

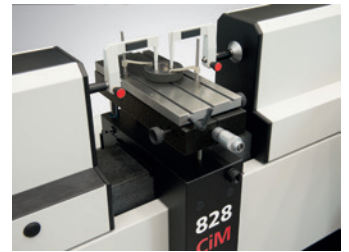
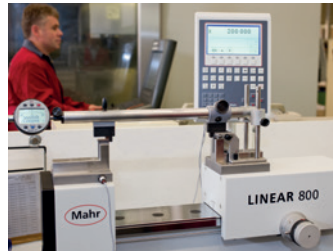
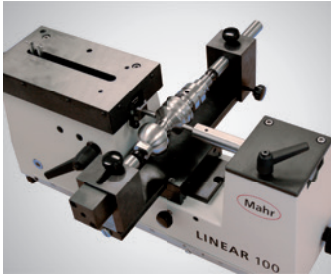
Precimar | Precision Length Measurement

Precimar stands for high-precision dimensional metrology – for both absolute and relative measurements. Typical applications include products and gages for the aerospace and automotive industries and the production testing of gages in calibration laboratories.



Precimar. Length Measurement for all Areas of Use

Length measurement is used today in all sorts of different sectors. LINEAR length measuring instruments are setting and measuring instruments designed for general workshop use. The well-established universal length measuring instruments (ULM) are standard instruments for quality assurance in calibration measurement. They are also used for highly accurate length measurements on precision parts. Motorized PLM and CiM instruments offer fast, reliable and user friendly measurement with the lowest possible uncertainty. With products ranging from the simple LINEAR length measuring instrument and the ULM devices to the ultra accurate, partially automated CiM Universal measuring machine, Mahr has practical solutions for manufacturing, measuring rooms and calibration laboratories. Precimar offers maximum precision combined with extremely efficient measuring processes.



Precimar SM 60

Length Measuring Bench

DESCRIPTION

- The Precimar SM 60 is a user-friendly measuring instrument for fast, precise outside measurements on workpieces.
- Simple instrument design
- Quick adaptation to new workpieces
- Rugged construction makes it suitable for use close to production
- Freely selectable measuring equipment (e.g. digital dial indicator, probes, etc.)
- Carbide measuring surfaces
- Integrated coupling protects the measuring equipment
- Wide choice of measuring attachments
- Suitable for left- and right-handed operators
- Large support table, Ø 60 mm, with variable height adjustment



TECHNICAL DATA

SM 60	
Size of table	Ø 60
Application range mm	0 – 60
Type	SM 60
Measuring range	0 – 25 mm
Direct measuring range [mm]	25
Device dimensions (LxWxH)	285 x 80 x 100 (without control elements) 290 x 140 x 120 (with control elements)
Measuring forces [N]	1 ± 0.2 + measuring force of measuring system
Mass [kg]	9



For more information, please visit our website: www.mahr.com

Precimar LINEAR 100

Length Measuring Instrument

DESCRIPTION

- The LINEAR 100 is a universal, easy to operate length measuring instrument for quick and precise outside and inside measurements up to 100 mm, directly on the production line. The simple design of the instrument speeds up the measurement process and makes it quick and easy to adapt to new measuring tasks.
- Cushioned measuring spindle with 2 preselectable measuring forces
- Constant measuring force over the entire measuring range
- Complies with Ernst Abbe's comparator principle for outer measurements
- Infinitely adjustable measuring table height for accurate adjustment of measuring positions
- Combined outer/inner measurement possible without the need for recalibration
- Easy change measuring anvils can be selected to match specific measuring tasks
- Sturdy cast body to eliminate stresses and bending errors
- Height adjustable support tables for inner and outer measurements
- MarCheck measurement display (with optional stand): including 2 channels, USB connection for printer or stick, USB connection for PC, and RS 232 interface for easy transfer of measured values to PCs
- Measured values can be transferred to all MS Windows® programs (e.g. Microsoft Excel®) via the MarCom software (optional)
- Various accessories available upon request



TECHNICAL DATA

LINEAR 100	
Digital display	MarCheck
Application range mm	for outer measurements from 0 to 100 for inner measurements from 15 to 100 6 to 100 on request
Type	LINEAR 100
Direct measuring range [mm]	50
Measuring range for outer measurement [mm]	0 to 100
Measuring range for inner measurement [mm]	15 to 100
Measuring uncertainty MPE_{E1} (L in mm) [μm]	$\leq (0.7 + L/1000)$
Measuring forces [N]	1 or 3
Device length [mm]	260

APPLICATIONS

- Quick and easy high-precision outer and inner measurements
- Outer diameter measurements (bolts, turned parts, etc.)
- Inner diameter measurements (bores, rings, etc.)
- 2-ball dimension checks on outer and inner gears

ACCESSORIES

- Outer measurement set (assorted measuring anvils)
- Inner measurement set (probe pair starting from 6 mm, floating plate, etc.)
- Centering tip mount set
- Support plate for cylindrical workpieces
- Foot switch, data cable, stand for display unit
- Outside and inside probes with M2.5 bore for gear measuring balls
- MarCom software for transferring measured values to Windows programs



For more information, please visit our website: www.mahr.com

Precimar LINEAR Series

Setting and Measuring Instrument

DESCRIPTION

- LINEAR length measuring instruments from Mahr are ideal for use as a setting and adjusting instrument close to the production area. They offer precision setting of inside and outside comparative measuring instruments, inside micrometers, 2-point bore gages, dial comparator snap gages and many other measuring instruments.
- As an infinitely adjustable dimensional standard, the LINEAR is a cost effective alternative to setting gages, adjustment rings and gage blocks.
- Key advantages include the ease of handling, short set-up time and ability to set any dimension. A switchable measuring force regulator, for both outside and inside measurements, delivers user independent measuring results.
- Base bar made of steel alloy, providing the same thermal behavior as the setting and measuring objects
- Precision ground and lapped guide rail, non-rusting
- Glued on steel scale along entire length of base bar
- Easy to operate
- Precision adjustable to 1/10 μm
- Measured values displayed with MarCheck:
- Display unit with extensive measuring functions, USB connection for printer or stick and USB connection and RS232 interface for transfer to PC
- A factory calibration or DAkkS/ DKD calibration is available for the measuring station



TECHNICAL DATA

Type	LINEAR Series	LINEAR Series	LINEAR Series
Product name	LINEAR 800	LINEAR 1200	LINEAR 2000
Measuring range for outer measurement [mm]	0 to 815	0 to 1215	0 to 2015
Measuring range for inner measurement [mm]	40 to 855	40 to 1255	40 to 2055
Measuring uncertainty MPE_{E1} (L in mm) [μm]	$\leq (0.7 + L/1000)$	$\leq (0.7 + L/1000)$	$\leq (0.7 + L/1000)$
Repeatability [μm]	≤ 0.5	≤ 0.5	≤ 0.5
Measuring forces [N]	3	3	3
Device length [mm]	1250	1650	2450
Mass [kg]	approx. 155	approx. 210	approx. 320

APPLICATIONS

- Setting comparative measuring instruments, e.g. Multimar 844 T
- Setting 2-point bore gages, e.g. Intramess 844 N
- Setting dial comparator snap gages, e.g. MaraMeter 840 F
- Checking and setting outer micrometers
- Checking setting standards, rods etc.
- Checking calipers
- Checking and setting inside micrometers
- Measuring cylindrical parts
- Measuring inner dimensions and bores, etc.

ACCESSORIES

- Testing devices for outside micrometers
- Clamping devices for 2-point bore gages for universal measuring table
- Support for large, 2-point bore gages and their accurate positioning and setup on the LINEAR
- Adjustable height support for setting up large bore gages
- Support plates for rings > 200 mm
- Holding device for long measuring equipment
- Attachment for dial comparator snap gages (height-adjustable)
- Height measuring system for universal measuring table
- Additional support table for long measuring objects
- Measuring anvils with \varnothing 20 mm balls; with ball-ended gage blocks; with \varnothing 15 mm and \varnothing 7.5 mm spindles
- Caliper, bore gages, plug-on heads, clamping elements
- Testing setups for depth gages
- Support for inside micrometers
- Temperature compensation



For more information, please visit our website: www.mahr.com

Precimar ULM-E

Calibration Measuring Instruments

DESCRIPTION

- ULM-E universal length measuring comparator instruments are mounted on highly homogeneous rigid granite in a horizontal configuration

X-axis measuring system:

- Heidenhain incremental, precision length measuring system, 100 mm long

Z-axis measuring system:

- Renishaw incremental, precision length measuring system, 80 mm long
- High measuring accuracy
- Compliant with Ernst Abbe's comparator principle
- Manual operation of measuring spindle
- Air bearings for smooth manual positioning of measuring element and counter bearing (not ULM 300-E)
- Object table height adjustment via pushbuttons (also positioning of predefined increments)
- Computer provided temperature measurement with 2 or 3 sensors
- Computer-aided correction of systematic instrument errors (CAA)
- Computer-aided instrument zero point stabilizing
- Computer-aided correction of temperature and measuring force influences
- Constant measuring force over the entire measuring spindle setting range
- Large object table with precision guidance in the Z direction and a loading capacity of 25 kg
- Automatic reversing point detection with static and dynamic adoption of measuring values
- Inner thread measurement supported by automatic Z positioning
- Highly flexible in application range
- Mahr 828 WIN measuring and evaluation software runs under MS Windows®
- Optional use of measuring axis extensions



TECHNICAL DATA

Type	ULM-E	ULM-E	ULM-E	ULM-E
Product name	ULM 300-E	ULM 600-E	ULM 1000-E	ULM 1500-E
Direct measuring range [mm]	100	100	100	100
Measuring range for outer measurement [mm]	0 to 305	0 to 640	0 to 1060	0 to 1560
Measuring range for inner measurement [mm]	0.5 to 150	0.5 to 485	0.5 to 905	0.5 to 1405
Measuring uncertainty MPE_{E1} (L in mm) [μm]	$\leq (0.09+L/2000)$	$\leq (0.09+L/2000)$ or $\leq (0.3+L/1500)$	$\leq (0.09+L/2000)$ or $\leq (0.3+L/1500)$	$\leq (0.09+L/2000)$ or $\leq (0.3+L/1500)$
Repeatability [μm]	≤ 0.05	≤ 0.05 or 0.1	≤ 0.05 or 0.1	≤ 0.05 or 0.1
Measuring forces [N]	0.2 ; 1.0 to 4.5 ; 11	0.2 ; 1.0 to 4.5 ; 11	0.2 ; 1.0 to 4.5 ; 11	0.2 ; 1.0 to 4.5 ; 11
Device length [mm]	685	1080	1500	2000
Mass [kg]	110	160	215	280

APPLICATIONS

Calibration of:

- Plain plug gages and gage rings
- Setting gage rings
- Snap gages
- Spherical gage blocks, internal micrometers
- Gage blocks
- Thread gages
- Taper thread gages
- Gear gages
- Taper gages
- Dial indicators
- Dial comparators
- 2-point bore gages
- Outside micrometers
- 2-point inside micrometers
- Length measurement on precision table

ACCESSORIES

- Large number of accessory kits and modular components for completing a wide variety of measuring tasks, including the measurement of:
 - Thread gages
 - Taper gages
 - Conical thread gages
 - Gears
- Factory calibration or DAKKS/DKD calibration can be additionally offered for this measuring station



For more information, please visit our website: www.mahr.com

Precimar ULM S-E

Calibration Measuring Instruments

DESCRIPTION

- Large universal length measuring instruments with large direct measuring range are mounted on highly homogeneous rigid granite in a horizontal configuration

X-axis measuring system:

- Heidenhain incremental, precision length measuring system, 100 mm long in measuring element
- Heidenhain incremental incident light measuring systems covering the entire length of the base bed and to its right and left

Z-axis measuring system:

- Renishaw incremental, precision length measuring system, 80 mm long
- Combined measuring instrument for ultra accurate measurements in the range to 100 mm and for measurements in the standard accuracy range
- Accurate throughout the entire movement range of the measuring element and counter bearing
- Recommended for measurements of larger measuring objects, but also suitable for measurements of smaller measuring objects
- Manual operation of measuring spindle
- Air bearings for smooth manual positioning of measuring element and counter bearing
- Object height adjustment via pushbuttons (also positioning of predefined increment)
- Computer provided temperature measurement with 3 sensors
- Computer-aided instrument zero point stabilizing and correction of systematic instrument errors (CAA)
- Constant measuring force over the entire measuring spindle setting range
- Computer-aided correction of temperature and measuring force influences
- Large object table with precision guidance in the Z direction and a loading capacity of 25 kg
- Mahr 828 WIN measuring and evaluation software runs under MS Windows®
- Optional use of measuring axis extensions
- Inner thread measurement supported by automatic Z positioning



TECHNICAL DATA

Type	ULM S-E	ULM S-E
Product name	ULM 520 S-E	ULM 1000 S-E
Direct measuring range [mm]	Outer measurement: 0 to 520 Inner measurement: 0.5 to 365	Outer measurement: 0 to 1025 Inner measurement: 0.5 to 870
Measuring range for outer measurement [mm]	0 to 520	0 to 1025
Measuring range for inner measurement [mm]	0.5 to 365	0.5 to 870
Measuring uncertainty MPE_{E1} (L in mm) [μm]	only with ABBE measuring element: $MPE_{E1} \leq (0.09+L/2000)$ with base bed measuring system: $MPE_{E1} \leq (0.6+L/1000)$	only with ABBE measuring element: $MPE_{E1} \leq (0.09+L/2000)$ with base bed measuring system: $MPE_{E1} \leq (0.6+L/1000)$
Repeatability [μm]	With Abbe measuring element: ≤ 0.05 With base bed measuring system: ≤ 0.2	With Abbe measuring element: ≤ 0.05 With base bed measuring system: ≤ 0.2
Measuring forces [N]	0.2 ; 1.0 to 4.5 ; 11	0.2 ; 1.0 to 4.5 ; 11
Device length [mm]	1080	1500
Mass [kg]	160	215

APPLICATIONS

Calibration of:

- Plain plug gages and gage rings
- Setting gage rings
- Snap gages
- Spherical gage blocks, internal micrometers
- Gage blocks
- Thread gages
- Taper thread gages
- Gear gages
- Taper gages
- Dial indicators
- Dial comparators
- 2-point bore gages
- Outside micrometers
- 2-point inside micrometers

ACCESSORIES

- Large number of accessory kits and modular components for completing a wide variety of measuring tasks, including the measurement of:
- Thread gages
- Taper gages
- Conical thread gages
- Gears
- Factory calibration or DAKKS/DKD calibration can be additionally offered for this measuring station



For more information, please visit our website: www.mahr.com

Precimar ULM L-E

Calibration Measuring Instruments

DESCRIPTION

- Universal length measuring instruments with laser measuring system are mounted on highly homogeneous rigid granite in a horizontal configuration

X-axis measuring system:

- Interferential laser measuring system, 525 or 1115 mm long

Z-axis measuring system:

- Renishaw incremental, precision length measuring system, 80 mm long
- High end length measuring instrument with large direct measuring range
- Compliant with Ernst Abbe's comparator principle
- Manual operation of measuring spindle
- Air bearings for smooth manual positioning of measuring element (with laser reflector) and counter element
- Object table height adjustment via pushbuttons (also positioning of predefined increment)
- Laser correction with respect to environmental influences: temperature, air pressure (humidity optional)
- Separate laser generator outside the measuring instrument, fed via optical cable, and laser beam cover
- Computer-aided instrument zero point stabilizing and correction of systematic instrument errors (CAA)
- Computer provided temperature measurement and computer-aided correction of temperature and measuring force influences
- Constant measuring force over the entire measuring spindle setting range
- Large object table with precision guidance in the Z direction and a loading capacity of 25 kg
- Automatic reversing point detection with static and dynamic adoption of measuring values
- Highly flexible within the application range (can be used for measuring both miniature and large measuring objects)
- Mahr 828 WIN measuring and evaluation software and MS Windows®
- Inner thread measurement supported by automatic Z positioning



TECHNICAL DATA

Type	ULM L-E	ULM L-E
Product name	ULM 800 L-E	ULM 1500 L-E
Direct measuring range [mm]	0 to 525	0 to 1115
Measuring range for outer measurement [mm]	0 to 830	0 to 1620
Measuring range for inner measurement [mm]	0.5 to 670	0.5 to 1465
Measuring uncertainty MPE_{E1} (L in mm) [μm]	$\leq (0.1+L/2000)$	$\leq (0.1+L/2000)$
Repeatability [μm]	≤ 0.05	≤ 0.05
Measuring forces [N]	0.2 ; 1.0 to 4.5 ; 11	0.2 ; 1.0 to 4.5 ; 11
Device length [mm]	1500	2300
Mass [kg]	220	325

APPLICATIONS

Calibration of:

- Plain plug gages and gage rings
- Setting gage rings
- Snap gages
- Spherical gage blocks, internal micrometers
- Gage blocks
- Thread gages
- Taper thread gages
- Gear gages
- Taper gages
- Dial indicators
- Dial comparators
- 2-point bore gages
- Outside micrometers
- 2-point inside micrometers

ACCESSORIES

- Large number of accessory kits and modular components for completing a wide variety of measuring tasks, including the measurement of:
- Thread gages
- Taper gages
- Conical thread gages
- Gears
- Factory calibration or DAKKS/DKD calibration can be additionally offered for this measuring station



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Precimar PLM-E

Precision Length Measuring Machine

DESCRIPTION

- The PLM-E precision length measuring machine is an Abbe compliant comparator mounted on highly homogeneous rigid granite in a horizontal configuration
- Sensitive adjustment in 5 axes, and object table with a loading capacity of 35 kg
- PC-based, multi-axis machine control, including PC workstation and 828 WIN "Free measurement" basic software
- Simple operating procedure by means of measuring force-adjusted and joystick-controlled measuring slides with progressive deflection characteristic and automatic contact detection
- Automatic detection of outside and inside measurements and computer-aided search for reversal points
- The motorized measuring slide allows for high travel speeds
- The CNC-controlled vertical and cross adjustment of the universal measuring table facilitates highly efficient measuring
- State-of-the-art machine control (MarEcon)
- Recording, processing, logging and transfer of measurement data via powerful software and menu-driven controls
- Software compensation of thermal dimensional deviations
- Very easy to set the measuring force using the software
- Aerostatic guides for all slides mounted on the machine bed ensure low measurement uncertainties
- Electronic generation of measuring force and automatic contacting
- Subjective influences largely eliminated and unintended collisions with the test piece avoided.
- Automatic bore and inner thread measurement
- Automatic TY adjustment: What's unique is that a manual TY-adjustment is still possible
- Motorized tilting axis (TB) for alignment. Alignment is carried out via the manual control panel or using the 828 WIN software.
- A factory calibration or DAkkS/ DKD calibration is available for the Precimar PLM-E



TECHNICAL DATA

Type	PLM-E	PLM-E
Product name	PLM 600-E	PLM 1000-E
Direct measuring range [mm]	200	200
Measuring range for outer measurement [mm]	0 bis 600	0 to 1000
Measuring range for inner measurement [mm]	0.5 to 445	0.5 to 845
Measuring uncertainty MPE_{E1} (L in mm) [μm]	$\leq (0.085 + L/1500)$	$\leq (0.085 + L/1500)$
Repeatability [μm]	≤ 0.05	≤ 0.05
Measuring forces [N]	0 to 13.9	0 to 13.9
Device length [mm]	1660	2110
Mass [kg]	480	535

* Proof can be carried out at the Göttingen site if required

APPLICATIONS

Calibration of:

- Plain plug gages and gage rings
- Setting gage rings
- Snap gages
- Spherical gage blocks, internal micrometers
- Gage blocks
- Thread gages
- Taper thread gages
- Gear gages
- Dial indicators
- Dial comparators
- 2-point bore gages
- Outside micrometers
- 2-point inside micrometers
- Precision length measurement
- Measurement of thin-walled and deformed workpieces

ACCESSORIES

- Large number of accessory kits and modular components for completing a wide variety of measuring tasks, including the measurement of:
- Thread gages
- Conical thread gages
- Gears
- Thread pitches



For more information, please visit our website: www.mahr.com

Precimar CIM 1000 CNC

Precision Length Measuring Machine

DESCRIPTION

- The Precimar CiM 1000 CNC precision length measuring machine is an Abbe-compliant comparator with horizontal base bed (highly homogeneous, rigid granite)
- Electronically controlled measuring force generation
- Motorized measuring spindle control with joystick and automatic contacting
- Air bearings for smooth positioning of measuring slide, counter bearing and object table
- Sensitive adjustment in 5 axes, and object table with a loading capacity of 25 kg
- Motorized object table height adjustment via joystick or CNC
- Maximum measuring accuracy
- Fast and reliable measurement
- Exceptionally low length measuring uncertainty for precision parts and gage monitoring
- Compliant with Ernst Abbe's comparator principle
- Online temperature monitoring
- Software-supported measuring force generation, especially advantageous for thin-walled workpieces and gages
- Semi-automatic bore and inner thread measurement
- Measuring and evaluation software runs under MS Windows®, 828 WIN
- Patented measuring procedure
- Aerostatic guides for all slides mounted on the machine bed ensure extremely low measuring uncertainties
- Movable measuring spindle mount via a spring parallelogram free from play and friction
- Electronic measuring force adjustment and automatic contacting – largely eliminating subjective influences and avoiding unintended collisions with the testpiece
- Possibility of calculating measuring result down to measuring force 0 N (dynamic measuring)



For more information, please visit our website: www.mahr.com

Precimar CIM 1000 CNC

Precision Length Measuring Machine

TECHNICAL DATA

CIM series	
Contacting speed with joystick (max)	8
Contacting speed with direction keys (max)	3.5
Drive (measuring slide)	aerostatically motorized
Resolution	0.1 μm
Total width	700.000000
Total height (excluding monitor) [mm]	1700.000000
Total length	2500.000000
Height of X-axis (above lowest table position)	70
Height movement, Z-drive (motorized)	70
Tilting movement ϕY [°]	3
Power consumption	200
Air consumption in l/h	100 to 276
mains pressure pn/pa (pn=mains pressure, pa=atmospheric pressure)	≥ 4 bar
Particle size	< 10 (< 934)
Transverse motion Y	25
Pivoting movement ϕZ	8
Floating movement X (\pm)	10
Supply pressure ps/pa (pn=system pressure, pa=air pressure)	3.000000
Temperature	20 ± 0.5 K
Operating temp. range	15°C to 35°C
Temperature lapse rate	< 0.2 K/h
Table surface (A x B) mm	150 x 350
Travel speed (max)	50
Numerical increment in μm	0.01
Type	CIM 1000 CNC
Direct measuring range [mm]	300
Measuring range for outer measurement [mm]	0 to 1000
Measuring range for inner measurement [mm]	0.5 to 845
Measuring uncertainty MPE_{E_1} (L in mm) [μm]	$\leq (0.055 + L/1500)$
Position deviation / error limit (L in mm) [μm] *	$\leq (0.04 + L/2000)$
Repeatability [μm]	≤ 0.03
Measuring forces [N]	0 to 13.9
Device length [mm]	2500
Mass [kg]	840

*Verification can be carried out at the Göttingen site if required

APPLICATIONS

Calibration of:

- Plain plug gages and gage rings
- Setting gage rings
- Snap gages
- Spherical gage blocks, internal micrometers
- Gage blocks
- Thread gages
- Taper thread gages
- Gear gages
- Dial indicators
- Dial comparators
- 2-point bore gages
- Outside micrometers
- 2-point inside micrometers
- Precision length measurement
- Measurement of thin-walled and deformed workpieces

ACCESSORIES

- Large number of accessory kits and modular components for completing a wide variety of measuring tasks, including the measurement of:
- Thread gages
- Conical thread gages
- Gears
- Thread pitches
- Factory calibration or DAkkS/DKD calibration can be additionally offered for this measuring station

Precimar SM 60

Length measuring bench

FEATURES

- Simple instrument design
- Quick adaptation to new work-pieces
- Rugged construction makes it suitable for use close to production
- Freely selectable measuring equipment (e.g. digital dial indicator, measuring probes, etc.)
- Carbide measuring surfaces
- Integrated coupling protects the measuring equipment
- Wide choice of measuring attachments
- Suitable for left- and right-handed operators
- Large support table, Ø 60 mm, with variable height adjustment



TECHNICAL DATA

Order no.		5357360
Type		SM 60
Mounting shaft diameter	mm	8
Application range mm	mm	0 –60
Measuring range	mm	0 –25 mm
Measuring surface ø	mm	6
Parallelism of measuring surfaces		<0,001 mm
Size of table	mm	Ø 60
Measuring forces [N]		1 ± 0,2 + measuring force of measuring system
Mass [kg]		9

ACCESSORIES

Order no.	Description	Type
4337661	Digital indicator, 0,0005 mm, 25 mm	1087 R
4337665	Digital indicator, 0,0005 mm, 25 mm	1087 Ri
4337621	Digital indicator, 0,0005 mm, 25 mm	1086 R
4337625	Digital indicator, 0,0005 mm, 25 mm	1086 Ri
5312010	Compact amplifier	C 1200
5323010	Inductive probe, ± 2 mm	P2004 M
5355368	Measuring attachment M 2.5	
5355410	Measuring attachment with plane surface Ø 2 mm	
5355411	Measuring attachment with flat-edged blade 2	
5355412	Measuring attachment with ball zone R20	
5355413	Measuring attachment with flat-edged blade 8 (pair)	
5355414	Measuring attachment with plane surface Ø 8 mm	
5355415	Measuring attachment with plane surface Ø 14 mm	
5355416	Measuring attachment with plane surface Ø 7.5 mm	
5355485	Measuring attachment with plane surface Ø 6.35 mm	



1087 R;1087 R-HR;1087 ZR



1087 Ri



1086 R;1086 R-HR;1086 ZR



1086 Ri



C1200;C 1200



P2004 M;P2004 T;P2004 U;P2004 F;P2004