Precimar. Precision Length Metrology

Request catalog

Precimar. Dial Indicator Testing Instruments

SEMI- AND FULLY AUTOMATED TESTING OF MEASURING EQUIPMENT WITH DISPLAYS

► | Dial indicator testing instruments from Mahr ensure efficient and precise metrology. These instruments provide absolute measurements for dial indicators, dial comparators, lever-type test indicators, inside micrometers and inductive and incremental probes. Typical applications include dial indicator testing in all branches of industry, inspection rooms, calibration laboratories and series testing by dial indicator manufacturers. With the Optimar 100, Mahr offers a practical solution for both cost-effective, semi-automated testing of analog dial indicators and efficient, fully automated testing of digital measuring equipment. | ◄




Optimar 100

Universal dial indicator testing machine

Description

The cost-effective testing station for semi- or fully automated testing of dial indicators, dial comparators, lever-type test indicators, 2-point inside measuring devices, and inductive and incremental probes.

Designed as a table-top unit, the **OPTIMAR 100** is user-friendly and ensures fast test runs. It features a motorized drive and is equipped with a high-resolution measuring system. The test run is software-controlled.

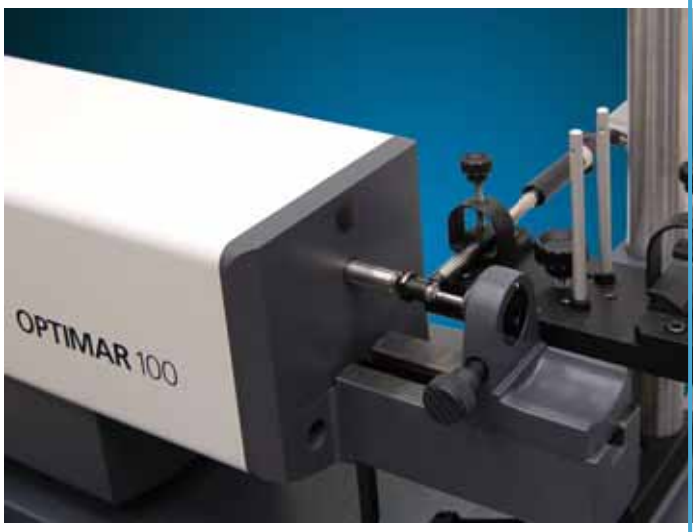
Features

- For dial indicators, dial comparators, lever-type test indicators, 2-point inside measuring devices, digital dial indicators and induc tive and incremental probes
- Automation of sub-processes (automated pre-positioning) using motorized measuring spindle drive
- Fully automated measuring run for digital devices
- **OPTIMAR 100** may be used horizontally (e.g. for measuring inside micrometers)
- Testpiece mounting via vertical guide. Height can be adjusted quickly (adaptation of testpieces to different measuring ranges)
- Box-shaped and thus rigid machine casing
- For testpieces with a shaft diameter of 8 mm, 28 mm or 3/8"
- Electronic handwheel for manual control of the measuring spindle's movement. Self-adjusting sensitivity of the electronic handwheel for adaptation to the specific test specimen Ergonomic design of all control elements
- Compliance with the Abbe comparator principle for maximum measuring accuracy
- LIF 101 measuring system with computer-aided error compen-sation. Testing of 2-point inside measuring devices without loss of accuracy
- Length measuring deviation in vertical and horizontal directions: MPE = (0.2 + L/100) µm, L in mm at T = 20 °C ±0.5 °C, permissible temperature gradient 0.1 K/h
- **Mahr software** or **QMSOFT software**

Application

- For both analog dial indicators, dial comparators, lever-type test indicators and 2-point inside measuring devices and digital dial indicators and inductive and incremental probes.

Request catalog or see WebCode 2421



Accessories

- Mount for lever-type test indicators
- Large selection of adapters for digital dial indicators and inductive and incremental probes
- Please ask for customized adapters if required
- Probe can be connected to Optimar via probe box
- Holder and software for testing 2-point inside measuring devices with a movable meausing bolt (tesing as per VDI/VDE/DGQ 2618, sheet 13.2., 2005)
- Device for force sensor on request
- **OPTIMAR** recalibrated on site by Mahr Service Center
- Calibration set for calibration by the operator

Technical Data

Optimar 100	**Order No. 5320005**
Range of measuring spindle	100 mm, 4 in (101.6 mm)
Measuring system	LIF 101 with correction of measured values
Digital increment	0.02 µm (0.8 µin)
Length measuring deviation (MPE)	(0.2 + L/100) µm, (L in mm)
Positioning speed	Max. 2 mm/s (0.08 in/s)
Positioning	
Pre-positioning:	Automatic
Fine positioning:	Electronic knob
Supply voltage	Via plug-in power supply unit 110/230 V/9 V AC, 18 VA
Dimensions (L x W x H)	235 mm x 216 mm x 480 mm (9.3 in x 8.5 in x 18.9 in)

Precimar. Gage Block Tester 130B-24, 16

Now even better: Models 130B-24 and 130B-16.
Gage block comparators

Description

The **130B-24** gage block comparator from **Mahr Federal** is the preferred choice of many major calibration laboratories. It is specifically designed for comparative gage block measurements. The **130B-24** model measures the industry's key dimensional standards with the ultimate in resolution and reproducibility.

Features

- A unique "floating measuring frame" ensures precise point-to-point measurement
- Single-sensor design minimizes electronic noise
- Finely balanced system optimizes control of measuring forces
- Resolution of 0.1 µin (0.001 µm)
- Reproducibility of 0.2 µin (0.005 µm) ($6\sigma < 1$ µin/0.025 µm)
- Measuring capacity of 0.010 in to 4 in (0.25 mm to 100 mm)
- Integrated measuring software and user interface
- Built-in positioner for reproducible measuring positions

Gage block positioner
An accurate positioner is built into the plate of the **130B-24**. The reference gage block and the testpiece gage block are loaded into the openings in the template. The device swivels between the contact points and positions the gage blocks – first the reference gage block and then the testpiece gage block in its reference position and in the corners of the gage block. Three easily exchangeable templates are included, one for square and two for rectangular (30 mm and 35 mm/1.18 in and 1.38 in) gage blocks.

Other templates are available as optional extras. The positioner is suitable for gage blocks from 0.20 in (0.5 mm) to 4 in (100 mm) long. It can be fitted for right- or left-handed users or removed completely if necessary. An acrylic breath shield is included to protect the measuring area against body heat. Please see our special brochure for further information on the **software**.

Technical Data 130B-24 / 130B-16

Size (without computer)	Approx. 15 in x 15 in x 23 in (385 mm x 385 mm x 590 mm)
Weight (without computer)	Approx. 225 lbs (100 kg)
Max. gage block length	0.010 in to 4 in (0.25 mm to 100 mm)
Measuring force (upper contact) (lower contact)	 3 oz (0.8 N) 1 oz (0.3 N)
Contact tip material	Hard metal (diamond - optional)
Contact tip radius	0.125 in (3.175 mm)
Sensor range	± 0.015 in (± 0.38 mm)
Measuring range	± 500 µin (±10.0 µm)
Reproducibility	6 σ < 1 µin (25 nm) measured on a 1 in gage block without removing the gage block
Linearity	Deviation <1 µin over the central ± 50 µin and <1 µin in any 50 µin within the ± 500 µin measuring range < 20 nm over the central ± 1.0 µm and < 20 nm in any ± 1.0 µm over a measuring range of ±10.0 µm

Precimar 130B-16

Model 130B-16 for longer gage blocks

The same highly linear, stable electronics as the 130B-24

Designed for gage blocks of up to 600 mm (24 in) but can also measure shorter blocks.

Approx. size (without computer)
385 mm x 385 mm x 1,016 mm
(15 in x 15 in x 40 in)
Approx. weight (without CPU)
140 kg (309 lbs)
Measuring length
2.5 mm to 600 mm (0.10 in to 23.6 in)
Measuring force
(upper probe) 4 oz., 1.1 N
(lower probe) 2 oz. ,0.6 N

All other data as for the **130B-24**.

Request catalog or see.
WebCode 10259.

Precimar 826 PC Gage Block Measuring Unit

Description

The **826 PC** gage block measuring unit is fast, reliable and extremely precise. In comparative measurement, it achieves a reproducibility of 0.01 µm.

An open and extremely rigid L-shaped stand forms the basis for the two opposing high-precision probes, and the perfectly level measuring table.

Work is made easy thanks to straightforward one-handed operation for manipulating reference and test gage blocks on the measuring table. The open design allows visual contact during testing.

The user is able to view the measuring process at all times which helps to ensure a unique level of process reliability.

Two professional measuring and evaluation programs (software) meet all the needs of internal gageblock tests, calibration laboratories and gageblock manufacturers.

The **826** enables quick and straightforward high-precision testing of European and US gage blocks up to 170 mm (6.69 in) long in accordance with ISO 3650.

Features

- Rigid cast-iron stand ensures a stable temperature and insensitivity to heat
- Easily adjustable vertical slide with upper probe
- Very ergonomic and convenient one-handed operation for positioning the gage block under the probe
- Fine adjustment via rigidly connected parallelogram springs
- Electropneumatic lifting of the probes
- Extremely smooth manipulator operation thanks to high-precision ball bushings
- Measurement not influenced by manual force applied
- Gage blocks easy to move on the measuring table thanks to round, hardened high-precision support pins
- No zero point setting required, since the set value is offset by the stored actual allowance of the respective reference gage block
- Very effective protection from heat due to an acrylic glass screen along the sides of the unit
- Flattening correction
- Correction of differing coefficients of thermal expansion
- Calculation of mean values
- Two measuring and evaluation programs: Calibration and data management or additionally with customer management, gageblock storage management and multi-test-unit management

Technical Data

826 gage block measuring unit Order No. 4448003

Application range	0.5 mm to 170 mm (0.02 in to 6.69 in)
Usable table surface	60 mm x 55 mm (2.36 in x 2.17 in)
Reproducibility	± 0.01 µm (0.4 µin)
Stylus ball radius, upper probe	1.5 mm (0.06 in)
Stylus radius, lower probe	1.5 mm (0.06 in)
Direct measuring range	0.2 mm (0.0008 in)
Weight	37 kg (81.6 lbs)

For testing gage blocks over 170 mm long (central length lm) we recommend the **ULM**, **828 CiM** or **PLM** universal measuring machines.

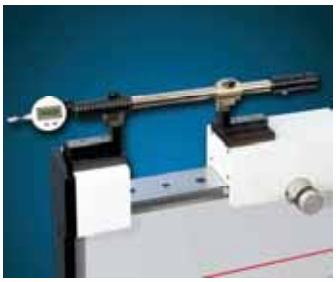
Request catalog or see WebCode 2335

Accessories

- **QM-Block** calibration software for calibration and data management of gage blocks and sets of gage blocks
- The evaluation software runs under Windows® NT/2000/XP

Precimar. Length Measuring Machines for Every Area of Use

► I Length metrology is used today in the most different areas. The LINEAR length measuring units are ideal for use as setting and adjusting instruments in the manufacturing environment. The well-established ULM universal length measuring instruments are standard quality assurance instruments in industrial manufacturing environments and reference instruments for gage and test equipment calibration. They are also used for high-precision length measurements on precision parts. The motorized PLM and CIM units enable operator-friendly, fast and reliable measurements with the smallest uncertainty. Typical applications include precision parts and test equipment. With an extensive selection of products ranging from the straightforward LINEAR to the ULM instruments to the ulta-precise, semi-automated CiM universal length measuring machine, Mahr offers practical solutions for manufacturing environments, inspection rooms and calibration laboratories. In other words, high-precision metrology with extremely efficient measurement processes. I ◄



Precimar LINEAR 100 for Workshop Length Metrology

Description

Linear 100 is a universal, user-freindly length measuring instrument for rapid, precise internal and external measurements up to 100 mm (4 in), directly in the manufacturing environment. The unit's simple design makes it possible to carry out measurements in no time at all and adapt quickly to new measurement tasks.

Features

- Damped measuring spindle with 2 pre-selectable measuring forces
- Measuring force remains virtually constant over the entire measuring range
- Direct measuring range of 50 mm
- Integrated measuring system based on the Abbe principle
- Infinitely adjustable measuring tables for precise measuring position adjustment
- Combined internal/external measurement possible without recalibration
- Solid cast body to avoid stresses and twisting errors from the utset
- MarCheck measuring value display with 2 channels (optionally with stand)
- MarCheck with RS 232 interface, for easy transfer of measured values to PCs.

Universal single-axis length measuring unit

Request brochure or see WebCode 12282-8080

Precimar LINEAR 800 / 1200 / 2000

Description

The **LINEAR** length measuring instruments from **Mahr** are ideal for use as setting and adjusting instruments in the manufacturing environment. They allow precise setting of internal and external comparators, 2-point inside measuring devices, indicating snap gages and many other measuring devices.

Features

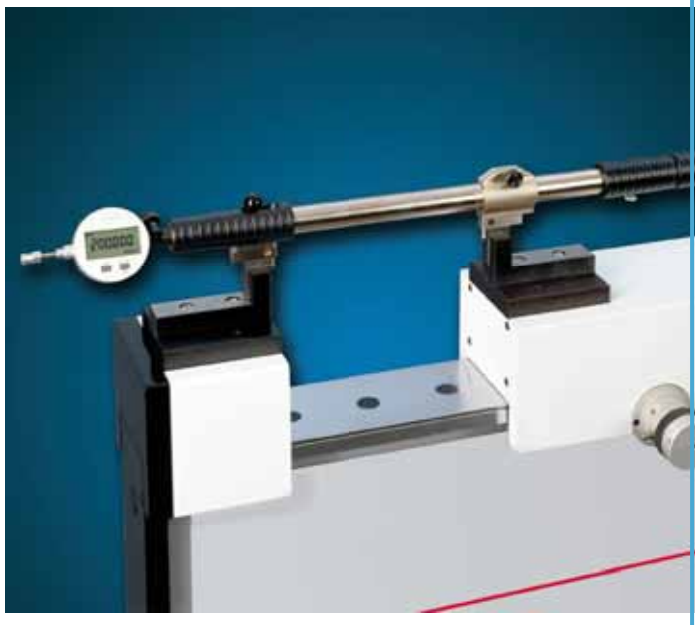
Applications

- Setting measuring instruments with displays such as the Multimar 844T
- Setting two-point internal measuring instruments such as the 844 N
- Setting indicator snap gages such as MaraMaeter 840 F
- Testing and checking setting external micrometers
  Checking setting dimensions, pins etc.
- Checking calipers
- Testing and setting inside micrometers
- Measuring cylindrical parts
- Measuring internal dimensions and bores, etc.

Versions

LINEAR 800
LINEAR 1200
LINEAR 2000

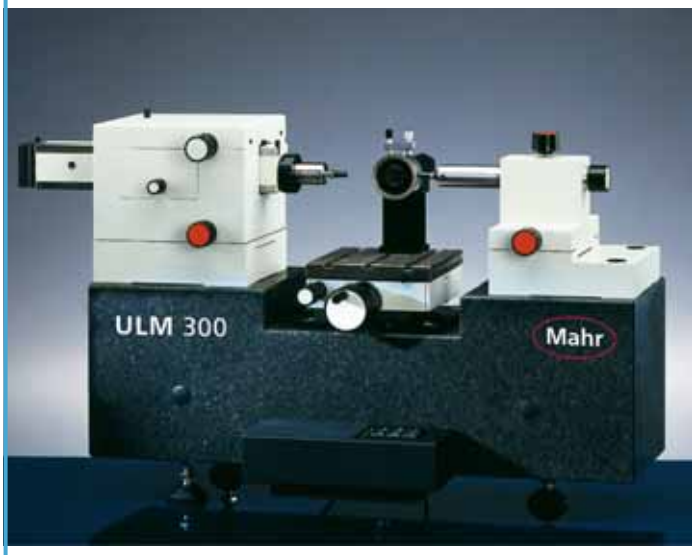
Universal single-axis length measuring and setting instruments

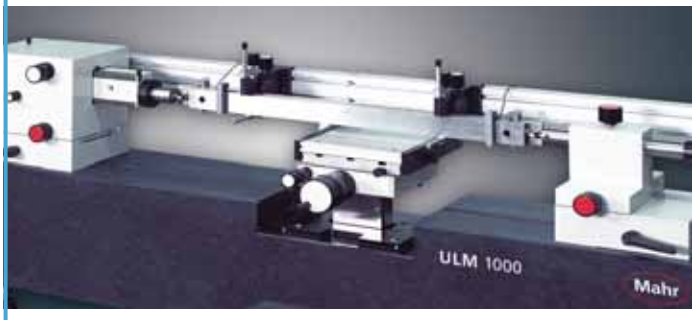


Request brochure or see WebCode 12283

Precimar ULM 300 / 600 / 1000 / 1500 for Calibration Metrology

Universal length measuring machines





Description

Model
Comparator with horizontal base (highly homogeneous and rigid granite)

Measuring system

X-axis:	Incremental, high-precision Heidenhain length measuring system, 100 mm (4 in) long
Z-axis	Incremental Heidenhain reflected light measuring system, 80 mm (3.15 in) long

Drives

X-axis:	Manual movement and fine motion control
Y-axis:	Micrometer, 25 mm (0.98 in) (analog or digital)
Z-axis:	Permanent field motor for motorized adjustment of object table height with 3 speeds

Measuring force generation
Mechanical using weights

Operation
- Measuring spindle, manual
- Air bearings make it very easy to position the measuring element and counter-bearing (not with ULM 300)
- Height of object table can be adjusted using buttons

Features

- Excellent measuring accuracy
- 100% compliance with Abbe comparator principle
- Online temperature measurement with 2 to 4 sensors
- Computer-aided correction of systematic machine errors (CAA)
- Computer-aided stabilization of instrument zero point
- Computer-aided correction of temperature and measuring force influences
- Measuring force remains constant over the entire measuring spindle adjustment range
- Large object table (load capacity 25 kg (55 lbs)) guided with high precision in the Z-direction
- Automatic reversal point recognition for static and dynamic measured value acquisition
- Great flexibility in the application range
- Large number of modular accessory sets and components to solve the most diverse measurement tasks, including threads, tapers, taper threads and gears
- Measuring and evaluation software runs under MS Windows **Mahr 828 WIN**

Details on metrological accessories are available on request.

Versions

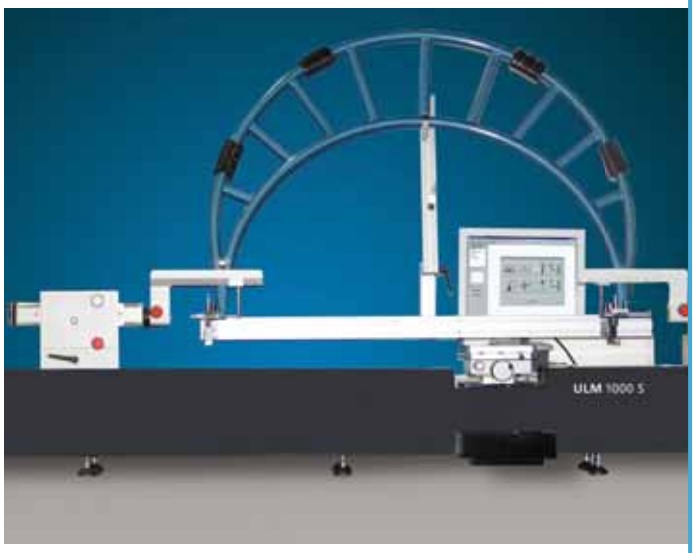
ULM 300
ULM 600
ULM 1000
ULM 1500

Request brochure or see WebCode 10454

Precimar ULM 520 S / 1000 S for Calibration Metrology

Description

Large universal length measuring instruments with large direct measuring range



Model
Comparator with horizontal base (highly homogeneous and rigid granite)

Measuring system

X-axis:	In the measuring element, incremental high-precision Heidenhain length measuring system, 100 mm (4 in) long; in the base, incremental Heidenhain reflected light measuring systems over entire length of base to left and right of object table
Z-axis:	Incremental Heidenhain reflected light measuring system, 80 mm (3.15 in) long

Drives

X-axis:	Manual movement and fine motion control
Y-axis:	Micrometer, 25 mm (0.98 in) (analog or digital)
Z-axis:	Permanent field motor for motorized adjustment of object table height with 3 speeds

Measuring force generation
Mechanical using weights

Operation
- Measuring spindle, manual
- Air bearings make it very easy to position the measuring element and counter-bearing
- Height of object table can be adjusted using buttons

Features

- Combined measuring instrument for very high-precision measurements in the range up to 100 mm (4 in) and standard-precision measurements over the entire range of movement of the measuring element and counter-bearing. X measured value formed from the measuring systems of the measuring element and the base
- Particularly recommended for measurements on large testpieces, but also suitable for measurements on smaller testpieces
- Online temperature measurement with 3 sensors
- Computer-aided stabilization of instrument zero point and correction of systematic machine errors (CAA)
- Measuring force remains constant over the entire measuring spindle adjustment range
- Computer-aided correction of temperature and measuring force influences
- Large object table (load capacity 25 kg (55 lbs)) guided with high precision in the Z-direction
- Large number of modular accessory sets and components to solve the most diverse measurement tasks, including threads, tapers, taper threads, gears and ball faces
- Measuring and evaluation software under MS-Windows **Mahr 828 WIN**

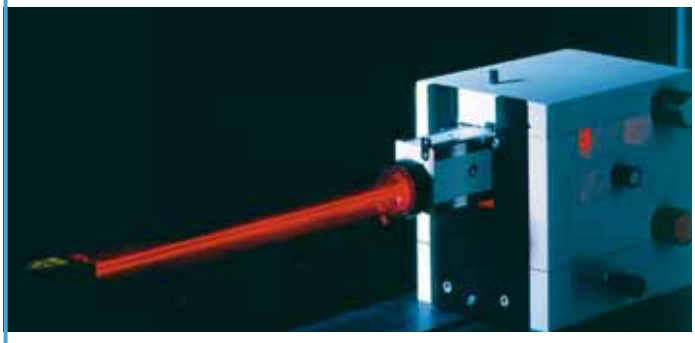
Versions

ULM 520 S
ULM 1000 S

Request brochure or see WebCode 10455

Precimar ULM 800 L / 1500 L for Calibration Metrology

Universal length measuring instrument with laser measuring system



Description

Model
Comparator with horizontal base (highly homogeneous and rigid granite)

Measuring system

X-axis:	Interferential laser measuring system, 525/1,115 mm (20.67/43.90 in) long
Z-axis:	Incremental Heidenhain reflected light measuring system, 80 mm (3.15 in) long

Drives

X-axis:	Manual movement and fine motion control
Y-axis:	Micrometer, 25 mm (0.98 in) (analog or digital)
Z-axis:	Permanent field motor for motorized adjustment of object table height with 3 speeds

Measuring force generation
Mechanical using weights

Operation
- Measuring spindle, manual
- Air bearings make it very easy to position the measuring element (with laser reflector) and counter-bearing
- Height of object table can be adjusted using buttons

Features

Combined measuring instrument for very high-precision measurements in the range up to 100 mm (4 in) and standard-precision measurements over the entire range of movement of the measuring element and counter-bearing. X measured value formed from the measuring systems of the measuring element and the base
- Particularly recommended for measurements on large testpieces, but also suitable for measurements on smaller testpieces
- Online temperature measurement with 3 sensors
- Computer-aided stabilization of instrument zero point and correction of systematic machine errors (CAA)
- Measuring force remains constant over the entire measuring spindle adjustment range
- Computer-aided correction of temperature and measuring force influences
- Large object table (load capacity 25 kg (55 lbs)) guided with high precision in the Z-direction
- Large number of modular accessory sets and components to solve the most diverse measurement tasks, including threads, tapers, taper threads, gears and ball faces
- Measuring and evaluation software runs under MS Windows **Mahr 828 WIN**

Main areas of application

For the calibration of

- Plain plug and ring gages
- Setting rings
- Snap gages
- Spherical gages, gages for deep bores
- Gage blocks
- Thread gages
- Taper thread gages
- Gear tooth gages
- Dial indicators
- Dial comparators
- 2-point inside measuring devices
- Micrometers

Versions

ULM 800 L
ULM 1500 L

Request brochure or see WebCode 10456

Precimar PLM 600-2 for Precision Length Metrology

Description

Model type
Comparator according to the Abbe principle with horizontal basic bed (highly homogeneous and rigid granite)

Measuring system

X-axis:	Incremental, high-precision Heidenhain length measuring system, 200 mm length
Z-axis :	Incremental Heidenhain illumination system, 70 mm length

Drives

X-axis	Motor-driven measuring slide and automatic contacting
Y-axis :	Micrometer 25 mm (analog or digital)
Z-axis :	Motorized adjustment of object table (semi-automatic / CNC-controlled)

Measuring force generation
Electronically controlled measuring force generation

Operation
- Measuring spindle via joystick as well as automatic contacting
- Measuring slide and tailstock are easily positionable due to air-bearings
- Motorized height adjustment of object table using joystick or CNC-controlled

Features

- The **Precimar PLM 600-2** features a universal measuring table with 5 finely adjustable axes and 25 kg (55 lbs) load capacity, a state-of-the-art PC-based multiple-axis machine control system with PC workstation, the **828 WIN** "Free Measurement" basic software and a calibration certificate
- Straightforward operation using measuring force-controlled, joy stick-operated measuring slide, with progressive deflection characteristic and automatic contact detection
- Automatic detection of internal and external measurements and computer-aided reversing point detection
- A motorized measuring slide allows high travel speeds
- The CNC-controlled motorized vertical movement of the support table (optional) results in excellent measuring efficiency
- State-of-the-art machine control, data recording, processing, logging and transfer with powerful software and menu-driven operation
- Software compensates for thermal dimensional deviations
- Software enables very straightforward setting and changing of measuring force
- Low measuring uncertainty due to aerostatic slide ways for all measuring carriages on the machine bed
- Electronic regulation of the measuring forces and automatic contacting; therefore almost all subjective influences are eliminated and unintentional corrections with the workpiece is avoided.
- Semi-automatic bore and inside thread measurement

Request brochure or see WebCode 2380

Universal length measuring machine

Precimar 828 CiM 1000 for Precision Length Metrology

Precision length measuring machine

Description

Model type
Comparator according to the Abbe principle with horizontal basic bed (highly homogeneous and rigid granite)

Measuring system

X-axis:	High quality, high-precision incremental length measuring system (LIF), 300 mm length
Z-axis:	Incremental Heidenhain illumination system, 70 mm length

Drives

X-axis	Motor-driven measuring slide and automatic contacting
Y-axis:	Micrometer 25 mm (analog or digital)
Z-axis:	motorized adjustment of object table (semi-automatic / CNC-controlled)

Measuring force generation
Electronically controlled measuring force generation

Operation
- Measuring spindle via joystick as well as automatic contacting
- Measuring slide and tailstock are easily positionable due to air-bearings
- Motorized height adjustment of object table using joystick or CNC-controlled

Features

- **Precimar 828 CIM 1000** has the highest measuring accuracy: Unique low length measuring uncertainty for precision products and gage calibration management
- Fast and reliable measurements
- 100% adherence to the comparator principle according to Ernst Abbe
- Online temperature monitoring
- Software-supported mesuring force generation, especially advanatageous for thin-walled workpieces and gage calibration devices
- Semi-automatic bore measurement and inside measurement
- High flexibility in the application range
- Numerous accessory sets and components in a modular system to solve different measuring tasks, incl. thread pitch, thread, tapered thread, toothing
- Measuring and evaluation software under MS-Windows, **828 WIN**
- Patented measuring procedure
- Minimum measuring uncertainty due to the use of aerostatic guides for all slides supported by the machine bed, the mobile bearing of the measuring spindle over a spring parallelogram which is free of both play and friction, electronic regulation of measuring forces and automatic contacting. Subjective influences are therefore minimized and unintentional collisions with the tespiece prevented

Details of metrological accessories are available on request.

Request brochure or see WebCode 2092.

Precimar Messuhrenprüfgeräte

	Optimar 100
Messbereich (mm)	100
Längenmessabweichung MPE_{E1} (µm)	(0,2 + L/100)
Prüfrichtung	vertikal und horizontal
Betriebsart	halbautomatisch, vollautomatisch

Precimar Endmaßprüfgeräte

	826 PC	130B-24	30B-16
Prüfbereich (mm)	0,5 bis 170	0,25 bis 100	2,5 bis 600
Endmaße	Europäisch (rechteckig) und US (quadratisch)	0,010" bis 4"	0,10" bis 24"
Wiederholbarkeit (µm)	0,01	6 σ <25 nm	

Precimar Längenmessgeräte für die Fertigung

	LINEAR 100	LINEAR 800	LINEAR 1200	LINEAR 2000
Messbereich außen (mm)	0 bis 100	0 bis 820	0 bis 1220	0 bis 2020
Messbereich innen (mm)	6 bis 100	1 bis 520	1 bis 920	1 bis 1720
Längenmessabweichung MPE_{E1} (µm)	(0,7 + L/1000)	(0,7 + L/1000)	(0,7 + L/1000)	(0,7 + L/1000)
Betriebsart	manuell	manuell	manuell	manuell

Precimar Längenmessmaschinen für Kalibrier- und Präzisionsmesstechnik

	ULM Baureihe	PLM 600-2	CiM 1000
Messbereiche außen (mm)	0 bis 1620*	0 bis 600	0 bis 1000
Messbereiche innen (mm)	0,5 bis 1465*	0,5 bis 445	0,5 bis 845
Messspannen direkt (mm)	100 bis 1115*	200	300
Längenmessabweichung MPE_{E1}(µm)	(0,1 + L/2000) bzw. (0,3 + L/1500)	(0,085 + L/1500)	(0,055 + L/1500)
Wiederholbarkeit (µm)	0,05 / 0,1	<0,05	<0,03
Messkraft (N)	gestuft 1 bis 11	0 bis 13,9 stufenlos	0 bis 13,9 stufenlos
Objekttisch Größe (mm)	160 x 160	350 x 150	350 x 150
Objekttisch Belastbarkeit (N)	250	250	250
Betriebsart	manuell, motorisch	motorisch, CNC-gesteuert	motorisch, CNC-gesteuert

* je nach Gerätetyp

FROM THE THUMBNAIL TEST...

...TO MARSURF.

The latest information on MARSURF products can be found on our website:
www.mahr.com, WebCode 158

► | Wherever surface structures influence the function, processing or appearance of components or products, careful testing is essential. But how can surfaces be tested? At the beginning of the 20th Century, experts still had to test by eye and touch. A practiced eye can detect features in the µm range, and even the much maligned thumbnail test delivered perfectly acceptable results. Now however, we live in an age of exchangeable parts, fits and internationalization, where subjective tests like this are no longer adequate. Today, computer-aided measuring instruments provide objective data. Measurement and evaluation have become considerably easier. For decades, Mahr has been a worldwide pioneer in this area, as demonstrated by the company's numerous innovations and patented solutions in the field of surface roughness metrology. The interplay between the stylus, drive and measuring setup plays a key role in influencing the quality of surface measurement tasks. This is where Mahr's core expertise comes in, as demonstrated by the company's numerous innovations and patented solutions. Over this time, we have succeeded in perfecting the stylus method, which is now in widespread use throughout the world. We can meet even the most demanding requirements for non-contact measurement, e.g. where extremely soft materials or ultra-short measuring times are involved, thanks to the range of optical sensors offered in the MarSurf product family. Developed with Mahr quality, expertise and know-how, MarSurf is the solution for all your surface metrology needs. | ◄