

# Precision Products Guide



# Starrett®

Precision, Quality, Innovation ... Since 1880

This Precision Product Guide provides an overview of many, but by no means all, of the Starrett line of precision measuring tools. For additional information, refer to our website at: [www.starrett.com](http://www.starrett.com), the Starrett Full Line Catalog, or product literature.

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Outside 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.

- Balanced frame and thimble for better “feel” on measured surfaces
- Tapered frame allows the anvil to be positioned in confined areas
- Ring-type lock nut for quick and sure locking
- Available with either friction thimble or combination ratchet/speeder for uniform pressure
- Standard Letter of Certification on some items available by request
- Micrometers above 6" use webbed frames to lighten the weight and increase strength
- Large micrometers, above 24" (600mm), are constructed of tubular steel, honeycomb aluminum or round tubing for lightness and rigidity
- Available in sizes up to 120". Special configurations can be ordered through our Special Order Department
- Micrometers can also be purchased with dial indicators installed in place of the micrometer heads to handle unique applications

Key to Starrett Micrometer Numbering System:

Prefixes:

- S** - Micrometer Set
- T** - .0001" Reading
- V** - 0.001mm or 0.002mm Reading, as specified

Suffixes:

- F** - Friction Thimble
- L** - Lock Nut
- M** - Metric
- P** - Plain
- R** - Ratchet Stop
- X** - Carbide Measuring Faces
- Z** - With Case



795XFL-1 Electronic Micrometer with IP67 protection & output



T230RL



V230MXFL



436.1MRL-50



714ARLZ Micrometer with No. 234 Standards



436RL-18

## Depth Micrometers, Bore Gages & Other Micrometer Products



823 Series  
Tubular Internal  
Micrometers



XT Series Bore Gages



Above: 781XT AccuBore®  
Electronic Bore Gage

Below: 780XT  
Electronic Bore Gage



78XT Internal  
Micrometer



Right: 464P Micrometer Head



Below: 673Z Bench Micrometer



Starrett's varied line of 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 available with electronic, mechanical digital, and regular readouts as well as rotating or non-rotating blades.

The purpose of these tools is to measure the depth of holes, slots, shoulders, and projections quickly and easily to .001" or 0.01mm. All heads used in our depth micrometers are accurate to  $\pm .0001"$  or  $\pm 0.002\text{mm}$ .

### Depth Micrometer 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
- Bases and rods are hardened, ground, and lapped for 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. Longer rods are available by special order
- Ring-type lock nut for quick and sure locking
- Blade-type rods are non-rotating for ease in positioning
- Half-base design (443 Series) for positioning close to working surfaces

### XT Series Bore Gages

These high quality, high accuracy bore gages have an extended range, reducing the need to exchange anvils. All contacts over 1/2" (12.5mm) have carbide-faced contacts for enhanced wear life. Extensions for deep hole measuring are available individually or in complete sets.

**781XT Series AccuBore®** provides single-hand operation, extended range and exceptional accuracy for fast, precise, 3-point contact hole measurement with RS232 output. Resolution is to .00005" (0.001mm).

**780XT Series Electronic Internal Micrometer** has IP65 level protection against coolant, water, dirt and dust. Resolution to .00005 (0.001mm), ground contact points, an easy-to-read LCD digital readout, and RS232 output.

**78XT Series Internal Micrometer** has resolution from .0001" (0.0025mm) on 2-point contact tools and .0002 (0.005mm) on 3-point contact tools. Includes ratchet stop, self-centering contacts, and blind bore measuring capability above 1/2" (12.5mm) diameter.

### Other Starrett Micrometer Products

In addition to outside and depth micrometers, Starrett also offers a wide variety of:

- Micrometer Heads
- Bench Micrometers
- Precision End Measuring Rods
- Inside Micrometers
- Special Function Outside Micrometers for specific applications
- Micrometer-based Special Order Gages

## Test Indicators, Bases & Accessories

Test indicators are primarily used for the testing or checking of parts and for machine setups. They are also frequently used for general production purposes, either singly or “ganged” in multiples for specified inspection applications.

Starrett’s product selection in dial, dial test, electronic and specialty indicators, as well as fixtures and adapters is broad and deep, providing a single source solution for virtually any application.

### 708 & 709 Test Indicators

These precision test indicators were designed to be positioned for easy and accurate readability. The versatility of the angled head, combined with the three dovetail mounts eliminates the need for having both vertical and horizontal style test indicators.

### 811 Test Indicators

These are one of the most unique and versatile indicators available because the handy swivel head feature allows positioning to suit your line of sight from horizontal to vertical and at any angle in between 90°. Why buy two or three gages to do what one will do – simplify your gage inventory.

### 711 Last Word® Test Indicators

These test indicators are 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 where he is.

### 196 Back Plunger Indicators

The 196 Back Plunger Indicator is one of the first introduced by Starrett, and is one of the most versatile available. Over the years this tool has been improved by methods and materials, but the accurate, reliable basic design is unchanged.

### Magnetic Bases, Adapters & Accessories

Starrett offers a comprehensive selection of magnetic bases, adapters, and other accessories to cover the setup requirements of the many applications for these versatile gages.

Magnetic bases are available in several sizes, with fixed posts, swivel posts, flexible posts, and with fine adjustments.

Even with all of the many indicator applications, there is a Starrett adapter, or combinations of adapters that is exactly what you need to make a setup that provides accurate, reliable, and repeatable measurements.



708AZ, B709AZ  
Dial Test  
Indicators w/  
Dovetail Mounts



811-5CZ

With 709A Dial Test Indicator



Above: 641 Back  
plunger dial test  
indicator



196MB5 Back Plunger  
Indicator

657AA Magnetic  
Base w/711FS  
Last Word® Dial  
Test Indicator



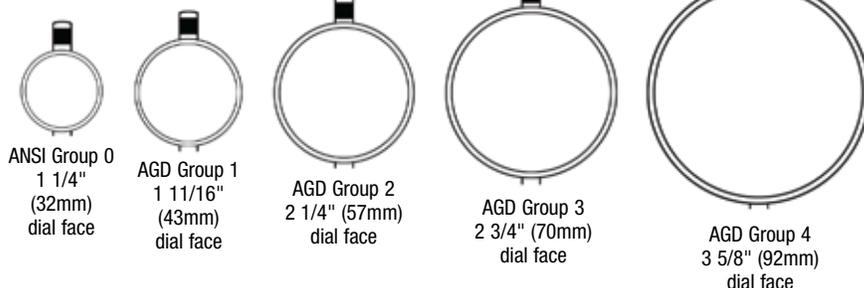
Accurate, rugged, versatile, and convenient, mechanical dial indicators with bottom plungers are the measurement workhorses of industrial production.

Starrett offers a complete line of mechanical/analog dial indicators – over 180 models.

## Points to Consider When Specifying for Your Application:

1. Regular analog styles with indicating hands are more readable than digital styles when the measurements are being visually monitored.
2. Accuracy - All indicators should be “loaded” 1/8-1/4 of a turn before 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.
3. Select the dial size. Five regular dial sizes are offered:
  - ANSI Specification: 1 1/4" (32mm)
  - AGD specification: 1 11/16" (43mm), 2 1/4" (57mm), 2 3/4" (70mm), 3 5/8" (92mm)

## Indicator Sizes



4. Choose both the accuracy and readout. Don't select a .0001" (or a 0.001mm) readout if .001" (or a 0.01mm) will do your job
5. Consider any special features – Inch or millimeter reading, special shock-less 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. We also manufacture a lot of special design, catering to the specific needs of our customers – challenge us!

## American Gage Design Specifications (AGD)

Starrett indicators are made to American Gage Design Specifications (AGD). These specifications were developed in 1945 by the National Institute of Standards and Technology (N.I.S.T.). These specifications provide the dimensions to allow interchangeability between indicators of different manufacturers in fixturing.



25 Series  
Dial Indicators



25-2041-J Dial Indicator  
with long range



665H Tool Post Holder on lathe

Crystal-  
mounted  
hands



Bezel-mounted  
hands



Dial Indicators  
w/Tolerance  
Hands



Snap-on  
bezel-mounted hands



652GJ Dial Comp. Stand  
w/granite base

## Electronic Indicators

Starrett Electronic Indicators are available in three styles. All are reliable, accurate, rugged, versatile, and convenient to use.

### 2600 Electronic Indicators

- 1" (25mm) range, readout available to .0005" and 0.01mm
- Large, easy-to-read LCD digital readout, surrounded by a rotating bezel
- Furnished with lug-on-center back
- Output to Starrett SPC Plus® system components on most models
- Utilizes standard indicator accessories and holding devices
- Rugged, sealed enclosure makes them F.F.F. (factory floor friendly)



2600 Indicators

### 2700 Electronic Indicators

This is our most versatile line of electronic indicators, three styles available. All indicators feature a glass scale design.

#### WISDOM® Basic Series

- 10 Resolutions and 5 Measuring Ranges Available
- Instant Inch/mm Conversion
- Maximum Reading Hold
- ZERO the tool at any position of the spindle

#### WISDOM® Plus Series

These models have all the features and functions of the Basic Series, plus the following additions:

- Preset mode to install any reading at any point in the display
- T.I.R.: Displays the difference between the highest and lowest value
- Tolerancing: Enter high and low tolerances – when entered tolerances are exceeded, the display will flash
- Minimum Reading Hold



2700  
Wisdom® Indicators,  
regular and oversized

### 3600 Electronic Indicators

3600 Series Electronic Indicators feature powerful, easy-to-use functions.

Two AGD (American Gage Design) Group 2 models are available – inch/metric, .500" (12.7mm) range, and metric only 12.7mm range.

The indicators have a resolution of .0005"/0.01mm and 0.01mm, respectively.

The indicators are activated as soon as the spindle moves, maintaining true spindle position, or reverse travel, which is clearly displayed by a +/- control figure showing spindle direction.

Other functions include inch/metric conversion on the inch/mm model, zero at any spindle position, and on/off and auto-off after 5 minutes of non-use to conserve battery life. The long-life battery lasts up to 8,000 hours (1-3 years). Readings are viewed from a large, easy-to-read LCD display.



2700 Wisdom® Indicators



3600-5  
Indicator

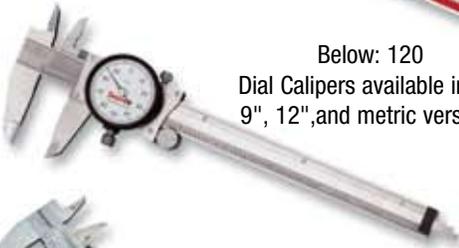
Below: 797 Electronic, IP65 coolant resistant Calipers are available in 6" (150mm), 8" (200mm), and 12" (300mm) models with standard RS232 output



Below: 799 Electronic Calipers available in 6", 8", and 12" Inch/mm



Below: 120 Dial Calipers available in 6", 9", 12", and metric versions



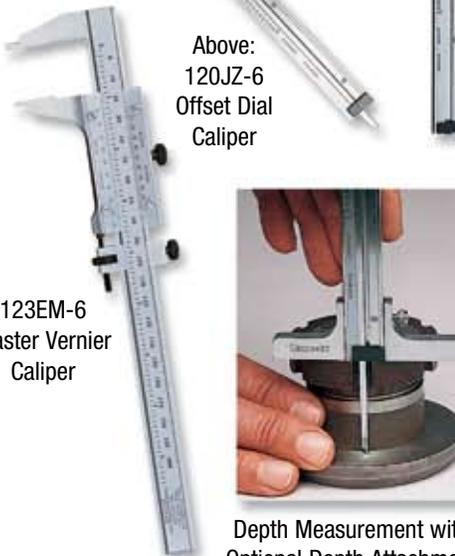
Right: 1202 Global Series Dial Calipers available in 6", 8", 12", and metric versions



Right: 120B-12 Dial Caliper with long nib jaws



Above: 120JZ-6 Offset Dial Caliper



123EM-6 Master Vernier Caliper



Depth Measurement with Optional Depth Attachment

**Slide calipers are very versatile measuring tools.** While they do not have a micrometer's level of precision, they are very accurate and each tool has a much wider range than a single micrometer.

**The best electronic and dial slide calipers**, regardless of resolution, are accurate to within .001" or 0.03mm, every 6" or 150mm. The best vernier calipers are accurate to .0005" or 0.013mm per foot or 300mm.

**Slide calipers come in different styles;** electronic-, mechanical dial-, vernier-, and plain slide-calipers.

## 797 Electronic Calipers with IP65 Protection against Coolant, Water, Dirt, and Dust

- Large, easy-to-read LCD display
- Hardened stainless steel measuring surface for long life
- Depth rod with available attachment to seat the tool for more accurate measurements on all sizes
- Fine adjustment for precision measurements
- Lock to hold the slide in position
- Automatic off
- Resolution is .0005" (0.01mm)
- In/mm conversion
- Zero at any position
- Manual off/on plus an automatic off after four hours of non use
- Output to RS232 device on all models

## Starrett Dial Caliper Features

- Sharp, clear dial graduations of .001" or 0.02mm with .100" or 2mm in one revolution
- Sharp, black graduations on the satin finished bar, every .100" or 1mm
- Knife-edge contacts for both inside and outside measurements
- One hand use with the thumb-operated, fine adjustment roll
- Lock screw for holding the sliding jaw in position
- Long-wearing carbide faces on outside contacts on X models
- Hardened stainless steel bar, measuring surfaces, rack, gears, and depth rod
- Resolution is .0005" (0.01mm)

## Machinists' Shop Tools & Precision Rules

Starrett offers many and varied high quality regular and special hand tools that every toolmaker, mechanic, and craftsman will need in his work at one time or another.

They include:

- Combination, Solid, and miscellaneous Squares
- Punches and Nail Sets
- Pin Vises
- Tap Wrenches
- Surface Gages
- V-Blocks
- Snugs
- Scribes
- Hand Cutting Tools including Utility Knives, Cut Nippers, and Hacksaw Frames
- All-Purpose Lubricant, Tool and Instrument Oil, and Layout Dye
- Positioning Tools - Edge and Center Finders, 1-2-3 Blocks, and "Little Giant" Jack Screws
- Toolmakers' Hammer and Bench Blocks
- Screwdrivers
- Speed Indicators & Tachometers
- Holding Devices including Angle Plates, Hold Downs, Clamps, and Machinists' Vises

### Precision Rules

Starrett's standard line of precision steel rules range in length up to 144" and 1000mm. They are made from fine quality steel and produced to the highest precision standards making them the most accurate and readable precision steel rules available. All rules are available in Starrett no-glare satin chrome finish for easier reading and rust resistance.

Our product line consists of:

- Full-flexible 1/64" (0.4mm) 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 2.5mm) thick

Graduation styles are Inch, Millimeter, Inch and Millimeter, shrink, and special graduations.

Quick-reading figures have finer graduations for easier counting. Most all inch graduations of 1/32" and finer have subdivisions numbered.

We inspect to Starrett Master Standards, which are traceable to the National Institute of Standards and Technology.



Above: 435-12-4R Combination Square

Below: 20 Solid Square



Below: 264 Center Punch Set



Left: 827B Edge Finder

Right: 93 Series Tap Wrench

Below: 568C V-Blocks & Clamps



Right: M1® All-Purpose Lubricant

Below: 240 Pin Vises



Below: Precision Rules





Above: 188 English Standard Wire Gage



Right: 186 Drill & Wire Gage

Below: 472 Screw Pitch Gage



Right: 666 Feeler Gage Stock, available in 25' rolls, as shown, 12" strips, and assortments.



Left: Checking a radius with a 167-3/16" Radius Gage attached to a 110 Holder

167 Series Radius Gages are also available in fractional, decimal, and millimeter sets



Right: 229 Series Telescoping Gages, available individually and in sets



Left: 829 Series Small Hole Gage available individually, in sets, and in a half-ball style (831 Series)



Above: 270 Taper Gage

## Fixed Gage Standards

The Starrett Fixed Gage Standards product line includes a comprehensive choice of standard gages that quickly check dimensions on a variety of workpieces. These are invaluable for both 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

## Hole & Slot Gages

Measurement of holes, slots, and recesses is an ongoing necessity wherever machining of parts is done. Starrett offers a line of very convenient and relatively inexpensive tools that cover a wide range of sizes for a variety of applications.

Products include:

- Small Hole Gages with full-ball measuring surface
- Small Hole Gages with half-ball for flat bottom measurement
- Small Hole Gages with half-ball for shallow areas
- Telescoping Gages with a single arm
- Telescoping Gages with self-centering double arms
- Taper Gages for quick fractional measurement of hole or slot size
- Taper Gages for decimal or millimeter measurement of hole or slot size
- Taper Gages for decimal and millimeter slot size

## Height Gages

Starrett Height Gages come in a variety of styles, sizes, readouts, and accuracies to suit individual needs.

Accuracies range from .000050" and 0.001mm on our DIGI-CHEK® series (see the Gage Block Section) to .001" and 0.03mm on our dial and vernier height gages.

Standard height measurements are available to 85" or 2150mm. Higher measuring tools are available on special order.

Height gages are normally used on a known flat surface such as our granite surface plates (see granite surface plate section), where the work to be measured is brought to the plate.

Some applications require the use of a height gage on a vertical plane. We offer practical lightweight tools such as our Nos. 751, 250, and 255 series for these situations.

All of our bases are hardened, ground, and lapped except the No. 252 base, which is not hardened. If these bases are moved rapidly on an extremely flat plate, there may be a tendency to "hum", since the two surfaces try to "wring" together. When the gage is brought to the work, it is good practice to make sure the two surfaces are clean and move the gage slowly.

### Altissimo® Electronic Height Gage

Starrett Altissimo® Electronic Height Gages are high on innovation and ease of use – loaded with the Starrett-exclusive functions you need to make your measuring routines run smoothly and reliably. They feature automatic calculation of eight measurement routines:

- Center
- Diameter
- Height
- Max
- Min
- TIR
- Distance to last feature
- Distance between last two points

### 3752 & 3751 Electronic Height Gages

The 3752 Electronic Height Gage has a large, easy-to-read display, an intuitive control panel, clear bar graduations, resolution of .0005", RS232 output, and a full range of user functions.

Overall, the 3752 provides a versatile and economical solution for most height measurement applications.

The entry-level 3751 Electronic Height Gage is light, portable and easy-to-use with a range of 0-6". It is a non-output gage with inch/mm conversion, Zero at any position, auto-off and a resolution of .0005".

Right:  
Altissimo® Platinum  
Electronic Height Gage

Below: 3752  
24" Electronic  
Height Gage



Right: 3751  
6" Electronic  
Height Gage

Left: 250-6 Dial  
Height Gage

Above: 254Z-12 Master  
Vernier Height Gage



Starrett offers a full line of Surface Plates and other granite products for a variety of applications



High Quartz Content Crystal Pink Granite® Surface Plate



Black Granite Surface Plate



Five-Face Master Square



Granite Parallels

Every linear measurement depends on an accurate reference surface from which final dimensions are taken. Precision Granite Surface Plates from the Starrett Tru-Stone Division are the ideal reference plane for inspection and 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 present in the stone. Quartz is more than twice as resistant to wear as 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 and thus greater value.

When a surface plate is to be used as a reference and measuring surface, the best choice is Starrett Crystal Pink Granite. Starrett Black Granite is best for applications in which load bearing is a major consideration.

### Accuracy

**Specifications:** Starrett Granite Surface Plates meet or exceed U.S. Federal Specification GGG-P-463c.

#### Three available grades of accuracy:

Grade AA – Laboratory Grade

Typically specified for precision operations in constant temperature gaging rooms and metrology departments

Grade A – Inspection Grade

Typically specified for general work in quality control

Grade B – Toolroom Grade

Typically specified for checking work on the shopfloor

### Other Starrett Tru-Stone Granite Products

- Five-Face Master Squares
- Parallels
- Toolmakers' Flats
- Fixture Bases made to your specifications
- Surface Plate Stands and Cabinet Bases
- Granite-based custom products

## Gage Blocks

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
- 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
- Ceramic gage blocks have an advantage over regular steel. They will outwear regular steel and they will not corrode
- croblox<sup>®</sup> Chromium Carbide — the superior gage block material. The reason our Webber Gage Division emphasizes gage blocks made from Chromium Carbide is because they are the most stable measuring devices ever developed. They outwear regular steel and ceramic. In addition, they will not corrode, are very stable and accurate, and have exceptional “wringing” qualities

No one in the world except Starrett-Webber has produced the accuracy and stability of our croblox<sup>®</sup> 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 (N.I.S.T.) and have remained stable over this period.

The Starrett-Webber line includes:

- English and Metric Gage Blocks, various materials, grades, and shapes
- Available in a variety of sets and as individual blocks
- Wide range of gage block accessories
- Angle Gage Blocks
- Polygons – Cubes
- Reference Bars
- Inspection, calibration, and repair services
- Workshop MicroAccurate<sup>®</sup> “B” Grade Set



Starrett-Webber offers a broad range of gage blocks and related products

Below croblox<sup>®</sup> Square Blocks English Set



Above: 258 DIGI-CHEK<sup>®</sup> Height Gage



Above: Ceramic Set in Case



Above: Angle Block Set

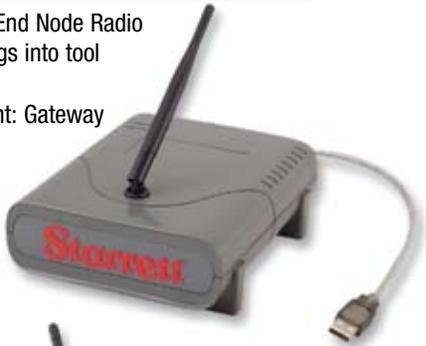


Left: Square Gage Block Accessories



Above: End Node Radio plugs into tool

Right: Gateway



Left: Router to extend range



Right: DataSure® Tool Management software



DataSure® Wireless Data Collection System adapts wireless technology to the specific challenges of shopfloor environments. With redundant data paths and feedback at the tool, it overcomes the electrical noise of the shopfloor, significantly improving throughput and reducing errors for those applications in which measurement data is recorded.

- 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 RS232 gages.
- 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 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.
- 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.
- Rechargeable routers are ideal for mobile applications and physically large component data collection environments such as aircraft assembly hangars, large casting foundries, auto body stamping facilities and more.
- Easy-to-use 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.

## DataSure® Wireless Data Collection System for the Shopfloor



## Custom Solutions

One thing that sets Starrett apart is our willingness and ability to develop custom solutions. We work directly with our customers to design and manufacture tools and gages, specifically for an application that no standard tool has the ability to measure.

The Starrett Special Gage Division is an independent group whose sole function is to design and build these custom products. They have provided solutions to industries including energy, aerospace, automotive, food packaging, high-technology plastics, medical components and many others as well as to NASA and other government agencies.

### Catalog Product, Special Order or Custom Solution

The process usually begins when a customer contacts us through our regular sales channels to request a tool to do a specific measurement. Sometimes, we can fulfill the request with a catalog product. In other cases, we refer them to our **Special Order Group** that specializes in modified versions of standard tools. When neither of these options provides a solution, our Special Gage Division begins a dialog with the company's engineering staff to develop a new tool for the specific task.



Above: Special Order 463P Micrometer Head with 3/8-40 threaded hub and nut for mounting

### A Collaborative Process

Next, there is a collaborative process between the customers' engineers and Starrett special gage designers. While usually accomplished fairly quickly, the process can be lengthy. The application is specified in detail with various approaches examined and discarded. Finally, a solution is found meeting the full satisfaction of our customer. Then, through a process involving CAD and/or hand drafting, prototype machining and testing, the final product specification is completed.

### From Problem to Innovation to Solution

The resulting special product usually involves highly specialized fixturing combined with a Starrett measuring tool component – most often an electronic or dial indicator head or a micrometer head.

There have been other variations, some of which have included contributions from parts of Starrett beyond the Athol, MA Special Gage Division location – Webber Gage in Ohio, Tru-Stone Granite in Minnesota or Kinematic Engineering in California.

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.



Right: Fast Food Container Measurement Gage

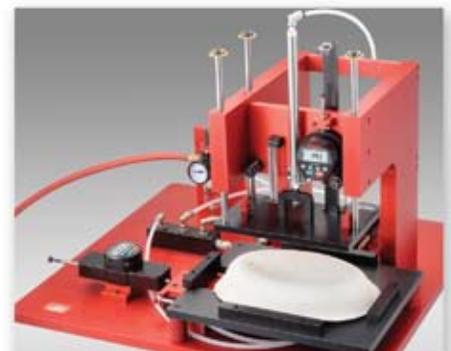
Left: Hot Steel Measurement Gage



Above: CAD screen of Vane Gage

Left: Custom Vane Measurement Gage

Below: Turbine Diameter Measurement Gage with DataSure® End Node for wireless data collection





Calibration, repair, refurbishing, and rebuilding of Starrett products at the Athol, MA factory



SCS, Duncan, SC provides fast, economical calibration and repair for all major brands



Granite Surface Plate Calibration at the Starrett Tru-Stone Division in Mount Airy, NC



Gage Block Calibration at Starrett-Webber in Cleveland, Ohio

Starrett offers a variety of calibration services at several of our facilities, with different emphasis and capabilities at each location.

Overall, Starrett offers a single source for most, or even all, of your calibration and repair requirements, and you have the assurance of dealing with the most trusted name in precision.

### Starrett Tools & Gages, Athol, MA

Operating out of our corporate headquarters, this division offers:

- Calibration for Starrett precision tools
- Repair, refurbishing, and rebuilding of your Starrett tools by the same craftsmen that originally made them
- Calibrations are A2LA accredited in accordance with ANSI/NCSL Z540-1, ISO/IEC 17025, and ISO Guide 25\*

### Starrett Calibration Services™, Duncan, SC

- Starrett Calibration Services (SCS) provides fast, economical calibration for all major brands of precision tools and gages
- Repair for all major brands with a large stock of parts on hand
- Highly experienced staff and modern, fully equipped facilities
- Many services can also be performed at your location
- Calibrations are A2LA accredited in accordance with ANSI/NCSL Z540-1, ISO/IEC 17025, and ISO Guide 25\*

### Starrett Tru-Stone Division, Waite Park, MN

- Provides calibration of granite surface plates, granite parallels, granite straight edges (2- and 4-sided), and granite squares
- Surface plate re-lapping
- Calibrations are A2LA accredited in accordance with ANSI/NCSL Z540-1, ISO/IEC 17025, and ISO Guide 25\*

### Starrett Webber Gage Division, Cleveland, OH

- Commercial grade gage block calibration in accordance with ISO 10012-1 and former U.S. MIL-STD-45662A
- Master grade gage block calibration in accordance with ANSI/NCSL Z540-1, ISO/IEC 17025, and ISO Guide 25, with detailed information and documentation regarding the geometry and parallelism of each block
- Accredited by NVLAP (National Voluntary Laboratory Accreditation Program) via NIST – the highest possible level for this type of calibration\*

\*Accreditation are site-specific and tool-specific.

The Scope of Accreditation is available upon request to each location.

## Shop-Floor Product Guide

This section lists typical departments found in metalworking manufacturing facilities, and lists some of the Starrett products that are commonly used in these areas.

Most of the listed tools include a Starrett catalog number in parenthesis. While the referenced tool is generally a good fit for the application, in many cases there are other Starrett tools that would work as well, or better for specific requirements. For alternative tools, see our Full Line Catalog.

### Raw Materials

- Digital Micrometer (216P-1)
- Tape Measure (XY1-16)
- Dial Caliper (120A-6)
- Steel Rule (C604RE-6)
- Decimal Wall Chart

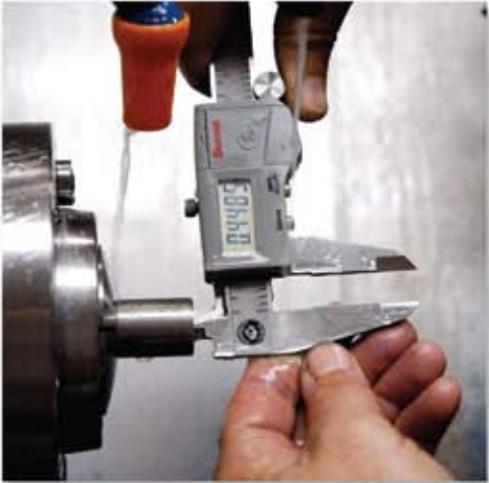
### Saw Center

- Saw Tension Gage (682EMZ)
- Band Saw Blade Alignment Gage (PT92925)
- Measuring Tape (MY109-25)
- Dial Caliper (120A-6)
- Digital Micrometer (216P-1)
- Steel Rule (C604RE-6)
- Electronic Tachometer (S793Z)
- Band Saw Blades

### Machining Centers & Milling Machines

- Dial Test Indicator (708AZ)
- Electronic Caliper with output (797)
- Steel Rule (C604RE-6)
- Edge Finder (827A)
- Jack Screw Set (S190)
- Tap Wrench (93C)
- V-Anvil Micrometer (to check end mills) (T483XRL-1)
- Electronic Micrometer with Output (795)
- Steel Protractor (C183)
- Micrometer Depth Gage (445DZ-12RL)
- Machinists' Level (98-8)
- Magnetic Base (659A)
- Dial Indicator (25-441J)
- DataSure® Wireless Data Collection





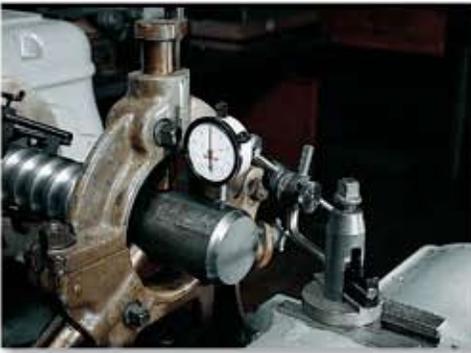
### Turning Centers & Lathes

- Outside Micrometer Set (ST436.1CXRLZ)
- Dial Caliper (120A-6)
- Electronic Caliper with output (797)
- Steel Rule (C604RE-6)
- Telescoping Gage Set (S579HZ)
- Center Gage (C391)
- Screw Pitch Gage (472)
- Radius Gage Set (S167AHZ)
- Spring-Type Caliper (79A-4)
- Hacksaw Frame (K145) and hacksaw blades
- Dial Test Indicator (708ACZ, 196A1Z)
- Test Indicator and Holder (657-1)
- Optical Projector
- Thread Micrometers
- DataSure® Wireless Data Collection



### Grinding Center

- Precision Grinding Vise (581)
- "A" Clamps (164A)
- Precision Angle Plate (580)
- Layout Dye (1610)
- Outside Micrometer (T230XRL)
- Steel Parallel Set (S384JZ)
- Portable Surface Roughness Tester (3800)
- Granite Surface Plate and Stand
- Height Transfer Gage (252Z-14)
- Dial Test Indicator (708ACZ)
- Vernier Protractor (C359BZ)
- Gage Block Set
- Thread Micrometers
- Angle Gage Block Set
- Optical Projector
- DataSure® Wireless Data Collection



## Shop-Floor Product Guide

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### Drilling Center

- Digital Micrometer (216P-1)
- Electronic Caliper (797)
- Drill and Steel Wire Gage (186)
- V-Blocks and Clamps (286A)
- Automatic Center Punch (18B)
- Hacksaw Frame (K145)
- Steel Rule (C604RE-6)
- Drill Point Gage (22C)
- DataSure® Wireless Data Collection



### Tool, Die, and Fixture Making Room

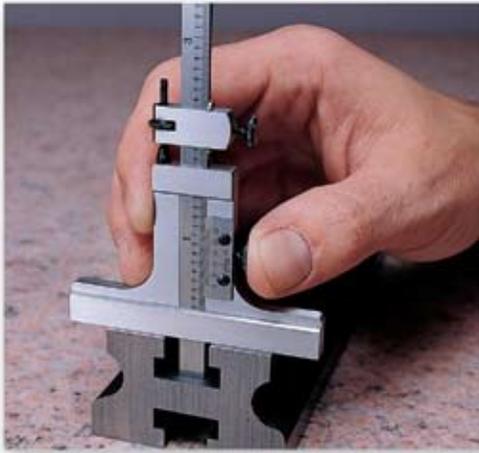
- Outside Micrometer Set, 0-12" (ST436EXRLZ)
- Layout Dye (1610)
- Radius Gage Set (S167AHZ)
- Master Vernier Calipers (123)
- Master Precision Square (20 Series)
- Master Vernier Height Gage (254 Series)
- Tubular Inside Micrometers (823 Series)
- Toolmakers Flat, Starrett Pink Granite
- Gage Block Set
- Precision Universal Bevel Protractor (359 Series)
- V-Blocks and Clamps (568)
- Radius Gage Set (167)
- Dial Test Indicator (708)
- Magnetic Base Indicator Holder (657AA)



### Welding/Fabricating

- Combination Square Set (C434-12-4R)
- Rule Depth Gage (237)
- Dial Caliper (120A-6)
- Tape Measure (AC34-16)
- Steel Rule (C604RE-6)
- Machinists' Level (98-8)
- V-Blocks and Clamps (568)
- Clamps (164A)
- Hacksaw Frame (K145) and hacksaw blades
- Divider (85A)
- Rafter/Framing Square (FS-24)
- Steel Protractor (C183)
- Angle Meter (AM-2)
- Universal Bevel (47)





### Quality Room

- Granite Surface Plate
- Surface Plate Stand
- Rectangular croblox® Gage Block Set (RC 88.AA)
- Angle Gage Block Set (AG 16.SI)
- Altissimo® Electronic Height Gage (2001-24)
- Electronic Height Gage (752A-12)
- Portable Surface Roughness Tester (3800)
- Gaging Amplifier (717)
- Hardness Tester (3817)
- Height Transfer Gage (252Z-24)
- DIGI-CHEK® Height Gage (258-12)
- Vernier Protractor (C359BZ)
- Master Precision Square (20-6)
- Steel Parallel Set (S384-3Z)
- V-Blocks and Clamps (568C)
- Precision Angle Plate (580)
- “A” Clamps (164A, B and C)
- Precision Grinding Vise (581)
- Dial Test Indicator (708AZ)
- Outside Micrometer Set (ST436.1CXRLZ)
- Vernier Protractor (C359BZ)
- Dial Calipers, 6" & 12" (120A-6, 120-12)
- Steel Rule (C404R-72)
- DataSure® Wireless Data Collection
- Optical Measuring Projector
- Vision System



### MRO/Facility Management

- 25" Measuring Tape (XY1-25)
- Dial Indicator Snap Gage (1150Z-2)
- Screwdriver Set (S551Z-7)
- M1® All Purpose Lubricant
- Tool and Instrument Oil (1620)
- Thickness Gage Set (66T)
- Screw Pitch Gage (155)



# Quality, Precision, Innovation ... Since 1880

## Where it Began

Headquartered in Athol, MA, in the heart of New England with its rich manufacturing history, Starrett has earned a reputation so solid that the words “quality” and “Starrett” have become virtually synonymous.

## Thousands of Precision Tools, Gages, and Instruments

The broad Starrett product line includes precision tools (micrometers, calipers, rules, etc.), electronic gages, indicators, gage blocks, granite surface plates, optical measuring projectors, vision systems, M1<sup>®</sup> lubricant, and precision ground flat stock and drill rod. Much of the Company’s production is concentrated in hand measuring tools and precision instruments.

## The Starrett Advantage

### Quality in Materials and Workmanship

Only the finest grade materials are used. Tools have a hand-crafted feel and finish.

### Accuracy and Repeatability

Manufacturing processes insure each tool is well within accuracy requirements. Starrett tools remain accurate longer.

### Precision and Innovation Since 1880

125 years of leadership and service to craftsmen and industry throughout the world.

### Product Line Innovation & Continuity

While new products continue to be developed and introduced, older products are fully supported.

### Repair and Calibration Facilities

Precision tools repaired and brought back to original manufacturer’s specifications in Athol, MA where they were originally made. Our Starrett Calibration Services™ facility provides fast, expert, economical calibration, and repair for all major brands. Calibration services are also available for Starrett-Webber Gage Blocks and Starrett Tru-Stone Granite Products.

### Custom Engineered Solutions & Special Products

Modification of existing Starrett tools & Custom Engineered Solutions to meet specified requirements.

### Commitment to Customer Service

Expert, factory-trained sales representatives and award winning after-sales service, support and calibration.



Corporate Headquarters — Athol, MA



Precision Measuring Tools, Shop Tools, Gage Blocks, Granite Products and much more



Custom Solutions



Calibration and Repair

- 
- Micrometers • Slide Calipers • Calipers, Dividers, Trammels • Tool Sets • Squares • Protractors • Angle Measurements
  - Precision Rules • Straight Edges • Parallels • Electronic Data Collection Systems • Electronic Testers • Dial & Electronic Indicators & Gages
  - Height Gages • Depth Gages • Hole Gages & Slot Gages • Fixed Gage Standards • Machinists’ Precision Shop Tools
  - Starrett-Webber Gage Blocks • Starrett Tru-Stone Granite Surface Plates & Accessories • Precision Ground Flat Stock & Drill Rod
  - Special Tools • Custom Solutions • Calibration & Repair Services
- 

# Starrett<sup>®</sup>

121 Crescent Street • Athol, MA 01331

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[starrett.com](http://starrett.com) • 978-249-3551

Specifications subject to change.