 10" | 54134 | 54424 |
| | 12" | 54135 | 54425 |
| 7/16" | 7/16" | 54136 | 54426 |
| | 1/2" | 54137 | 54427 |
| | 3/4" | 54138 | 54428 |
| | 1" | 54139 | 54429 |
| | 1-1/4" | 54140 | 54430 |
| | 1-1/2" | 54141 | 54431 |
| | 2" | 54142 | 54432 |
| | 2-1/2" | 54143 | 54433 |
| | 3" | 54144 | 54434 |
| | 4" | 54145 | 54435 |
| | 6" | 54146 | 54436 |

| 496 Oil Hardening Precision Ground Flat Stock | | | |
|---|---|---|---|
| Thickness | Width | 18" Length | 36" Length |
| 1/2" | 1/2" | 54147 | 54437 |
| | 5/8" | 54148 | 54438 |
| | 3/4" | 54149 | 54439 |
| | 1" | 54150 | 54440 |
| | 1-1/4" | 54151 | 54441 |
| | 1-1/2" | 54152 | 54442 |
| | 1-3/4" | 57234 | 57241 |
| | 2" | 54153 | 54443 |
| | 2-1/2" | 54154 | 54444 |
| | 3" | 54155 | 54445 |
| | 3-1/2" | 54156 | 54446 |
| | 4" | 54157 | 54447 |
| | 4-1/2" | 54158 | 54448 |
| | 5" | 54159 | 54449 |
| | 6" | 54160 | 54450 |
| | 7" | 54161 | 54451 |
| | 8" | 54162 | 54452 |
| | 10" | 54163 | 54453 |
| | 12" | 54164 | 59159 |
| | 14" | 54165 | |
| 9/16" | 9/16" | 54166 | 54455 |
| | 3/4" | 54167 | 54456 |
| | 1" | 54168 | 54457 |
| | 1-1/4" | 54169 | 54458 |
| | 1-1/2" | 54170 | 54459 |
| | 2" | 54171 | 54460 |
| 5/8" | 5/8" | 54172 | 54461 |
| | 3/4" | 54173 | 54462 |
| | 1" | 54174 | 54463 |
| | 1-1/4" | 54175 | 54464 |
| | 1-1/2" | 54176 | 54465 |
| | 2" | 54177 | 54466 |
| | 2-1/2" | 54178 | 54467 |
| | 3" | 54179 | 54468 |
| | 3-1/2" | 54180 | 54469 |
| | 4" | 54181 | 54470 |
| | 5" | 54182 | 54471 |
| | 6" | 54183 | 54472 |
| | 8" | 54185 | 54474 |
| | 10" | 54186 | 54475 |
| | 12" | 57235 | 57242 |
| 3/4" | 3/4" | 54187 | 54476 |
| | 1" | 54188 | 54477 |
| | 1-1/4" | 54189 | 54478 |
| | 1-1/2" | 54190 | 54479 |
| | 2" | 54191 | 54480 |
| | 2-1/2" | 54192 | 54481 |
| | 3" | 54193 | 54482 |
| | 3-1/2" | 54194 | 54483 |
| | 4" | 54195 | 54484 |
| | 4-1/2" | 54196 | 54485 |
| | 5" | 54197 | 54486 |
| | 6" | 54198 | 54487 |
| | 8" | 54199 | 54488 |
| | 10" | 54200 | 54489 |
| | 12" | 54201 | 54490 |

| 496 Oil Hardening Precision Ground Flat Stock | | | |
|---|---|---|---|
| Thickness | Width | 18" Length | 36" Length |
| 7/8" | 7/8" | 54202 | 54491 |
| | 1" | 54203 | 54492 |
| | 1-1/4" | 54204 | 54493 |
| | 1-1/2" | 54205 | 54494 |
| | 2" | 54206 | 54495 |
| | 2-1/2" | 54207 | 54496 |
| | 3" | 54208 | 54497 |
| | 4" | 54209 | 54498 |
| | 6" | 54210 | 54499 |
| 1" | 1" | 54211 | 54500 |
| | 1-1/4" | 54212 | 54501 |
| | 1-1/2" | 54213 | 54502 |
| | 2" | 54214 | 54503 |
| | 2-1/2" | 54215 | 54504 |
| | 3" | 54216 | 54505 |
| | 3-1/2" | 54217 | 54506 |
| | 4" | 54218 | 54507 |
| | 4-1/2" | 54219 | 54508 |
| | 5" | 54220 | 54509 |
| | 6" | 54221 | 54510 |
| | 8" | 54222 | 54511 |
| | 10" | 54223 | 54512 |
| | 12" | 54224 | 54513 |
| 1-1/8" | 1-1/2" | 54225 | 54514 |
| | 2" | 54226 | 54515 |
| | 3" | 54227 | 54516 |
| | 4" | 54228 | 54517 |
| | 6" | 54229 | 54518 |
| 1-1/4" | 1-1/4" | 54230 | 54519 |
| | 1-1/2" | 54231 | 54520 |
| | 2" | 54232 | 54521 |
| | 2-1/2" | 54233 | 54522 |
| | 3" | 54234 | 54523 |
| | 4" | 54235 | 54524 |
| | 5" | 54236 | 54525 |
| | 6" | 54237 | 54526 |
| | 8" | 54238 | 54527 |
| | 10" | 54239 | 54528 |
| 1-1/2" | 1-1/2" | 54240 | 54529 |
| | 2" | 54241 | 54530 |
| | 2-1/2" | 54242 | 54531 |
| | 3" | 54243 | 54532 |
| | 3-1/2" | 54244 | 54533 |
| | 4" | 54245 | 54534 |
| | 5" | 54246 | 54535 |
| | 6" | 54247 | 54536 |
| | 8" | 54248 | 54537 |
| | 10" | 54249 | 54538 |
| | 12" | 59189 | |
| 2" | 2" | 54250 | 54539 |
| | 3" | 54251 | 54540 |
| | 4" | 54252 | 54541 |
| | 6" | 54253 | 54542 |

Sizes other than listed priced on application



# Precision Ground Flat Stock

## 495 Oil Hardening Precision Ground Flat Stock

### OVERSIZE TOLERANCE

| 495 Oil Hardening Ground Flat Stock | | | |
|---|---|---|---|
| Thickness | Width | 18" Length | 36" Length |
| 3/16" | 3/16" | 56957 | 57677 |
| | 1/2" | 56958 | 56813 |
| | 3/4" | 56959 | 56814 |
| | 1" | 56960 | 56815 |
| | 1-1/4" | 56961 | 56816 |
| | 1-1/2" | 56962 | 56817 |
| | 2" | 56963 | 56818 |
| | 2-1/2" | 56964 | 56819 |
| | 3" | 56965 | 56820 |
| | 4" | 56966 | 56821 |
| | 5" | 56967 | |
| | 6" | 56968 | 56822 |
| | 8" | 56969 | |
| | 10" | 56970 | |
| 1/4" | 1/4" | 56971 | 57678 |
| | 1/2" | 56972 | 56823 |
| | 3/4" | 56973 | 56824 |
| | 1" | 56974 | 56825 |
| | 1-1/4" | 56975 | 56826 |
| | 1-1/2" | 56976 | 56827 |
| | 1-3/4" | 56977 | |
| | 2" | 56978 | 56828 |
| | 2-1/2" | 56979 | 56829 |
| | 3" | 56980 | 56830 |
| | 3-1/2" | 56981 | 56831 |
| | 4" | 56982 | 56832 |
| | 4-1/2" | 56983 | |
| | 5" | 56984 | 56833 |
| | 6" | 56985 | 56834 |
| | 8" | 56986 | |
| 5/16" | 5/16" | 56987 | |
| | 1/2" | 56988 | 56835 |
| | 3/4" | 56989 | 56836 |
| | 1" | 56990 | 56837 |
| | 1-1/4" | 56991 | 56838 |
| | 1-1/2" | 56992 | 56839 |
| | 2" | 56993 | 56840 |
| | 2-1/2" | 56994 | 56841 |
| | 3" | 56995 | 56842 |
| | 4" | 56996 | 56843 |
| | 5" | 56997 | 56844 |
| | 6" | | 56845 |

| 495 Oil Hardening Ground Flat Stock | | | |
|---|---|---|---|
| Thickness | Width | 18" Length | 36" Length |
| 3/8" | 3/8" | 56998 | 57679 |
| | 1/2" | 56999 | 56846 |
| | 3/4" | 57000 | 56847 |
| | 1" | 57001 | 56848 |
| | 1-1/4" | 57002 | 56849 |
| | 1-1/2" | 57003 | 56850 |
| | 2" | 57004 | 56851 |
| | 2-1/2" | 57005 | 56852 |
| | 3" | 57006 | 56853 |
| | 3-1/2" | 57007 | |
| | 4" | 57008 | 56854 |
| | 4-1/2" | 57009 | |
| | 5" | 57010 | 56855 |
| | 6" | 57011 | 56856 |
| | 8" | 57012 | 56857 |
| | 12" | 57013 | |
| 1/2" | 1/2" | 57014 | 56858 |
| | 3/4" | 57015 | 56859 |
| | 1" | 57016 | 56860 |
| | 1-1/4" | 57017 | 56861 |
| | 1-1/2" | 57018 | 56862 |
| | 2" | 57019 | 56863 |
| | 2-1/2" | 57020 | 56864 |
| | 3" | 57021 | 56865 |
| | 3-1/2" | 57022 | |
| | 4" | 57023 | 56866 |
| | 4-1/2" | 57024 | |
| | 5" | 57025 | 56867 |
| | 6" | 57026 | 56868 |
| | 8" | 57027 | 56869 |
| | 10" | 57028 | 56870 |
| | 12" | 57029 | |
| 5/8" | 5/8" | 57030 | 56871 |
| | 3/4" | 57031 | 57680 |
| | 1" | 57032 | 56872 |
| | 1-1/4" | 57033 | 56873 |
| | 1-1/2" | 57034 | 56874 |
| | 2" | 57035 | 56875 |
| | 2-1/2" | 57036 | 56876 |
| | 3" | 57037 | 56877 |
| | 3-1/2" | 57038 | |
| | 4" | 57039 | 56878 |
| | 5" | 57040 | 56879 |
| | 6" | 57041 | 56880 |

| 495 Oil Hardening Ground Flat Stock | | | |
|---|---|---|---|
| Thickness | Width | 18" Length | 36" Length |
| 3/4" | 3/4" | 57042 | 56881 |
| | 1" | 57043 | 56882 |
| | 1-1/4" | 57044 | |
| | 1-1/2" | 57045 | 56883 |
| | 2" | 57046 | 56884 |
| | 2-1/2" | 57047 | 56885 |
| | 3" | 57048 | 56886 |
| | 3-1/2" | 57049 | |
| | 4" | 57050 | 56887 |
| | 5" | 57051 | |
| | 6" | 57052 | 56888 |
| | 8" | 57053 | |
| 1" | 1" | 57054 | 56889 |
| | 1-1/4" | 57055 | 57681 |
| | 1-1/2" | 57056 | 56890 |
| | 2" | 57057 | 56891 |
| | 2-1/2" | 57058 | 56892 |
| | 3" | 57059 | 56893 |
| | 3-1/2" | 57060 | |
| | 4" | 57061 | 56894 |
| | 5" | 57062 | |
| | 6" | 57063 | 56895 |

Sizes other than listed priced on application



# Precision Ground Flat Stock

## 497 Air Hardening Precision Ground Flat Stock

STANDARD

## 499 Air Hardening Precision Ground Flat Stock

OVERSIZE

### Dimensionally stable

- The 5% chromium content makes this steel especially desirable for punches and dies to be used in long production runs since it gives the tools far longer life. Up to 50% more pieces per sharpening can be produced than with oil hardening steel.
- High wear resistance is also ideal for punches and dies to stamp silicon, stainless steels, monel metal and other types of abrasive material
- Maintains close dimensional accuracy throughout the heat treating process. The wide 75º hardening range make this virtually foolproof.
- Full-length identification eliminates confusion with other steels
- Starrett uses its own ground flat stock for many of its precision tool parts

| Size | Temperature | Cool | Rockwell C |
|---|---|---|---|
| All Sizes | 1700º-1775º F | Still Air | 63.5-65 |

### Nominal Analysis (AISI A2)

| | |
|---|---|
| Carbon | 1.00 |
| Chromium | 5.25 |
| Manganese | .60 |
| Molybdenum | 1.00 |
| Vanadium | .25 |




### Specifications

Furnished in 18" and 36" lengths, ground straight and parallel.

### Hardening

497 and 499 Air Hardening Ground Flat Stock have a wide hardening range of 1700ºF to 1775ºF, with 1750ºF recommended for most work. For heavier sections use the high side of the range. Heat uniformly throughout but do not soak longer than necessary. Cool in still air. No pre-heat is required if pack or atmosphere controlled furnace methods are used, but with the open furnace method a pre-heat of 1450ºF is recommended.

### Tempering

A tempering time of two hours at temperature is recommended. Use chart for selecting the desired Rockwell C hardness and corresponding tempering temperature. For maximum toughness, double temper for two hours at each temperature recommended. The following may also be used as a guide, depending on the type of work.

### Light Blanking Punches and Dies

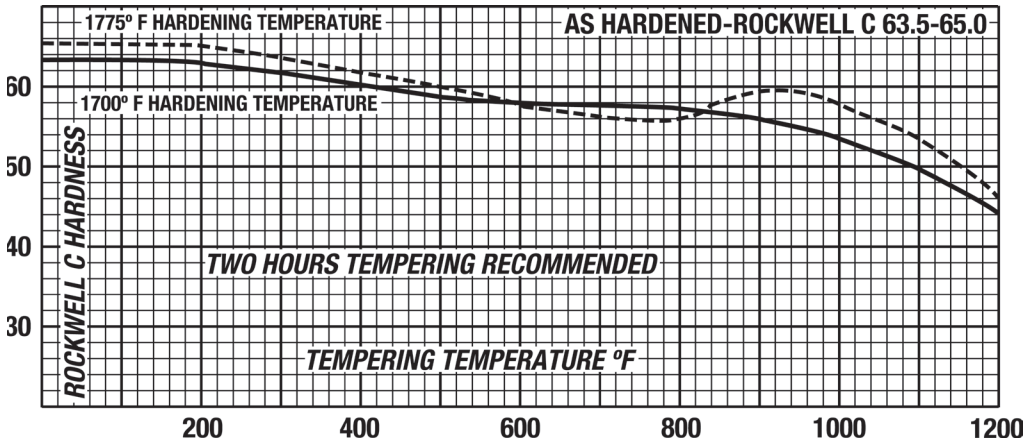
400º-425º F

### Heavy Blanking Punches and Dies

700º F

### Annealing

1525º-1575º F. Furnace cool at no more than 50º per hour to 800º for maximum softness.




499, 1-1/4" and over is Blanchard ground with saw cut edges



# Precision Ground Flat Stock

## 497 Air Hardening Precision Ground Flat Stock

### STANDARD TOLERANCE

| 497 Air Hardening Precision Ground Flat Stock | | | |
|---|---|---|---|
| Thickness | Width | 18" Length | 36" Length |
| 1/16" | 1/2" | 57489 | 57301 |
| | 3/4" | 57490 | 57302 |
| | 1" | 57491 | 57303 |
| | 1-1/4" | 57492 | 57304 |
| | 1-1/2" | 57493 | 57305 |
| | 2" | 57494 | 57306 |
| | 2-1/2" | 57495 | 57307 |
| | 3" | 57496 | 57308 |
| | 4" | 57497 | 57309 |
| 3/32" | 1/2" | 57498 | 57310 |
| | 3/4" | 57499 | 57311 |
| | 1" | 57500 | 57312 |
| | 1-1/4" | 57501 | 57313 |
| | 1-1/2" | 57502 | 57314 |
| | 2" | 57503 | 57315 |
| | 2-1/2" | 57504 | 57316 |
| | 3" | 57505 | 57317 |
| | 4" | 57506 | 57318 |
| 1/8" | 1/2" | 57243 | 57245 |
| | 5/8" | 57507 | 57319 |
| | 3/4" | 57244 | 57246 |
| | 1" | 54589 | 54546 |
| | 1-1/4" | 54590 | 54547 |
| | 1-1/2" | 54591 | 54548 |
| | 1-3/4" | 57508 | 57320 |
| | 2" | 54592 | 54549 |
| | 2-1/2" | 54593 | 54550 |
| | 3" | 54594 | 54551 |
| | 3-1/2" | 54595 | 54552 |
| | 4" | 54596 | 54553 |
| | 5" | 54598 | 54555 |
| | 6" | 54599 | 54556 |
| | 7" | 57509 | 57321 |
| | 8" | 57510 | 57322 |
| | 10" | 57511 | 57323 |
| | 12" | 57512 | 57324 |
| 5/32" | 1/2" | 57513 | 57325 |
| | 3/4" | 57514 | 57326 |
| | 1" | 54600 | 54557 |
| | 1-1/4" | 54601 | 54558 |
| | 1-1/2" | 54602 | 54559 |
| | 1-3/4" | 57515 | 57327 |
| | 2" | 54603 | 54560 |
| | 2-1/2" | 54604 | 54561 |
| | 3" | 54605 | 54562 |
| | 3-1/2" | 54606 | 54563 |
| | 4" | 54607 | 54564 |
| | 5" | 54608 | 54565 |
| | 6" | 54609 | 54566 |
| | 8" | 57516 | 57328 |

| 497 Air Hardening Precision Ground Flat Stock | | | |
|---|---|---|---|
| Thickness | Width | 18" Length | 36" Length |
| 3/16" | 3/16" | 57517 | 57329 |
| | 1/2" | 57518 | 57330 |
| | 3/4" | 57519 | 57331 |
| | 1" | 54610 | 54567 |
| | 1-1/4" | 54611 | 54568 |
| | 1-1/2" | 54612 | 54569 |
| | 1-3/4" | 57520 | 57332 |
| | 2" | 54613 | 54570 |
| | 2-1/2" | 54614 | 54571 |
| | 3" | 54615 | 54572 |
| | 3-1/2" | 54616 | 54573 |
| | 4" | 54617 | 54574 |
| | 5" | 54618 | 54575 |
| | 6" | 54619 | 54576 |
| | 7" | 57521 | 57333 |
| | 8" | 57522 | 57334 |
| | 12" | 59129 | 59161 |
| 1/4" | 1/4" | 57523 | 57335 |
| | 1/2" | 57524 | 57336 |
| | 3/4" | 57525 | 57337 |
| | 1" | 54620 | 54577 |
| | 1-1/4" | 54621 | 54578 |
| | 1-1/2" | 54622 | 54579 |
| | 1-3/4" | 57526 | 57338 |
| | 2" | 54623 | 54580 |
| | 2-1/2" | 54624 | 54581 |
| | 3" | 54625 | 54582 |
| | 3-1/2" | 54626 | 54583 |
| | 4" | 54627 | 54584 |
| | 5" | 54629 | 54586 |
| | 6" | 54631 | 54588 |
| | 8" | 59130 | 59162 |
| | 12" | 59131 | 59163 |
| 5/16" | 5/16" | 57527 | 57339 |
| | 1/2" | 57528 | 57340 |
| | 3/4" | 57529 | 57341 |
| | 1" | 54717 | 54632 |
| | 1-1/4" | 54718 | 54633 |
| | 1-1/2" | 54719 | 54634 |
| | 1-3/4" | 57530 | 57342 |
| | 2" | 54720 | 54635 |
| | 2-1/2" | 54721 | 54636 |
| | 3" | 54722 | 54637 |
| | 3-1/2" | 54723 | 54638 |
| | 4" | 54724 | 54639 |
| | 5" | 54726 | 54641 |
| | 6" | 54727 | 54642 |
| | 8" | 59132 | 59164 |

| 497 Air Hardening Precision Ground Flat Stock | | | |
|---|---|---|---|
| Thickness | Width | 18" Length | 36" Length |
| 3/8" | 3/8" | 57531 | 57343 |
| | 1/2" | 57532 | 57344 |
| | 3/4" | 57533 | 57345 |
| | 1" | 54728 | 54643 |
| | 1-1/4" | 54729 | 54644 |
| | 1-1/2" | 54730 | 54645 |
| | 1-3/4" | 57534 | 57346 |
| | 2" | 54731 | 54646 |
| | 2-1/2" | 54732 | 54647 |
| | 3" | 54733 | 54648 |
| | 3-1/2" | 54734 | 54649 |
| | 4" | 54735 | 54650 |
| | 5" | 54737 | 54652 |
| | 6" | 54739 | 54654 |
| | 8" | 59133 | 59165 |
| | 12" | 59134 | 59166 |
| 1/2" | 1/2" | 56495 | 56505 |
| | 5/8" | 57535 | 57347 |
| | 3/4" | 56494 | 56506 |
| | 1" | 56493 | 56507 |
| | 1-1/4" | 57536 | 57348 |
| | 1-1/2" | 57537 | 57349 |
| | 1-3/4" | 57538 | 57350 |
| | 2" | 54748 | 54663 |
| | 2-1/2" | 54749 | 54664 |
| | 3" | 54750 | 54665 |
| | 3-1/2" | 54751 | 54666 |
| | 4" | 54752 | 54667 |
| | 5" | 54754 | 54669 |
| | 6" | 54755 | 54670 |
| | 8" | 54757 | 54672 |
| | 12" | 59135 | 59167 |
| 5/8" | 5/8" | 56499 | 56508 |
| | 3/4" | 56498 | 56509 |
| | 1" | 56497 | 56510 |
| | 1-1/2" | 56496 | 56511 |
| | 2" | 54760 | 54675 |
| | 2-1/2" | 54761 | 54676 |
| | 3" | 54762 | 54677 |
| | 3-1/2" | 54763 | 54678 |
| | 4" | 54764 | 54679 |
| | 5" | 54765 | 54680 |
| | 6" | 54766 | 54681 |
| | 8" | 59136 | 59168 |

Sizes other than listed priced on application



# Precision Ground Flat Stock

## 497 Air Hardening Precision Ground Flat Stock

### STANDARD TOLERANCE

| 497 Air Hardening Precision Ground Flat Stock | | | |
|---|---|---|---|
| Thickness | Width | 18" Length | 36" Length |
| 3/4" | 3/4" | 54770 | 54685 |
| | 1" | 56501 | 56512 |
| | 1-1/4" | 57539 | 57351 |
| | 1-1/2" | 56500 | 56513 |
| | 2" | 54771 | 54686 |
| | 2-1/2" | 54772 | 54687 |
| | 3" | 54773 | 54688 |
| | 4" | 54775 | 54690 |
| | 5" | 54777 | 54692 |
| | 6" | 54778 | 54693 |
| 7/8" | 7/8" | 54781 | 54696 |
| | 1" | 56503 | 56514 |
| | 1-1/2" | 56502 | 56515 |
| | 2" | 54782 | 54697 |
| | 2-1/2" | | 54698 |
| | 3" | 54784 | 54699 |
| | 4" | 54785 | 54700 |
| | 6" | 54786 | 54701 |

| 497 Air Hardening Precision Ground Flat Stock | | | |
|---|---|---|---|
| Thickness | Width | 18" Length | 36" Length |
| 1" | 1" | 54787 | 54702 |
| | 1-1/4" | 57540 | 57352 |
| | 1-1/2" | 56504 | 56516 |
| | 2" | 54788 | 54703 |
| | 2-1/2" | 54789 | 54704 |
| | 3" | 54790 | 54705 |
| | 4" | 54792 | 54707 |
| | 5" | 54794 | 54709 |
| | 6" | 54795 | 54710 |
| 1-1/4" | 1-1/4" | 54834 | 57684 |
| | 1-1/2" | 57683 | 57686 |
| | 2" | 54835 | 57687 |
| | 2-1/2" | 54836 | 57688 |
| | 3" | 54837 | 57689 |
| | 4" | 54838 | 57690 |
| | 5" | 54839 | 57691 |
| | 6" | 54840 | 57692 |

| 497 Air Hardening Precision Ground Flat Stock | | | |
|---|---|---|---|
| Thickness | Width | 18" Length | 36" Length |
| 1-1/2" | 1-1/2" | 54843 | 57693 |
| | 2" | 54844 | 57694 |
| | 2-1/2" | 54845 | 57695 |
| | 3" | 54846 | 57696 |
| | 3-1/2" | 54847 | 57697 |
| | 4" | 54848 | 57698 |
| | 6" | 54850 | 57699 |
| 2" | 2" | 54853 | 57700 |
| | 2-1/2" | 54854 | 57701 |
| | 3" | 54855 | 57702 |
| | 4" | 54857 | 57703 |

Sizes other than listed priced on application

## 499 Air Hardening Ground Flat Stock

### OVERSIZE TOLERANCE

| 499 Air Hardening Ground Flat Stock | | | |
|---|---|---|---|
| Thickness | Width | 18" Length | 36" Length |
| 1/8" | 1/2" | 57541 | 57353 |
| | 5/8" | 57542 | 57354 |
| | 3/4" | 57543 | 57355 |
| | 1" | 57544 | 57356 |
| | 1-1/4" | 57545 | 57357 |
| | 1-1/2" | 57546 | 57358 |
| | 1-3/4" | 57547 | 57359 |
| | 2" | 57548 | 57360 |
| | 2-1/2" | 57549 | 57361 |
| | 3" | 57550 | 57362 |
| | 3-1/2" | 57551 | 57363 |
| | 4" | 57552 | 57364 |
| | 5" | 57553 | 57365 |
| | 6" | 57554 | 57366 |
| | 7" | 57555 | 57367 |
| | 8" | 57556 | 57368 |
| | 10" | 57557 | 57369 |
| | 12" | 57558 | 57370 |

| 499 Air Hardening Ground Flat Stock | | | |
|---|---|---|---|
| Thickness | Width | 18" Length | 36" Length |
| 5/32" | 1/2" | 57559 | 57371 |
| | 3/4" | 57560 | 57372 |
| | 1" | 57561 | 57373 |
| | 1-1/4" | 57562 | 57374 |
| | 1-1/2" | 57563 | 57375 |
| | 2" | 57564 | 57376 |
| | 2-1/2" | 57565 | 57377 |
| | 3" | 57566 | 57378 |
| | 4" | 57567 | 57379 |
| | 5" | 57568 | 57380 |
| | 6" | 57569 | 57381 |
| | 8" | 57570 | 57382 |
| 3/16" | 3/16" | 57571 | 57383 |
| | 1/2" | 57572 | 57384 |
| | 3/4" | 57573 | 57385 |
| | 1" | 57162 | 56896 |
| | 1-1/4" | 57163 | 56897 |
| | 1-1/2" | 57164 | 56898 |
| | 1-3/4" | 57574 | 57386 |
| | 2" | 57165 | 56899 |
| | 2-1/2" | 57166 | 56900 |
| | 3" | 57167 | 56901 |

| 499 Air Hardening Ground Flat Stock | | | |
|---|---|---|---|
| Thickness | Width | 18" Length | 36" Length |
| 3/16" | 3-1/2" | 57575 | 57387 |
| | 4" | 57168 | 56902 |
| | 5" | 57576 | 57388 |
| | 6" | 57577 | 57389 |
| | 8" | 57578 | 57390 |
| | 10" | 57579 | 57391 |
| 1/4" | 1/4" | 57580 | 57392 |
| | 3/8" | | 58906 |
| | 1/2" | 57581 | 57393 |
| | 3/4" | 57582 | 57394 |
| | 1" | 57169 | 56903 |
| | 1-1/4" | 57170 | 56904 |
| | 1-1/2" | 57171 | 56905 |
| | 1-3/4" | 57583 | 57395 |
| | 2" | 57172 | 56906 |
| | 2-1/2" | 57173 | 56907 |
| | 3" | 57174 | 56908 |
| | 3-1/2" | 57584 | 57396 |
| | 4" | 57175 | 56909 |
| | 5" | 57176 | 56910 |
| | 6" | 57177 | 56911 |
| | 7" | 57585 | 57397 |

499, 1-1/4" and over is Blanchard ground with saw cut edges
Sizes other than listed priced on application



# Precision Ground Flat Stock

## 499 Air Hardening Ground Flat Stock

### OVERSIZE TOLERANCE

| 499 Air Hardening Ground Flat Stock | | | |
|---|---|---|---|
| Thickness | Width | 18" Length | 36" Length |
| 1/4" | 8" | 57586 | 57398 |
| | 10" | 57587 | 57399 |
| | 12" | 57588 | 57400 |
| 5/16" | 5/16" | 57589 | 57401 |
| | 1/2" | 57590 | 57402 |
| | 3/4" | 57591 | 57403 |
| | 1" | 57178 | 56912 |
| | 1-1/4" | 57179 | 56913 |
| | 1-1/2" | 57180 | 56914 |
| | 1-3/4" | 57592 | 57404 |
| | 2" | 57181 | 56915 |
| | 2-1/2" | 57593 | 57405 |
| | 3" | 57182 | 56916 |
| | 3-1/2" | 57594 | 57406 |
| | 4" | 57183 | 56917 |
| | 5" | 57184 | 56918 |
| | 6" | 57595 | 57407 |
| | 8" | 57596 | 57408 |
| 3/8" | 3/8" | 57597 | 57409 |
| | 1/2" | 57598 | 57410 |
| | 3/4" | 57599 | 57411 |
| | 1" | 57185 | 56919 |
| | 1-1/4" | 57186 | 56920 |
| | 1-1/2" | 57187 | 56921 |
| | 1-3/4" | 57600 | 57412 |
| | 2" | 57188 | 56922 |
| | 2-1/2" | 57189 | 56923 |
| | 3" | 57190 | 56924 |
| | 3-1/2" | 57191 | 56925 |
| | 4" | 57192 | 56926 |
| | 4-1/2" | 57601 | 57413 |
| | 5" | 57193 | 56927 |
| | 6" | 57194 | 56928 |
| | 7" | 57602 | 57414 |
| | 8" | 57603 | 57415 |
| | 10" | 57604 | 57416 |
| | 12" | 57605 | 57417 |
| 1/2" | 1/2" | 57195 | 56929 |
| | 5/8" | 57606 | 57418 |
| | 3/4" | 57196 | 56930 |
| | 1" | 57197 | 56931 |
| | 1-1/4" | 57607 | 57419 |
| | 1-1/2" | 57608 | 57420 |
| | 1-3/4" | 57609 | 57421 |
| | 2" | 57198 | 56932 |

| 499 Air Hardening Ground Flat Stock | | | |
|---|---|---|---|
| Thickness | Width | 18" Length | 36" Length |
| 1/2" | 2-1/2" | 57199 | 56933 |
| | 3" | 57200 | 56934 |
| | 3-1/2" | 57201 | 56935 |
| | 4" | 57202 | 56936 |
| | 4-1/2" | 57610 | 57422 |
| | 5" | 57203 | 56937 |
| | 6" | 57204 | 56938 |
| | 7" | 57611 | 57423 |
| | 8" | 57612 | 57424 |
| | 10" | 57613 | 57425 |
| | 12" | 57614 | 57426 |
| 9/16" | 2" | 57615 | 57427 |
| | 2-1/2" | 57616 | 57428 |
| | 3" | 57617 | 57429 |
| | 4" | 57618 | 57430 |
| 5/8" | 5/8" | 57205 | 56939 |
| | 3/4" | 57206 | 56940 |
| | 1" | 57207 | 56941 |
| | 1-1/4" | 57619 | 57431 |
| | 1-1/2" | 57208 | 56942 |
| | 2" | 57209 | 56943 |
| | 2-1/2" | 57210 | 56944 |
| | 3" | 57211 | 56945 |
| | 3-1/2" | 57212 | 56946 |
| | 4" | 57620 | 57432 |
| | 5" | 57621 | 57433 |
| | 6" | 57622 | 57434 |
| | 8" | 57623 | 57435 |
| | 10" | 57624 | 57436 |
| 3/4" | 3/4" | 57213 | 56947 |
| | 1" | 57214 | 56948 |
| | 1-1/4" | 57625 | 57437 |
| | 1-1/2" | 57215 | 56949 |
| | 1-3/4" | 57626 | 57438 |
| | 2" | 57216 | 56950 |
| | 2-1/2" | 57627 | 57439 |
| | 3" | 57217 | 56951 |
| | 3-1/2" | 57628 | 57440 |
| | 4" | 57218 | 56952 |
| | 4-1/2" | 57629 | 57441 |
| | 5" | 57630 | 57442 |
| | 6" | 57631 | 57443 |
| | 8" | 57632 | 57444 |
| | 10" | 57633 | 57445 |
| | 12" | 57634 | 57446 |

| 499 Air Hardening Ground Flat Stock | | | |
|---|---|---|---|
| Thickness | Width | 18" Length | 36" Length |
| 7/8" | 7/8" | 57635 | 57447 |
| | 1" | 57636 | 57448 |
| | 1-1/4" | 57637 | 57449 |
| | 1-1/2" | 57638 | 57450 |
| | 2" | 57639 | 57451 |
| | 2-1/2" | 57640 | 57452 |
| | 3" | 57641 | 57453 |
| | 3-1/2" | 57642 | 57454 |
| | 4" | 57643 | 57455 |
| | 5" | 57644 | 57456 |
| | 6" | 57645 | 57457 |
| 1" | 1" | 57219 | 56953 |
| | 1-1/4" | 57646 | 57458 |
| | 1-1/2" | 57220 | 56954 |
| | 1-3/4" | 57647 | 57459 |
| | 2" | 57221 | 56955 |
| | 2-1/2" | 57648 | 57460 |
| | 3" | 57222 | 56956 |
| | 3-1/2" | 57649 | 57461 |
| | 4" | 57650 | 57462 |
| | 4-1/2" | 57651 | 57463 |
| | 5" | 57652 | 57464 |
| | 6" | 57653 | 57465 |
| | 8" | 57654 | 57466 |
| | 12" | 57655 | 57467 |
| 1-1/4" | 1-1/4" | 57656 | 57468 |
| | 1-1/2" | 57657 | 57469 |
| | 2" | 57658 | 57470 |
| | 2-1/2" | 57659 | 57471 |
| | 3" | 57660 | 57472 |
| | 4" | 57661 | 57473 |
| | 5" | 57662 | 57474 |
| | 6" | 57663 | 57475 |
| 1-1/2" | 1-1/2" | 57664 | 57476 |
| | 2" | 57665 | 57477 |
| | 2-1/2" | 57666 | 57478 |
| | 3" | 57667 | 57479 |
| | 3-1/2" | 57668 | 57480 |
| | 4" | 57669 | 57481 |
| | 6" | 57670 | 57482 |
| | 8" | 59137 | 59169 |
| | 12" | 59138 | 59170 |
| 2" | 2" | 57671 | 57483 |
| | 2-1/2" | 57672 | 57484 |
| | 3" | 57673 | 57485 |
| | 4" | 57674 | 57486 |
| 2-1/2" | 2-1/2" | 57675 | 57487 |
| 3" | 3" | 57676 | 57488 |

499, 1-1/4" and over is Blanchard ground with saw cut edges
Sizes other than listed priced on application



# Precision Ground Flat Stock

## 344 A6 Air Hardening Precision Ground Flat Stock

A6 is a medium alloyed air hardening tool steel that provides an excellent balance of machinability, toughness and wear resistance. Its lower heat treating temperature, which is similar to that of oil hardening steel, results in deep hardness and minimum distortion.




### Specifications

Furnished in 36" lengths, ground straight and parallel.

Heat Treatment and Tempering Data available upon request

### Nominal Analysis (AISI A6)

| | |
|---|---|
| Carbon | .70 |
| Chromium | 1.00 |
| Manganese | 2.00 |
| Molybdenum | 1.25 |
| Vanadium | – |
| Tungsten | – |

## 344 Air Hardening Precision Ground Flat Stock

| 344 Air Hardening Precision Ground Flat Stock | | |
|---|---|---|
| Thickness | Width | 36" Length |
| 1/16" | 1/4" | 58907 |
| | 5/16" | 58908 |
| | 3/8" | 58909 |
| | 1/2" | 58910 |
| | 5/8" | 58911 |
| | 3/4" | 58912 |
| | 7/8" | 58913 |
| | 1" | 58914 |
| | 1-1/4" | 58915 |
| | 1-1/2" | 58916 |
| | 1-3/4" | 58917 |
| | 2" | 58918 |
| | 2-1/2" | 58919 |
| | 3" | 58920 |
| | 3-1/2" | 58921 |
| | 4" | 58922 |
| | 5" | 58923 |
| | 6" | 58924 |

| 344 Air Hardening Precision Ground Flat Stock | | |
|---|---|---|
| Thickness | Width | 36" Length |
| 3/32" | 1/4" | 58925 |
| | 5/16" | 58926 |
| | 3/8" | 58927 |
| | 1/2" | 58928 |
| | 5/8" | 58929 |
| | 3/4" | 58930 |
| | 7/8" | 58931 |
| | 1" | 58932 |
| | 1-1/4" | 58933 |
| | 1-1/2" | 58934 |
| | 1-3/4" | 58935 |
| | 2" | 58936 |
| | 2-1/2" | 58937 |
| | 3" | 58938 |
| | 3-1/2" | 58939 |
| | 4" | 58940 |
| | 5" | 58941 |
| | 6" | 58942 |

| 344 Air Hardening Precision Ground Flat Stock | | |
|---|---|---|
| Thickness | Width | 36" Length |
| 1/8" | 1/4" | 58943 |
| | 5/16" | 58944 |
| | 3/8" | 58945 |
| | 1/2" | 58946 |
| | 5/8" | 58947 |
| | 3/4" | 58948 |
| | 7/8" | 58949 |
| | 1" | 58950 |
| | 1-1/4" | 58951 |
| | 1-1/2" | 58952 |
| | 1-3/4" | 58953 |
| | 2" | 58954 |
| | 2-1/2" | 58955 |
| | 3" | 58956 |
| | 3-1/2" | 58957 |
| | 4" | 58958 |
| | 5" | 58959 |
| | 6" | 58960 |
| | 7" | 58961 |
| | 8" | 58962 |
| | 10" | 58963 |
| | 12" | 58964 |

Sizes other than listed priced on application



# Precision Ground Flat Stock

## 344 Air Hardening Precision Ground Flat Stock

| 344 Air Hardening Precision Ground Flat Stock | | |
|---|---|---|
| Thickness | Width | 36" Length |
| 3/16" | 3/16" | 58965 |
| | 1/4" | 58966 |
| | 5/16" | 58967 |
| | 3/8" | 58968 |
| | 1/2" | 58969 |
| | 5/8" | 58970 |
| | 3/4" | 58971 |
| | 7/8" | 58972 |
| | 1" | 58973 |
| | 1-1/4" | 58974 |
| | 1-1/2" | 58975 |
| | 1-3/4" | 58976 |
| | 2" | 58977 |
| | 2-1/2" | 58978 |
| | 3" | 58979 |
| | 3-1/2" | 58980 |
| | 4" | 58981 |
| | 5" | 58982 |
| | 6" | 58983 |
| | 7" | 58984 |
| | 8" | 58985 |
| | 10" | 58986 |
| | 12" | 58987 |
| 1/4" | 1/4" | 58988 |
| | 5/16" | 58989 |
| | 3/8" | 58990 |
| | 1/2" | 58991 |
| | 5/8" | 58992 |
| | 3/4" | 58993 |
| | 7/8" | 58994 |
| | 1" | 58995 |
| | 1-1/4" | 58996 |
| | 1-1/2" | 58997 |
| | 1-3/4" | 58998 |
| | 2" | 58999 |
| | 2-1/2" | 59000 |
| | 3" | 59001 |
| | 3-1/2" | 59002 |
| | 4" | 59003 |
| | 5" | 59004 |
| | 6" | 59005 |
| | 7" | 59006 |
| | 8" | 59007 |
| | 10" | 59008 |
| | 12" | 59009 |
| 5/16" | 5/16" | 59010 |
| | 3/8" | 59011 |
| | 1/2" | 59012 |
| | 5/8" | 59013 |
| | 3/4" | 59014 |
| | 7/8" | 59015 |
| | 1" | 59016 |
| | 1-1/4" | 59017 |
| | 1-1/2" | 59018 |
| | 1-3/4" | 59019 |

| 344 Air Hardening Precision Ground Flat Stock | | |
|---|---|---|
| Thickness | Width | 36" Length |
| 5/16" | 2" | 59020 |
| | 2-1/2" | 59021 |
| | 3" | 59022 |
| | 3-1/2" | 59023 |
| | 4" | 59024 |
| | 4-1/2" | 59025 |
| | 5" | 59026 |
| | 5-1/2" | 59027 |
| | 6" | 59028 |
| | 8" | 59029 |
| | 10" | 59030 |
| | 12" | 59031 |
| 3/8" | 3/8" | 59032 |
| | 1/2" | 59033 |
| | 5/8" | 59034 |
| | 3/4" | 59035 |
| | 7/8" | 59036 |
| | 1" | 59037 |
| | 1-1/4" | 59038 |
| | 1-1/2" | 59039 |
| | 1-3/4" | 59040 |
| | 2" | 59041 |
| | 2-1/2" | 59042 |
| | 3" | 59043 |
| | 3-1/2" | 59044 |
| | 4" | 59045 |
| | 4-1/2" | 59046 |
| | 5" | 59047 |
| | 6" | 59048 |
| | 7" | 59049 |
| | 8" | 59050 |
| | 10" | 59051 |
| | 12" | 59052 |
| 1/2" | 1/2" | 59053 |
| | 5/8" | 59054 |
| | 3/4" | 59055 |
| | 7/8" | 59056 |
| | 1" | 59057 |
| | 1-1/4" | 59058 |
| | 1-1/2" | 59059 |
| | 1-3/4" | 59060 |
| | 2" | 59061 |
| | 2-1/2" | 59062 |
| | 3" | 59063 |
| | 3-1/2" | 59064 |
| | 4" | 59065 |
| | 4-1/2" | 59066 |
| | 5" | 59067 |
| | 5-1/2" | 59068 |
| | 6" | 59069 |
| | 7" | 59070 |
| | 8" | 59071 |
| | 10" | 59072 |
| | 12" | 59073 |

| 344 Air Hardening Precision Ground Flat Stock | | |
|---|---|---|
| Thickness | Width | 36" Length |
| 5/8" | 5/8" | 59074 |
| | 3/4" | 59075 |
| | 7/8" | 59076 |
| | 1" | 59077 |
| | 1-1/4" | 59078 |
| | 1-1/2" | 59079 |
| | 1-3/4" | 59080 |
| | 2" | 59081 |
| | 2-1/2" | 59082 |
| | 3" | 59083 |
| | 3-1/2" | 59084 |
| | 4" | 59085 |
| | 4-1/2" | 59086 |
| | 5" | 59087 |
| | 5-1/2" | 59088 |
| | 6" | 59089 |
| | 7" | 59090 |
| | 8" | 59091 |
| | 10" | 59092 |
| 3/4" | 3/4" | 59093 |
| | 7/8" | 59094 |
| | 1" | 59095 |
| | 1-1/4" | 59096 |
| | 1-1/2" | 59097 |
| | 1-3/4" | 59098 |
| | 2" | 59099 |
| | 2-1/2" | 59100 |
| | 3" | 59101 |
| | 3-1/2" | 59102 |
| | 4" | 59103 |
| | 4-1/2" | 59104 |
| | 5" | 59105 |
| | 5-1/2" | 59106 |
| | 6" | 59107 |
| | 7" | 59108 |
| | 8" | 59109 |
| | 10" | 59110 |
| 1" | 1" | 59111 |
| | 1-1/4" | 59112 |
| | 1-1/2" | 59113 |
| | 1-3/4" | 59114 |
| | 2" | 59115 |
| | 2-1/2" | 59116 |
| | 3" | 59117 |
| | 3-1/2" | 59118 |
| | 4" | 59119 |
| | 4-1/2" | 59120 |
| | 5" | 59121 |
| | 5-1/2" | 59122 |
| | 6" | 59123 |
| | 7" | 59124 |
| | 8" | 59125 |
| | 10" | 59126 |

Sizes other than listed priced on application



# Precision Ground Flat Stock

## 401 and 402 High Carbon, High Chromium Precision Ground Flat Stock

- High carbon, high chromium steel
- For applications that demand the highest wear resistance
- 401 is standard tolerance
- 402 is oversize tolerance




### Specifications

Furnished in 18" and 36" lengths, ground straight and parallel.

## 401 High Carbon, High Chromium Precision Ground Flat Stock

### STANDARD TOLERANCE

| 401 High Carbon, High Chromium Precision Ground Flat Stock | | | |
|---|---|---|---|
| Thickness | Width | 18" Length | 36" Length |
| 1/16" | 1/2" | 69097 | 69232 |
| | 3/4" | 69098 | 69233 |
| | 1" | 69099 | 69234 |
| | 1-1/4" | 69100 | 69235 |
| | 1-1/2" | 69101 | 69236 |
| | 2" | 69102 | 69237 |
| | 2-1/2" | 69103 | 69238 |
| | 3" | 69104 | 69239 |
| | 4" | 69105 | 69240 |
| | 5" | 69106 | 69241 |
| | 6" | 69107 | 69242 |
| 3/32" | 1/2" | 69108 | 69243 |
| | 3/4" | 69109 | 69244 |
| | 1" | 69110 | 69245 |
| | 1-1/4" | 69111 | 69246 |
| | 1-1/2" | 69112 | 69247 |
| | 2" | 69113 | 69248 |
| | 2-1/2" | 69114 | 69249 |
| | 3" | 69115 | 69250 |
| | 4" | 69116 | 69251 |
| | 5" | 69117 | 69252 |
| | 6" | 69118 | 69253 |
| 1/8" | 1/2" | 69119 | 69254 |
| | 3/4" | 69120 | 69255 |
| | 1" | 69121 | 69256 |
| | 1-1/4" | 69122 | 69257 |
| | 1-1/2" | 69123 | 69258 |
| | 2" | 69124 | 69259 |
| | 2-1/2" | 69125 | 69260 |
| | 3" | 69126 | 69261 |
| | 4" | 69127 | 69262 |
| | 5" | 69128 | 69263 |
| | 6" | 69129 | 69264 |
| 5/32" | 1/2" | 69130 | 69265 |
| | 3/4" | 69131 | 69266 |
| | 1" | 69132 | 69267 |
| | 1-1/4" | 69133 | 69268 |
| | 1-1/2" | 69134 | 69269 |
| | 2" | 69135 | 69270 |
| | 2-1/2" | 69136 | 69271 |
| | 3" | 69137 | 69272 |
| | 4" | 69138 | 69273 |
| | 5" | 69139 | 69274 |
| | 6" | 69140 | 69275 |

| 401 High Carbon, High Chromium Precision Ground Flat Stock | | | |
|---|---|---|---|
| Thickness | Width | 18" Length | 36" Length |
| 3/16" | 1/2" | 69141 | 69276 |
| | 3/4" | 69142 | 69277 |
| | 1" | 69143 | 69278 |
| | 1-1/4" | 69144 | 69279 |
| | 1-1/2" | 69145 | 69280 |
| | 2" | 69146 | 69281 |
| | 2-1/2" | 69147 | 69282 |
| | 3" | 69148 | 69283 |
| | 4" | 69149 | 69284 |
| | 5" | 69150 | 69285 |
| | 6" | 69151 | 69286 |
| 1/4" | 1/2" | 69152 | 69287 |
| | 3/4" | 69153 | 69288 |
| | 1" | 69154 | 69289 |
| | 1-1/4" | 69155 | 69290 |
| | 1-1/2" | 69156 | 69291 |
| | 2" | 69157 | 69292 |
| | 2-1/2" | 69158 | 69293 |
| | 3" | 69159 | 69294 |
| | 4" | 69160 | 69295 |
| | 5" | 69161 | 69296 |
| | 6" | 69162 | 69297 |
| 5/16" | 1/2" | 69163 | 69298 |
| | 3/4" | 69164 | 69299 |
| | 1" | 69165 | 69300 |
| | 1-1/4" | 69166 | 69301 |
| | 1-1/2" | 69167 | 69302 |
| | 2" | 69168 | 69303 |
| | 2-1/2" | 69169 | 69304 |
| | 3" | 69170 | 69305 |
| | 4" | 69171 | 69306 |
| | 5" | 69172 | 69307 |
| | 6" | 69173 | 69308 |
| 3/8" | 1/2" | 69174 | 69309 |
| | 3/4" | 69175 | 69310 |
| | 1" | 69176 | 69311 |
| | 1-1/4" | 69177 | 69312 |
| | 1-1/2" | 69178 | 69313 |
| | 2" | 69179 | 69314 |
| | 2-1/2" | 69180 | 69315 |
| | 3" | 69181 | 69316 |
| | 4" | 69182 | 69317 |
| | 5" | 69183 | 69318 |
| | 6" | 69184 | 69319 |

| 401 High Carbon, High Chromium Precision Ground Flat Stock | | | |
|---|---|---|---|
| Thickness | Width | 18" Length | 36" Length |
| 1/2" | 3/4" | 69185 | 69320 |
| | 1" | 69186 | 69321 |
| | 1-1/4" | 69187 | 69322 |
| | 1-1/2" | 69188 | 69323 |
| | 2" | 69189 | 69324 |
| | 2-1/2" | 69190 | 69325 |
| | 3" | 69191 | 69326 |
| | 4" | 69192 | 69327 |
| | 5" | 69193 | 69328 |
| | 6" | 69194 | 69329 |
| 5/8" | 5/8" | 69195 | 69330 |
| | 3/4" | 69196 | 69331 |
| | 1" | 69197 | 69332 |
| | 1-1/4" | 69198 | 69333 |
| | 1-1/2" | 69199 | 69334 |
| | 2" | 69200 | 69335 |
| | 2-1/2" | 69201 | 69336 |
| | 3" | 69202 | 69337 |
| | 4" | 69203 | 69338 |
| | 5" | 69204 | 69339 |
| | 6" | 69205 | 69340 |
| 3/4" | 3/4" | 69206 | 69341 |
| | 1" | 69207 | 69342 |
| | 1-1/4" | 69208 | 69343 |
| | 1-1/2" | 69209 | 69344 |
| | 2" | 69210 | 69345 |
| | 2-1/2" | 69211 | 69346 |
| | 3" | 69212 | 69347 |
| | 4" | 69213 | 69348 |
| | 5" | 69214 | 69349 |
| | 6" | 69215 | 69350 |
| 7/8" | 7/8" | 69216 | 69351 |
| | 1" | 69217 | 69352 |
| | 2" | 69218 | 69353 |
| | 3" | 69219 | 69354 |
| | 4" | 69220 | 69355 |
| | 5" | 69221 | 69356 |
| | 6" | 69222 | 69357 |
| 1" | 1" | 69223 | 69358 |
| | 1-1/4" | 69224 | 69359 |
| | 1-1/2" | 69225 | 69360 |
| | 2" | 69226 | 69361 |
| | 2-1/2" | 69227 | 69362 |
| | 3" | 69228 | 69363 |
| | 4" | 69229 | 69364 |
| | 5" | 69230 | 69365 |
| | 6" | 69231 | 69366 |

Sizes other than listed priced on application



# Precision Ground Flat Stock

## 402 High Carbon, High Chromium Ground Flat Stock

### OVERSIZE TOLERANCE

| 402 High Carbon, High Chromium Ground Flat Stock | | | |
|---|---|---|---|
| Thickness | Width | 18" Length | 36" Length |
| | 1/2" | 69367 | 69481 |
| | 3/4" | 69368 | 69482 |
| | 1" | 69369 | 69483 |
| | 1-1/4" | 69370 | 69484 |
| | 1-1/2" | 69371 | 69485 |
| 1/8" | 2" | 69372 | 69486 |
| | 2-1/2" | 69373 | 69487 |
| | 3" | 69374 | 69488 |
| | 4" | 69375 | 69489 |
| | 5" | 69376 | 69490 |
| | 6" | 69377 | 69491 |
| | 1/2" | 69378 | 69492 |
| | 3/4" | 69379 | 69493 |
| | 1" | 69380 | 69494 |
| | 1-1/4" | 69381 | 69495 |
| | 1-1/2" | 69382 | 69496 |
| 5/32" | 2" | 69383 | 69497 |
| | 2-1/2" | 69384 | 69498 |
| | 3" | 69385 | 69499 |
| | 4" | 69386 | 69500 |
| | 5" | 69387 | 69501 |
| | 6" | 69388 | 69502 |
| | 1/2" | 69389 | 69503 |
| | 3/4" | 69390 | 69504 |
| | 1" | 69391 | 69505 |
| | 1-1/4" | 69392 | 69506 |
| | 1-1/2" | 69393 | 69507 |
| 3/16" | 2" | 69394 | 69508 |
| | 2-1/2" | 69395 | 69509 |
| | 3" | 69396 | 69510 |
| | 4" | 69397 | 69511 |
| | 5" | 69398 | 69512 |
| | 6" | 69399 | 69513 |
| | 1/2" | 69400 | 69514 |
| | 3/4" | 69401 | 69515 |
| | 1" | 69402 | 69516 |
| | 1-1/4" | 69403 | 69517 |
| | 1-1/2" | 69404 | 69518 |
| 1/4" | 2" | 69405 | 69519 |
| | 2-1/2" | 69406 | 69520 |
| | 3" | 69407 | 69521 |
| | 4" | 69408 | 69522 |
| | 5" | 69409 | 69523 |
| | 6" | 69410 | 69524 |

| 402 High Carbon, High Chromium Ground Flat Stock | | | |
|---|---|---|---|
| Thickness | Width | 18" Length | 36" Length |
| | 1/2" | 69411 | 69525 |
| | 3/4" | 69412 | 69526 |
| | 1" | 69413 | 69527 |
| | 1-1/4" | 69414 | 69528 |
| | 1-1/2" | 69415 | 69529 |
| 5/16" | 2" | 69416 | 69530 |
| | 2-1/2" | 69417 | 69531 |
| | 3" | 69418 | 69532 |
| | 4" | 69419 | 69533 |
| | 5" | 69420 | 69534 |
| | 6" | 69421 | 69535 |
| | 1/2" | 69422 | 69536 |
| | 3/4" | 69423 | 69537 |
| | 1" | 69424 | 69538 |
| | 1-1/4" | 69425 | 69539 |
| | 1-1/2" | 69426 | 69540 |
| 3/8" | 2" | 69427 | 69541 |
| | 2-1/2" | 69428 | 69542 |
| | 3" | 69429 | 69543 |
| | 4" | 69430 | 69544 |
| | 5" | 69431 | 69545 |
| | 6" | 69432 | 69546 |
| | 1/2" | 69433 | 69547 |
| | 3/4" | 69434 | 69548 |
| | 1" | 69435 | 69549 |
| | 1-1/4" | 69436 | 69550 |
| | 1-1/2" | 69437 | 69551 |
| 1/2" | 2" | 69438 | 69552 |
| | 2-1/2" | 69439 | 69553 |
| | 3" | 69440 | 69554 |
| | 4" | 69441 | 69555 |
| | 5" | 69442 | 69556 |
| | 6" | 69443 | 69557 |
| | 5/8" | 69444 | 69558 |
| | 3/4" | 69445 | 69559 |
| | 1" | 69446 | 69560 |
| | 1-1/4" | 69447 | 69561 |
| | 1-1/2" | 69448 | 69562 |
| 5/8" | 2" | 69449 | 69563 |
| | 2-1/2" | 69450 | 69564 |
| | 3" | 69451 | 69565 |
| | 4" | 69452 | 69566 |
| | 5" | 69453 | 69567 |
| | 6" | 69454 | 69568 |

| 402 High Carbon, High Chromium Ground Flat Stock | | | |
|---|---|---|---|
| Thickness | Width | 18" Length | 36" Length |
| | 3/4" | 69455 | 69569 |
| | 1" | 69456 | 69570 |
| | 1-1/4" | 69457 | 69571 |
| | 1-1/2" | 69458 | 69572 |
| | 2" | 69459 | 69573 |
| 3/4" | 2-1/2" | 69460 | 69574 |
| | 3" | 69461 | 69575 |
| | 4" | 69462 | 69576 |
| | 5" | 69463 | 69577 |
| | 6" | 69464 | 69578 |
| | 7/8" | 69465 | 69579 |
| | 1" | 69466 | 69580 |
| | 1-1/2" | 69467 | 69581 |
| 7/8" | 2" | 69468 | 69582 |
| | 3" | 69469 | 69583 |
| | 4" | 69470 | 69584 |
| | 6" | 69471 | 69585 |
| | 1" | 69472 | 69586 |
| | 1-1/4" | 69473 | 69587 |
| | 1-1/2" | 69474 | 69588 |
| | 2" | 69475 | 69589 |
| 1" | 2-1/2" | 69476 | 69590 |
| | 3" | 69477 | 69591 |
| | 4" | 69478 | 69592 |
| | 5" | 69479 | 69593 |
| | 6" | 69480 | 69594 |

Sizes other than listed priced on application



# Precision Ground Flat Stock

## 498 Low Carbon Precision Ground Flat Stock

- Substantial cost reductions over tool steel ground flat stock. There are savings up to 60% because this is a low carbon steel and furnished in 24" lengths. This means that you get one-third more steel at less cost.
- Ideal for a wide variety of parts that don't require more expensive heat treated steels, such as stripper plates, jigs, fixtures, machine and component parts, templates, etc.
- This steel can be carburized or case hardened. After hardening, its physical properties, especially tensile strength, yield point, and Brinell hardness, are substantially higher.
- **NOTE**: Thicknesses of 1/8" and under are made from AISI 1010 material
- Starrett uses its own ground flat stock for many of its precision tool parts




### Specifications

Furnished in 24" lengths, ground straight and parallel.

### Analysis

Starrett 498 Low Carbon Precision Ground Flat Stock is a .20 carbon fine-grained, milled steel, which can be carburized or case hardened. Very similar to AISI 1018.

### Heat Treatment

For many applications, stock can be used unhardened. However, if surface hardening is desired, it can be carburized or case hardened. If carburized, a case of 1/32" will be obtained if the steel is held in carburizing salt at 1700º F for three hours.

## 498 Low Carbon Precision Ground Flat Stock

| 498 Low Carbon Precision Ground Flat Stock | | |
|---|---|---|
| Thickness | Width | 24" Length |
| 1/16" | 1/2" | 54866 |
| | 3/4" | 54867 |
| | 1" | 54868 |
| | 1-1/4" | 54869 |
| | 1-1/2" | 54870 |
| | 2" | 54871 |
| | 2-1/2" | 54872 |
| | 3" | 54873 |
| | 3-1/2" | 54874 |
| | 4" | 54875 |
| | 5" | 54876 |
| | 6" | 54877 |
| | 8" | 54878 |
| | 10" | 54879 |
| | 12" | 54880 |
| 3/32" | 1/2" | 54881 |
| | 3/4" | 54882 |
| | 1" | 54883 |
| | 1-1/4" | 54884 |
| | 1-1/2" | 54885 |
| | 2" | 54886 |
| | 2-1/2" | 54887 |
| | 3" | 54888 |
| | 3-1/2" | 58285 |
| | 4" | 54889 |

| 498 Low Carbon Precision Ground Flat Stock | | |
|---|---|---|
| Thickness | Width | 24" Length |
| 3/32" | 5" | 54890 |
| | 6" | 54891 |
| | 8" | 54892 |
| | 10" | 58286 |
| | 12" | 58287 |
| 1/8" | 1/2" | 54893 |
| | 3/4" | 54894 |
| | 1" | 54895 |
| | 1-1/4" | 54896 |
| | 1-1/2" | 54897 |
| | 2" | 54898 |
| | 2-1/2" | 54899 |
| | 3" | 54900 |
| | 3-1/2" | 54901 |
| | 4" | 54902 |
| | 5" | 54903 |
| | 6" | 54904 |
| | 8" | 54905 |
| | 10" | 54906 |
| | 12" | 54907 |
| 5/32" | 1/2" | 54908 |
| | 3/4" | 54909 |
| | 1" | 54910 |
| | 1-1/4" | 54911 |
| | 1-1/2" | 54912 |

| 498 Low Carbon Precision Ground Flat Stock | | |
|---|---|---|
| Thickness | Width | 24" Length |
| 5/32" | 2" | 54913 |
| | 2-1/2" | 54914 |
| | 3" | 54915 |
| | 3-1/2" | 58290 |
| | 4" | 54917 |
| | 5" | 54918 |
| | 6" | 54919 |
| | 8" | 58291 |
| | 10" | 58292 |
| | 12" | 58293 |
| 3/16" | 3/16" | 57247 |
| | 1/2" | 54921 |
| | 3/4" | 54922 |
| | 1" | 54923 |
| | 1-1/4" | 54924 |
| | 1-1/2" | 54925 |
| | 2" | 54926 |
| | 2-1/2" | 54927 |
| | 3" | 54928 |
| | 3-1/2" | 54929 |
| | 4" | 54930 |
| | 5" | 54931 |
| | 6" | 54932 |
| | 8" | 54933 |
| | 10" | 54934 |
| | 12" | 57248 |

Sizes other than listed priced on application



# 498 Low Carbon Precision Ground Flat Stock

| 498 Low Carbon Precision Ground Flat Stock | | |
|---|---|---|
| **Thickness** | **Width** | **24" Length** |
| 1/4" | 1/4" | 57249 |
| | 1/2" | 54935 |
| | 3/4" | 54936 |
| | 1" | 54937 |
| | 1-1/4" | 54938 |
| | 1-1/2" | 54939 |
| | 2" | 54940 |
| | 2-1/2" | 54941 |
| | 3" | 54942 |
| | 3-1/2" | 54943 |
| | 4" | 54944 |
| | 5" | 54945 |
| | 6" | 54946 |
| | 8" | 54947 |
| | 10" | 54948 |
| | 12" | 54949 |
| 5/16" | 5/16" | 57250 |
| | 1/2" | 54950 |
| | 3/4" | 54951 |
| | 1" | 54952 |
| | 1-1/4" | 54953 |
| | 1-1/2" | 54954 |
| | 2" | 54955 |
| | 2-1/2" | 54956 |
| | 3" | 54957 |
| | 3-1/2" | 54958 |
| | 4" | 54959 |
| | 5" | 54960 |
| | 6" | 54961 |
| | 8" | 54962 |
| | 10" | 57251 |
| | 12" | 57252 |
| 3/8" | 3/8" | 54964 |
| | 1/2" | 54965 |
| | 3/4" | 54966 |
| | 1" | 54967 |
| | 1-1/4" | 54968 |
| | 1-1/2" | 54969 |
| | 2" | 54970 |
| | 2-1/2" | 54971 |
| | 3" | 54972 |
| | 3-1/2" | 54973 |
| | 4" | 54974 |
| | 5" | 54975 |
| | 6" | 54976 |
| | 7" | 54977 |
| | 8" | 54978 |
| | 9" | 54979 |
| | 10" | 54980 |
| | 12" | 54981 |
| 7/16" | 7/16" | 54982 |

| 498 Low Carbon Precision Ground Flat Stock | | |
|---|---|---|
| **Thickness** | **Width** | **24" Length** |
| 1/2" | 1/2" | 54983 |
| | 3/4" | 54984 |
| | 1" | 54985 |
| | 1-1/4" | 54986 |
| | 1-1/2" | 54987 |
| | 2" | 54988 |
| | 2-1/2" | 54989 |
| | 3" | 54990 |
| | 3-1/2" | 54991 |
| | 4" | 54992 |
| | 5" | 54993 |
| | 6" | 54994 |
| | 7" | 54995 |
| | 8" | 54996 |
| | 9" | 54997 |
| | 10" | 54998 |
| | 12" | 54999 |
| 9/16" | 9/16" | 55000 |
| 5/8" | 5/8" | 55001 |
| | 3/4" | 55002 |
| | 1" | 55003 |
| | 1-1/4" | 55004 |
| | 1-1/2" | 55005 |
| | 2" | 55006 |
| | 2-1/2" | 55007 |
| | 3" | 55008 |
| | 3-1/2" | 55009 |
| | 4" | 55010 |
| | 5" | 55011 |
| | 6" | 55012 |
| | 7" | 55013 |
| | 8" | 55014 |
| | 9" | 55015 |
| | 10" | 55016 |
| | 12" | 57253 |
| 3/4" | 3/4" | 55017 |
| | 1" | 55018 |
| | 1-1/4" | 55019 |
| | 1-1/2" | 55020 |
| | 2" | 55021 |
| | 2-1/2" | 55022 |
| | 3" | 55023 |
| | 3-1/2" | 55024 |
| | 4" | 55025 |
| | 5" | 55026 |
| | 6" | 55027 |
| | 7" | 57254 |
| | 8" | 55028 |
| | 9" | 55029 |
| | 10" | 55030 |
| | 12" | 55031 |

| 498 Low Carbon Precision Ground Flat Stock | | |
|---|---|---|
| **Thickness** | **Width** | **24" Length** |
| 7/8" | 7/8" | 55032 |
| | 1" | 55033 |
| | 1-1/4" | 55034 |
| | 1-1/2" | 55035 |
| | 2" | 55036 |
| | 2-1/2" | 55037 |
| | 3" | 55038 |
| | 3-1/2" | 57255 |
| | 4" | 55039 |
| | 6" | 55040 |
| 1" | 1" | 55041 |
| | 1-1/4" | 55042 |
| | 1-1/2" | 55043 |
| | 2" | 55044 |
| | 2-1/2" | 55045 |
| | 3" | 55046 |
| | 3-1/2" | 55047 |
| | 4" | 55048 |
| | 5" | 55049 |
| | 6" | 55050 |
| | 7" | 57256 |
| | 8" | 55051 |
| | 9" | 55052 |
| | 10" | 55053 |
| | 12" | 55054 |
| 1-1/8" | 1-1/8" | 58288 |
| 1-1/4" | 1-1/4" | 55055 |
| | 1-1/2" | 55056 |
| | 2" | 55057 |
| | 2-1/2" | 55058 |
| | 3" | 55059 |
| | 4" | 55060 |
| | 5" | 55061 |
| | 6" | 55062 |
| | 8" | 55063 |
| | 10" | 55065 |
| | 12" | 57257 |
| 1-1/2" | 1-1/2" | 55066 |
| | 2" | 55067 |
| | 2-1/2" | 55068 |
| | 3" | 55069 |
| | 3-1/2" | 55070 |
| | 4" | 55071 |
| | 5" | 55072 |
| | 6" | 55073 |
| | 8" | 55074 |
| | 10" | 55075 |
| 2" | 2" | 55076 |
| 2-1/2" | 2-1/2" | 58289 |

Sizes other than listed priced on application



# Precision Drill Rod

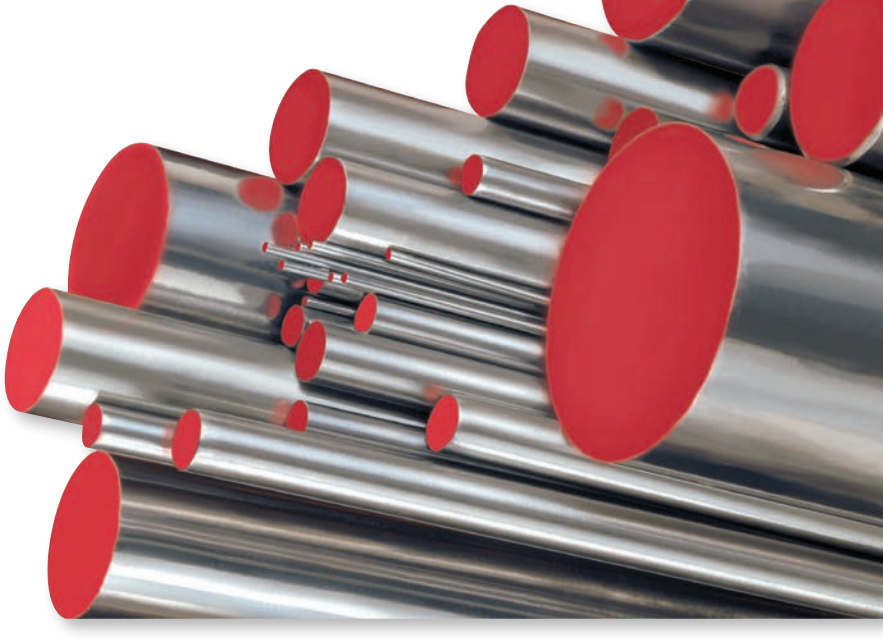
## O1 480 Precision Ground and Polished Drill Rod

AISI/SAE O1 is a general purpose tool steel with good wear resistance, toughness and machinability.

| Tolerances | | |
|---|---|---|
| **Size Range** | **Diameter** | **Length** |
| .124" round and less | ± .0003" | + 1/8"- 0 |
| .125" to .499" | ± .0005" | + 1/8"- 0 |
| .500" to 2" | ± .0010" | + 1/8"- 0 |

### Nominal Analysis (AISI O1)

| | |
|---|---|
| Carbon | .90 |
| Chromium | .50 |
| Manganese | 1.20 |
| Tungsten | .50 |
| Vanadium | .20 |



Heat Treatment and Tempering Data available upon request

## O1 480 Precision Ground and Polished Drill Rod

| Letter Sizes | | |
|---|---|---|
| **Diameter** | **Decimal** | **36" Length** |
| A | 0.2340 | 68201 |
| B | 0.2380 | 68202 |
| C | 0.2420 | 68203 |
| D | 0.2460 | 68204 |
| E | 0.2500 | 68205 |
| F | 0.2570 | 68206 |
| G | 0.2610 | 68207 |
| H | 0.2660 | 68208 |
| I | 0.2720 | 68209 |
| J | 0.2770 | 68210 |
| K | 0.2810 | 68211 |
| L | 0.2900 | 68212 |
| M | 0.2950 | 68213 |
| N | 0.3020 | 68214 |
| O | 0.3160 | 68215 |
| P | 0.3230 | 68216 |
| Q | 0.3320 | 68217 |
| R | 0.3390 | 68218 |
| S | 0.3480 | 68219 |
| T | 0.3580 | 68220 |
| U | 0.3680 | 68221 |
| V | 0.3770 | 68222 |
| W | 0.3860 | 68223 |
| X | 0.3970 | 68224 |
| Y | 0.4040 | 68225 |
| Z | 0.4130 | 68226 |

| Number Sizes | | |
|---|---|---|
| **Diameter** | **Decimal** | **36" Length** |
| 52 | 0.0630 | 68251 |
| 51 | 0.0660 | 68252 |
| 50 | 0.0690 | 68253 |
| 49 | 0.0720 | 68254 |
| 48 | 0.0750 | 68255 |
| 47 | 0.0770 | 68256 |
| 46 | 0.0790 | 68257 |
| 45 | 0.0810 | 68258 |
| 44 | 0.0850 | 68259 |
| 43 | 0.0880 | 68260 |
| 42 | 0.0920 | 68261 |
| 41 | 0.0950 | 68262 |
| 40 | 0.0970 | 68263 |
| 39 | 0.0990 | 68264 |
| 38 | 0.1010 | 68265 |
| 37 | 0.1030 | 68266 |
| 36 | 0.1060 | 68267 |
| 35 | 0.1080 | 68268 |
| 34 | 0.1100 | 68269 |
| 33 | 0.1120 | 68270 |
| 32 | 0.1150 | 68271 |
| 31 | 0.1200 | 68272 |
| 30 | 0.1270 | 68273 |
| 29 | 0.1340 | 68274 |
| 28 | 0.1390 | 68275 |
| 27 | 0.1430 | 68276 |

| Number Sizes | | |
|---|---|---|
| **Diameter** | **Decimal** | **36" Length** |
| 26 | 0.1460 | 68277 |
| 25 | 0.1480 | 68278 |
| 24 | 0.1510 | 68279 |
| 23 | 0.1530 | 68280 |
| 22 | 0.1550 | 68281 |
| 21 | 0.1570 | 68282 |
| 20 | 0.1610 | 68283 |
| 19 | 0.1640 | 68284 |
| 18 | 0.1680 | 68285 |
| 17 | 0.1720 | 68286 |
| 16 | 0.1750 | 68287 |
| 15 | 0.1780 | 68288 |
| 14 | 0.1800 | 68289 |
| 13 | 0.1820 | 68290 |
| 12 | 0.1850 | 68291 |
| 11 | 0.1880 | 68292 |
| 10 | 0.1910 | 68293 |
| 9 | 0.1940 | 68294 |
| 8 | 0.1970 | 68295 |
| 7 | 0.1990 | 68296 |
| 6 | 0.2010 | 68297 |
| 5 | 0.2040 | 68298 |
| 4 | 0.2070 | 68299 |
| 3 | 0.2120 | 68300 |
| 2 | 0.2190 | 68301 |
| 1 | 0.2270 | 68302 |

Sizes other than listed priced on application



## O1 480 Precision Ground and Polished Drill Rod

| Fractional Sizes | | |
|---|---|---|
| Diameter | | |
| Inch | Decimal | 36 Length |
| 1/16 | 0.0625 | 68303 |
| 5/64 | 0.0781 | 68304 |
| 3/32 | 0.0938 | 68305 |
| 7/64 | 0.1094 | 68306 |
| 1/8 | 0.1250 | 68307 |
| 9/64 | 0.1406 | 68308 |
| 5/32 | 0.1563 | 68309 |
| 11/64 | 0.1719 | 68310 |
| 3/16 | 0.1875 | 68311 |
| 13/64 | 0.2031 | 68312 |
| 7/32 | 0.2188 | 68313 |
| 15/64 | 0.2344 | 68314 |
| 1/4 | 0.2500 | 68315 |
| 17/64 | 0.2656 | 68316 |
| 9/32 | 0.2813 | 68317 |
| 19/64 | 0.2969 | 68318 |
| 5/16 | 0.3125 | 68319 |
| 21/64 | 0.3281 | 68320 |
| 11/32 | 0.3438 | 68321 |
| 23/64 | 0.3594 | 68322 |
| 3/8 | 0.3750 | 68323 |
| 25/64 | 0.3906 | 68324 |
| 13/32 | 0.4063 | 68325 |
| 27/64 | 0.4219 | 68326 |
| 7/16 | 0.4375 | 68327 |
| 29/64 | 0.4531 | 68328 |
| 15/32 | 0.4688 | 68329 |
| 31/64 | 0.4844 | 68330 |
| 1/2 | 0.5000 | 68331 |
| 33/64 | 0.5156 | 68332 |
| 17/32 | 0.5313 | 68333 |
| 35/64 | 0.5469 | 68334 |
| 9/16 | 0.5625 | 68335 |
| 37/64 | 0.5781 | 68336 |
| 19/32 | 0.5938 | 68337 |
| 39/64 | 0.6094 | 68338 |
| 5/8 | 0.6250 | 68339 |
| 41/64 | 0.6406 | 68340 |
| 21/32 | 0.6563 | 68341 |
| 43/64 | 0.6719 | 68342 |
| 11/16 | 0.6875 | 68343 |
| 45/64 | 0.7031 | 68344 |
| 23/32 | 0.7188 | 68345 |
| 47/64 | 0.7344 | 68346 |
| 3/4 | 0.7500 | 68347 |
| 49/64 | 0.7656 | 68348 |
| 25/32 | 0.7813 | 68349 |
| 51/64 | 0.7969 | 68350 |
| 13/16 | 0.8125 | 68351 |
| 53/64 | 0.8281 | 68352 |
| 27/32 | 0.8438 | 68353 |

| Fractional Sizes | | |
|---|---|---|
| Diameter | | |
| Inch | Decimal | 36 Length |
| 55/64 | 0.8594 | 68354 |
| 7/8 | 0.8750 | 68355 |
| 57/64 | 0.8906 | 68356 |
| 29/32 | 0.9063 | 68357 |
| 59/64 | 0.9219 | 68358 |
| 15/16 | 0.9375 | 68359 |
| 61/64 | 0.9531 | 68360 |
| 31/32 | 0.9688 | 68361 |
| 63/64 | 0.9844 | 68362 |
| 1 | 1.0000 | 68363 |
| 1-1/64 | 1.0156 | 68364 |
| 1-1/32 | 1.0313 | 68365 |
| 1-3/64 | 1.0469 | 68366 |
| 1-1/16 | 1.0625 | 68367 |
| 1-5/64 | 1.0781 | 68368 |
| 1-3/32 | 1.0938 | 68369 |
| 1-7/64 | 1.1094 | 68370 |
| 1-1/8 | 1.1250 | 68371 |
| 1-9/64 | 1.1406 | 68372 |
| 1-5/32 | 1.1563 | 68373 |
| 1-11/64 | 1.1719 | 68374 |
| 1-3/16 | 1.1875 | 68375 |
| 1-13/64 | 1.2031 | 68376 |
| 1-7/32 | 1.2188 | 68377 |
| 1-15/64 | 1.2344 | 68378 |
| 1-1/4 | 1.2500 | 68379 |
| 1-17/64 | 1.2656 | 68380 |
| 1-9/32 | 1.2813 | 68381 |
| 1-19/64 | 1.2969 | 68382 |
| 1-5/16 | 1.3125 | 68383 |
| 1-21/64 | 1.3281 | 68384 |
| 1-11/32 | 1.3438 | 68385 |
| 1-23/64 | 1.3594 | 68386 |
| 1-3/8 | 1.3750 | 68387 |
| 1-25/64 | 1.3906 | 68388 |
| 1-13/32 | 1.4063 | 68389 |
| 1-27/64 | 1.4219 | 68390 |
| 1-7/16 | 1.4375 | 68391 |
| 1-29/64 | 1.4531 | 68392 |
| 1-15/32 | 1.4688 | 68393 |
| 1-31/64 | 1.4844 | 68394 |
| 1-1/2 | 1.5000 | 68395 |
| 1-9/16 | 1.5625 | 68396 |
| 1-5/8 | 1.6250 | 68397 |
| 1-11/16 | 1.6875 | 68398 |
| 1-3/4 | 1.7500 | 68399 |
| 1-13/16 | 1.8125 | 68400 |
| 1-7/8 | 1.8750 | 68401 |
| 1-15/16 | 1.9375 | 68402 |
| 2 | 2.0000 | 68403 |

| Metric Sizes | | |
|---|---|---|
| Diameter | | |
| mm | Decimal | 36" Length |
| 2 | 0.0787 | 68227 |
| 3 | 0.1181 | 68228 |
| 4 | 0.1575 | 68229 |
| 5 | 0.1969 | 68230 |
| 6 | 0.2362 | 68231 |
| 7 | 0.2756 | 68232 |
| 8 | 0.3150 | 68233 |
| 9 | 0.3543 | 68234 |
| 10 | 0.3937 | 68235 |
| 11 | 0.4331 | 68236 |
| 12 | 0.4724 | 68237 |
| 13 | 0.5118 | 68238 |
| 14 | 0.5512 | 68239 |
| 15 | 0.5906 | 68240 |
| 16 | 0.6299 | 68241 |
| 17 | 0.6693 | 68242 |
| 18 | 0.7087 | 68243 |
| 19 | 0.7480 | 68244 |
| 20 | 0.7874 | 68245 |
| 21 | 0.8268 | 68246 |
| 22 | 0.8661 | 68247 |
| 23 | 0.9055 | 68248 |
| 24 | 0.9449 | 68249 |
| 25 | 0.9843 | 68250 |

Sizes other than listed priced on application



# Precision Drill Rod

## W1 481 Precision Ground and Polished Drill Rod

AISI/SAE W1 is a versatile and less expensive tool steel that has superior machinability and maintains good wear resistance and toughness characteristics.

| Tolerances | | |
|---|---|---|
| Size Range | Diameter | Length |
| .124" round and less | ± .0003" | + 1/8"- 0 |
| .125" to .499" | ± .0005" | + 1/8"- 0 |
| .500" to 2" | ± .0010" | + 1/8"- 0 |

### Nominal Analysis (AISI W1)

Carbon ..... .90-1.05
Manganese ..... .30-.50



Heat Treatment and Tempering Data available upon request

## W1 481 Precision Ground and Polished Drill Rod

| Letter Sizes | | |
|---|---|---|
| Diameter | Decimal | 36" Length |
| A | 0.2340 | 68404 |
| B | 0.2380 | 68405 |
| C | 0.2420 | 68406 |
| D | 0.2460 | 68407 |
| E | 0.2500 | 68408 |
| F | 0.2570 | 68409 |
| G | 0.2610 | 68410 |
| H | 0.2660 | 68411 |
| I | 0.2720 | 68412 |
| J | 0.2770 | 68413 |
| K | 0.2810 | 68414 |
| L | 0.2900 | 68415 |
| M | 0.2950 | 68416 |
| N | 0.3020 | 68417 |
| O | 0.3160 | 68418 |
| P | 0.3230 | 68419 |
| Q | 0.3320 | 68420 |
| R | 0.3390 | 68421 |
| S | 0.3480 | 68422 |
| T | 0.3580 | 68423 |
| U | 0.3680 | 68424 |
| V | 0.3770 | 68425 |
| W | 0.3860 | 68426 |
| X | 0.3970 | 68427 |
| Y | 0.4040 | 68428 |
| Z | 0.4130 | 68429 |

| Number Sizes | | |
|---|---|---|
| Diameter | Decimal | 36" Length |
| 52 | 0.0630 | 68430 |
| 51 | 0.0660 | 68431 |
| 50 | 0.0690 | 68432 |
| 49 | 0.0720 | 68433 |
| 48 | 0.0750 | 68434 |
| 47 | 0.0770 | 68435 |
| 46 | 0.0790 | 68436 |
| 45 | 0.0810 | 68437 |
| 44 | 0.0850 | 68438 |
| 43 | 0.0880 | 68439 |
| 42 | 0.0920 | 68440 |
| 41 | 0.0950 | 68441 |
| 40 | 0.0970 | 68442 |
| 39 | 0.0990 | 68443 |
| 38 | 0.1010 | 68444 |
| 37 | 0.1030 | 68445 |
| 36 | 0.1060 | 68446 |
| 35 | 0.1080 | 68447 |
| 34 | 0.1100 | 68448 |
| 33 | 0.1120 | 68449 |
| 32 | 0.1150 | 68450 |
| 31 | 0.1200 | 68451 |
| 30 | 0.1270 | 68452 |
| 29 | 0.1340 | 68453 |
| 28 | 0.1390 | 68454 |
| 27 | 0.1430 | 68455 |

| Number Sizes | | |
|---|---|---|
| Diameter | Decimal | 36" Length |
| 26 | 0.1460 | 68456 |
| 25 | 0.1480 | 68457 |
| 24 | 0.1510 | 68458 |
| 23 | 0.1530 | 68459 |
| 22 | 0.1550 | 68460 |
| 21 | 0.1570 | 68461 |
| 20 | 0.1610 | 68462 |
| 19 | 0.1640 | 68463 |
| 18 | 0.1680 | 68464 |
| 17 | 0.1720 | 68465 |
| 16 | 0.1750 | 68466 |
| 15 | 0.1780 | 68467 |
| 14 | 0.1800 | 68468 |
| 13 | 0.1820 | 68469 |
| 12 | 0.1850 | 68470 |
| 11 | 0.1880 | 68471 |
| 10 | 0.1910 | 68472 |
| 9 | 0.1940 | 68473 |
| 8 | 0.1970 | 68474 |
| 7 | 0.1990 | 68475 |
| 6 | 0.2010 | 68476 |
| 5 | 0.2040 | 68477 |
| 4 | 0.2070 | 68478 |
| 3 | 0.2120 | 68479 |
| 2 | 0.2190 | 68480 |
| 1 | 0.2270 | 68481 |

Sizes other than listed priced on application



## W1 481 Precision Ground and Polished Drill Rod

| Fractional Sizes | | |
|---|---|---|
| Diameter | | 36" Length |
| Inch | Decimal | |
| 1/16 | 0.0625 | 68482 |
| 5/64 | 0.0781 | 68483 |
| 3/32 | 0.0938 | 68484 |
| 7/64 | 0.1094 | 68485 |
| 1/8 | 0.1250 | 68486 |
| 9/64 | 0.1406 | 68487 |
| 5/32 | 0.1563 | 68488 |
| 11/64 | 0.1719 | 68489 |
| 3/16 | 0.1875 | 68490 |
| 13/64 | 0.2031 | 68491 |
| 7/32 | 0.2188 | 68492 |
| 15/64 | 0.2344 | 68493 |
| 1/4 | 0.2500 | 68494 |
| 17/64 | 0.2656 | 68495 |
| 9/32 | 0.2813 | 68496 |
| 19/64 | 0.2969 | 68497 |
| 5/16 | 0.3125 | 68498 |
| 21/64 | 0.3281 | 68499 |
| 11/32 | 0.3438 | 68500 |
| 23/64 | 0.3594 | 68501 |
| 3/8 | 0.3750 | 68502 |
| 25/64 | 0.3906 | 68503 |
| 13/32 | 0.4063 | 68504 |
| 27/64 | 0.4219 | 68505 |
| 7/16 | 0.4375 | 68506 |
| 29/64 | 0.4531 | 68507 |
| 15/32 | 0.4688 | 68508 |
| 31/64 | 0.4844 | 68509 |
| 1/2 | 0.5000 | 68510 |
| 33/64 | 0.5156 | 68511 |
| 17/32 | 0.5313 | 68512 |
| 35/64 | 0.5469 | 68513 |
| 9/16 | 0.5625 | 68514 |
| 37/64 | 0.5781 | 68515 |
| 19/32 | 0.5938 | 68516 |
| 39/64 | 0.6094 | 68517 |
| 5/8 | 0.6250 | 68518 |
| 41/64 | 0.6406 | 68519 |
| 21/32 | 0.6563 | 68520 |
| 43/64 | 0.6719 | 68521 |
| 11/16 | 0.6875 | 68522 |
| 45/64 | 0.7031 | 68523 |
| 23/32 | 0.7188 | 68524 |
| 47/64 | 0.7344 | 68525 |
| 3/4 | 0.7500 | 68526 |
| 49/64 | 0.7656 | 68527 |
| 25/32 | 0.7813 | 68528 |
| 51/64 | 0.7969 | 68529 |
| 13/16 | 0.8125 | 68530 |
| 53/64 | 0.8281 | 68531 |

| Fractional Sizes | | |
|---|---|---|
| Diameter | | 36" Length |
| Inch | Decimal | |
| 27/32 | 0.8438 | 68532 |
| 55/64 | 0.8594 | 68533 |
| 7/8 | 0.8750 | 68534 |
| 57/64 | 0.8906 | 68535 |
| 29/32 | 0.9063 | 68536 |
| 59/64 | 0.9219 | 68537 |
| 15/16 | 0.9375 | 68538 |
| 61/64 | 0.9531 | 68539 |
| 31/32 | 0.9688 | 68540 |
| 63/64 | 0.9844 | 68541 |
| 1 | 1.0000 | 68542 |
| 1-1/64 | 1.0156 | 68543 |
| 1-1/32 | 1.0313 | 68544 |
| 1-3/64 | 1.0469 | 68545 |
| 1-1/16 | 1.0625 | 68546 |
| 1-5/64 | 1.0781 | 68547 |
| 1-3/32 | 1.0938 | 68548 |
| 1-7/64 | 1.1094 | 68549 |
| 1-1/8 | 1.1250 | 68550 |
| 1-9/64 | 1.1406 | 68551 |
| 1-5/32 | 1.1563 | 68552 |
| 1-11/64 | 1.1719 | 68553 |
| 1-3/16 | 1.1875 | 68554 |
| 1-13/64 | 1.2031 | 68555 |
| 1-15/64 | 1.2344 | 68557 |
| 1-1/4 | 1.2500 | 68558 |
| 1-17/64 | 1.2656 | 68559 |
| 1-9/32 | 1.2813 | 68560 |
| 1-19/64 | 1.2969 | 68561 |
| 1-5/16 | 1.3125 | 68562 |
| 1-21/64 | 1.3281 | 68563 |
| 1-11/32 | 1.3438 | 68564 |
| 1-23/64 | 1.3594 | 68565 |
| 1-3/8 | 1.3750 | 68566 |
| 1-25/64 | 1.3906 | 68567 |
| 1-13/32 | 1.4063 | 68568 |
| 1-27/64 | 1.4219 | 68569 |
| 1-7/16 | 1.4375 | 68570 |
| 1-29/64 | 1.4531 | 68571 |
| 1-15/32 | 1.4688 | 68572 |
| 1-31/64 | 1.4844 | 68573 |
| 1-1/2 | 1.5000 | 68574 |
| 1-9/16 | 1.5625 | 68575 |
| 1-5/8 | 1.6250 | 68576 |
| 1-11/16 | 1.6875 | 68577 |
| 1-3/4 | 1.7500 | 68578 |
| 1-13/16 | 1.8125 | 68579 |
| 1-7/8 | 1.8750 | 68580 |
| 1-15/16 | 1.9375 | 68581 |
| 2 | 2.0000 | 68582 |

Sizes other than listed priced on application



# Precision Drill Rod

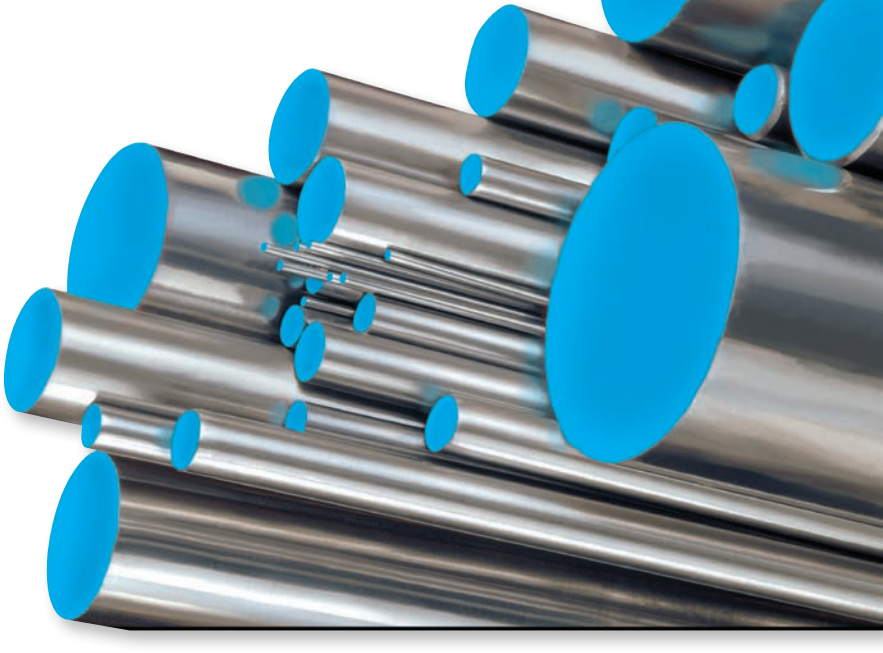
## A2 482 Precision Ground and Polished Drill Rod

AISI/SAE A2 is a more highly alloyed tool steel that provides excellent wear resistance and toughness and good machinability.

| Tolerances | | |
|---|---|---|
| **Size Range** | **Diameter** | **Length** |
| .124" round and less | ± .0003" | + 1/8"- 0 |
| .125" to .499" | ± .0005" | + 1/8"- 0 |
| .500" to 2" | ± .0010" | + 1/8"- 0 |

### Nominal Analysis (AISI A2)

| | |
|---|---|
| Carbon | 1.00 |
| Chromium | 5.25 |
| Manganese | .60 |
| Molybdenum | 1.00 |
| Silicon | .40 |
| Vanadium | .25 |



Heat Treatment and Tempering Data available upon request

## A2 482 Precision Ground and Polished Drill Rod

| Fractional Sizes | | |
|---|---|---|
| **Diameter** | | **36" Length** |
| **Inch** | **Decimal** | |
| 1/16 | 0.0625 | 68662 |
| 5/64 | 0.0781 | 68663 |
| 3/32 | 0.0938 | 68664 |
| 7/64 | 0.1094 | 68665 |
| 1/8 | 0.1250 | 68583 |
| 9/64 | 0.1406 | 68666 |
| 5/32 | 0.1563 | 68631 |
| 11/64 | 0.1719 | 68667 |
| 3/16 | 0.1875 | 68584 |
| 13/64 | 0.2031 | 68668 |
| 7/32 | 0.2188 | 68632 |
| 15/64 | 0.2344 | 68669 |
| 1/4 | 0.2500 | 68585 |
| 17/64 | 0.2656 | 68670 |
| 9/32 | 0.2813 | 68633 |
| 19/64 | 0.2969 | 68671 |
| 5/16 | 0.3125 | 68586 |
| 21/64 | 0.3281 | 68672 |
| 11/32 | 0.3438 | 68634 |
| 23/64 | 0.3594 | 68673 |
| 3/8 | 0.3750 | 68587 |
| 25/64 | 0.3906 | 68674 |
| 13/32 | 0.4063 | 68675 |
| 27/64 | 0.4219 | 68676 |

| Fractional Sizes | | |
|---|---|---|
| **Diameter** | | **36" Length** |
| **Inch** | **Decimal** | |
| 7/16 | 0.4375 | 68588 |
| 29/64 | 0.4531 | 68677 |
| 15/32 | 0.4688 | 68678 |
| 31/64 | 0.4844 | 68679 |
| 1/2 | 0.5000 | 68589 |
| 17/32 | 0.5313 | 68680 |
| 9/16 | 0.5625 | 68590 |
| 19/32 | 0.5938 | 68681 |
| 5/8 | 0.6250 | 68591 |
| 21/32 | 0.6563 | 68682 |
| 11/16 | 0.6875 | 68592 |
| 23/32 | 0.7188 | 68683 |
| 3/4 | 0.7500 | 68593 |
| 13/16 | 0.8125 | 68594 |
| 7/8 | 0.8750 | 68595 |
| 15/16 | 0.9375 | 68684 |
| 1 | 1.0000 | 68596 |
| 11/16 | 1.0625 | 68685 |
| 1-1/8 | 1.1250 | 68597 |
| 1-1/4 | 1.2500 | 68598 |
| 13/8 | 1.3750 | 68686 |
| 1-1/2 | 1.5000 | 68599 |
| 13/4 | 1.7500 | 68687 |
| 2 | 2.0000 | 68688 |

Sizes other than listed priced on application





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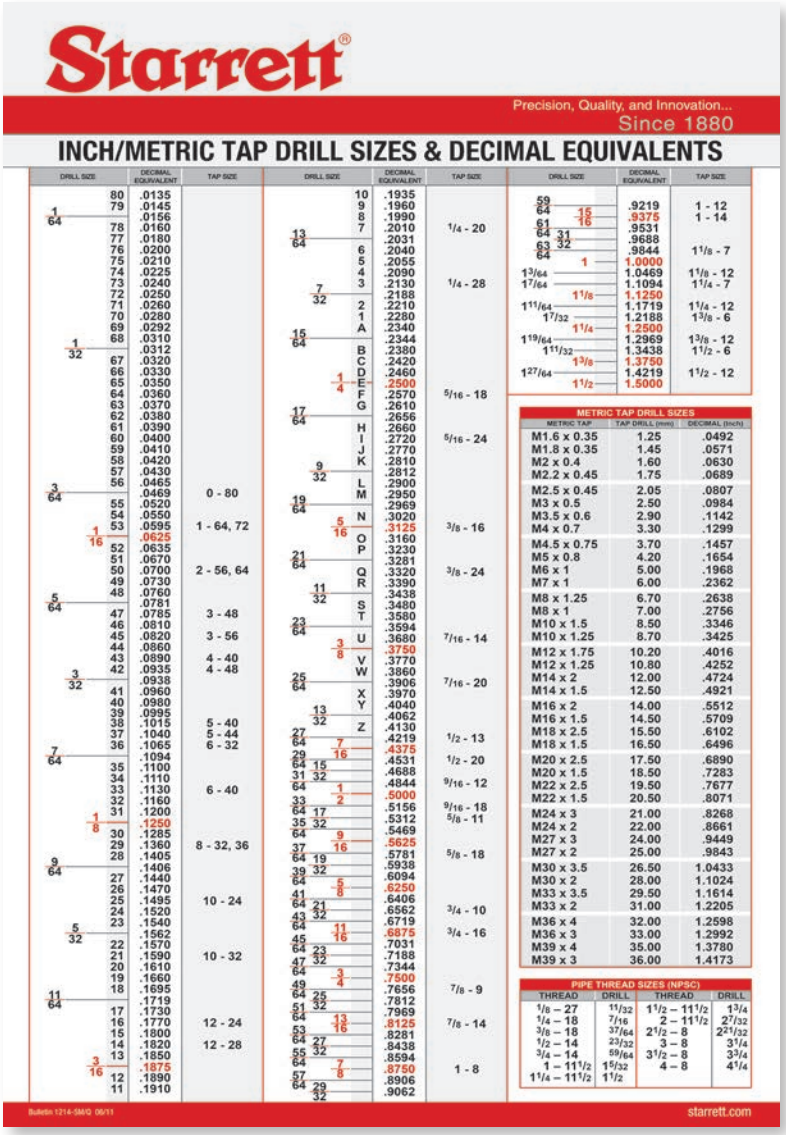
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## INCH/METRIC TAP DRILL SIZES AND DECIMAL EQUIVALENTS WALL CHART

Suited for factory-machine areas and tool cribs, as well as classroom use. Charts are packed one per tube.

Decimal equivalents of 8ths, 16ths, 32nds and 64ths of an inch; decimal equivalents of letter size drills (A-Z) and number size drills (1-80); drill sizes for standard taps from #0-80 to 1-1/2–12 (approximately 65% thread); and pipe taps from 1/8-27 to 4-8. Metric tap/drill sizes section. Size 25" x 41-1/2" (635 x 1054mm).







## MEMO NOTEPADS

Convenient 40-paged notepad featuring the 795 Electronic Micrometer on the front cover. Measures 3" x 5".




## PRECISION TOOL POSTER

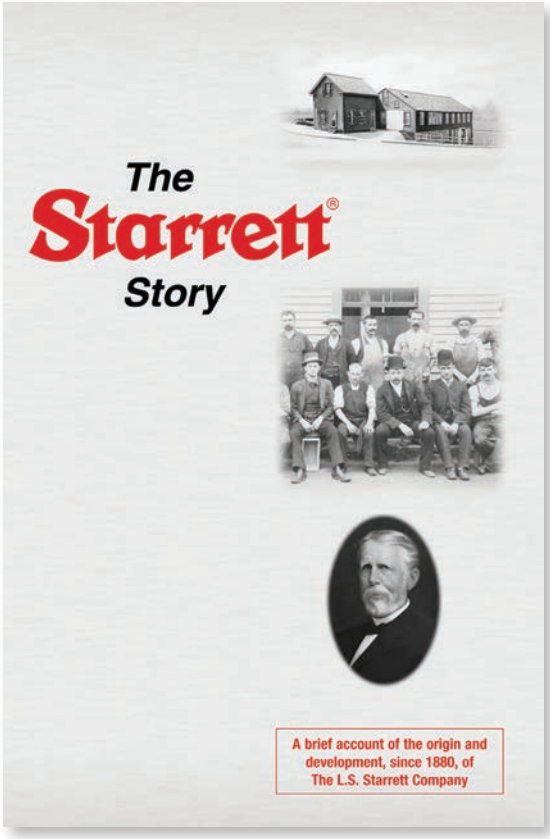
Attractive wall poster displaying a sample of our most popular tools. Posters are packed 1 per tube. Measures 26" x 39".

## Tools and Rules for Precision Measuring

This valuable and popular training aid includes coverage of newer tools as well as the familiar reference material to traditional topics. This booklet tells the story of precision measurements in down-to-earth language that has been popular over the years.

Information includes: linear measuring standards; measuring and transferring measurements; steel rules; calipers and dividers; how to read vernier tools and the micrometer; types of micrometers; gage blocks and digital measuring tools; dial indicators; layout with accuracy; measuring lathe work; measuring screw threads; facts about fit; limits of tolerance; electronic tools; and also includes a helpful reference section – decimal equivalents, squares, cubes, square and cube roots, tap drill and screw thread information.

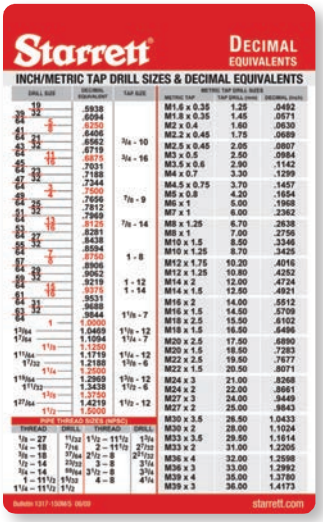


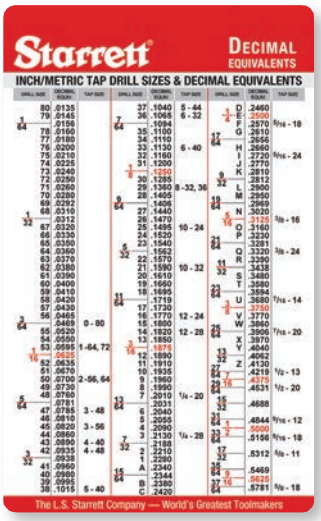



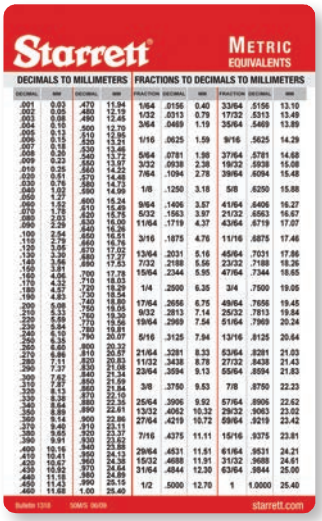

## The Starrett Story

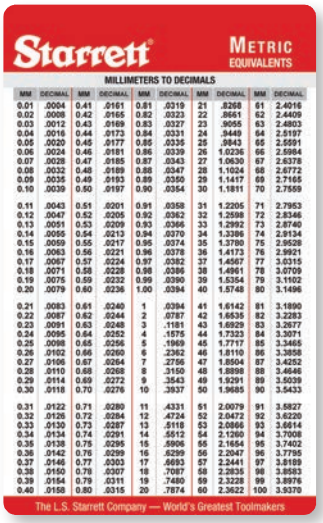
A brief history of The L.S. Starrett Company, which was founded over 133 years ago by an early mechanical genius, Laroy S. Starrett. It reviews the founder's boyhood years, business problems and successes, tools introduced, personal philosophy and community service. A fascinating story of ambition, perseverance, accomplishment and contribution to industry and his fellow man.






## Decimal Equivalents Card

Card shows decimal equivalents of 8ths, 16ths, 32nds and 64ths of an inch; decimal equivalents of letter size drills (A-Z) and number size drills (1-80); drill sizes for standard taps from #0-80 to 1-1/2-12 (approximately 65% thread); and pipe taps from 1/8-27 to 4-8. Metric tap/drill sizes section. Printed on two sides in red and black. Pocket size 3" x 5" (75 x 125mm).

## Metric Equivalents Card

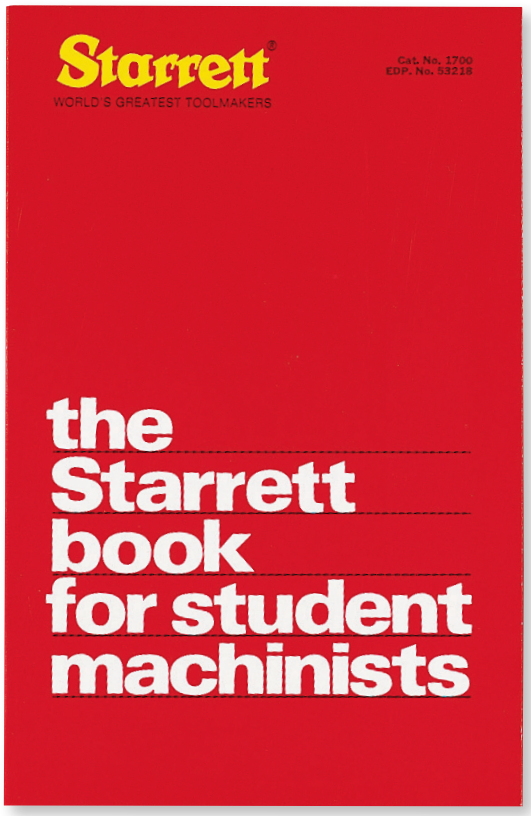
Card shows millimeters to decimals equivalents from 0.01 mm to 100mm (.0004"-3.9370"); decimals-to-millimeters from .001" to 1.00" (0.03-25.40mm); and fractions-to- decimals-to-millimeters from 1/64" to 1" (0.40-25.40mm). Printed on two sides in red and black. Pocket size 3" x 5" (75 x 125mm).

# Priced Literature

## The Starrett Book for Student Machinists

This familiar handbook for machine shop beginners is written in clear, simple language, contains 160 pages including 200 diagrams, illustrations, reference tables, and is fully indexed. Printed on coated paper with soil-resistant binding for durable machine shop use.

Chapter Headings: Mechanical Drawings; Fits and Terminology; Bench Work; How to Make Measurements; Cutting Speed and Cutting Fluids; Drilling and Related Operations; Lathe Operations; Grinding; Metal Sawing; Toolmaking; Geometry; Mechanics.







## Set of 17 Educational Charts

### WALL SIZE | THREE-RING NOTEBOOK SIZE

Seventeen white print charts help learners recognize basic tools, their principal parts and uses. Tools illustrated: outside and inside micrometers; micrometer depth gage; vernier caliper and height gage; electronic micrometer and caliper; hook rule; combination square and bevel protractor; dial indicator and dial test indicators; dial caliper; magnetic base indicator holders; surface gage.
The set includes sheets on "How to Read Metric Measuring Tools" and "How to Read English Measuring Tools."

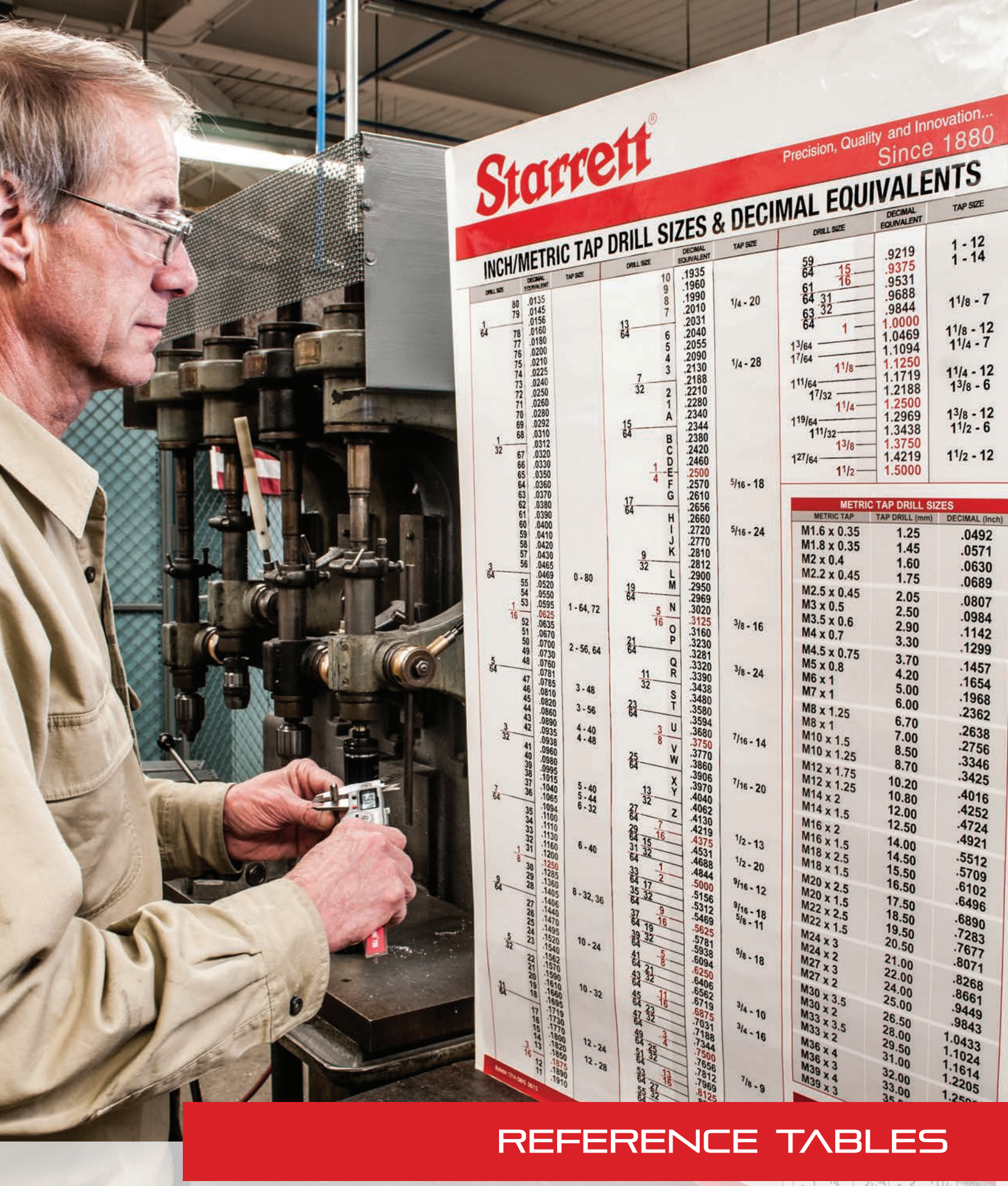
Wall size charts are 18-5/8" x 14-5/8" (473 x 371mm). Notebook size is 3-hole punched and 11" x 8-1/2" (280 x 216mm).

**Priced Educational Material**

| Description | Cat. No. | EDP |
|---|---|---|
| The Starrett Book for Student Machinists | 1700 | 53218 |
| Wall Size Educational Charts | 1702 | 56172 |
| Three-Ring Notebook Size Educational Charts | 1715 | 53220 |

## How to Order Priced Literature

To order priced literature please contact Customer Service at (978) 249-3551 extension 400.




# REFERENCE TABLES

# Metric and English Equivalents

| Linear Measure | |
|---|---|
| **Metric to Inch** | **Inch to Metric** |
| 1 millimeter = 0.03937 inch | 1 inch = 25.4 millimeters = 2.54 centimeters |
| 1 centimeter = 0.3937 inch | 1 foot = 304.8 millimeters = 0.3048 meter |
| 1 meter = 39.37 inches = 3.2808 feet = 1.0936 yards | 1 yard = 0.9144 meter |
| 1 kilometer = 0.6214 mile | 1 mile = 1.609 kilometers |

| Square Measure | |
|---|---|
| **Metric to Inch** | **Inch to Metric** |
| 1 square millimeter = 0.00155 square inch | 1 square inch = 6.452 square centimeters = 645.2 square millimeters |
| 1 square centimeter = 0.155 square inch | 1 square foot = 0.0929 square meter = 929 square centimeters |
| 1 square meter = 10.764 square feet = 1.196 square yards | 1 square yard = 0.836 square meter |
| 1 are = 0.0247 acre = 1076.4 square feet | 1 acre = 0.4047 hectare = 40.47 ares |
| 1 hectare = 2.471 acres = 107,639 square feet | 1 square mile = 2.5900 square kilometers |
| 1 square kilometer = 0.3861 square mile = 247.1 acres | |

| Cubic Measure | |
|---|---|
| **Metric to English** | **English to Metric** |
| 1 liter = 0.2642 U.S. gallon = 1.0567 U.S. quarts | 1 U.S. quart = 0.946 liter |
| 1 liter (cubic decimeter) = 0.0353 cubic foot = 61.024 cubic inches | 1 U.S. gallon = 3.785 liters = 231 cubic inches |
| 1 cubic centimeter = 0.061 cubic inch | 1 cubic inch = 16.38706 cubic centimeters |
| 1 cubic meter = 264.2 U.S. gallons | 1 cubic foot = 0.02832 cubic meter = 28.317 liters |
| 1 cubic meter = 35.315 cubic feet = 1.308 cubic yards | 1 cubic yard = 0.7646 cubic meter |

| Weight | |
|---|---|
| **Metric to English** | **English to Metric** |
| 1 gram = 15.432 grains | 1 grain = 0.0648 gram |
| 1 gram = 0.03527 ounce avoirdupois (Commercial) | 1 ounce avoirdupois (Commercial) = 28.35 grams |
| 1 kilogram = 2.2046 pounds = 35.274 ounces avoirdupois (Commercial) | 1 pound = 0.4536 kilogram = 453.6 grams |
| 1 metric ton = 0.9842 ton (of 2240 pounds) = 2204.6 pounds | 1 short ton (2,000 pounds) = .907 metric ton = 907 kilograms |

# Inch to Millimeter Conversions



| Decimal | mm |
|---|---|
| 0.001 | 0.0254 |
| 0.002 | 0.0508 |
| 0.003 | 0.0762 |
| 0.004 | 0.1016 |
| 0.005 | 0.1270 |
| 0.006 | 0.1524 |
| 0.007 | 0.1778 |
| 0.008 | 0.2032 |
| 0.009 | 0.2286 |
| 0.010 | 0.2540 |
| 0.020 | 0.5080 |
| 0.030 | 0.7620 |
| 0.040 | 1.0160 |
| 0.050 | 1.2700 |
| 0.060 | 1.5240 |
| 0.070 | 1.7780 |
| 0.080 | 2.0320 |
| 0.090 | 2.2860 |
| 0.100 | 2.5400 |
| 0.110 | 2.7940 |
| 0.120 | 3.0480 |
| 0.130 | 3.3020 |
| 0.140 | 3.5560 |
| 0.150 | 3.8100 |
| 0.160 | 4.0640 |
| 0.170 | 4.3180 |
| 0.180 | 4.5720 |
| 0.190 | 4.8260 |
| 0.200 | 5.0800 |
| 0.210 | 5.3340 |
| 0.220 | 5.5880 |
| 0.230 | 5.8420 |
| 0.240 | 6.0690 |
| 0.250 | 6.3500 |
| 0.260 | 6.6040 |
| 0.270 | 6.8580 |
| 0.280 | 7.1120 |
| 0.290 | 7.3660 |
| 0.300 | 7.6200 |
| 0.310 | 7.8740 |
| 0.320 | 8.1280 |
| 0.330 | 8.3820 |
| 0.340 | 8.6360 |
| 0.350 | 8.8900 |
| 0.360 | 9.1440 |
| 0.370 | 9.3980 |
| 0.380 | 9.6520 |
| 0.390 | 9.9060 |
| 0.400 | 10.1600 |
| 0.410 | 10.4140 |
| 0.420 | 10.6680 |
| 0.430 | 10.9220 |
| 0.440 | 11.1760 |
| 0.450 | 11.4300 |
| 0.460 | 11.6840 |
| 0.470 | 11.9380 |
| 0.480 | 12.1920 |
| 0.490 | 12.4460 |

| Decimal | mm |
|---|---|
| 0.500 | 12.7000 |
| 0.510 | 12.9540 |
| 0.520 | 13.2080 |
| 0.530 | 13.4620 |
| 0.540 | 13.7160 |
| 0.550 | 13.9700 |
| 0.560 | 14.2240 |
| 0.570 | 14.4780 |
| 0.580 | 14.7320 |
| 0.590 | 14.9860 |
| 0.600 | 15.2400 |
| 0.610 | 15.4940 |
| 0.620 | 15.7480 |
| 0.630 | 16.0020 |
| 0.640 | 16.2560 |
| 0.650 | 16.5100 |
| 0.660 | 16.7640 |
| 0.670 | 17.0180 |
| 0.680 | 17.2720 |
| 0.690 | 17.5260 |
| 0.700 | 17.7800 |
| 0.710 | 18.0340 |
| 0.720 | 18.2880 |
| 0.730 | 18.5420 |
| 0.740 | 18.7960 |
| 0.750 | 19.0500 |
| 0.760 | 19.3040 |
| 0.770 | 19.5580 |
| 0.780 | 19.8120 |
| 0.790 | 20.0660 |
| 0.800 | 20.3200 |
| 0.810 | 20.5740 |
| 0.820 | 20.8280 |
| 0.830 | 21.0820 |
| 0.840 | 21.3360 |
| 0.850 | 21.5900 |
| 0.860 | 21.8440 |
| 0.870 | 22.0980 |
| 0.880 | 22.3520 |
| 0.890 | 22.6060 |
| 0.900 | 22.8600 |
| 0.910 | 23.1140 |
| 0.920 | 23.3680 |
| 0.930 | 23.6220 |
| 0.940 | 23.8760 |
| 0.950 | 24.1300 |
| 0.960 | 24.3840 |
| 0.970 | 24.6380 |
| 0.980 | 24.8920 |
| 0.990 | 25.1460 |
| 1.000 | 25.4000 |

| Fraction | Decimal | mm |
|---|---|---|
| 1/64 | 0.0156 | 0.3969 |
| 1/32 | 0.0313 | 0.7938 |
| 3/64 | 0.0469 | 1.1906 |
| 1/16 | 0.0625 | 1.5875 |
| 5/64 | 0.0781 | 1.9844 |
| 3/32 | 0.0938 | 2.3812 |
| 7/64 | 0.1094 | 2.7781 |
| 1/8 | 0.1250 | 3.1750 |
| 9/64 | 0.1406 | 3.5719 |
| 5/32 | 0.1563 | 3.9688 |
| 11/64 | 0.1719 | 4.3656 |
| 3/16 | 0.1875 | 4.7625 |
| 13/64 | 0.2031 | 5.1594 |
| 7/32 | 0.2188 | 5.5562 |
| 15/64 | 0.2344 | 5.9531 |
| 1/4 | 0.2500 | 6.3500 |
| 17/64 | 0.2656 | 6.7469 |
| 9/32 | 0.2813 | 7.1438 |
| 19/64 | 0.2969 | 7.5406 |
| 5/16 | 0.3125 | 7.9375 |
| 21/64 | 0.3281 | 8.3344 |
| 11/32 | 0.3438 | 8.7312 |
| 23/64 | 0.3594 | 9.1281 |
| 3/8 | 0.3750 | 9.5250 |
| 25/64 | 0.3906 | 9.9219 |
| 13/32 | 0.4063 | 10.3188 |
| 27/64 | 0.4219 | 10.7156 |
| 7/16 | 0.4375 | 11.1125 |
| 29/64 | 0.4531 | 11.5094 |
| 15/32 | 0.4688 | 11.9062 |
| 31/64 | 0.4844 | 12.3031 |
| 1/2 | 0.5000 | 12.700 |

| Fraction | Decimal | mm |
|---|---|---|
| 33/64 | 0.5156 | 13.0969 |
| 17/32 | 0.5313 | 13.4938 |
| 35/64 | 0.5469 | 13.8906 |
| 9/16 | 0.5625 | 14.2875 |
| 37/64 | 0.5781 | 14.6844 |
| 19/32 | 0.5938 | 15.0812 |
| 39/64 | 0.6094 | 15.4781 |
| 5/8 | 0.6250 | 15.8750 |
| 41/64 | 0.6406 | 16.2719 |
| 21/32 | 0.6563 | 16.6688 |
| 43/64 | 0.6719 | 17.0656 |
| 11/16 | 0.6875 | 17.4625 |
| 45/64 | 0.7031 | 17.8594 |
| 23/32 | 0.7188 | 18.2562 |
| 47/64 | 0.7344 | 18.6531 |
| 3/4 | 0.7500 | 19.0500 |
| 49/64 | 0.7656 | 19.4469 |
| 25/32 | 0.7813 | 19.8438 |
| 51/64 | 0.7969 | 20.2406 |
| 13/16 | 0.8125 | 20.6375 |
| 53/64 | 0.8281 | 21.0344 |
| 27/32 | 0.8438 | 21.4312 |
| 55/64 | 0.8594 | 21.8281 |
| 7/8 | 0.8750 | 22.2250 |
| 57/64 | 0.8906 | 22.6219 |
| 29/32 | 0.9063 | 23.0188 |
| 59/64 | 0.9219 | 23.4156 |
| 15/16 | 0.9375 | 23.8125 |
| 61/64 | 0.9531 | 24.2094 |
| 31/32 | 0.9688 | 24.6062 |
| 63/64 | 0.9844 | 25.0031 |
| 1 | 1.0000 | 25.4000 |

# Millimeter to Inch Conversions

| mm | Decimal |
|---|---|
| 0.01 | .00039 |
| 0.02 | .00079 |
| 0.03 | .00118 |
| 0.04 | .00157 |
| 0.05 | .00197 |
| 0.06 | .00236 |
| 0.07 | .00276 |
| 0.08 | .00315 |
| 0.09 | .00354 |
| 0.10 | .00394 |
| 0.11 | .00433 |
| 0.12 | .00472 |
| 0.13 | .00512 |
| 0.14 | .00551 |
| 0.15 | .00591 |
| 0.16 | .00630 |
| 0.17 | .00669 |
| 0.18 | .00709 |
| 0.19 | .00748 |
| 0.20 | .00787 |
| 0.21 | .00827 |
| 0.22 | .00866 |
| 0.23 | .00906 |
| 0.24 | .00945 |
| 0.25 | .00984 |
| 0.26 | .01024 |
| 0.27 | .01063 |
| 0.28 | .01102 |
| 0.29 | .01142 |
| 0.30 | .01181 |
| 0.31 | .01220 |
| 0.32 | .01260 |
| 0.33 | .01299 |
| 0.34 | .01339 |
| 0.35 | .01378 |
| 0.36 | .01417 |
| 0.37 | .01457 |
| 0.38 | .01496 |
| 0.39 | .01535 |
| 0.40 | .01575 |
| 0.41 | .01614 |
| 0.42 | .01654 |
| 0.43 | .01693 |
| 0.44 | .01732 |
| 0.45 | .01772 |
| 0.46 | .01811 |
| 0.47 | .01850 |
| 0.48 | .01890 |
| 0.49 | .01929 |
| 0.50 | .01969 |

| mm | Decimal |
|---|---|
| 0.51 | .02008 |
| 0.52 | .02047 |
| 0.53 | .02087 |
| 0.54 | .02126 |
| 0.55 | .02165 |
| 0.56 | .02205 |
| 0.57 | .02244 |
| 0.58 | .02283 |
| 0.59 | .02323 |
| 0.60 | .02362 |
| 0.61 | .02402 |
| 0.62 | .02441 |
| 0.63 | .02480 |
| 0.64 | .02520 |
| 0.65 | .02559 |
| 0.66 | .02598 |
| 0.67 | .02638 |
| 0.68 | .02677 |
| 0.69 | .02717 |
| 0.70 | .02756 |
| 0.71 | .02795 |
| 0.72 | .02835 |
| 0.73 | .02874 |
| 0.74 | .02913 |
| 0.75 | .02953 |
| 0.76 | .02992 |
| 0.77 | .03031 |
| 0.78 | .03071 |
| 0.79 | .03110 |
| 0.80 | .03150 |
| 0.81 | .03189 |
| 0.82 | .03228 |
| 0.83 | .03268 |
| 0.84 | .03307 |
| 0.85 | .03346 |
| 0.86 | .03386 |
| 0.87 | .03425 |
| 0.88 | .03465 |
| 0.89 | .03504 |
| 0.90 | .03543 |
| 0.91 | .03583 |
| 0.92 | .03622 |
| 0.93 | .03661 |
| 0.94 | .03701 |
| 0.95 | .03740 |
| 0.96 | .03780 |
| 0.97 | .03819 |
| 0.98 | .03858 |
| 0.99 | .03898 |
| 1.00 | .03937 |

| mm | Decimal |
|---|---|
| 1 | .03937 |
| 2 | .07874 |
| 3 | .11811 |
| 4 | .15748 |
| 5 | .19685 |
| 6 | .23622 |
| 7 | .27559 |
| 8 | .31496 |
| 9 | .35433 |
| 10 | .39370 |
| 11 | .43307 |
| 12 | .47244 |
| 13 | .51181 |
| 14 | .55118 |
| 15 | .59055 |
| 16 | .62992 |
| 17 | .66929 |
| 18 | .70866 |
| 19 | .74803 |
| 20 | .78740 |
| 21 | .82677 |
| 22 | .86614 |
| 23 | .90551 |
| 24 | .94488 |
| 25 | .98425 |
| 26 | 1.02362 |
| 27 | 1.06299 |
| 28 | 1.10236 |
| 29 | 1.14173 |
| 30 | 1.18110 |
| 31 | 1.22047 |
| 32 | 1.25984 |
| 33 | 1.29921 |
| 34 | 1.33858 |
| 35 | 1.37795 |
| 36 | 1.41732 |
| 37 | 1.45669 |
| 38 | 1.49606 |
| 39 | 1.53543 |
| 40 | 1.57480 |
| 41 | 1.61417 |
| 42 | 1.65354 |
| 43 | 1.69291 |
| 44 | 1.73228 |
| 45 | 1.77165 |
| 46 | 1.81102 |
| 47 | 1.85039 |
| 48 | 1.88976 |
| 49 | 1.92913 |
| 50 | 1.96850 |

| mm | Decimal |
|---|---|
| 51 | 2.00787 |
| 52 | 2.04724 |
| 53 | 2.08661 |
| 54 | 2.12598 |
| 55 | 2.16535 |
| 56 | 2.20472 |
| 57 | 2.24409 |
| 58 | 2.28346 |
| 59 | 2.32283 |
| 60 | 2.36220 |
| 61 | 2.40157 |
| 62 | 2.44094 |
| 63 | 2.48031 |
| 64 | 2.51969 |
| 65 | 2.55906 |
| 66 | 2.59843 |
| 67 | 2.63780 |
| 68 | 2.67717 |
| 69 | 2.71654 |
| 70 | 2.75591 |
| 71 | 2.79528 |
| 72 | 2.83465 |
| 73 | 2.87402 |
| 74 | 2.91339 |
| 75 | 2.95276 |
| 76 | 2.99213 |
| 77 | 3.03150 |
| 78 | 3.07087 |
| 79 | 3.11024 |
| 80 | 3.14961 |
| 81 | 3.18898 |
| 82 | 3.22835 |
| 83 | 3.26772 |
| 84 | 3.30709 |
| 85 | 3.34646 |
| 86 | 3.38583 |
| 87 | 3.42520 |
| 88 | 3.46457 |
| 89 | 3.50394 |
| 90 | 3.54331 |
| 91 | 3.58268 |
| 92 | 3.62205 |
| 93 | 3.66142 |
| 94 | 3.70079 |
| 95 | 3.74016 |
| 96 | 3.77953 |
| 97 | 3.81890 |
| 98 | 3.85827 |
| 99 | 3.89764 |
| 100 | 3.93701 |

# Decimal Equivalents of 8ths, 16ths, 32nds and 64ths

| 8ths |
|---|
| 1/8 = .125 |
| 1/4 = .250 |
| 3/8 = .375 |
| 1/2 = .500 |
| 5/8 = .625 |
| 3/4 = .750 |
| 7/8 = .875 |

| 16ths |
|---|
| 1/16 = .0625 |
| 3/16 = .1875 |
| 5/16 = .3125 |
| 7/16 = .4375 |
| 9/16 = .5625 |
| 11/16 = .6875 |
| 13/16 = .8125 |
| 15/16 = .9375 |

| 32nds |
|---|
| 1/32 = .03125 |
| 3/32 = .09375 |
| 5/32 = .15625 |
| 7/32 = .21875 |
| 9/32 = .28125 |
| 11/32 = .34375 |
| 13/32 = .40625 |
| 15/32 = .46875 |
| 17/32 = .53125 |
| 19/32 = .59375 |
| 21/32 = .65625 |
| 23/32 = .71875 |
| 25/32 = .78125 |
| 27/32 = .84375 |
| 29/32 = .90625 |
| 31/32 = .96875 |

| 64ths | |
|---|---|
| 1/64 = .015625 | 33/64 = .515625 |
| 3/64 = .046875 | 35/64 = .546875 |
| 5/64 = .078125 | 37/64 = .578125 |
| 7/64 = .109375 | 39/64 = .609375 |
| 9/64 = .140625 | 41/64 = .640625 |
| 11/64 = .171875 | 43/64 = .671875 |
| 13/64 = .203125 | 45/64 = .703125 |
| 15/64 = .234375 | 47/64 = .734375 |
| 17/64 = .265625 | 49/64 = .765625 |
| 19/64 = .296875 | 51/64 = .796875 |
| 21/64 = .328125 | 53/64 = .828125 |
| 23/64 = .359375 | 55/64 = .859375 |
| 25/64 = .390625 | 57/64 = .890625 |
| 27/64 = .421875 | 59/64 = .921875 |
| 29/64 = .453125 | 61/64 = .953125 |
| 31/64 = .484375 | 63/64 = .984375 |

# Decimal Equivalents of Letter Size Drills

| Letter | Size of Drill in Inches |
|---|---|
| A | .234 |
| B | .238 |
| C | .242 |
| D | .246 |
| E | .250 |
| F | .257 |
| G | .261 |
| H | .266 |
| I | .272 |
| J | .277 |
| K | .281 |
| L | .290 |
| M | .295 |

| Letter | Size of Drill in Inches |
|---|---|
| N | .302 |
| O | .316 |
| P | .323 |
| Q | .332 |
| R | .339 |
| S | .348 |
| T | .358 |
| U | .368 |
| V | .377 |
| W | .386 |
| X | .397 |
| Y | .404 |
| Z | .413 |

# Decimal Equivalents of Number Size Drills

| No. | Size of Drill in Inches | No. | Size of Drill in Inches | No. | Size of Drill in Inches | No. | Size of Drill in Inches |
|---|---|---|---|---|---|---|---|
| 1 | .2280 | 21 | .1590 | 41 | .0960 | 61 | .0390 |
| 2 | .2210 | 22 | .1570 | 42 | .0935 | 62 | .0380 |
| 3 | .2130 | 23 | .1540 | 43 | .0890 | 63 | .0370 |
| 4 | .2090 | 24 | .1520 | 44 | .0860 | 64 | .0360 |
| 5 | .2055 | 25 | .1495 | 45 | .0820 | 65 | .0350 |
| 6 | .2040 | 26 | .1470 | 46 | .0810 | 66 | .0330 |
| 7 | .2010 | 27 | .1440 | 47 | .0785 | 67 | .0320 |
| 8 | .1990 | 28 | .1405 | 48 | .0760 | 68 | .0310 |
| 9 | .1960 | 29 | .1360 | 49 | .0730 | 69 | .0292 |
| 10 | .1935 | 30 | .1285 | 50 | .0700 | 70 | .0280 |
| 11 | .1910 | 31 | .1200 | 51 | .0670 | 71 | .0260 |
| 12 | .1890 | 32 | .1160 | 52 | .0635 | 72 | .0250 |
| 13 | .1850 | 33 | .1130 | 53 | .0595 | 73 | .0240 |
| 14 | .1820 | 34 | .1110 | 54 | .0550 | 74 | .0225 |
| 15 | .1800 | 35 | .1100 | 55 | .0520 | 75 | .0210 |
| 16 | .1770 | 36 | .1065 | 56 | .0465 | 76 | .0200 |
| 17 | .1730 | 37 | .1040 | 57 | .0430 | 77 | .0180 |
| 18 | .1695 | 38 | .1015 | 58 | .0420 | 78 | .0160 |
| 19 | .1660 | 39 | .0995 | 59 | .0410 | 79 | .0145 |
| 20 | .1610 | 40 | .0980 | 60 | .0400 | 80 | .0135 |

# American Standard Pipe Thread and Tap Drill Sizes

| Pipe Size Inches | Threads Per Inch | Root Diameter Small End of Pipe and Gage | Tap Drill | |
|---|---|---|---|---|
| | | | Taper NPT | Straight NPS |
| 1/8 | 27 | .3339" | Q | 11/32" |
| 1/4 | 18 | .4329" | 7/16" | 7/16" |
| 3/8 | | .5676" | 9/16" | 37/64" |
| 1/2 | 14 | .7013" | 45/64" | 23/32" |
| 3/4 | | .9105" | 29/32" | 59/64" |
| 1 | 11-1/2 | 1.1441" | 1-9/64" | 1-5/32" |
| 1-1/4 | | 1.4876" | 1-31/64" | 1-1/2" |
| 1-1/2 | | 1.7265" | 1-47/64" | 1-3/4" |
| 2 | | 2.1995" | 2-13/64" | 2-7/32" |

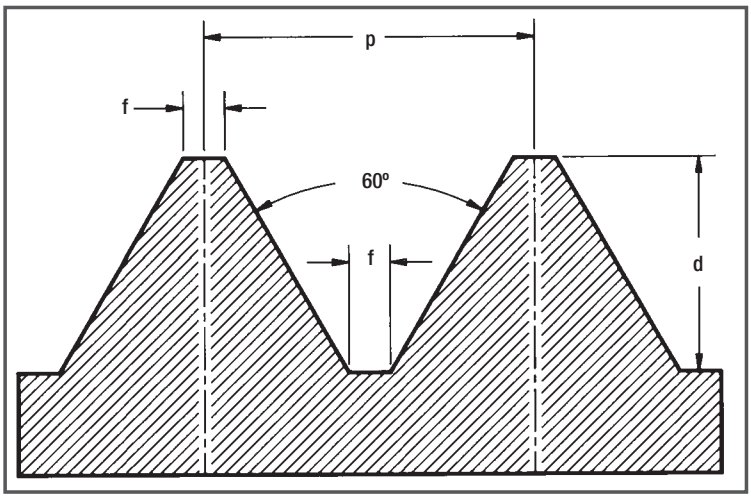
# American National and Unified Coarse and Fine Thread Dimensions and Tap Drill Sizes

$$p = \text{pitch} = \frac{1}{\text{thread per inch}}$$

$$d = \text{depth} = p \times .649519$$

$$f = \text{flat} = \frac{p}{8}$$

$$\text{pitch diameter} = D - \frac{.6495}{N}$$




| Size | Threads per inch NC UNC | NF UNF | Outside Diameter Inches | Pitch Diameter Inches | Root Diameter Inches | Tap Drill Approx. 75% Full Thread | Decimal Equiv. of Tap Drill |
|---|---|---|---|---|---|---|---|
| 0 | – | 80 | .0600 | .0519 | .0438 | 3/64" | .0469 |
| 1 | 64 | – | .0730 | .0629 | .0527 | 53 | .0595 |
| 1 | – | 72 | .0730 | .0640 | .0550 | 53 | .0595 |
| 2 | 56 | – | .0860 | .0744 | .0628 | 50 | .0700 |
| 2 | – | 64 | .0860 | .0759 | .0657 | 50 | .0700 |
| 3 | 48 | – | .0990 | .0855 | .0719 | 47 | .0785 |
| 3 | – | 56 | .0990 | .0874 | .0758 | 46 | .0810 |
| 4 | 40 | – | .1120 | .0958 | .0795 | 43 | .0890 |
| 4 | – | 48 | .1120 | .0985 | .0849 | 42 | .0935 |
| 5 | 40 | – | .1250 | .1088 | .0925 | 38 | .1015 |
| 5 | – | 44 | .1250 | .1102 | .0955 | 37 | .1040 |
| 6 | 32 | – | .1380 | .1177 | .0974 | 36 | .1065 |
| 6 | – | 40 | .1380 | .1218 | .1055 | 33 | .1130 |
| 8 | 32 | – | .1640 | .1437 | .1234 | 29 | .1360 |
| 8 | – | 36 | .1640 | .1460 | .1279 | 29 | .1360 |
| 10 | 24 | – | .1900 | .1629 | .1359 | 26 | .1470 |
| 10 | – | 32 | .1900 | .1697 | .1494 | 21 | .1590 |
| 12 | 24 | – | .2160 | .1889 | .1619 | 16 | .1770 |
| 12 | – | 28 | .2160 | .1928 | .1696 | 15 | .1800 |
| 1/4" | 20 | – | .2500 | .2175 | .1850 | 7 | .2010 |
| 1/4" | – | 28 | .2500 | .2268 | .2036 | 3 | .2130 |
| 5/16" | 18 | – | .3125 | .2764 | .2403 | F | .2570 |
| 5/16" | – | 24 | .3125 | .2854 | .2584 | I | .2720 |
| 3/8" | 16 | – | .3750 | .3344 | .2938 | 5/16" | .3125 |
| 3/8" | – | 24 | .3750 | .3479 | .3209 | Q | .3320 |
| 7/16" | 14 | – | .4375 | .3911 | .3447 | U | .3680 |
| 7/16" | – | 20 | .4375 | .4050 | .3726 | 25/64" | .3906 |
| 1/2" | 13 | – | .5000 | .4500 | .4001 | 27/64" | .4219 |
| 1/2" | – | 20 | .5000 | .4675 | .4351 | 29/64" | .4531 |
| 9/16" | 12 | – | .5625 | .5084 | .4542 | 31/64" | .4844 |
| 9/16" | – | 18 | .5625 | .5264 | .4903 | 33/64" | .5156 |
| 5/8" | 11 | – | .6250 | .5660 | .5069 | 17/32" | .5312 |
| 5/8" | – | 18 | .6250 | .5889 | .5528 | 37/64" | .5781 |
| 3/4" | 10 | – | .7500 | .6850 | .6201 | 21/32" | .6562 |
| 3/4" | – | 16 | .7500 | .7094 | .6688 | 11/16" | .6875 |
| 7/8" | 9 | – | .8750 | .8028 | .7307 | 49/64" | .7656 |
| 7/8" | – | 14 | .8750 | .8286 | .7822 | 13/16" | .8125 |

# American National and Unified Coarse and Fine Thread Dimensions and Tap Drill Sizes

| Size | Threads per inch NC UNC | NF UNF | Outside Diameter Inches | Pitch Diameter Inches | Root Diameter Inches | Tap Drill Approx. 75% Full Thread | Decimal Equiv. of Tap Drill |
|---|---|---|---|---|---|---|---|
| 1" | 8 | – | 1.0000 | .9188 | .8376 | 7/8" | .8750 |
| 1" | – | 12 | 1.0000 | .9459 | .8917 | 59/64" | .9219 |
| 1-1/8" | 7 | – | 1.1250 | 1.0322 | .9394 | 63/64" | .9844 |
| 1-1/8" | – | 12 | 1.1250 | 1.0709 | 1.0168 | 1-3/64" | 1.0469 |
| 1-1/4" | 7 | – | 1.2500 | 1.1572 | 1.0644 | 1-7/64" | 1.1094 |
| 1-1/4" | – | 12 | 1.2500 | 1.1959 | 1.1418 | 1-11/64" | 1.1719 |
| 1-3/8" | 6 | – | 1.3750 | 1.2667 | 1.1585 | 1-7/32" | 1.2187 |
| 1-3/8" | – | 12 | 1.3750 | 1.3209 | 1.2668 | 1-19/64" | 1.2969 |
| 1-1/2" | 6 | – | 1.5000 | 1.3917 | 1.2835 | 1-11/32" | 1.3437 |
| 1-1/2" | – | 12 | 1.5000 | 1.4459 | 1.3918 | 1-27/64" | 1.4219 |
| 1-3/4" | 5 | – | 1.7500 | 1.6201 | 1.4902 | 1-9/16" | 1.5625 |
| 2" | 4-1/2 | – | 2.0000 | 1.8557 | 1.7113 | 1-25/32" | 1.7812 |
| 2-1/4" | 4-1/2 | – | 2.2500 | 2.1057 | 1.9613 | 2-1/32" | 2.0313 |
| 2-1/2" | 4-1/2 | – | 2.5000 | 2.3376 | 2.1752 | 2-1/4" | 2.2500 |
| 2-3/4" | 4 | – | 2.7500 | 2.5876 | 2.4252 | 2-1/2" | 2.5000 |
| 3" | 4 | – | 3.0000 | 2.8376 | 2.6752 | 2-3/4" | 2.7500 |
| 3-1/4" | 4 | – | 3.2500 | 3.0876 | 2.9252 | 3" | 3.0000 |
| 3-1/2" | 4 | – | 3.5000 | 3.3376 | 3.1752 | 3-1/4" | 3.2500 |
| 3-3/4" | 4 | – | 3.7500 | 3.5876 | 3.4252 | 3-1/2" | 3.5000 |
| 4" | 4 | – | 4.0000 | 3.3786 | 3.6752 | 3-3/4" | 3.7500 |

# Millimeter Tap Drill Sizes

| Metric Tap | Tap Drill mm | Decimal Equiv. Inches |
|---|---|---|
| M1.6 x 0.35 | 1.25 | .0492 |
| M1.8 x 0.35 | 1.45 | .0571 |
| M2 x 0.4 | 1.60 | .0630 |
| M2.2 x 0.45 | 1.75 | .0689 |
| M2.5 x 0.45 | 2.05 | .0807 |
| M3 x 0.5 | 2.50 | .0984 |
| M3.5 x 0.6 | 2.90 | .1142 |
| M4 x 0.7 | 3.30 | .1299 |
| M4.5 x 0.75 | 3.70 | .1457 |
| M5 x 0.8 | 4.20 | .1654 |
| M6 x 1 | 5.00 | .1968 |
| M7 x 1 | 6.00 | .2362 |
| M8 x 1.25 | 6.70 | .2638 |
| M8 x 1 | 7.00 | .2756 |
| M10 x 1.5 | 8.50 | .3346 |
| M10 x 1.25 | 8.70 | .3425 |
| M12 x 1.75 | 10.20 | .4016 |
| M12 x 1.25 | 10.80 | .4252 |
| M14 x 2 | 12.00 | .4724 |
| M14 x 1.5 | 12.50 | .4921 |

| Metric Tap | Tap Drill mm | Decimal Equiv. Inches |
|---|---|---|
| M16 x 2 | 14.00 | .5512 |
| M16 x 1.5 | 14.50 | .5709 |
| M18 x 2.5 | 15.50 | .6102 |
| M18 x 1.5 | 16.50 | .6496 |
| M20 x 2.5 | 17.50 | .6890 |
| M20 x 1.5 | 18.50 | .7283 |
| M22 x 2.5 | 19.50 | .7677 |
| M22 x 1.5 | 20.50 | .8071 |
| M24 x 3 | 21.00 | .8268 |
| M24 x 2 | 22.00 | .8661 |
| M27 x 3 | 24.00 | .9449 |
| M27 x 2 | 25.00 | .9843 |
| M30 x 3.5 | 26.50 | 1.0433 |
| M30 x 2 | 28.00 | 1.1024 |
| M33 x 3.5 | 29.50 | 1.1614 |
| M33 x 2 | 31.00 | 1.2205 |
| M36 x 4 | 32.00 | 1.2598 |
| M36 x 3 | 33.00 | 1.2992 |
| M39 x 4 | 35.00 | 1.3780 |
| M39 x 3 | 36.00 | 1.4173 |

# Tap Drill Sizes for Fractional Size Threads

## APPROXIMATELY 65% DEPTH THREAD/AMERICAN NATIONAL THREAD FORM

| Tap Size | Threads per Inch | Hole Diameter | Drill |
|---|---|---|---|
| 1/16 | 72 | .049 | 3/64 |
| 1/16 | 64 | .047 | 3/64 |
| 1/16 | 60 | .046 | 56 |
| 5/64 | 72 | .065 | 52 |
| 5/64 | 64 | .063 | 1/16 |
| 5/64 | 60 | .062 | 1/16 |
| 5/64 | 56 | .061 | 53 |
| 3/32 | 60 | .077 | 5/64 |
| 3/32 | 56 | .076 | 48 |
| 3/32 | 50 | .074 | 49 |
| 3/32 | 48 | .073 | 49 |
| 7/64 | 56 | .092 | 42 |
| 7/64 | 50 | .090 | 43 |
| 7/64 | 48 | .089 | 43 |
| 1/8 | 48 | .105 | 36 |
| 1/8 | 40 | .101 | 38 |
| 1/8 | 36 | .098 | 40 |
| 1/8 | 32 | .095 | 3/32 |
| 9/64 | 40 | .116 | 32 |
| 9/64 | 36 | .114 | 33 |
| 9/64 | 32 | .110 | 35 |
| 5/32 | 40 | .132 | 30 |
| 5/32 | 36 | .129 | 30 |
| 5/32 | 32 | .126 | 1/8 |
| 11/64 | 36 | .145 | 27 |
| 11/64 | 32 | .141 | 9/64 |
| 3/16 | 36 | .161 | 20 |
| 3/16 | 32 | .157 | 22 |
| 3/16 | 30 | .155 | 23 |
| 3/16 | 24 | .147 | 26 |
| 13/64 | 32 | .173 | 17 |
| 13/64 | 30 | .171 | 11/64 |
| 13/64 | 24 | .163 | 20 |
| 7/32 | 32 | .188 | 12 |
| 7/32 | 28 | .184 | 13 |
| 7/32 | 24 | .178 | 16 |
| 15/64 | 32 | .204 | 6 |
| 15/64 | 28 | .200 | 8 |
| 15/64 | 24 | .194 | 10 |
| 1/4 | 32 | .220 | 7/32 |

| Tap Size | Threads per Inch | Hole Diameter | Drill |
|---|---|---|---|
| 1/4 | 28 | .215 | 3 |
| 1/4 | 27 | .214 | 3 |
| 1/4 | 24 | .209 | 4 |
| 1/4 | 20 | .201 | 7 |
| 5/16 | 32 | .282 | 9/32 |
| 5/16 | 27 | .276 | J |
| 5/16 | 24 | .272 | I |
| 5/16 | 20 | .264 | 17/64 |
| 5/16 | 18 | .258 | F |
| 3/8 | 27 | .339 | R |
| 3/8 | 24 | .334 | Q |
| 3/8 | 20 | .326 | 21/64 |
| 3/8 | 16 | .314 | 5/16 |
| 7/16 | 27 | .401 | Y |
| 7/16 | 24 | .397 | X |
| 7/16 | 20 | .389 | 25/64 |
| 7/16 | 14 | .368 | U |
| 1/2 | 27 | .464 | 15/32 |
| 1/2 | 24 | .460 | 29/64 |
| 1/2 | 20 | .451 | 29/64 |
| 1/2 | 13 | .425 | 27/64 |
| 1/2 | 12 | .419 | 27/64 |
| 9/16 | 27 | .526 | 17/32 |
| 9/16 | 18 | .508 | 33/64 |
| 9/16 | 12 | .481 | 31/64 |
| 5/8 | 27 | .589 | 19/32 |
| 5/8 | 18 | .571 | 37/64 |
| 5/8 | 12 | .544 | 35/64 |
| 5/8 | 11 | .536 | 17/32 |
| 11/16 | 16 | .627 | 5/8 |
| 11/16 | 11 | .599 | 19/32 |
| 3/4 | 27 | .714 | 23/32 |
| 3/4 | 16 | .689 | 11/16 |
| 3/4 | 12 | .669 | 43/64 |
| 3/4 | 10 | .653 | 21/32 |
| 13/16 | 12 | .731 | 47/64 |
| 13/16 | 10 | .715 | 23/32 |
| 7/8 | 27 | .839 | 27/32 |
| 7/8 | 18 | .821 | 53/64 |
| 7/8 | 14 | .805 | 13/16 |

| Tap Size | Threads per Inch | Hole Diameter | Drill |
|---|---|---|---|
| 7/8 | 12 | .794 | 51/64 |
| 7/8 | 9 | .767 | 49/64 |
| 15/16 | 12 | .856 | 55/64 |
| 15/16 | 9 | .829 | 53/64 |
| 1 | 27 | .964 | 31/32 |
| 1 | 14 | .930 | 15/16 |
| 1 | 12 | .919 | 59/64 |
| 1 | 8 | .878 | 7/8 |
| 1-1/16 | 8 | .941 | 15/16 |
| 1-1/8 | 12 | 1.044 | 1-3/64 |
| 1-1/8 | 7 | .986 | 63/64 |
| 1-3/16 | 7 | 1.048 | 1-3/64 |
| 1-1/4 | 12 | 1.169 | 1-11/64 |
| 1-1/4 | 7 | 1.111 | 1-7/64 |
| 1-5/16 | 7 | 1.173 | 1-11/64 |
| 1-3/8 | 12 | 1.294 | 1-19/64 |
| 1-3/8 | 6 | 1.213 | 1-7/32 |
| 1-1/2 | 12 | 1.419 | 1-27/64 |
| 1-1/2 | 6 | 1.338 | 1-11/32 |
| 1-5/8 | 5-1/2 | 1.448 | 1-29/64 |
| 1-3/4 | 5 | 1.555 | 1-9/16 |
| 1-7/8 | 5 | 1.680 | 1-11/16 |
| 2 | 4-1/2 | 1.783 | 1-25/32 |
| 2-1/8 | 4-1/2 | 1.909 | 1-29/32 |
| 2-1/4 | 4-1/2 | 2.034 | 2-1/32 |
| 2-3/8 | 4 | 2.131 | 2-1/8 |
| 2-1/2 | 4 | 2.256 | 2-1/4 |
| 2-5/8 | 4 | 2.381 | 2-3/8 |
| 2-3/4 | 4 | 2.506 | 2-1/2 |
| 2-7/8 | 3-1/2 | 2.597 | 2-19/32 |
| 3 | 3-1/2 | 2.722 | 2-23/32 |
| 3-1/8 | 3-1/2 | 2.847 | 2-27/32 |
| 3-1/4 | 3-1/2 | 2.972 | 2-31/32 |
| 3-3/8 | 3-1/4 | 3.075 | 3-1/16 |
| 3-1/2 | 3-1/4 | 3.200 | 3-3/16 |
| 3-5/8 | 3-1/4 | 3.325 | 3-5/16 |
| 3-3/4 | 3 | 3.425 | 3-7/16 |
| 4 | 3 | 3.675 | 3-11/16 |

# Double Depth of Screw Threads

$$D.D. = \frac{1.732}{N}$$ For V Thread

$$D.D. = \frac{1.299}{N}$$ For American Nat. Form, U.S. Std

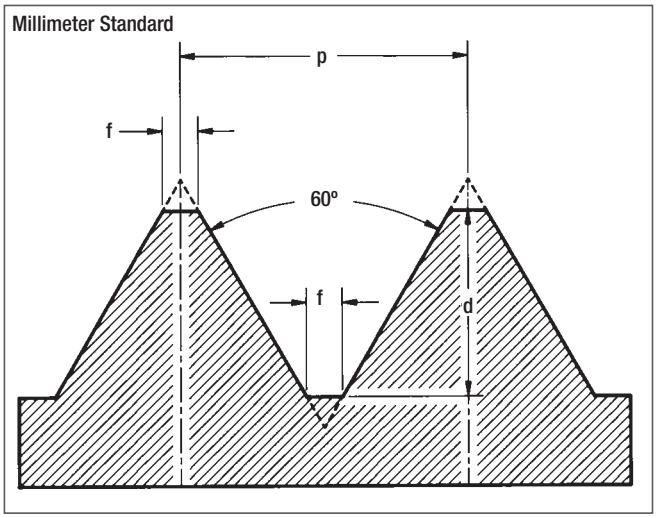
$$D.D. = \frac{1.28}{N}$$ For Whitworth Standard

| Threads per Inch | V Threads | Am. Nat. Form U.S. Standard | Whitworth Standard |
|---|---|---|---|
| N | D.D. | D.D. | D.D. |
| 2 | .86600 | .64950 | .64000 |
| 3 | .57733 | .43300 | .42666 |
| 4 | .43300 | .32475 | .32000 |
| 10 | .17320 | .12990 | .12800 |
| 13 | .13323 | .09992 | .09846 |
| 18 | .09622 | .07216 | .07111 |
| 20 | .08660 | .06495 | .06400 |
| 22 | .07872 | .05904 | .05818 |
| 24 | .07216 | .05412 | .05333 |
| 26 | .06661 | .04996 | .04923 |
| 27 | .06415 | .04811 | .04740 |
| 28 | .06185 | .04639 | .04571 |
| 30 | .05773 | .04330 | .04266 |
| 32 | .05412 | .04059 | .04000 |
| 34 | .05094 | .03820 | .03764 |
| 36 | .04811 | .03608 | .03555 |
| 38 | .04558 | .03418 | .03368 |
| 40 | .04330 | .03247 | .03200 |
| 56 | .03093 | .02319 | .02285 |
| 60 | .02887 | .02165 | .02133 |
| 80 | .02165 | .01623 | .01600 |

# ISO External Threads

## MEDIUM FIT

Millimeter Standard




p = distance between any point on a thread to the corresponding point on the adjacent thread
d = depth – 0.64952P
f = flat – 0.125P

| Designation | mm Diameter | mm Pitch |
|---|---|---|
| M2 x 0.4 | 2 | 0.4 |
| M3 x 0.5 | 3 | 0.5 |
| M4 x 0.7 | 4 | 0.7 |
| M5 x 0.8 | 5 | 0.8 |
| M6 x 1 | 6 | 1.0 |
| M8 x 1.25 | 8 | 1.25 |
| M10 x 1.5 | 10 | 1.5 |
| M12 x 1.75 | 12 | 1.75 |
| M16 x 2 | 16 | 2.0 |
| M20 x 2.5 | 20 | 2.5 |
| M24 x 3 | 24 | 3.0 |
| M30 x 3.5 | 30 | 3.5 |

# American Standard Acme Screw Thread Dimensions

h = Basic depth of thread
h' = Depth of thread with clearance
K = Tap drill
Basic minor diameter of nut
Fc = Width of flat at crest of thread
Fr = Width of flat at bottom of space
n = Number of threads per inch
p = Pitch of thread
Kr = Minor diameter of screw
D = Major diameter of screw
T = Major diameter of tap

**FOR 10 OR FEWER THREADS PER INCH**

$h' = \frac{P}{2}$ plus .010

$Fr = \frac{.3707}{n}$ minus .0052

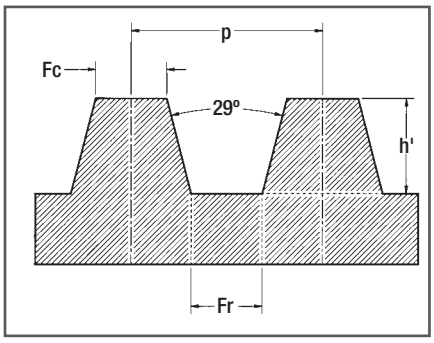
T = D plus .020

**FOR MORE THAN 10 THREADS PER INCH**

$h' = \frac{P}{2}$ plus .005

$Fr = \frac{.3707}{n}$ minus .0026

T = D plus .010




$p = \frac{1}{n}$ $Fc = \frac{.3707}{n}$

K = D minus p Kr = D minus 2h'

| Threads per inch (n) | Depth of Thread with Clearance (h') | Flat at Top of Thread (Fc) | Flat at Bottom of Space (Fr) | Space at Top of Thread | Thickness at Root of Thread |
|---|---|---|---|---|---|
| 1 | .5100 | .3707 | .3655 | .6293 | .6345 |
| 1-1/3 | .3850 | .2780 | .2728 | .4720 | .4772 |
| 2 | .2600 | .1854 | .1802 | .3146 | .3198 |
| 3 | .1767 | .1236 | .1184 | .2097 | .2149 |
| 4 | .1350 | .0927 | .0875 | .1573 | .1625 |
| 5 | .1100 | .0741 | .0689 | .1259 | .1311 |
| 6 | .0933 | .0618 | .0566 | .1049 | .1101 |
| 7 | .0814 | .0530 | .0478 | .0899 | .0951 |
| 8 | .0725 | .0463 | .0411 | .0787 | .0839 |
| 9 | .0655 | .0412 | .0360 | .0699 | .0751 |
| 10 | .0600 | .0371 | .0319 | .0629 | .0681 |
| 12 | .0467 | .0309 | .0283 | .0524 | .0550 |
| 14 | .0407 | .0265 | .0239 | .0449 | .0475 |
| 16 | .0363 | .0232 | .0206 | .0393 | .0419 |

# Tapers and Angles

| Taper per Foot | Degree | Included Angle Minute | Second | Degree | Angle With Center Line Minute | Second | Taper per inch | Taper per inch from Center Line |
|---|---|---|---|---|---|---|---|---|
| 1/8" | 0 | 35 | 49 | 0 | 17 | 54 | .010417 | .005208 |
| 1/4" | 1 | 11 | 37 | 0 | 35 | 49 | .020833 | .010417 |
| 3/8" | 1 | 47 | 25 | 0 | 53 | 43 | .031250 | .015625 |
| 1/2" | 2 | 23 | 13 | 1 | 11 | 37 | .041667 | .020833 |
| 5/8" | 2 | 59 | 1 | 1 | 29 | 30 | .052083 | .026042 |
| 3/4" | 3 | 34 | 47 | 1 | 47 | 24 | .062500 | .031250 |
| 7/8" | 4 | 10 | 33 | 2 | 5 | 17 | .072917 | .036458 |
| 1" | 4 | 46 | 19 | 2 | 23 | 9 | .083333 | .041667 |
| 1-1/4" | 5 | 57 | 47 | 2 | 58 | 53 | .104167 | .052084 |
| 1-1/2" | 7 | 9 | 10 | 3 | 34 | 35 | .125000 | .062500 |
| 1-3/4" | 8 | 20 | 27 | 4 | 10 | 14 | .145833 | .072917 |
| 2" | 9 | 31 | 38 | 4 | 45 | 49 | .166667 | .083333 |
| 2-1/2" | 11 | 53 | 37 | 5 | 56 | 49 | .208333 | .104167 |
| 3" | 14 | 2 | 0 | 7 | 1 | 30 | .250000 | .125000 |
| 3-1/2" | 16 | 35 | 39 | 8 | 17 | 50 | .291667 | .145833 |
| 4" | 18 | 55 | 29 | 9 | 27 | 44 | .333333 | .166667 |
| 4-1/2" | 21 | 14 | 22 | 10 | 37 | 11 | .375000 | .187500 |
| 5" | 23 | 32 | 12 | 11 | 46 | 6 | .416667 | .208333 |
| 6" | 28 | 4 | 21 | 14 | 2 | 10 | .500000 | .250000 |

# Pitch Diameter Tables – American National Thread Form

FOR NOS. 575 AND 585 SCREW THREAD MICROMETERS

**Number Sizes**

Caliper Reading or Pitch Diameter = $D - \frac{.6495}{N}$

**Fractional Sizes**

Caliper Reading or Pitch Diameter = $D - \frac{.6495}{N}$

| No. | Basic and Max. Outside Diameter | Threads Per Inch | Caliper Reading or Max. Pitch Diameter | Single Depth of Thread |
|---|---|---|---|---|
| | D | N | $D - \frac{.6495}{N}$ | $\frac{.6495}{N}$ |
| 0 | .060 | 80 | .0519 | .0081 |
| 1 | .073 | 72 | .0640 | .0090 |
| 2 | .086 | 64 | .0759 | .0101 |
| 3 | .099 | 56 | .0874 | .0116 |
| 4 | .112 | 48 | .0985 | .0135 |
| 5 | .125 | 44 | .1102 | .0148 |
| 6 | .138 | 40 | .1218 | .0162 |
| 7 | .151 | 36 | .1330 | .0180 |
| 8 | .164 | 36 | .1460 | .0180 |
| 9 | .177 | 32 | .1567 | .0203 |
| 10 | .190 | 30 | .1684 | .0217 |
| 12 | .216 | 28 | .1928 | .0232 |
| 14 | .242 | 24 | .2149 | .0271 |
| 16 | .268 | 22 | .2385 | .0295 |
| 18 | .294 | 20 | .2615 | .0325 |
| 20 | .320 | 20 | .2875 | .0325 |
| 22 | .346 | 18 | .3099 | .0361 |
| 24 | .372 | 16 | .3314 | .0406 |
| 26 | .398 | 16 | .3574 | .0406 |
| 28 | .424 | 14 | .3776 | .0464 |
| 30 | .450 | 14 | .4036 | .0464 |

| Diameter Inches | Threads Per Inch | Caliper Reading of Pitch Diameter | Single Depth of Thread |
|---|---|---|---|
| D | N | $D - \frac{.6495}{N}$ | $\frac{.6495}{N}$ |
| **NOTE:** As there is no standard of diameter for the finer pitches, this column is left blank. | 64 | — | .0101 |
| | 62 | — | .0105 |
| | 60 | — | .0108 |
| | 58 | — | .0112 |
| | 56 | — | .0116 |
| | 54 | — | .0120 |
| | 52 | — | .0125 |
| | 50 | — | .0130 |
| | 48 | — | .0135 |
| | 46 | — | .0141 |
| | 44 | — | .0148 |
| | 42 | — | .0155 |
| | 40 | — | .0162 |
| | 38 | — | .0171 |
| | 36 | — | .0180 |
| | 34 | — | .0191 |
| | 32 | — | .0203 |
| | 30 | — | .0217 |
| | 28 | — | .0232 |
| | 26 | — | .0250 |
| | 24 | — | .0271 |
| | 22 | — | .0295 |
| 1/4 | 20 | .2175 | .0325 |
| 5/16 | 18 | .2764 | .0361 |
| 3/8 | 16 | .3344 | .0406 |
| 7/16 | 14 | .3911 | .0464 |
| 1/2 | 13 | .4501 | .0499 |
| 9/16 | 12 | .5084 | .0541 |
| 5/8 | 11 | .5660 | .0590 |
| 3/4 | 10 | .6851 | .0649 |
| 7/8 | 9 | .8029 | .0721 |
| 1 | 8 | .9188 | .0812 |
| 1-1/8 | 7 | 1.0322 | .0928 |
| 1-1/4 | 7 | 1.1572 | .0928 |
| 1-3/8 | 6 | 1.2668 | .1082 |
| 1-1/2 | 6 | 1.3918 | .1082 |
| 1-5/8 | 5-1/2 | 1.5070 | .1180 |
| 1-3/4 | 5 | 1.6201 | .1299 |
| 1-7/8 | 5 | 1.7451 | .1299 |
| 2 | 4-1/2 | 1.8557 | .1443 |
| 2-1/2 | 4 | 2.3376 | .1624 |
| 3 | 3-1/2 | 2.8145 | .1855 |
| 3-1/2 | 3-1/4 | 3.3002 | .1998 |
| 4 | 3 | 3.7835 | .2165 |

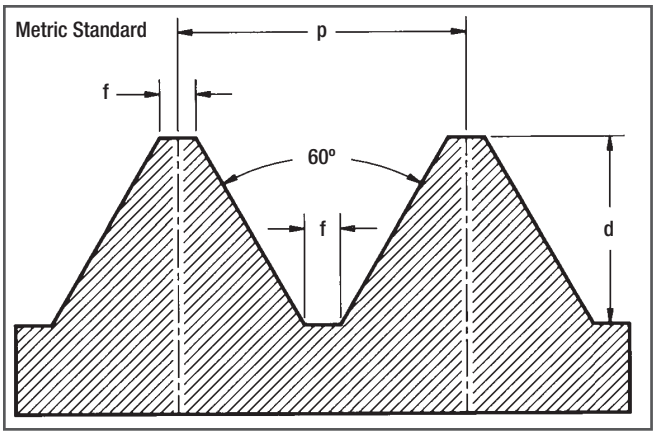
# Pitch Diameter Tables

## FOR NOS. 575 AND 585 SCREW THREAD MICROMETERS

**Whitworth Standard**

Caliper Reading or Pitch Diameter for Whitworth Threads = $D - \frac{.640}{N}$

| Diameter Inches D | Threads per Inch N | Caliper Reading or Pitch Diameter $D - \frac{.640}{N}$ | Single Depth of Thread $\frac{.640}{N}$ |
|---|---|---|---|
| — | 48 | — | .0133 |
| — | 46 | — | .0139 |
| — | 44 | — | .0146 |
| — | 42 | — | .0152 |
| — | 40 | — | .0160 |
| — | 38 | — | .0168 |
| — | 36 | — | .0178 |
| — | 34 | — | .0188 |
| — | 32 | — | .0200 |
| — | 30 | — | .0213 |
| — | 28 | — | .0229 |
| — | 26 | — | .0246 |
| — | 24 | — | .0267 |
| — | 22 | — | .0291 |
| 1/4 | 20 | .2180 | .0320 |
| 5/16 | 18 | .2769 | .0355 |
| 3/8 | 16 | .3350 | .0400 |
| 7/16 | 14 | .3918 | .0457 |
| 1/2 | 12 | .4467 | .0533 |
| 9/16 | 12 | .5092 | .0533 |
| 5/8 | 11 | .5668 | .0582 |
| 11/16 | 11 | .6293 | .0582 |
| 3/4 | 10 | .6860 | .0640 |
| 13/16 | 10 | .7485 | .0640 |
| 7/8 | 9 | .8039 | .0711 |
| 15/16 | 9 | .8664 | .0711 |
| 1 | 8 | .9200 | .0800 |
| 1-1/8 | 7 | 1.0336 | .0914 |
| 1-1/4 | 7 | 1.1586 | .0914 |
| 1-3/8 | 6 | 1.2684 | .1066 |
| 1-1/2 | 6 | 1.3934 | .1066 |
| 1-5/8 | 5 | 1.4970 | .1280 |
| 1-3/4 | 5 | 1.6220 | .1280 |
| 1-7/8 | 4-1/2 | 1.7328 | .1422 |
| 2 | 4-1/2 | 1.8578 | .1422 |
| 2-1/8 | 4-1/2 | 1.9828 | .1422 |




p = pitch = $\frac{1}{\text{No. thread per inch}}$

d = depth = p x .6495

f = flat = $\frac{\text{pitch}}{8}$

| Size Mm | Pitch Intl. Std. | French Std. |
|---|---|---|
| 2 | .45 | .50 |
| 3 | .55 | .50 |
| 4 | .70 | .75 |
| 5 | .85 | .75 |
| 6 | 1.00 | 1.00 |
| 7 | 1.00 | 1.00 |
| 8 | 1.25 | 1.00 |
| 9 | 1.25 | 1.00 |
| 10 | 1.50 | 1.50 |
| 11 | 1.50 | — |
| 12 | 1.75 | 1.50 |
| 14 | 2.00 | 2.00 |
| 16 | 2.00 | 2.00 |
| 18 | 2.50 | 2.50 |
| 20 | 2.50 | 2.50 |
| 22 | 2.50 | 2.50 |
| 24 | 3.00 | 3.00 |
| 26 | — | 3.00 |
| 27 | 3.00 | — |
| 28 | — | 3.00 |
| 30 | 3.50 | 3.50 |
| 32 | — | 3.50 |
| 33 | 3.50 | 3.50 |
| 34 | — | 3.50 |
| 36 | 4.00 | 4.00 |
| 38 | — | 4.00 |
| 39 | 4.00 | — |
| 40 | — | 4.00 |

# Pitch Diameter Table

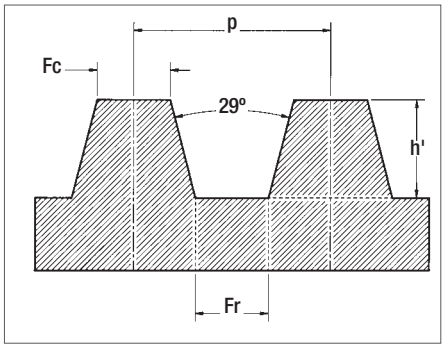
## FOR NOS. 575 AND 585 SCREW THREAD MICROMETERS "V" STANDARD THREAD FORM

Caliper Reading or Pitch Diameter for "V" Threads = $D - \frac{.866}{N}$

| Diameter Inches D | Threads per Inch N | Caliper Reading or Pitch Diameter $D - \frac{.866}{N}$ | Single Depth of Thread $\frac{.866}{N}$ | Diameter Inches* D | Threads per Inch N | Caliper Reading or Pitch Diameter $D - \frac{.866}{N}$ | Single Depth of Thread $\frac{.866}{N}$ |
|---|---|---|---|---|---|---|---|
| **Note:** As there is no standard of diameter for the finer pitches, this column is left blank. | 64 | — | .0135 | 1/4 | 24 | .2139 | .0361 |
| | 62 | — | .0140 | 1/4 | 20 | .2067 | .0433 |
| | 60 | — | .0144 | 5/16 | 20 | .2692 | .0433 |
| | 58 | — | .0149 | 5/16 | 18 | .2644 | .0481 |
| | 56 | — | .0155 | 3/8 | 18 | .3269 | .0481 |
| | 54 | — | .0161 | 3/8 | 16 | .3209 | .0541 |
| | 52 | — | .0167 | 7/16 | 16 | .3834 | .0541 |
| | 50 | — | .0173 | 7/16 | 14 | .3756 | .0619 |
| | 48 | — | .0180 | 1/2 | 14 | .4381 | .0619 |
| | 46 | — | .0188 | 1/2 | 13 | .4334 | .0666 |
| | 44 | — | .0197 | 1/2 | 12 | .4278 | .0722 |
| | 42 | — | .0206 | 9/16 | 14 | .5006 | .0619 |
| | 40 | — | .0217 | 9/16 | 12 | .4903 | .0722 |
| | 38 | — | .0228 | 5/8 | 11 | .5463 | .0787 |
| | 36 | — | .0241 | 5/8 | 10 | .5384 | .0866 |
| | 34 | — | .0255 | 11/16 | 10 | .6009 | .0866 |
| | 32 | — | .0271 | 3/4 | 10 | .6634 | .0866 |
| | 30 | — | .0289 | 7/8 | 9 | .7788 | .0962 |
| | 28 | — | .0309 | 1 | 8 | .8918 | .1082 |
| | 26 | — | .0333 | 1-1/8 | 8 | 1.0168 | .1082 |
| | — | — | — | 1-1/4 | 7 | 1.1263 | .1237 |
| | — | — | — | 1-1/2 | 6 | 1.3557 | .1443 |

* These figures give the outside diameter for screws with threads cut theoretically sharp. As it is not practical to make these threads sharp, the outside diameter will measure less than the figures given, the pitch diameter remaining the same.

# American Standard Acme Screw Thread Dimensions




h = Basic depth of thread
h' = Depth of thread with clearance
K = Tap drill / Basic minor diameter of nut
Fc = Width of flat at crest of thread
Fr = Width of flat at bottom of space
n = Number of threads per inch
p = Pitch of thread
Kr = Minor diameter of screw
D = Major diameter of screw
T = Major diameter of tap

$p = \frac{1}{n}$ $Fc = \frac{.3707}{n}$

K = minus p Kr = D minus 2h'

**FOR 10 OR FEWER THREADS PER INCH**

$h' = \frac{P}{2}$ plus .010

$Fr = \frac{.3707}{n}$ minus .0052

T = D plus .020

**FOR MORE THAN 10 THREADS PER INCH**

$h' = \frac{P}{2}$ plus .005

$Fr = \frac{.3707}{n}$ minus .0026

T = D plus .010

| Threads per inch (n) | Depth of Thread with Clearance (h') | Flat at Top of Thread (Fc) | Flat at Bottom of Space (Fr) | Space at Top of Thread | Thickness at Root of Thread |
|---|---|---|---|---|---|
| 1 | .5100 | .3707 | .3655 | .6293 | .6345 |
| 1-1/3 | .3850 | .2780 | .2728 | .4720 | .4772 |
| 2 | .2600 | .1854 | .1802 | .3146 | .3198 |
| 3 | .1767 | .1236 | .1184 | .2097 | .2149 |
| 4 | .1350 | .0927 | .0875 | .1573 | .1625 |
| 5 | .1100 | .0741 | .0689 | .1259 | .1311 |
| 6 | .0933 | .0618 | .0566 | .1049 | .1101 |
| 7 | .0814 | .0530 | .0478 | .0899 | .0951 |
| 8 | .0725 | .0463 | .0411 | .0787 | .0839 |
| 9 | .0655 | .0412 | .0360 | .0699 | .0751 |
| 10 | .0600 | .0371 | .0319 | .0629 | .0681 |
| 12 | .0467 | .0309 | .0283 | .0524 | .0550 |
| 14 | .0407 | .0265 | .0239 | .0449 | .0475 |
| 16 | .0363 | .0232 | .0206 | .0393 | .0419 |

# General Guide for Cutting Speeds and Feeds for Drills

The following information is a general guide. Specific jobs may need to be modified because of varying job conditions, such as coolant, equipment and job requirements.

## Guide for Drill Feeds

Drill feeds are governed by the size of the drill and also the material to be drilled.

The lower feeds should be used when drilling relatively hard materials such as alloy steels. The higher feeds should be used when drilling relatively soft materials such as aluminum and brass.

These feeds are based on the peripheral speed of a drill.

| Drill Dia. | Feed per Rev. | Drill Dia. | Feed per Rev. |
|---|---|---|---|
| Under 1/80 | .0010 - .0020 | Under 3mm | .025 - .05mm |
| 1/80 - 1/40 | .0020 - .0040 | 3 - 6mm | .05 - .100mm |
| 1/40 - 1/20 | .0040 - .0070 | 6 - 13mm | .100 - .180mm |
| 1/20 - 10 | .0070 - .0150 | 13 - 25mm | .180 - .370mm |
| Over 10 | .0150 - .0250 | Over 25mm | .370 - .630mm |

## Guide for Peripheral Speeds

| Material | Feet/Minute | | Meters/Minute | |
|---|---|---|---|---|
| | Carbon Drill | HSS Drill | Carbon Drill | HSS Drill |
| Machinery Steel | 30 | 80 | 9 | 24 |
| Cast Iron | 35 | 100 | 10.5 | 30 |
| Brass | 60 | 200 | 18 | 60 |
| Alloy Steel | – | 50 | – | 15 |

| Drill Diameter | | Peripheral Speeds – Feet per Minute (Meters per Minute) Revolutions per Minute | | | | | |
|---|---|---|---|---|---|---|---|
| Inches | mm | 30 (9 ) | 50 (15) | 60 (18) | 80 (24) | 100 (30) | 200 (60) |
| 1/8 | 3 | 917 | 1528 | 1833 | 2445 | 3056 | 6112 |
| 1/4 | 6 | 458 | 764 | 917 | 1222 | 1528 | 3056 |
| 1/2 | 13 | 229 | 382 | 458 | 611 | 764 | 1528 |
| 1 | 25 | 115 | 191 | 229 | 306 | 382 | 764 |
| 1-1/2 | 38 | 76 | 127 | 153 | 204 | 255 | 509 |
| 2 | 50 | 57 | 96 | 115 | 153 | 191 | 382 |
| 3 | 75 | 38 | 64 | 76 | 102 | 127 | 255 |

# Standards for Sheet and Wire Gages with Corresponding Starrett Gages

| Dimensions of Sizes in Decimal Parts of an Inch | | | | | | |
|---|---|---|---|---|---|---|
| Number of Wire Gage | 281<br>American or Brown & Sharpe | 188<br>245<br>Birmingham or Stubs' Iron Wire | 287<br>Washburn & Moen, Worcester, MA | 280<br>American S. & W. Co's. Music Wire Gage | Stubs' Steel Wire | 283<br>U.S. Standard Gage for Sheet and Plate Iron and Steel |
| 00000000 | .731429 | | | | | |
| 0000000 | .651356 | | | | | |
| 000000 | .580049 | | | .004 | | .46875 |
| 00000 | .516549 | | | .005 | | .4375 |
| 0000 | .460000 | .454 | .3938 | .006 | | .40625 |
| 000 | .409642 | .425 | .3625 | .007 | | .375 |
| 00 | .364797 | .380 | .3310 | .008 | | .34375 |
| 0 | .324861 | .340 | .3065 | .009 | | .3125 |
| 1 | .289279 | .300 | .2830 | .010 | .227 | .28125 |
| 2 | .257626 | .284 | .2625 | .011 | .219 | .265625 |
| 3 | .229423 | .259 | .2437 | .012 | .212 | .250 |
| 4 | .204307 | .238 | .2253 | .013 | .207 | .234375 |
| 5 | .181941 | .220 | .2070 | .014 | .204 | .21875 |
| 6 | .162023 | .203 | .1920 | .016 | .201 | .203125 |
| 7 | .144285 | .180 | .1770 | .018 | .199 | .1875 |
| 8 | .128490 | .165 | .1620 | .020 | .197 | .171875 |
| 9 | .114424 | .148 | .1483 | .022 | .194 | .15625 |
| 10 | .101897 | .134 | .1350 | .024 | .191 | .140625 |
| 11 | .090742 | .120 | .1205 | .026 | .188 | .125 |
| 12 | .080808 | .109 | .1055 | .029 | .185 | .109375 |
| 13 | .071962 | .095 | .0915 | .031 | .182 | .09375 |
| 14 | .064084 | .083 | .0800 | .033 | .180 | .078125 |
| 15 | .057068 | .072 | .0720 | .035 | .178 | .0703125 |
| 16 | .050821 | .065 | .0625 | .037 | .175 | .0625 |
| 17 | .045257 | .058 | .0540 | .039 | .172 | .05625 |
| 18 | .040303 | .049 | .0475 | .041 | .168 | .050 |
| 19 | .035891 | .042 | .0410 | .043 | .164 | .04375 |
| 20 | .031961 | .035 | .0348 | .045 | .161 | .0375 |
| 21 | .028462 | .032 | .03175 | .047 | .157 | .034375 |
| 22 | .025347 | .028 | .0286 | .049 | .155 | .03125 |
| 23 | .022572 | .025 | .0258 | .051 | .153 | .028125 |
| 24 | .020101 | .022 | .0230 | .055 | .151 | .025 |
| 25 | .017900 | .020 | .0204 | .059 | .148 | .021875 |
| 26 | .015941 | .018 | .0181 | .063 | .146 | .01875 |
| 27 | .014196 | .016 | .0173 | .067 | .143 | .0171875 |
| 28 | .012641 | .014 | .0162 | .071 | .139 | .015625 |
| 29 | .011258 | .013 | .0150 | .075 | .134 | .0140625 |
| 30 | .010025 | .012 | .0140 | .080 | .127 | .0125 |
| 31 | .008928 | .010 | .0132 | .085 | .120 | .0109375 |
| 32 | .007950 | .009 | .0128 | .090 | .115 | .01015625 |
| 33 | .007080 | .008 | .0118 | .095 | .112 | .009375 |
| 34 | .006305 | .007 | .0104 | | .110 | .00859375 |
| 35 | .005615 | .005 | .0095 | | .108 | .0078125 |
| 36 | .005000 | .004 | .0090 | | .106 | .00703125 |
| 37 | .004453 | | | | .103 | .006640625 |
| 38 | .003965 | | | | .101 | .00625 |
| 39 | .003531 | | | | .099 | |
| 40 | .003145 | | | | .097 | |

# Temperature Conversions

This table shows conversions from degrees Fahrenheit (ºF) directly to degrees Celsius (ºC) and vice versa. It covers the range of temperatures used in most hardening, tempering and annealing operations.

Lower, higher and intermediate conversions can be made by substituting a known Fahrenheit (ºF) or Celsius (ºC) temperature figure in either of the following formulas:

$$^{\circ}F = \frac{^{\circ}C \times 9}{5} + 32 \qquad ^{\circ}C = \frac{^{\circ}F - 32}{9} \times 5$$

| ºF | ºC |
|---|---|
| –160 | –107 |
| –140 | –96 |
| –120 | –84 |
| –100 | –73 |
| –80 | –62 |
| –60 | –51 |
| –40 | –40 |
| –20 | –29 |
| 0 | –18 |
| 20 | –7 |
| 32 | 0 |
| 40 | 4 |
| 60 | 16 |
| 80 | 27 |
| 100 | 38 |
| 120 | 49 |
| 140 | 60 |
| 160 | 71 |
| 180 | 82 |
| 200 | 93 |
| 212 | 100 |
| 220 | 104 |
| 300 | 149 |
| 400 | 204 |
| 500 | 260 |
| 600 | 316 |
| 700 | 371 |
| 800 | 427 |
| 1000 | 538 |
| 1200 | 649 |
| 1400 | 760 |
| 1600 | 871 |
| 1800 | 982 |
| 2000 | 1093 |
| 2200 | 1204 |

# Rules Relative to the Circle

## To Find Circumference

- Multiply diameter by 3.1416
- Or divide diameter by 0.3183

## To Find Diameter

- Multiply circumference by 0.3183
- Or divide circumference by 3.1416

## To Find Radius

- Multiply circumference by 0.15915
- Or divide circumference by 6.28318

## To Find Side of an Inscribed Square

- Multiply diameter by 0.7071
- Or multiply circumference by 0.2251
- Or divide circumference by 4.4428

## To Find Side of an Equal Square

- Multiply diameter by 0.8862
- Or divide diameter by 1.1284
- Or multiply circumference by 0.2821
- Or divide circumference by 3.545

## Square

- A side multiplied by 1.4142 equals diameter of its circumscribing circle
- A side multiplied by 4.443 equals circumference of its circumscribing circle
- A side multiplied by 1.128 equals diameter of an equal side
- A side multiplied by 3.547 equals circumference of an equal circle

## To Find the Area of a Circle

- Multiply circumference by one-quarter of the diameter
- Or multiply the square of diameter by 0.7854
- Or multiply the square of circumference by .07958
- Or multiply the square of 1/2 diameter by 3.1416

## To Find the Surface of a Sphere or Globe

- Multiply the diameter by the circumference
- Or multiply the square of a diameter by 3.1416
- Or multiply four times the square of radius by 3.1416

# High Temperatures Judged by Color

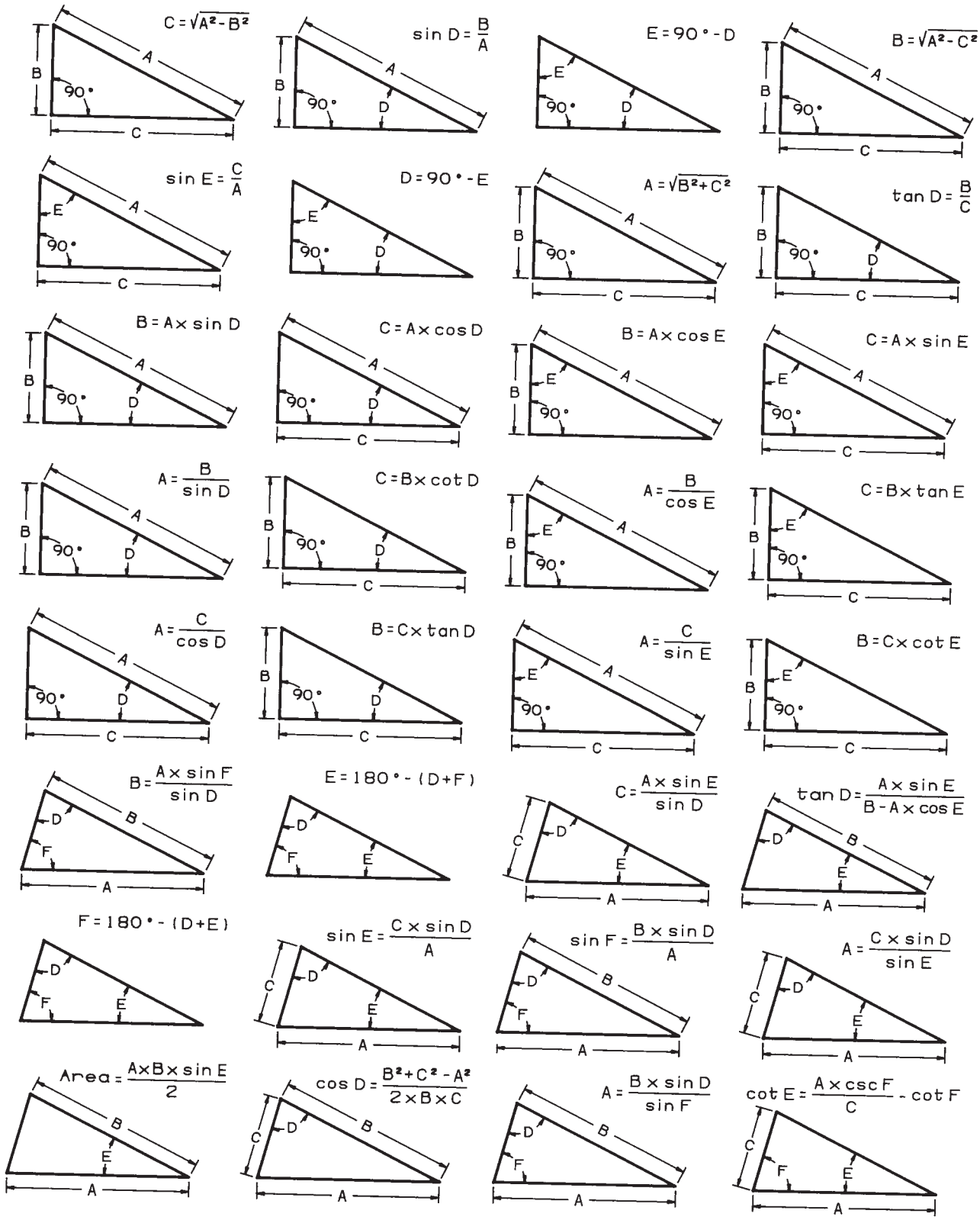
| Degrees Centigrade | Degrees Fahrenheit | High Temperatures Judged by Color |
|---|---|---|
| 400 | 752 | Red heat, visible in the dark |
| 525 | 975 | Red heat, visible in daylight |
| 700 | 1292 | Dark red |
| 900 | 1652 | Cherry-red |
| 1100 | 2012 | Orange-red |
| 1300 | 2372 | Yellow-white |
| 1500 | 2732 | Brilliant white |

# Colors for Tempering

| Degrees Centigrade | Degrees Fahrenheit | Colors for Tempering |
|---|---|---|
| 221.1 | 430 | Very pale yellow |
| 237.8 | 460 | Straw-yellow |
| 254.4 | 490 | Yellow-brown |
| 260.0 | 500 | Brown-yellow |
| 271.1 | 520 | Brown-purple |
| 282.2 | 540 | Full purple |
| 293.3 | 560 | Full blue |

# Triangle Chart

FOR THE RAPID SOLUTION OF RIGHT-ANGLE AND OBLIQUE-ANGLE TRIANGLES






# INDEX

# A

## Amplifiers


Electronic Gage . . . . . 236–239

Gage–Chek™ . . . . . 237


# B

## Blocks


Bench . . . . . 350

Gage . . . . . 393

Inspection . . . . . 366

Reverse Reading . . . . . 120

Riser . . . . . 120

Wear . . . . . 385


## Bore Gages


AccuPlug . . . . . 217–220

Dial . . . . . 214–216

Electronic . . . . . 206–210

AccuBore® . . . . . 206–208

Special Measuring Heads . . . . . 213

Vernier . . . . . 211


# C

## Calibration, Accuracy/General


**Service Information** . . . . . 14–16


## Calipers


Firm–Joint . . . . . 317–318

Lock–Joint . . . . . 317–318

Hermaphrodite . . . . . 317–318

Leg Type

Spring–Type, Round Legs . . . . . 316

Spring–Type, "Yankee" Flat Legs . . . . . 316


## Slide Calipers


Carbon Fiber . . . . . 92

Center Distance Attachment . . . . . 99

Circumference . . . . . 106

Dial . . . . . 96, 98–99

Electronic . . . . . 91

Groove . . . . . 95

Long Jaw . . . . . 94

Pocket . . . . . 106

Vernier

Gear Tooth . . . . . 104

Master . . . . . 100

Spring–Type . . . . . 316

"Yankee" . . . . . 316



**Trammels** . . . . . 319–320

**Center Finder/Wiggler** . . . . . 348


## Clamps


Shaft Alignment . . . . . 195

Toolmakers' Parallel . . . . . 363

Toolmakers' Steel . . . . . 364



**Collet Adaptor** . . . . . 137, 139, 349


## Combination Squares


Attachments . . . . . 278

Blades . . . . . 276

Heads . . . . . 277

Junior . . . . . 280

Large . . . . . 279

Student . . . . . 279

with Square and Center Heads . . . . . 273

with Square, Center and Non–reversible

Protractor Heads . . . . . 275



**Cut Nippers** . . . . . 347

# D


**Data Collection Systems** . . . . . 225–234

DataSure® Wireless Systems . . . . . 226–230

GageMux . . . . . 233

SmartCables . . . . . 234

Software

Wedge™ . . . . . 231, 233–234

**Depth Gages** . . . . . 123–131

Attachment for Height Gages . . . . . 120

Bases . . . . . 131–132

Depth and Angle . . . . . 129

Dial . . . . . 127, 130–132

Electronic . . . . . 124–126

Protractor . . . . . 313

Steel Rule . . . . . 128

Vernier . . . . . 128

**Dividers**

Toolmakers' . . . . . 316

Yankee . . . . . 316

**Drill Rod** . . . . . 530–534


# E


**Educational Materials** . . . . . 535–538


# G


**Gages**

Acme Screw Thread . . . . . 330

Angle . . . . . 129, 333

Angle and Depth . . . . . 129

Center . . . . . 333

Chamfer . . . . . 186

Combination Taper, Wire, Thickness . . . . . 342

Comparator Stands . . . . . 185

Countersink . . . . . 187

Crankshaft Distortion Dial/Strain . . . . . 196

Cylinder . . . . . 198

Dial

Comparator . . . . . 185

Diameter . . . . . 200– 202

Groove . . . . . 193

Inside . . . . . 194

Inside Caliper . . . . . 194

Outside Caliper . . . . . 193

Pocket . . . . . 190

Sheet . . . . . 188

Snap . . . . . 192

Thickness . . . . . 191

Universal Back–Plunger . . . . . 142

Diameter

Set Master . . . . . 203–204

Diameter Gages and Masters . . . . . 199–204

Drill

Drill & Steel Wire . . . . . 329–330

Jobbers' . . . . . 329

Letter Size . . . . . 329

Tap and Drill . . . . . 329

Electronic

Amplifier . . . . . 239

Snap . . . . . 190

Engineers' Combination . . . . . 342

Fixed Gage Standards . . . . . 327–342

Angle . . . . . 333

Holder . . . . . 336

Hole . . . . . 188, 322–325

Piano Tuners' . . . . . 330
Radius . . . . . 332
Scratch . . . . . 346
Screw Pitch . . . . . 334–335
Sets
Radius . . . . . 336
Steel Pin . . . . . 328
Surface . . . . . 344–345
Surface, Universal Snugs . . . . . 345
Taper . . . . . 326
Telescoping . . . . . 324–325
Thickness . . . . . 338–342
"Feeler" Stock . . . . . 340–342
U.S. Standard . . . . . 330
Wire . . . . . 330
American Standard . . . . . 330
American Steel & Wire Co. . . . . 330
English Standard . . . . . 330

**Granite Products** . . . . . 411–424

Angle Plates . . . . . 423
Cleaner . . . . . 422
Covers . . . . . 423
Cubes . . . . . 422
Master Squares . . . . . 421
Parallels . . . . . 421
Repeat Reading Gage . . . . . 424
Stands . . . . . 419
Cabinet . . . . . 419
Straight Edges . . . . . 422
Surface Plates
Crystal Pink® . . . . . 416
Superior Black . . . . . 418
Toolmakers' Flats . . . . . 420
Tri–Squares . . . . . 420
V–Blocks . . . . . 422

**Ground Flat Stock** . . . . . 516–529

Air Hardening . . . . . 520–525
High Carbon . . . . . 526–527
Low Carbon . . . . . 528–529
Oil Hardening . . . . . 516–519

## H

**Hammer, Toolmakers'** . . . . . 350

**Height Gages** . . . . . 107

Accessories . . . . . 120–122
Altissimo® . . . . . 108–110
Dial . . . . . 117
DIGI–CHEK™ . . . . . 119
DIGI–CHEK™ II . . . . . 118
Electronic . . . . . 108–113
Scribers . . . . . 122
Transfer Gage . . . . . 121
Vernier . . . . . 114–116
Master . . . . . 115

**Hold–Downs** . . . . . 363

## I

**Indicators** . . . . . 133–176

Attachments and Accessories . 137, 139, 143, 166–169, 169
Backs . . . . . 163, 165
Bases/Holders . . . . . 177–185
Contact Points . . . . . 167–168

Dial
AGD . . . . . 148
Accessories . . . . . 169–170
Comparison Chart . . . . . 148–149
Design Features . . . . . 145
General Information . . . . . 144–145
Group 1 . . . . . 154–155
Group 2 . . . . . 156–157
Group 3 . . . . . 158
Group 4 . . . . . 159, 162
Sets . . . . . 157
Specifications . . . . . 144
Back Plunger . . . . . 141–143
Comparator . . . . . 164, 185
Long Range . . . . . 160–162
Miniature . . . . . 146
Nonshock Mechanism . . . . . 166
Numbering and Line Styles . . . . . 150–153
Shock Absorbing Anvil Unit . . . . . 167
Special Function . . . . . 186–202
Spindle Squares . . . . . 189
Dial Test . . . . . 135–140
Dovetail Mount . . . . . 135–136
Last Word® . . . . . 138
Swivel Head . . . . . 136
Displays and Probes . . . . . 175
Electronic
AGD Group 2 . . . . . 172, 176
Wisdom® . . . . . 173
Holders . . . . . 177–186
Flex–O–Post . . . . . 180
Inspection . . . . . 184
Magnetic . . . . . 178–181
Heavy–Duty . . . . . 182
Mini . . . . . 182
Testers . . . . . 171

## J

**Jack Screws** . . . . . 349

## K

**Kleenscribe™ Layout Dye** . . . . . 347

## L

**Laser Measurement** . . . . . 493
Profile360
Accessories . . . . . 502
Apex Extrusion . . . . . 508
Auto Seals . . . . . 496
Metal Profiles . . . . . 499
Pipe and Tube . . . . . 500
PVC Extrusion . . . . . 497
Software . . . . . 503
Wire and Cable . . . . . 501
Wood–Plastic Composite . . . . . 498
Tire Industry
Bead–to–Bead . . . . . 512
Green Tire Uniformity System . . . . . 510
Off–Line Profilometer . . . . . 506
Off–Line Profilometer SL . . . . . 507
On–Line Profilometer . . . . . 505
Ply Splice Monitor . . . . . 509
Tread Wear Measurement System . . . . . 511
**Layout Dye** . . . . . 347
**Levels**
Machinists' . . . . . 372–376

Bench . . . . . 374, 376
Cross Test . . . . . .375
Master Precision . . . . . .372
Pocket . . . . . 376
with ground and graduated vials . . . . . 373

**Lubricant** . . . . . 368

M1® All–Purpose . . . . . 368–369
Tool & Instrument Oil . . . . . 366


# M


**Machinists' Precision Shop Tools** . . . . . 343–368

**Material Test and Force Measurement** . . . . . 477

Frames
Dual . . . . . .484, 488
Single . . . . . .482, 486
Load Cells . . . . . .490–491
Systems . . . . . .478–481
Test Fixtures . . . . . .492

**Micrometers** . . . . . .

. . . . . 19, 119, 206, 210, 231, 264, 383, 395, 537

Attachments
Ball . . . . . 60
Bench . . . . . .75–76
Calipers
Inside . . . . . .83
Depth . . . . . 84–88
Digital Outside. . . . . 28–29
Electronic . . . . . 26–27
Bench . . . . . .75
Blade–Type . . . . . 55
Disc–Type . . . . . 57
Multi–Anvil . . . . . .47
Outside . . . . . .24–27
Rounded Anvil . . . . . .59
Screw Thread Comparator . . . . . .62
Sheet Metal . . . . . .49
Tube . . . . . .50
Heads . . . . . 66–74
0–1"/0–25mm . . . . . .71
0–1"/0–25mm, Heavy Duty . . . . . 72
0–1"/0–25mm, Non–Rotating . . . . . 72
0–1/4" . . . . . 67
0–1/2" . . . . . 68
0–1/2"/0–13mm . . . . . 67
0–1/2", Non–Rotating Spindles . . . . . 66
0–1/2", Stainless Steel . . . . . 68
0–1/4"/0–6.5mm . . . . . 67
0–1", Digital . . . . . 70
0–1", Large, Super–Precision . . . . . 74
0–2"/0–50mm, Electronic . . . . . .69
0–2", Electronic . . . . . 69
0–2", Large, Direct–Reading . . . . . .73
0–2", Long Range . . . . . .70
0–1" . . . . . 71
Speeds Gaging . . . . . .45
Inside . . . . . .77–82
Combination Head with Inside Micrometer . . . . . 79
End Measuring Rods . . . . . 77–78
Heads and Rods to 107" . . . . . 82
Heads and Solid–Rods to 32" . . . . . .80
Heads and Tubular Rods to 40" . . . . . .81
Internal Groove . . . . . 83
Internal Micrometers . . . . . .80
Measuring Tips . . . . . 77
Tubular . . . . . 81–82
Measuring Rods . . . . . 78

Mul–T Anvil . . . . . 46
Outside . . . . . 30–31, 34–37
Automotive Crankshaft . . . . . 51
Automotive Disc Brake . . . . . 52
Blade–Type . . . . . 54–55
Can Curl . . . . . 64
Can Seam . . . . . 64
Disc–Type . . . . . 56–57
Groove . . . . . 52
Hi–Precision . . . . . 32
Hub . . . . . 65
Insulated Frame . . . . . 32
Interchangeable Anvil . . . . . 40–42,
Paper Gage . . . . . 53
Rounded Anvils . . . . . 58–59
Screw Thread . . . . . 61–62
Screw Thread Comparator . . . . . 62
Sheet Metal . . . . . 48–49
Special Function . . . . . 45–67
Stainless Steel . . . . . 33
Stand . . . . . 44
Steel Mill . . . . . 60
Tube . . . . . 50
Tubular Bow Type . . . . . 42–43, 43
Tubular Deep Throat . . . . . 45
V–Anvil . . . . . 63
Wire . . . . . 63
Sets . . . . . 28, 34, 38–39, 79, 82

# O

**Optical Comparators** . . . . . 455–476
Accessories . . . . . 469
Adaptor . . . . . 468
Horizontal Benchtop . . . . . 456, 458, 460
Horizontal Floor Standing . . . . . 464
Side Bed . . . . . 466
Vertical . . . . . 462

# P

**Parallels**
Steel . . . . . 307
**Precision Angle Plate** . . . . . 363
**Precision Shop Tools** . . . . . 343–370
Adjustable–Jaw Cut Nippers . . . . . 347
**Protractors** . . . . . 309–314
Drill Point Gage . . . . . 313
Non–Reversible Bevel . . . . . 314
Reversible Bevel . . . . . 314
Special Dial Heads . . . . . 312
Steel . . . . . 311–312
Universal Bevel . . . . . 310, 312
Vernier Bevel . . . . . 310
**Punches** . . . . . 351–355
Automatic . . . . . 351
Center . . . . . 351–352
Drive Pin . . . . . 354
Drive Pin, Brass . . . . . 354
Drive Pin, Machine . . . . . 355
Drive Pin, Machine, Brass . . . . . 355
Hinge–Locating . . . . . 351
Prick . . . . . 353
Round Shank . . . . . 352
Square–Head . . . . . 353

# R


**Reference Tables** . . . . . 541

**Rules** . . . . . 287–305

Accessories

Holder . . . . . 305

Key Seat Clamps . . . . . 304

Pocket Clip . . . . . 289

English Pattern . . . . . 303

Hook . . . . . 289

Parallels . . . . . 308

Steel . . . . . 305–306

Decimal Equivalents . . . . . 302

Draftsmen's . . . . . 306

Folding, Circumference . . . . . 303

General Utility . . . . . 303

Letter and Number Drill Sizes . . . . . 302

Precision . . . . . 288–301

Shrink Graduations . . . . . 301


# S


**Screwdrivers** . . . . . 356–357

Jewelers' . . . . . 356

Pocket . . . . . 357

Precision . . . . . 356

**Scribers**

Adjustable Sleeve . . . . . 346

Improved . . . . . 346

Pocket . . . . . 346

**Slide Calipers**

Electronic . . . . . 90

Vernier . . . . . 103

Master . . . . . 105

**Small Hole Gages** . . . . . 323

**Special Gaging** . . . . . 255–268

**Squares** . . . . . 269–288

Diemakers' . . . . . 285–286

Double . . . . . 283–284

Heads

Cast Iron . . . . . 272–273

Center and Protractor . . . . . 274

Hardened Steel . . . . . 272–273

Master Precision . . . . . 281

Toolmakers' Stainless Steel . . . . . 282

Try . . . . . 282

**Straight Edges**

Steel . . . . . 306


# T


**Tachometer** . . . . . 370

**Tap Wrenches** . . . . . 359

**Testers**

Hardness

Analog . . . . . 240

Compact . . . . . 244

Digital . . . . . 241, 252

Portable . . . . . 245–247

Roundess . . . . . 247–248

Software

TalyProfile . . . . . 251

Surface Roughness . . . . . 249–251

Thickness . . . . . 253–254

**Tool and Instrument Oil** . . . . . 366

**Tool Chest** . . . . . 224

**Tool Sets** . . . . . 221–224
Automotive . . . . . 223
Basic Precision . . . . . 223

# V

**V–Blocks** . . . . . 360–362
Dual–Vee, Magnetic . . . . . 361
**Video Borescopes** . . . . . 367
**Video Inspection Systems** . . . . . 440–442
**Vises**
Combination Hand . . . . . 365
Pin . . . . . 358
Double End . . . . . 358
Tapered . . . . . 358
Precision Grinding . . . . . 364
**Vision Systems** . . . . . 426–454
Accessories . . . . . 443
Automatic Vision Systems . . . . . 430, 432
Horizontal Digital Video Projector . . . . . 438
Large Format Premier . . . . . 436
Manual Vision Systems . . . . . 427, 428
Microscope–Based Optics . . . . . 434
Motion Stages . . . . . 444
Multi–Sensor . . . . . 434
Software . . . . . 454
Metlogix™ . . . . . 452
Quadra–Chek® . . . . . 450–451
**Vocational and Educational** . . . . . 535–540

# W

**Webber Gage** . . . . . 377–410
Angle Gage Blocks . . . . . 401–402
Calibration . . . . . 409–410
Chamois . . . . . 408
croblox® Reflecting Cubes . . . . . 404–405
Indicator Accessory Set . . . . . 391
Internal Measuring Machine Jaws . . . . . 396
MicroAccurate® . . . . . 384
Optical Flats . . . . . 407
Polygons . . . . . 406
Reference Bars . . . . . 400–401
Steel Internal Measuring Machine Jaws . . . . . 387
Stones . . . . . 408
True Squares . . . . . 403
Wear Blocks . . . . . 391
**Wiggler/Center Finder** . . . . . 348
**Wireless Data Collection** . . . . . 232
**Wooden Tool Chest** . . . . . 224

| | | |
|---|---|---|
| **1** | Adjustable–Jaw Cut Nippers | 347 |
| **M1** | Metlogix™ Software | 452 |
| **M1®** | Industrial Quality All–Purpose Lubricant | 368 |
| **2** | Outside Micrometers | 31 |
| **2A** | Outside Micrometers | 31 |
| **L2** | Systems | 479 |
| **L2 Plus** | Systems | 480 |
| **M2** | Metlogix™ Software | 452 |
| **S2** | Systems | 478 |
| **L3** | Systems | 481 |
| **M3** | Metlogix™ Software | 452 |
| **6** | Screw Pitch Gage | 334 |
| **8** | Large Combination Squares | 279 |
| **9** | Combination Squares | 275 |
| **9.MA1** | Mini–Metric Rectangular Steel Gage Block Set | 393 |
| **10** | Student Combination Squares | 279 |
| **11H** | Combination Squares | 272 |
| **11HC** | Combination Squares | 273 |
| **12** | Non–reversible Bevel Protractors | 314 |
| **13** | Double Squares with hardened blades | 283 |
| **14** | Double Steel Squares | 284 |
| **18** | Automatic Center Punches | 351 |
| **C19** | Steel Protractor | 311 |
| **20** | Master Precision Squares | 281 |
| **22C** | Drill Point Gage | 313 |
| **25** | Dial Indicators | 148, 156 |
| **25** | Dial Indicators, Long Range | 160–161 |
| **25LC** | Range Limit Cap | 169 |
| **25R** | Contact Point Set | 168 |
| **25SC** | Split Collets | 169 |
| **25W** | Roller Indicator Contact Point | 168 |
| **26** | Firm–Joint Calipers, Outside | 318 |
| **27** | Firm–Joint Calipers, Inside | 318 |
| **28** | Shock Absorbing Anvil | 167 |
| **29** | Scratch Gage | 346 |
| **33H** | Forged and Hardened Steel Heads | 272 |
| **33HC** | Combination Squares | 273 |
| **33J** | Junior Combination Squares | 280 |
| **36** | Lock–Joint Transfer Calipers, Outside | 318 |
| **37** | Lock–Joint Transfer Calipers, Inside | 318 |
| **38** | Lock–Joint Calipers, Outside | 318 |
| **39** | Lock–Joint Calipers, Inside | 318 |
| **42** | Hermaphrodite Calipers | 317 |
| **47** | Universal Bevel | 312 |
| **50** | Trammels | 319 |
| **54** | Hold–Downs | 363 |
| **55** | Master Precision Squares with Beveled Edges | 281 |
| **56** | Small Surface Gages | 344 |
| **57** | Full–sized Surface Gages | 345 |
| **57S** | Universal Snugs | 143, 345 |
| **58S** | Universal Snugs | 143, 345 |
| **59** | Trammels | 319 |
| **61** | "Reliable" Try Square | 282 |
| **62** | Rule Holder | 305 |
| **63** | Long Range Micrometer Heads | 70 |
| **66** | Thickness Gage | 338–339 |

**67** Improved Scriber . . . . . 346
**68** Adjustable Sleeve Scriber . . . . . 346
**70** Pocket Scribers . . . . . 346
**73** "Yankee" Inside Calipers . . . . . 316
**78XT** Bore Gages . . . . . 211–212
**79** "Yankee" Outside Calipers . . . . . 316
**80** Miniature Dial Indicators . . . . . 146
**81** Dial Indicators . . . . . 154–155
**82** Dial Bore Gages . . . . . 215
**83** "Yankee" Dividers . . . . . 316
**84** Dial Bore Gages . . . . . 216
**86** Combination Hand Vise . . . . . 365
**91** Tap Wrenches . . . . . 359
**93** T–Handle Tap Wrenches . . . . . 359
**98** Machinists' Levels . . . . . 373
**C100A** Steel Rules . . . . . 301
**C100F** Steel Rules . . . . . 301
**QC100** Quadra–Chek® Software . . . . . 450
**SR100** Surface Roughness Tester . . . . . 249
**110** Gage Holder . . . . . 336
**117** Center Punches . . . . . 352
**119** Bench Blocks . . . . . 350
**120B** Dial Calipers with Long Nib Jaws . . . . . 99
**120** Dial Calipers . . . . . 96
**120J** Offset Dial Caliper . . . . . 99
**121** Long Range Tubular Inside Micrometer Sets . . . . . 82
**123** Master Vernier Calipers . . . . . 100
**124** Inside Micrometers . . . . . 80
**125** Vernier Calipers . . . . . 103
**128** Inside Micrometers . . . . . 79
**128** Micrometer Sets . . . . . 79
**129** Bench Blocks . . . . . 350
**130** Bench Level . . . . . 376
**132** Precision Bench Levels . . . . . 374
**134** Cross Test Level and Plumb . . . . . 375
**135** Pocket Levels . . . . . 376
**136** Cross Test Level . . . . . 375
**154** Adjustable Parallels . . . . . 308
**155** Screw Pitch Gage . . . . . 334
**156** Screw Pitch Gages . . . . . 335
**159** Screw Pitch Gages . . . . . 335
**160** Toolmakers' Steel Clamps . . . . . 364
**161** Toolmakers' Parallel Clamps . . . . . 363
**162** Pin Vises . . . . . 358
**165** Double End Pin Vise . . . . . 358
**166** Pin Vises . . . . . 358
**167** Gage Holders . . . . . 336
**S167** Gage Holders . . . . . 336
**SD167** Gage Holders . . . . . 336
**170** Dial Sheet Gages . . . . . 188
**172** Thickness Gages . . . . . 338–339
**173** Thickness Gages . . . . . 339
**174** Tap Wrench . . . . . 359
**178** Fillet or Radius Gages . . . . . 332
**C182** Steel Protractor . . . . . 311
**C183** Steel Protractor . . . . . 311
**185** Time Saver® Tap and Drill Gage . . . . . 329

**186** Drill and Steel Wire Gage . . . . . 329
**187** Jobbers' Drill Gage – Hardened . . . . . 329
**188** English Standard Wire Gage . . . . . 330
**190** "Little Giant" Jack Screws . . . . . 349
**191** "Little Giant" Jack Screws . . . . . 349
**193** Steel Protractor . . . . . 312
**196** Universal Back–Plunger Dial Indicators . . 142
**198** Standard Letter Size Drill Gage . . . . . 329
**199** Master Precision Level . . . . . 372
**AVR200** Automatic Vision Metrology Systems . . . 432
**MVR200** Manual Vision Metrology Systems . . . . . 428
**QC200** Quadra–Chek® Software . . . . . 450
**200W** Wooden Toolbox . . . . . 224
**207** Can Seam Outside Micrometers . . . . . 64
**208** Can Seam Outside Micrometers . . . . . 64
**209** Can Curl Micrometers . . . . . 64
**210** Screw Thread Comparator Outside Micrometers . . . . . 62
**211** Rounded Anvil Outside Micrometers . . . . . 58
**216** Digital Micrometers . . . . . 28–29
**220** Mul–T–Anvil Outside Micrometers . . . . . 46
**221** Outside Micrometers . . . . . 32
**222** Sheet Metal Outside Micrometers . . . . . 48
**223** Paper Gage Outside Micrometers . . . . . 53
**224** Interchangeable Anvil Micrometers . . . . . 40
**225** Wire Micrometers . . . . . 63
**226** Outside Micrometers . . . . . 34
**228** Hub Outside Micrometer . . . . . 65
**229** Telescoping Gages . . . . . 324
**230** Outside Micrometers . . . . . 30
**231** Outside Micrometers . . . . . 32
**232** Outside Micrometers . . . . . 30
**234** End Measuring Rods . . . . . 78
**236** Depth and Angle Gages . . . . . 129
**237** Steel Rule Depth Gages . . . . . 128
**240** Pin Vises . . . . . 358
**243** Hermaphrodite Calipers . . . . . 317
**245** Engineers' Taper, Wire and Thickness Gage . . . . . 342
**247** Micrometer Ball Attachments . . . . . 60
**248** Drive Pin Punches . . . . . 355
**C251** Trammels and Attachments . . . . . 320
**252** Height Transfer Gages . . . . . 121
**253** Dial Indicator Sets . . . . . 157
**254** Master Vernier Height Gages . . . . . 115
**255** Vernier Height Gages . . . . . 116
**255EM** Vernier Height Gages . . . . . 116
**256** Disc–Type Outside Micrometers . . . . . 56
**257** Surface Gages . . . . . 345
**258** DIGI–CHEK™ Height Gages . . . . . 119
**258R** Riser Blocks . . . . . 120
**258RRB** Reverse Reading Blocks . . . . . 120
**260** Groove Outside Micrometers . . . . . 52–53
**261** Micrometer Heads . . . . . 66
**262** Micrometer Heads . . . . . 72
**263** Micrometer Heads . . . . . 71
**264** Center Punches . . . . . 352
**267** Taper Gage . . . . . 326

**268** V–Blocks and Clamp . . . . . 360
**269** Taper Gages . . . . . 326
**270** Taper Gage . . . . . 326
**271** V–Blocks and Clamp . . . . . 360
**272** Fillet or Radius Gages . . . . . 332
**274** Toolmakers' Inside Calipers . . . . . 316
**275** Toolmakers' Outside Calipers . . . . . 316
**277** Toolmakers' Dividers . . . . . 316
**278** V–Blocks and Clamps . . . . . 360
**279** Fillet or Radius Gages . . . . . 332
**280** Piano Tuners' Gage . . . . . 330
**281** American Standard Wire Gage . . . . . 330
**283** U.S. Standard Gage . . . . . 330
**284** Acme Standard Screw Thread Gage . . . . 330
**286** Drill and Steel Wire Gage . . . . . 330
**287** American Steel & Wire Co. Gage . . . . . 330
**289** Attachment for Combination Squares . . . 278
**298** Key Seat Clamps . . . . . 304
**299** Rule Clamp . . . . . 304
**AV300+** Multi–Sensor Vision Machine . . . . . 434
**AV300** Automatic Vision Metrology Systems . . . 430
**AVR300** Automatic Vision Metrology Systems . . . 432
**HDV300** Horizontal Digital Video Projector . . . . . 438
**AV300+ Micro** Microscope–Based Optics . . . . . 434
**MV300** Manual Vision Metrology Systems . . . . . 427
**MVR300** Manual Vision Metrology Systems . . . . . 428
**SR300** Surface Roughness Tester . . . . . 250–251
**300W** Wooden Tool Box . . . . . 224
**C303R** Steel Rules . . . . . 292
**C303SR** Steel Rules . . . . . 292, 294–295
**C304R** Steel Rules . . . . . 292, 294–295
**C304SRE** Steel Rules . . . . . 292, 294
**C305R** Steel Rules . . . . . 292, 294–295
**C306R** Steel Rules . . . . . 292, 294
**C309R** Steel Rules . . . . . 292
**C310K** Steel Rules with Pocket Clip . . . . . 292
**C310R** Steel Rules . . . . . 292, 294
**C310T** Tapered Steel Rules . . . . . 292
**C316R** Steel Rules . . . . . 292, 294–295
**C330** Steel Rules . . . . . 298
**C331** Steel Rules . . . . . 300
**C334** Steel Rules . . . . . 300
**C335S** Steel Rules . . . . . 298
**344** A6 Air Hardening Flat Stock . . . . . 524–525
**AV350+** Multi–Sensor Vision Machine . . . . . 434
**AV350** Automatic Vision Metrology Systems . . . 430
**MV350** Manual Metrology Systems . . . . . 427
**359** Universal Bevel Protractors . . . . . 310
**363** Digital Micrometer Heads . . . . . 70
**C368** Steel Rules . . . . . 301
**C369** Steel Rules . . . . . 301
**C370** Steel Rules . . . . . 301
**C374** Steel Rules . . . . . 301
**C375** Steel Rules . . . . . 301
**C376** Steel Rules . . . . . 301
**C377** Steel Rules . . . . . 301
**C378** Steel Rules . . . . . 301
**380** Steel Straight Edges . . . . . 306

**384** Steel Parallels . . . . . .307

**385** Steel Straight Edges, Bevel Edge . . . . . .306

**386** Draftsmen's Steel Straight Edges with Bevel Edge . . . . . .306

**387** Steel Straight Edges, Bevel and Graduated Edge . . . . . .306

**C389** Steel Rules . . . . . .301

**C396** Center Gage . . . . . .333

**C398** Center Gage . . . . . .333

**HDV400** Horizontal Digital Video Projector . . . . . .438

**SR400** Surface Roughness Tester . . . . . .250

**401** High Carbon, High Chromium Flat Stock .526

**402** High Carbon, High Chromium Flat Stock . . . . . .526–527

**C404R** Steel Rules . . . . . .295–296

**CH404R** Steel Rules . . . . . .295–296

**414** Steel Rules, English Pattern . . . . . .303

**C416R** Steel Rules . . . . . .295–296

**CH416R** Steel Rules . . . . . .295–296

**423** Small Steel Rules with Holder . . . . . .305

**424** Stainless Steel Pocket Slide Calipers . . .106

**434** Combination Squares . . . . . .274

**435** Square, Center and Protractor Head . . . .274

**436–3 1/2** Automotive Crankshaft Outside Micrometers . . . . . .51

**436** Outside Micrometers . . . . . .35–39

**440** Depth Micrometers . . . . . .87

**443** Micrometer Depth Gages with Half Base . .88

**445** Depth Micrometers . . . . . .87

**446** Digital Micrometer Depth Gages . . . . . .85

**448** Vernier Depth Gages . . . . . .128

**449** Micrometer Depth Gages . . . . . .86

**450** Dial Depth Gages . . . . . .127

**452** Cylinder Gages . . . . . .198

**453** Diemakers' Squares . . . . . .285

**456** Gear Tooth Vernier Calipers . . . . . .104

**457** Diemakers' Square . . . . . .286

**458** Automotive Disc Brake Outside Micrometers . . . . . .52

**460B** Micrometer Heads . . . . . .67

**460** Micrometer Heads . . . . . .67

**463** Micrometer Heads . . . . . .68

**464** Micrometer Heads . . . . . .67

**465** Micrometer Heads . . . . . .73

**466** Angle Gage . . . . . .333

**467** Thickness Gage . . . . . .338

**467** Thickness Gages . . . . . .339

**468** Micrometer Heads . . . . . .73

**469** Micrometer Heads . . . . . .74

**471** Steel Folding Rule, Circumference . . . . .303

**472** Screw Pitch Gage . . . . . .335

**473** Screw Pitch Gage . . . . . .335

**474** Screw Pitch Gage . . . . . .334

**476** Screw Pitch Gage . . . . . .335

**480** Oil Hardening Drill Rod, O1 . . . . . .530–531

**481** Water Hardening Drill Rod, W1 . . . .532–533

**482** Air Hardening Drill Rod, A2 . . . . . .534

**483** V–Anvil Outside Micrometers . . . . . .63

**484** Screw Pitch Gage . . . . . 334
**485** V–Anvil Micrometers . . . . . 63
**486** Blade Type Outside Micrometers . . . . . 54
**490** Reversible Bevel Protractors . . . . . 314
**491** Reversible Bevel Protractors . . . . . 314
**493** Protractor and Depth Gages . . . . . 313
**C493B** Protractor and Depth Gages . . . . . 313
**C493** Protractor and Depth Gages . . . . . 313
**495** Oil Hardening Flat Stock . . . . . 516
**496** Oil Hardening Flat Stock . . . . . 516–521
**497** Air Hardening Flat Stock . . . . . 520–522
**498** Low Carbon Flat Stock . . . . . 528–529
**499** Air Hardening Flat Stock . . . . 520, 522–523
**RT500** Roundess Tester . . . . . 247
**551** Precision Screwdrivers . . . . . 356
**553** Pocket Screwdrivers . . . . . 357
**555** Jewelers' Screwdrivers . . . . . 356
**563** Firm–Joint Hermaphrodite Calipers . . . . 317
**565** Drive Pin Punches . . . . . 354
**566** Dual–Vee Magnetic V–Block . . . . . 361
**567** V–Block and Clamp . . . . . 362
**568** V–Blocks and Clamps . . . . . 361
**569** Tube Outside Micrometers . . . . . 50
**572** Thickness Gage . . . . . 339
**575** Screw Thread Outside Micrometers . . . . . 61
**576** Rounded Anvil Outside Micrometers . . . . . 58
**577** Rounded Anvil Outside Micrometers . . . . . 58
**578** V–Block and Clamp . . . . . 362
**579** Telescoping Gages . . . . . 325
**580** Precision Angle Plate . . . . . 363
**581** Precision Grinding Vise . . . . . 364
**585** Screw Thread Outside Micrometers . . . . . 61
**C601** Steel Rules . . . . . 293–294
**604R** Steel Rules . . . . . 293–294
**C604R** Steel Rules . . . . . 292–296
**CD604R** Steel Rules . . . . . 293–294
**CH604R** Steel Rules . . . . . 293–296
**DH604R** Steel Rules . . . . . 293–294
**C604RE** Steel Rules . . . . . 293–294
**H604R** Steel Rules . . . . . 293–294
**C606R** Steel Rules . . . . . 293–294
**C607R** Steel Rules . . . . . 293–296
**610N** Steel Rules . . . . . 293–294
**C610N** Steel Rules . . . . . 293–294
**CH610N** Steel Rules . . . . . 293
**H610N** Steel Rules . . . . . 293–294
**611N** Steel Rules . . . . . 293
**C616R** Steel Rules . . . . . 293–294
**C622R–6** Steel Rule, Decimal Equivalents . . . . . 302
**C635** Steel Rules . . . . . 298
**C635E** Steel Rules . . . . . 298
**635N** Steel Rules . . . . . 298
**C636EM** Steel Rules . . . . . 300
**C636ME** Steel Rules . . . . . 300
**C637** Steel Rules . . . . . 298
**C637E** Steel Rules . . . . . 298
**640** Dial Depth Gages . . . . . 130
**641** Back–Plunger Dial Indicators . . . . . 143

**642** Top Reading Dial Depth Gages . . . . . 132
**643** Dial Depth Gage . . . . . 130
**644** Dial Depth Gages . . . . . 131
**647** Dial Comparator Indicators . . . . . 164
**648** Depth Gage Bases . . . . . 131
**648** Depth Gage Bases with Stem Collet . . . . 169
**649** Spindle Squares . . . . . 189
**650** Back–Plunger Dial Indicators . . . . . 141
**651** Back Plunger Dial Indicators . . . . . 141
**653** Dial Comparators . . . . . 185
**653G** Dial Comparators . . . . . 185
**655** Dial Indicators . . . . . 148, 158
**655** Dial Indicators, Long Range . . . . . 160–161
**656** Dial Indicators . . . . . 148, 159
**656** Dial Indicators, Extra Long Range . . . . . 162
**656** Dial Indicators, Long Range . . . . . 160
**657–1** Magnetic Base Universal Indicator Holder . . . . . 181
**657–2** Magnetic Base Universal Indicator Holder . . . . . 181
**657AA** Magnetic Base Indicator Holder . . . . . 178
**657A** Magnetic Base Indicator Holder . . . . . 179
**657** Indicator Holders . . . . . 177
**657T** Flex–O–Post Indicator Holders . . . . . 180
**659** Heavy–Duty Magnetic Base Indicator Holder . . . . . 182
**660** Magnetic Base Indicator Holder . . . . . 181
**661** Mini Magnetic Indicator Holder . . . . . 182
**663** Heavy Duty Micrometer Heads . . . . . 72
**665** Inspection Holder and Dial Indicators . . . 184
**666** Thickness Gages/"Feeler" Stock . . . . . 340
**667** Thickness Gages/"Feeler" Stock . . . . . 341
**668** Shaft Alignment Clamp Sets . . . . . 195
**670** Indicator Hole Attachment . . . . . 166
**671** Universal Attachment . . . . . 166
**673** Bench Micrometers . . . . . 76
**675** Dial Comparators . . . . . 185
**683** Internal Chamfer Gages . . . . . 186
**684** Internal Chamfer Gages . . . . . 186
**685** External Chamfer Gages . . . . . 186
**686** External Chamfer Gages . . . . . 186
**687** Countersink Gages, 82º . . . . . 187
**688** Countersink Gages, 90º . . . . . 187
**689** Countersink Gages, 100º . . . . . 187
**696** Crankshaft Distortion Dial/Strain Gage . . 196
**697** Inside Dial Gages . . . . . 194
**698** Video Borescopes . . . . . 367
**699** Video Borescopes . . . . . 367
**700** Inside Micrometer Calipers . . . . . 83
**701** Internal Groove Micrometers . . . . . 83
**706** Inspection Blocks . . . . . 366
**707** Steel Internal Measuring Machine Jaws . 387
**708** Dial Test Indicators with dovetail mounts . 135
**709** Dial Test Indicators with dovetail mounts . 135
**711** Last Word® Dial Test Indicators . . . . . 138
**714** Electronic Interchangeable Anvil Outside Micrometers . . . . . 41
**715** Electronic Gage Amplifier Gage Heads . . 239

**716** Indicator Testers . . . . . 171
**717** Electronic Gage Amplifier . . . . . 236
**719** Software Wedge™ . . . . . 231, 233–234
**724** Tubular Outside Micrometers . . . . . 42
**725** Deep Throat Tubular Micrometer . . . . . 45
**733** Electronic Micrometers (with output) . . . . . 27
**736** Tubular Outside Micrometers . . . . . 43
**749** Electronic Micrometer Depth Gage . . . . . 84
**756** Electronic Disc–Type Micrometers . . . . . 57
**760** Electronic Screw Thread Comparator Micrometer . . . . . 62
**762** Micrometer Heads . . . . . 69
**764** Electronic Sheet Metal Micrometers . . . . . 49
**765A** Electronic Snap Gage . . . . . 190
**S766** Basic Electronic Tool Sets . . . . . 222
**769** Electronic Tube Micrometers . . . . . 50
**776** Gage–Chek™ . . . . . 237
**777** Electronic Bench Micrometers . . . . . 75
**780XT** Electronic Internal Micrometers . . . 209–210
**781XT** AccuBore® Electronic Bore Gages . 206–208
**786** Electronic Blade–Type Outside Micrometers . . . . . 55
**788** Rounded Anvil Outside Micrometers . . . . 59
**790** Electronic Multi–Anvil Outside Micrometers . . . . . 47
**795** Electronic Micrometers (with output) . . 24–25
**796** Electronic Micrometers . . . . . 24–25
**798** Electronic Calipers . . . . . 90
**799** Electronic Calipers . . . . . 91
**RT800** Roundess Tester . . . . . 248
**800** Square–Head Nail Sets . . . . . 353
**806** Thickness Gage Holders . . . . . 342
**806D** Thickness Gage or "Feeler" Stock Holders . . . . . 342
**811** Dial Test Indicators with swivel head . . . . 136
**815** Toolmakers' Hammer . . . . . 350
**816** Prick Punches . . . . . 353
**818** Automatic Center Punches . . . . . 351
**819** Automatic Center Punches . . . . . 351
**823** Tubular Inside Micrometers . . . . . 81
**824** Inside Micrometers . . . . . 82
**827** Edge Finders . . . . . 348
**828** Wiggler/Center Finder . . . . . 348
**829** Small Hole Gages . . . . . 322
**830** Small Hole Gages . . . . . 322
**831** Small Hole Gages . . . . . 323
**S909** Basic Precision Measuring Tool Sets . . . . 223
**1010** Dial Indicator Pocket Gages . . . . . 190
**1015** Portable Dial Thickness Gages . . . . . 191
**1017** Outside Dial Caliper Gages . . . . . 193
**1019** Internal Dial Caliper Gages . . . . . 194
**1025** Stainless Steel Pocket Slide Calipers . . . 106
**1100** Heavy–Duty Dial Indicator Diameter Gages . . . . . 202
**1101** Dial Indicator Diameter Gages . . . . . 201
**1102** Dial Indicator Diameter Gages . . . . . 200
**1126** Setting Masters for 1100, 1101 Diameter Gages . . . . . 204

**1127** Setting Master for 1102 Diameter Gages . . . . . 203
**1150** Dial Indicator Snap Gages . . . . . 192
**1175** Dial Indicator Groove Gages . . . . . 193
**1202** Dial Calipers . . . . . 98
**1202F** Fractional Dial Calipers . . . . . 98
**1212** Stainless Steel Outside Micrometers . . . . . 33
**1213** Precision Tool Poster . . . . . 537
**1223** Dial Indicator Vernier Calipers . . . . . 105
**1230** Stainless Steel Outside Micrometers . . . . . 33
**1263** Stainless Steel Micrometer Heads . . . . . 71
**1309R** Steel Rules . . . . . 292
**1317** Decimal Equivalents Card . . . . . 539
**1318** Metric Equivalents Card . . . . . 539
**1463** Micrometer Heads . . . . . 68
**1604R** Steel Rules . . . . . 293–294
**1610** Kleenscribe™ Layout Dye . . . . . 347
**1612** Rule Case . . . . . 293
**1620** Tool and Instrument Oil . . . . . 366
**1634** Rule Case . . . . . 293
**1700** The Starrett Book for Student Machinists . . . . . 540
**1702** Wall Size Educational Charts . . . . . 540
**2000** Altissimo® Electronic Height Gages . . . . . 108
**2700** Wisdom® Electronic Indicators . . . . . 173
**2900** Electronic Indicators . . . . . 172
**3020** Toolmakers' Grade Stainless Steel Squares . . . . . 282
**3089** Dial Bore Gages . . . . . 214
**3206** Outside Micrometer Stand . . . . . 44
**3250** Dial Height Gage . . . . . 117
**3259–AC** Digital Height Gage Scriber Carrier Holder . . . . . 122
**3600** Electronic Indicators . . . . . 176
**3732** Electronic Micrometers . . . . . 26
**3751** Electronic Height Gage . . . . . 111
**3752** Electronic Height Gages . . . . . 112
**3753A** Electronic Depth Gage . . . . . 125
**3753B** Electronic Depth Gage . . . . . 126
**3805** Electronic Durometer . . . . . 252
**3808** Dial Test Indicators . . . . . 140
**3809** Dial Test Indicators . . . . . 140
**3810A** Digital Portable Hardness Tester . . . . . 245
**3811** Portable Hardness Tester . . . . . 244
**3812** Ultrasonic Thickness Gage . . . . . 253
**3813** Coating Thickness Gage . . . . . 254
**3814** Analog Bench Hardness Tester . . . . . 240
**3816** Digital Bench Hardness Tester . . . . . 241
**3908** Dial Test Indicators . . . . . 140
**3909** Dial Test Indicators . . . . . 140
**S4000** Pin Gages . . . . . 328
**5000** Carbon Fiber Calipers . . . . . 92
**5001** Carbon Fiber Calipers . . . . . 92
**5002** Carbon Fiber Calipers . . . . . 92
**5004** Electronic Depth Gages . . . . . 124
**5005** Electronic Long Jaw Calipers . . . . . 94
**5006** Electronic Groove Calipers . . . . . 95
**QC5200** Quadra–Chek® Software . . . . . 451

**QC5300** Quadra–Chek® Software . . . . . 451
**7612** 4–Port GageMux USB . . . . . 233
**7613** 4–Port GageMux USB . . . . . 233
**S7793Z** Digital Tachometer . . . . . 370
**B248** Brass Drive Pin Punches . . . . . 355
**B565** Brass Drive Pin Punches . . . . . 354
**C623R–6** Steel Rule with Letter and Number Drill Sizes . . . . . 302
**D1** Dimensioning Software . . . . . 454
**FMD** Force Measurement Frames, Dual Column . . . . . 484
**FMS** Force Measurement Frames, Single Column . . . . . 482
**HB400** Horizontal Digital Video Projector . . . . . 458
**HD400** Horizontal Digital Video Projector . . . . . 460
**HE400** Optical Comparators . . . . . 456
**HF600** Optical Comparators . . . . . 464
**HF750** Optical Comparators . . . . . 464
**HS600** Side Bed Optical Comparators . . . . . 466
**HS750** Side Bed Optical Comparators . . . . . 466
**KineMic™** Video Inspection Systems . . . . . 440
**KineScope** Video Inspection Systems . . . . . 442
**LF** Large Format Premier . . . . . 436
**MLC** Load Cell Sensor . . . . . 490
**MMD** Material Tester Frames, Dual Column . . . . 488
**MMS** Material Tester Frames, Single Column . . . 486
**OV2™** Optical Comparator Video Adaptor . . . . . 468
**S216** Digital Micrometer Set . . . . . 28
**S226** Micrometer Sets . . . . . 34
**S436** Micrometer Sets with Standards . . . . . 38–39
**S766** Basic Electronic Tool Set . . . . . 222
**S898Z** Automotive Inspection Sets . . . . . 223
**SR400** Surface Roughness Tester . . . . . 250–251
**ULC** Load Cell Sensor . . . . . 490
**VB400** Optical Comparators . . . . . 462
**VF600** Optical Comparators . . . . . 462

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- **Laser Measurement**:
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- **Granite Surface Plates and Accessories**:
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- **Gage Blocks**:
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- **Canada**:
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- **Mexico**:
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  Starrett Calibration Services, Duncan, SC, (864) 433-8407
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