<table>
<thead>
<tr>
<th>DIMENSIONAL METROLOGY</th>
</tr>
</thead>
<tbody>
<tr>
<td>[Images of various measurement tools]</td>
</tr>
<tr>
<td>[Text: Details about Dimensional Metrology]</td>
</tr>
<tr>
<td>MarCal</td>
</tr>
<tr>
<td>---------</td>
</tr>
<tr>
<td>Digimar</td>
</tr>
<tr>
<td>Micromar</td>
</tr>
<tr>
<td>MarTest</td>
</tr>
<tr>
<td>MarCator</td>
</tr>
<tr>
<td>Millimess</td>
</tr>
<tr>
<td>Millimar</td>
</tr>
<tr>
<td>MarStand</td>
</tr>
<tr>
<td>MaraMeter</td>
</tr>
<tr>
<td>Multimar</td>
</tr>
<tr>
<td>MarConnect</td>
</tr>
<tr>
<td>MarTool</td>
</tr>
<tr>
<td>MarGage</td>
</tr>
</tbody>
</table>
In order to be able to produce the growing variety of parts cost-effectively, manufacturers now require not only flexible production facilities, but also equally flexible measuring equipment. This is particularly true of the automotive industry and its suppliers. Given that customized vehicles with different engines and transmission systems are now the norm, items such as shaft-shaped parts need to be manufactured in a number of different designs, then measured and tested for quality assurance purposes. To measure the different parts produced in small lots, it is not cost-effective to purchase and maintain the individual multi-gaging units that were used in the past for these customized designs. A better option is to use a universal measuring machine. Such a machine should be able to adapt very quickly and flexibly to a number of different designs while also allowing fast quality assurance thanks to short measuring times. Mahr has a number of appropriate solutions.

The latest information on MARSHAFT products can be found on our website: www.mahr.com, WebCode 20593
MarShaft. Shaft Measuring Systems

MarShaft. Measurement of Shaft-Shaped Parts on the Shop Floor 19-2

MarShaft MAN
Manual Tactile Shaft Measuring Machine 19-3

MarShaft SCOPE plus
Optical Shaft Measuring Machine 19-3

MarShaft
Data Overview 19-5

Request a brochure.
MarShaft. Shaft Measuring Machines

MEASUREMENT OF SHAFT-SHAPED PARTS ON THE SHOP FLOOR

MarShaft shaft measuring machines are primarily used on the shop floor but their excellent measuring accuracy means they can also be used in measurement laboratories. The machines come in various sizes and, thanks to their modular design, can be optimized to suit the relevant measuring tasks. Measuring directly on the shop floor during production saves you having to perform time-consuming measurements in the inspection room and improves product reliability.
### Mar Shaft MAN

**Description**

The modular design of the Mar Shaft MAN shaft measuring machine allows rotationally symmetrical parts to be measured quickly and flexibly.

- No operator influence
- Highly accurate measuring results
- Excellent repeatability
- Measuring system for all typical measuring tasks such as length, diameter, radial run-out, axial run-out, groove width, taper angle, roundness, coaxiality, concentricity and many others besides

**Features**

- Measuring force regulator to avoid operator influences
- Ideal for use on the shop floor so can be used directly in production environments
- MarCheck display unit which is easy to operate (2 models)

**Application**

Measurement of round parts such as:
- Gear shafts, camshafts, crankshafts, drive shafts, toothed racks, hollow shafts, etc.

### Mar Shaft SCOPE plus

**Description**

Optical measuring instrument for turned parts with matrix camera for direct use on the shop floor.

- Flexible optical measuring system for round parts
- Maximum precision directly on the shop floor
- Reliable measuring results without operator influence

**Features**

- Matrix camera, camera picture approx. 8 mm x 8 mm (0.31 x 0.31 in)
- Easy operation thanks to touchscreen monitor
- Record generator

**Application**

Measurement of round parts such as:
- Precision turned parts, camshafts, drive shafts, gear shafts, toothed racks, hollow shafts, etc.
- Tactile measuring unit for radial and axial run-outs (optional)
- Temperature compensation (optional)
- Thread software (optional)

---

Request brochure or see WebCode 20595.

Request brochure or see WebCode 20594.
MarShaft SCOPE 250 plus
Optical and tactile shaft measuring units

Description
With the flexible shaft Measuring Machine MarShaft SCOPE 250 plus Mahr offers the right measurement solution for the fast, precise and fully automatic measurement of rotationally symmetrical workpieces in production.

Features
• New, high-resolution CMOS matrix camera with 40 mm large live image field enables for quick scanning with more than 120 frames per second
• High accuracy for diameter and length measurement
• Extremely short measuring times due to high measuring speeds up to 200 mm/s
• With use of the Mahr software platform MarWin, all decades of experience in the fields of length, form, position and contour measurement available
• Very good entry price into the segment of small optical shaft measuring machines

Application
Turned parts, journals, hollow shafts, drive shafts, turbocharger shafts, bone screws, balance shafts, hydraulic parts, valves (gasoline engine), injection valves and many more

Request brochure or see WebCode 20818

Measuring and Evaluation Unit MarCheck

Description
• The measuring and evaluation computer MarCheck serves to calculate, process and display measuring and form deviations.
• The operation of the unit can be quickly learned. The operator is guided through the menus and can specifically conduct the measurements using the operation keys.
• Retrofit package for numerous shaft and length measuring units

Features
• 3 measuring channels, can be freely configurated
• Large display
• All 3 measuring channels can be displayed at once
• Possibility to create records
• Modern interface USB e.g. data export to external PC
• Learning programming
• Increased measuring accuracy due to correction data
• Resolution: switchable in increments from 0.0001 to 0.1 mm
### MarShaft. Data Overview

<table>
<thead>
<tr>
<th></th>
<th>MarShaft MAN</th>
<th>MarShaft SCOPE</th>
<th>MarShaft SCOPE 250 plus</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Measuring Range</strong></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Length (Z) (mm)</td>
<td>400 / 800 / 1600 / 2000 / 2400</td>
<td>350 / 750 / 1000</td>
<td>250</td>
</tr>
<tr>
<td>Diameter (X) (mm)</td>
<td>120 or 220</td>
<td>80 or 120</td>
<td>40</td>
</tr>
<tr>
<td><strong>Workpiece</strong></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Weight (max.) (kg)</td>
<td>20/60</td>
<td>15</td>
<td>5</td>
</tr>
<tr>
<td><strong>Resolution</strong></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Lengths/Diameter (mm)</td>
<td>0.0001</td>
<td>0.01 to 0.0001</td>
<td>0.01 to 0.0001</td>
</tr>
<tr>
<td>Angle (Degree)</td>
<td>0.001</td>
<td>0.01 to 0.0001</td>
<td>0.01 to 0.0001</td>
</tr>
<tr>
<td><strong>Error Limits</strong></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Lengths (µm), L (length) in mm</td>
<td>(3+L/100)</td>
<td>(2+L/125) SCOPE 1000: (3+L/125)</td>
<td>(3+L/100)</td>
</tr>
<tr>
<td>Diameter (µm), L (lengths) in mm</td>
<td>(0.8+L/100)</td>
<td>(1.5+L/125) SCOPE 1000: (2+L/125)</td>
<td>(2+L/100)</td>
</tr>
<tr>
<td><strong>Drive</strong></td>
<td>Manual</td>
<td>Servo motors</td>
<td>Servo motors</td>
</tr>
<tr>
<td><strong>Optics</strong></td>
<td>Camera or measuring microscope possible</td>
<td>Telecentric precision lens system, high-resolution CCD array</td>
<td>Telecentric precision lens system, high-resolution CCD array</td>
</tr>
</tbody>
</table>

* (2 σ at 20 °C ± 1 °C relative to reference standard)

### MarCheck. Technical Data

- **Dimensions (L x W x H)**: 260 mm x 180 mm x 50 mm
- **Weight**: Electronics with plug-in power supply: 2 kg (without unit base)
- **Display**: LCD monochrome, 240 x 160 pixels with background illumination
- **Digit size measuring axes**: ca. 13 mm
- **Resolution per measuring channel can be independently set**: 0.0001 mm; 0.001 mm; 0.01 mm
  - 0.00001 inch; 0.0001 inch; 0.001 inch
  - 0.001° decimal; * min, sec
- **Incremental inputs**: T1; T2; T3 sin/cos 1Vss 15 pol. sub D
- **Data interfaces**: 1x RS 232, 1x USB slave connection to PC for data exchange and software installation, 1x USB master 16FAT
  - max. 3 GB USB stick; connection to USB printer, preferably Mahr no. 4429015
  - Only the print record HP PCL5 is supported
- **Unit of measure**: mm / inch can be set in the MENU
The design and manufacture of high-precision, reliable part-specific gages requires extensive metrological experience and expertise. Cutting-edge Millimar length measurement components provide reliable measuring instruments for a wide range of different workpiece geometries with different levels of automation. Our portfolio covers all the necessary project stages up to the point where the measuring device is handed over, ready for operation, to the customer. These include project planning, design, manufacture, assembly, putting into service and training.
# MarSolution. Customer Specific Metrology

<table>
<thead>
<tr>
<th>Section</th>
<th>Page</th>
</tr>
</thead>
<tbody>
<tr>
<td>MarSolution. Standardized Measuring Devices</td>
<td>20- 4</td>
</tr>
<tr>
<td>MarSolution. Customer Specific Measuring Units</td>
<td>20- 5</td>
</tr>
<tr>
<td>MarSolution. Software D1200X</td>
<td>20- 7</td>
</tr>
</tbody>
</table>

Request a brochure or see WebCode 19304
MarSolution. Measuring Units Based on Millimar Standard Components

The use of Millimar Standard Elements allows multi-gage measuring devices to be designed and implemented for the widest possible range of workpieces, e.g. rotationally symmetrical and non-rotationally symmetrical parts. Rotationally symmetrical workpieces can be mounted between centers or on prismatic supports, whereas non-rotationally symmetrical workpieces often require a special holder.

Gage modules
Travel distance: 5 - 10 - 20 mm

XY tables
Travel distance
2.5 - 5 - 7 mm

Angular adjustment
0 - 30 - 45 - 60 - 90°

Measuring inserts

Description

Versatile

The versatility of the Millimar Standard Elements means that the right solution can be provided, whatever the measurement task at hand.

Whether it’s a question of external, internal or length measurements, the Millimar Standard Elements will be able to meet your requirements, even with complex workpiece geometries.

Thanks to the space-saving design of the styli, a high number of measuring points can be inspected within a small area of the testpiece.

The pneumatic lifting mechanisms integrated into the measuring elements simplify the job of moving the testpiece into the measuring position and reduce the amount of wear on the styli.

Flexible

The modular concept using Millimar Standard Elements is continued throughout the construction of the whole system. A generous amount of travel in the styli (up to 20 mm / 0.79") allows a high degree of flexibility in terms of the variety of testpieces that can be accommodated.

Precise

The Millimar Standard Elements are specially designed for use in the workshop and are manufactured using a rigorous process. This guarantees that the measuring devices give stable and reliable measurements.

For example, using styli fitted with two ball-bearing guides to support the moving part, it is possible to achieve measurement accuracy on the μm scale, if this is required due to the tolerances of the feature being measured.

Reliable

All components are long-lasting and low-maintenance thanks to the use of rust-proof materials, the selection of appropriate heat treatments, and the use of a lifting mechanism to minimize the effects of friction acting on the styli when the workpiece is inserted.

Economical

Our systems can either be constructed by the customer from standard elements obtained from the catalog, or alternatively we can provide ready-built devices as turn-key solutions. Whichever option you choose, you can be sure that you are purchasing a system that is tailored to your specific requirements on the most favorable of terms.

Below are just a few examples of the many factors that contribute to the cost effectiveness of the Millimar Standard Elements:

• Reusability of standard elements: Once manufacture of a particular type of workpiece has ceased, all standard elements used in the test equipment can be reused for a different type of workpiece.

• A choice of different mechanisms for guiding the moving part of the stylus, according to the accuracy requirements of the measuring task (optimal price-performance ratio).

• Reduction in development and implementation time.

• Availability of the equipment: Our standard elements are manufactured under standard production conditions and are always available off the shelf and ready to use.
MarSolution. Standardized Measuring Devices

Description

With the product group „MarSolution“, Mahr offers special customer-specific solutions for dimensional metrology - semi- and fully automatic measuring systems that operate directly on the shop floor. Mahr uses its proven standard components (Millimar measuring interface, probes and other standard measuring components) thus offering reliable and precise metrology. Always the right solution for your task. Mahr offers solutions for various industries and branches.

Vertical measuring device with pivoting clamping of workpiece between centers

These measuring devices allow inspection of diameter, length, and radial and axial run-out for rotationally symmetrical parts. With manual or automatic swivelling of the workpiece mount between centers.

Dynamic measurement of the workpiece is also possible thanks to motorized rotation.

Measuring device with rotary table

Measuring devices with rotary table allow combined external and internal measurements as well as automatic radial and axial run-out testing.

These measuring devices can also be motorized to enable dynamic measurements.

Horizontal measuring device

Workpiece mounting on prisms or between centers, including work-piece loading table

The horizontal measuring devices allows workpieces to be held on prismatic supports or between centers. These systems are particularly suitable for heavy workpieces.

The workpiece can be loaded into the workpiece holder outside of the actual measuring station.

WebCode 19305