

Probes for Coordinate Measuring Machines

Bulletin No. 1989



Mitutoyo

MPP-300Q/MPP-300

Ultra High-Accuracy Scanning



• Fast scanning

The MPP-300Q/300 is a multi-functional probe designed for CNC coordinate measuring machines. It can not only perform a continuous path contact-type scanning measurement [a measurement method that implements a collection of a large amount of coordinate data while traveling along the path in contact with the workpiece] at $V_2 \leq 0.3 \mu\text{m}$ (reference value when the LEGEX series is installed), but also high-accuracy point measurement ($\sigma \leq 0.1 \mu\text{m}$: when the LEGEX series is installed, and data collection from a centering point measurement (shown below).

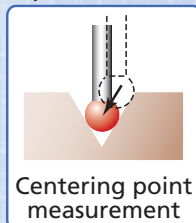
• Omni-directional scanning

The MPP-300Q/300 has internally incorporated high-accuracy scales with a minimum resolution of $0.01 \mu\text{m}$ for each direction (X, Y, and Z axes), which makes it possible to read the stylus displacement in any direction.

The air bearing employed in the sliding section of each axis helps enable this probe with minimum directionality.

• Low measuring force

The ordinary touch trigger probe, even if it has only a small force to generate a trigger signal the moment the stylus actually comes into contact with the workpiece, may be subject to several tens to several hundred grams of force at the press-in that immediately follows contact.



Centering point measurement

In addition, some of the scanning probes from other manufacturers employ such a structure that the motor drive mechanism forcibly specifies the probing position in order to permit the use of a longer stylus, necessitating the probe to actually have a greater measuring force.

In contrast, the MPP-300Q/300 can reduce its measuring force to a minimum of 0.03N so that it can even measure elastic workpieces such as resins, etc., without damaging them at all.

•Fast scanning

For a scanning measurement, either of the following scanning methods can be selected: one in which scanning progresses while automatically following an unknown geometry (unknown geometry scanning), or one in which scanning progresses based on the locus of the probe tip given beforehand (known geometry scanning). With known geometry scanning it is possible to perform fast scanning at 120 mm/s .

Conventionally, it is normal to evaluate geometries such as a line or a circle through point measurement. However, for evaluating the flatness or roundness of an extra precision-machined workpiece, it is better to improve the reliability of the measurement result by evaluating the object at more measurement points.

Unfortunately, it takes an extended amount of time for a touch-trigger probe to measure an object point by point. The MPP-300Q/300 can, for example, complete its measurement in several seconds even if it is required to measure inside diameters of $\phi 100 \text{ mm}$ at 1000 measurement points. In addition, measurement can be pursued effectively while changing the scanning speed, depending on the measurement accuracy required.

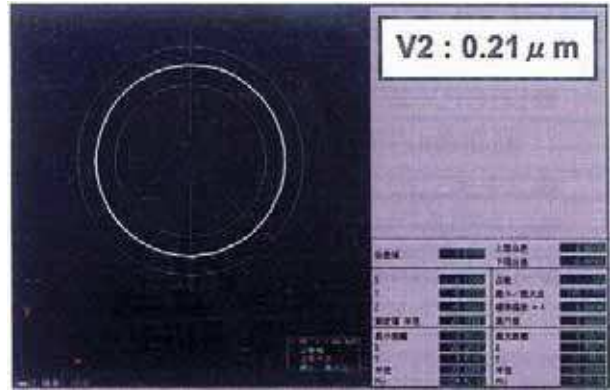
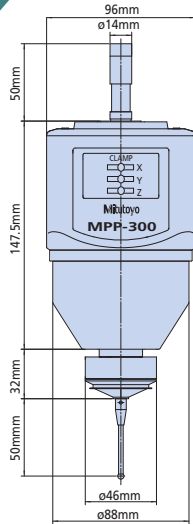
• Optional units

A wide variety of optional units, including rotary table MRT320 for synchronized scanning and the automatic stylus change system, are provided.

MPP-300Q/MPP-300 Specifications

MPP-300Q/ MPP-300	Measurement range	$\pm 1 \text{ mm}$
	Resolution	0.01 m
	Max. permissible probing error	$\text{MPE}_P'' 0.45 \text{ m}$ (LEGEX500/700/900: When the $\phi 4 \times 18 \text{ mm}$ stylus is used.)
	Max. permissible probing error during scanning	$\text{MPE}_{\text{THP}}'' 1.4 \text{ m}$ (LEGEX500/700/900: When the $\phi 4 \times 18 \text{ mm}$ stylus is used.)
	Spring rate	0.2 N/mm
	Max. stylus length	200mm for both vertical and horizontal
	Max. stylus mass	75g
	Stylus mount	M4 screw
	Max. tracing speed	120 mm/s [at a known geometry scanning]
	Air flow rate	30 NL/min
	Probe head	N/A
Applicable models	CNC CMM (LEGEX500/700/900/1200 series)	
Automatic stylus change system (optional)	No. of mountable stylus modules	- 4 standard units [Port 1 is dedicated for the standard stylus (for calibration purpose)] - Expandable to max. 10 ports. Note, all styli should be arranged on the same axis.

Dimensions

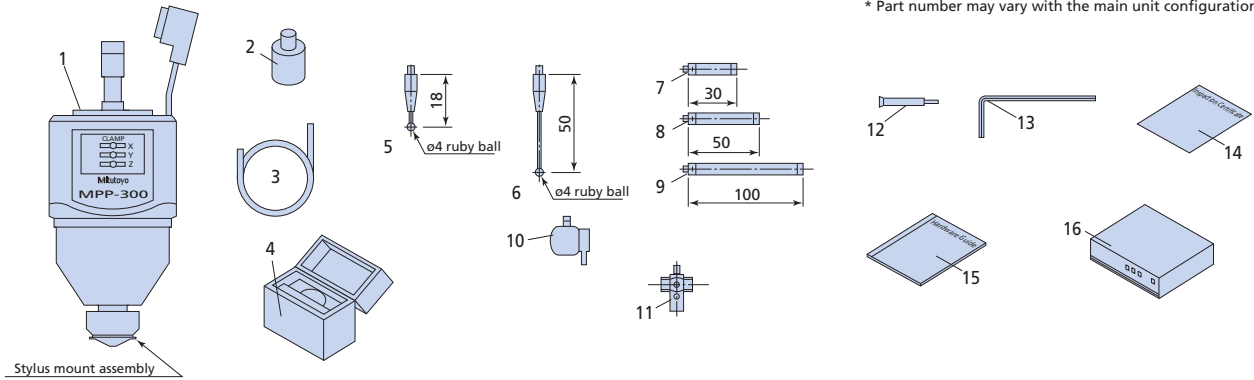


An example scanning measurement of a ring gage with the LEGEX series and MPP-300

Set configuration

Unit	Ref. No.	Description	Part No.	Qty	Mass (kg)	Remark
Configuration of the MPP-300 main unit No. 02AQD310	1	MPP-300 probe main unit	02AQD330	1	1.5	3.3 Including one stylus mount assembly. Silicon oil (2000CS) Air hose for MPP-CMM Wooden box for storing MPP-300 Standard stylus M4-M4 ceramics M4-M4 ceramics M4-M4 ceramics For attaching/detaching M4 stylus Nominal diameter: 1.5 Hardware-only Operation Manual
	2	Damping oil	02AQD090	1	0.017	
	3	Connection air hose	970117	1	0.05	
MPP-300 probe set Order No. 06ABJ729	4	Storage box	02AQD480	1	1.5	
	5	φ4X18mm stylus	-	1	0.002	
	6	φ4X50mm stylus	-	5	0.005	
	7	Extension L=30 mm	181280	2	0.005	
	8	Extension L=50 mm	181281	1	0.007	
	9	Extension L=100 mm	06AAD458	1	0.01	
	10	MS4-stylus knuckle	06AAD460	1	0.015	
	11	MS4-stylus center	06ACH817	1	0.04	
	12	Stylus tool	181279	2	0.001	
	13	Allen wrench	538411H	1	0.001	
	14	Inspection certificate	-	1	0.002	
	15	MPP-300 Hardware Guide	99MCA242	1	0.15	
Clamp unit	16	MPP-300 clamp unit configuration (of rack-mount specification)	02AQD500A	1	1.8	

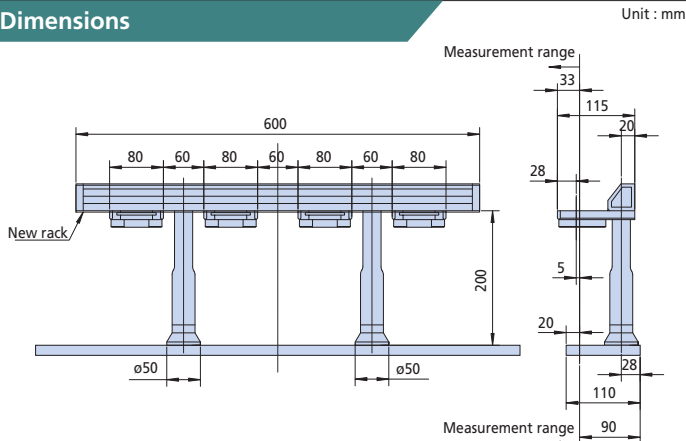
* Part number may vary with the main unit configuration.



Optional units

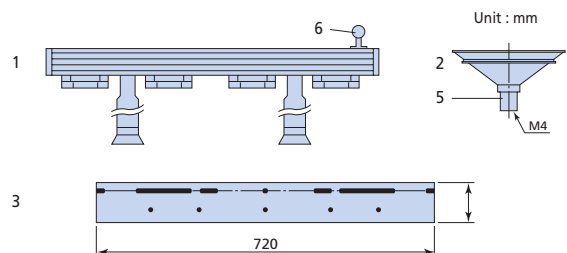
Automatic Stylus Changer

Dimensions



Detail

Unit	Ref. No.	Description	Part No.	Qty	Mass (kg)	Remark
Automatic stylus change system	1	Auto-stylus change rack	06ABGS97	1	5	13.04 Supplied with 4 ports for replacement. Used for installing a rack on the CMM base.
	2	Stylus mount assembly	02AQD042	3	0.04	
Set Order No. 06ABGS96	3	Auxiliary plate	06ABGS98	1	8	For re-calibration
	4	φ4X18mm stylus	-	3	0.005	
	5	MS4-stylus center	06ABH817	3	0.012	
	6	Reference sphere	06ABH818	1	0.04	



SP80

High-accuracy scanning probe adaptive to long-type stylus

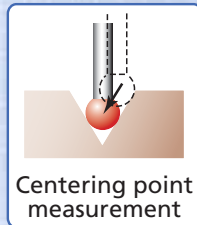


• High-accuracy scanning probe adaptive to long-type stylus

The SP80 scanning probe is designed to employ a long stylus that has high measurement accuracy and a maximum length of 500 mm (measured in both the horizontal and vertical directions). It is a multi-function probe for CNC coordinate measuring machines that undertakes not only scanning measurement (a measurement method that collects a large amount of coordinate data while traveling along the path in contact with the workpiece) but also high-accuracy point measurement as well as data collection from a centering point measurement (shown below).

• Fast scanning

For scanning measurement, either of the following scanning methods can be selected: one in which scanning progresses while automatically following an unknown geometry (unknown geometry scanning), or one in which scanning progresses based on the locus of the probe tip given beforehand (known geometry scanning). With known geometry scanning it is possible to perform fast scanning at 120 mm/s. Conventionally, it is normal to evaluate geometries such as a line or circle through point measurement. However, for evaluating the flatness or roundness of an extra precision-machined workpiece, it is better to improve the reliability of the measurement result by evaluating the object at more measurement points. Unfortunately, extended time is required for a touch-trigger probe to measure an object point by point. The MPP-300Q/300 can, for example, complete its measurement in several seconds, even if it is required



Centering point measurement

to measure inside diameters of $\varnothing 100$ mm at 1000 measurement points. In addition, any measurement can be pursued effectively while changing the scanning speed, depending on the measurement accuracy required.

• Optional units

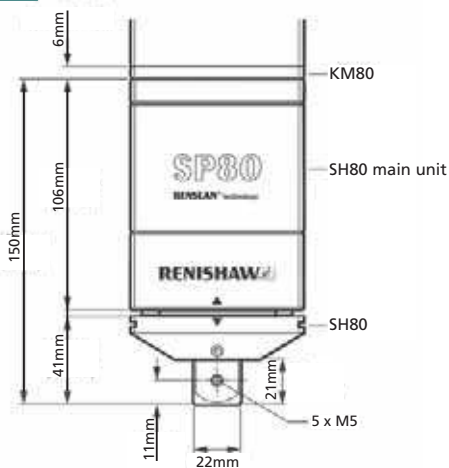
A wide variety of optional units, including rotary table MRT320 for synchronized scanning and the automatic stylus change system, are provided.



SP80 Specifications

SP80	Measurement range	± 2.5 mm
	Max. permissible probing error during scanning	MPE _{THP} 2.0 μ m (Crysta-Apex C700/900: If the $\varnothing 8 \times 60$ mm stylus is used.)
	Spring rate	1.8N/mm
	Max. stylus length	500mm
	Max. stylus mass	500g
	Stylus mount	M5
	Max. scanning speed	120mm/s [at a known geometry scanning]
	Probe head	N/A
	Applicable models	CNC coordinate measuring machines

Dimensions



Set configuration

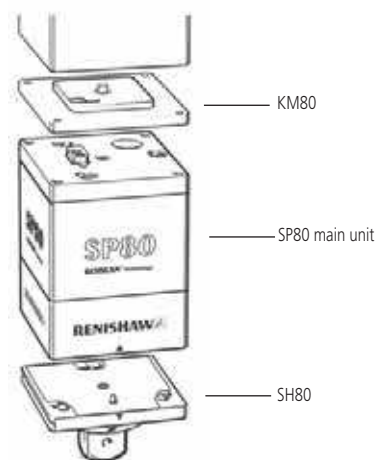
SP80 main unit

Description	Part No.	Mass (kg)	Remark
SP80 basic set	06ABT513	2.6	One SP80 main unit, SH80, KM80, and ø8X60mm stylus

Parts for SP80

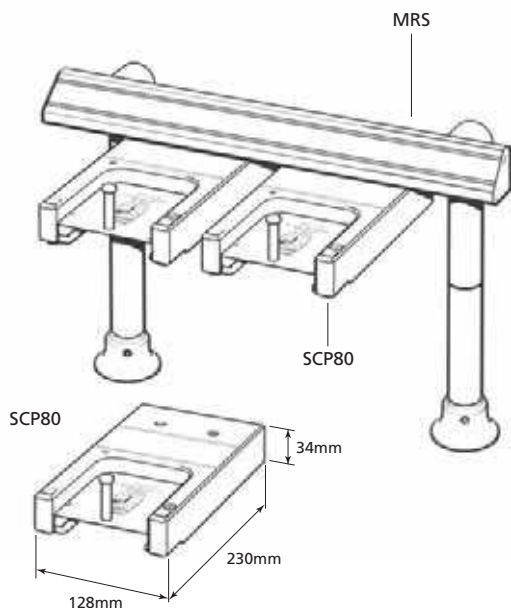
Description	Part No.	Mass (kg)	Qty
SP80 adapter	06ABT587	0.3	1
SP80 Probe cable	06ABT588	0.1	1
SP80 EXT cable	06ABT590	0.2	1
IU 80	06ABT525	0.51	1
SP80 Power Supply BOX	06ABT591	1	1
OPT200S-MPP2	06ABN865	0.2	1
OPT200 attachment	06AAS741	0.4	1
Control ROM (MAIN)	06ZAA058	0.01	1
Control ROM (OPT)	06ZAA059	0.01	1
Mass (kg)			3.73

* Part number may vary with the main unit configuration.



Optional units

Automatic Stylus Changer



SP80 stylus change set 1 (600mm-rail specifications) / Oder No. 06ABT766

Description	Part No.	Unit	Mass (kg)
MRS kit#2	06ABT529	1	3.5
SH80	06ABT523	1	0.24
SCP80	06ABT524	2	2.1
Rack plate (auxiliary plate)	06ABG598	1	8
ACR3 attachment	06ABP467	1	0.05
Mass (kg)			13.89

SP80 stylus change set 2 (1000mm-rail specifications) / Oder No. 06ABT767

Description	Part No.	Unit	Mass (kg)
MRS kit#3	06ABT530	1	3.7
SH80	06ABT523	3	0.48
SCP80	06ABT524	4	4.2
Rack plate (auxiliary plate)	06ABG598	1	8
ACR3 attachment	06ABP467	1	0.05
Mass (kg)			16.43

SP25M

Compact High-accuracy Scanning Probe



• Compact high-accuracy scanning probes

The SP25 is a compact high-accuracy scanning probe with an outside diameter of $\varnothing 25$ mm. This multi-functional probe is suitable for a CNC coordinate measuring machine that performs not only scanning measurement (measurement method that collects a large amount of coordinate data while traveling along the path in contact with the workpiece), but also high-accuracy point measurement, as well as data collection from a centering point measurement (shown below).

• Fast scanning

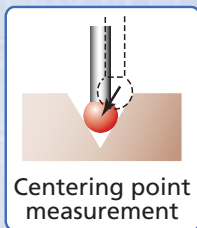
For a scanning measurement either of the following scanning methods can be selected: one in which the scanning progresses while automatically following an unknown geometry (unknown geometry scanning), and one in which scanning progresses based on the locus of the probe tip given beforehand (known geometry scanning). With known geometry scanning it is possible to perform fast scanning at a maximum of 120 mm/s. Conventionally, it is normal to evaluate geometries such as a line or a circle through point measurement. However, for evaluating the flatness or roundness of an extra precision-machined workpiece, it is better to improve the reliability of a measurement result by evaluating the object at more measurement points. Unfortunately, an extended of time is required for a touch-trigger probe to measure such an object point by point. The SP-25 can, for example, complete its measurement in several seconds even if it is required to measure inside diameters of $\varnothing 100$ mm at 1000 measurement points. In addition, it can pursue any measurement effectively while changing the scanning speed, depending on the measurement accuracy required.

• Enhancing the setup and measurement efficiency through automatic change of probe orientations

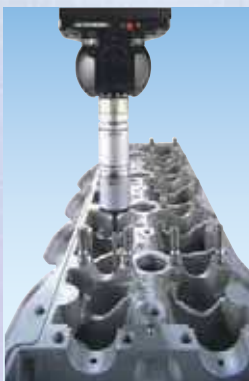
Since the SP25 can be mounted on a probe head such as the PH10M/PH10MQ that automatically changes the probe orientation, it can greatly reduce the preparation time for measurement and for actual measurement in comparison to a conventional-type scanning probe whose position is fixed downward. In addition, the use of other probes, as advantaged by the probe change system, makes it possible to realize full automation in measuring various forms of machined parts.

• Optional units

A wide variety of optional units, including rotary table MRT320 for synchronized scanning and the automatic stylus change system, are provided.



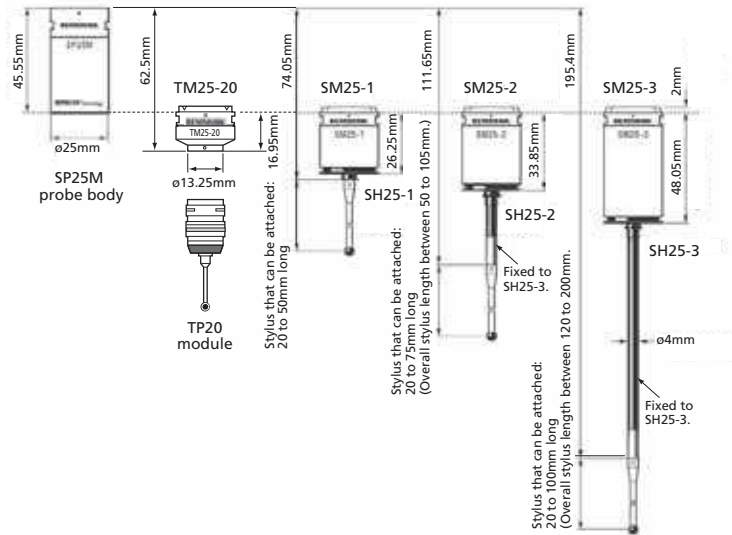
Centering point measurement



SP25M Specifications

SP25M	Measurement range	± 0.5 mm
	Max. permissible probing error during scanning	MPE _{THP} 2.3 μ m (Crysta-Apex C700/900: If the $\varnothing 4 \times 50$ mm stylus is used.)
	Spring rate	0.4N/mm
	Amount of over travel	± 2.0 mm (XY) ± 1.7 mm (Z)
	Max. stylus length	200mm (When SM25-3 or SH25-3 is used.)
	Stylus mount	M3
	Max. scanning speed	120mm/s [at a known geometry scanning]
	Probe head	Essential: PH10M/PH10MQ
	Applicable models	CNC coordinate measuring machines

Dimensions



Configuration

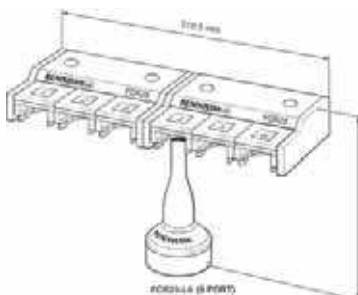
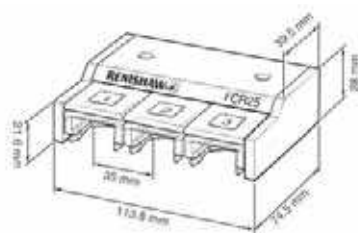


Description	Part No.	Remark
SP25M full combination kit	06ABS969	A complete set of SP25M, SM25-1/2/3, SH25-1/2/3, and TM25-20
SP25M scanning kit #1	06ABS970	A complete set of SP25M, SM25-1, and SH25-1
SP25M scanning kit #2	06ABS971	A complete set of SP25M, SM25-2, and SH25-2
SP25M scanning kit #3	06ABS972	A complete set of SP25M, SM25-3, and SH25-3
Scanning module SM25-1 kit	06ABS452	A complete set of SM25-1 and SH25-1
Scanning module SM25-2 kit	06ABS453	A complete set of SM25-2 and SH25-2
Scanning module SM25-3 kit	06ABS454	A complete set of SM25-3 and SH25-3
Stylus holder SH25-1	06ABS455	
Stylus holder SH25-2	06ABS456	
Stylus holder SH25-3	06ABS457	
TM25-20TTP module adapter kit #1	06ABS475	A set of TP20 standard force module and TM25-20
TTP module adapter kit TM25-20	06ABS473	

* TTP module (TM25-20, TP20 module) will be supported for MCOSMOS V2.4 or later releases.

Optional units

Automatic Scanning Module Changer/Automatic Stylus Changer



* SP25M internally uses the high-power LED light source. Exercise caution when handling, in accordance with the Operation Manual.

* Can be mounted on the MRS rack.

MPP-100

High-Accuracy Scanning Probe

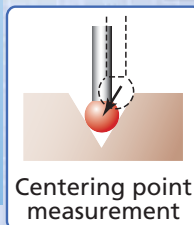


• Low-cost scanning probes

The MPP-100 is a low-price and high-accuracy scanning probe. It is a multi-function probe for CNC coordinate measuring machines that performs not only a scanning measurement (a measurement method that collects a large amount of coordinate data while traveling along the path in contact with the workpiece) but also a high-accuracy point measurement, as well as data collection from centering point measurement (shown below).

• Fast scanning

For scanning measurement, either of the following scanning methods can be selected: one in which scanning progresses while automatically following an unknown geometry (unknown geometry scanning), and one in which scanning progresses based on the locus of the probe tip given beforehand (known geometry scanning). With known geometry scanning it is possible to perform fast scanning at 120 mm/s. Conventionally, it is normal to evaluate geometries such as a line or circle through point measurement. However, for evaluating the flatness or roundness of an extra precision-machined workpiece, it is better to improve the reliability of a measurement result by evaluating the object at more measurement points. Unfortunately, an extended amount of time is required for a touch-trigger probe to measure such the object point by point. The MPP-100 can, for example, complete its measurement in several seconds, even if it is required to measure inside diameters of $\varnothing 100$ mm at 1000 measurement points. In addition, it can pursue any measurement effectively while changing the scanning speed, depending on the measurement accuracy required.



• Omni-directional scanning

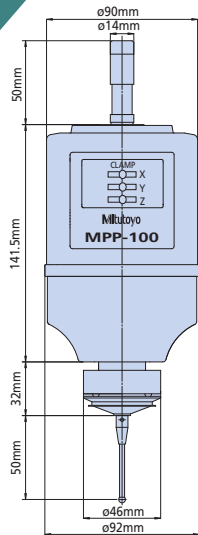
The MPP-100 has internally incorporated high-accuracy scales with a minimum resolution of $0.01\mu\text{m}$ for each direction (X, Y and Z axes), which makes it possible to read the stylus displacement in any direction.



MPP-100 Specifications

MPP-100	Measurement range	$\pm 1\text{mm}$
	Resolution	$0.1\ \mu\text{m}$
	Max. permissible probing error during scanning	$\text{MPE}_{\text{THP}} \approx 3.0\ \mu\text{m}$ (Crysta-Apex C series: if the $\varnothing 4 \times 18\text{mm}$ stylus is used.)
	Spring rate	0.75N/mm
	Max. stylus length	200mm for both vertical and horizontal
	Max. stylus mass	75g
	Stylus mount	M4 screw
	Max. scanning speed	120mm/s
	Air flow rate	30NL/min
	Probe head	N/A
	Applicable models	CNC CMM (Crysta-Apex C series, Bright-STRATO series)
Automatic stylus change system (optional)	No. of mountable stylus modules	- 4 standard units [Port 1 is dedicated to the standard stylus (for calibration purposes)] - Expandable to a maximum 10 ports. However, all styli should be arranged on the same axis.

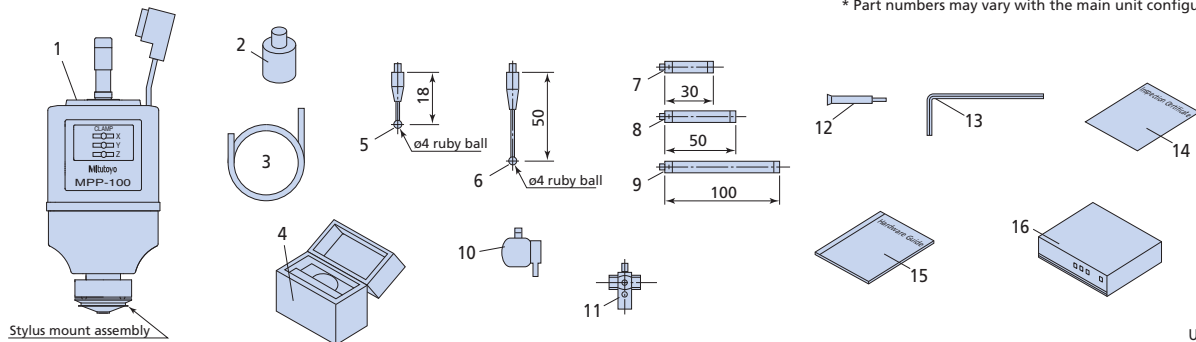
Dimensions



Set configuration

Unit	Ref. No.	Description	Part No.	Qty	Mass (kg)	Remark
MPP-100 main unit configuration No. 02AQD010	1	MPP-100 probe main unit	02AQD030	1	1.5	3.3 Including one stylus mount assembly. Silicon oil (2000CS) Air hose for MPP-CMM Wooden box for storing MPP-100 Standard stylus M4-M4 ceramics M4-M4 ceramics M4-M4 ceramics For attaching/detaching M4 stylus Nominal diameter: 1.5 Hardware-only Operation Manual
	2	Damping oil	02AQD090	1	0.017	
	3	Connection air hose	970117	1	0.05	
	4	Storage box	02AQD020	1	1.5	
MPP-100 probe set Order No. 06ABG594	5	ø4X18mm stylus	-	1	0.002	
	6	ø4X50mm stylus	-	5	0.005	
	7	Extension L=30mm	181280	2	0.005	
	8	Extension L=50mm	181281	1	0.007	
	9	Extension L=100mm	06AAD458	1	0.01	
	10	MS4-stylus knuckle	06AAD460	1	0.015	
	11	MS4-stylus center	06ABH817	1	0.04	
	12	Stylus tool	181279	2	0.001	
	13	Allen wrench	538411H	1	0.001	
	14	Inspection certificate	-	1	0.002	
	15	MPP-100 Hardware Guide	99MCA231	1	0.15	
Clamp unit	16	MPP-100 clamp unit configuration (desktop specification)	02AQD100A	1	1.8	

* Part numbers may vary with the main unit configuration.

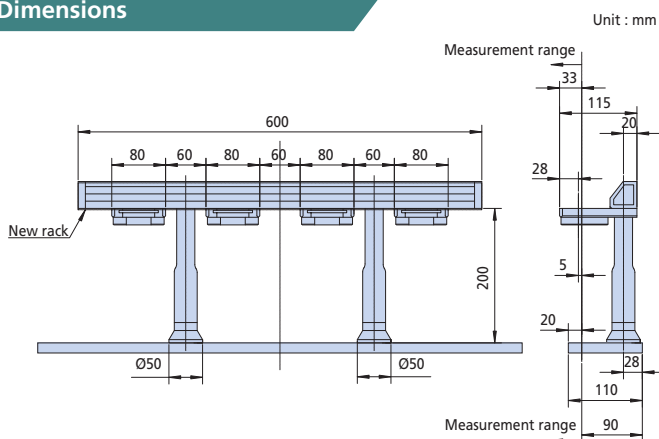


Unit : mm

Optional units

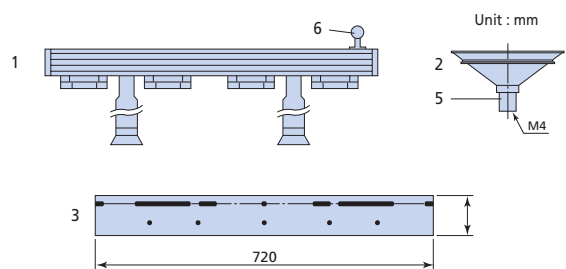
Automatic stylus change system

Dimensions



Detail

Unit	Ref. No.	Description	Part No.	Qty	Mass (kg)	Remark
Automatic stylus change system	1	Auto-stylus change rack	06ABG597	1	5	13.04 Supplied with 4 ports for replacement. Used for installing a rack on the CMM base. For re-calibration
	2	Stylus mount assembly	02AQD042	3	0.04	
Set No. 06ABG596	3	Auxiliary plate	06ABG598	1	8	
	4	ø4X18mm stylus	916491	3	0.005	
	5	MS4-stylus center	06ABH817	3	0.012	
	6	Reference sphere	06ABH818	1	0.04	



Unit : mm



- **Provides image measuring capability for coordinate measuring machines**

The QVP probe performs form measurement by image processing micro geometry that cannot be measured by a contact type probe, or elastic bodies that are easily deformed by slight measuring forces.

Although the method of microscopic measurement with the centering microscope mounted on the coordinate measuring machine has been used since coordinate measuring machines came into use in the industry, they have an inherent disadvantage in that the operation of identifying positions is dependent on the operator's eye, resulting in possible measurement errors. Even with a CNC coordinate measuring machine manual measurement must be performed sometimes, such as with an installed centering microscope. The QVP probe is a vision probe dedicated for coordinate measuring machines and was developed based on Mitutoyo's state-of-the-art technology, in order to enable full automation of image measurement with a CNC coordinate measuring machine. This technology was originally developed for Mitutoyo vision measuring machines.

- **Automatic detection of workpiece edge**

The QVP-captured image will have various automatic edge detections performed by the dedicated software, Visionpak, and then various calculation processes (calculation of dimensions and geometrical deviations) will be performed by the general-purpose measurement program, Geopak.

- **Standard provision of white LED illumination**

Since the QVP is equipped with the standard co-axial light running through the lens system as well as white-light LED ring illumination, which is bright and has a long service life, no auxiliary illumination is required. The light volume can be set to between 0 and 100% at 1% increments.

- **Mounting onto the Automatic Probe Changer**

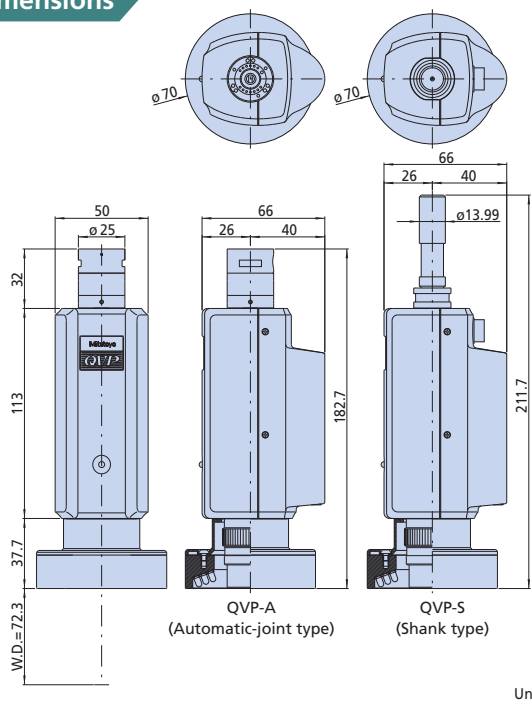
The QVP can also be mounted onto an automatic probe changer, allowing full-automatic measurement including both the contact and non-contact types in combination with the contact-type probes.



QVP Specifications

QVP main unit	CCD size	1/2 inch (B/W)			
	Optical tube magnification	0.5X			
	Illuminating function	Co-axial	White light LED source (built-in): Power dissipation 5W or less		
		Ring	White light LED source: Power dissipation 10W or less		
	Mass	Automatic-joint type: 310g, shank type: 385g			
	Optical magnification	0.5X	1.5X	2.5X	5X
	Observation range (mm)	9.6X12.8	3.2X4.3	1.9X2.6	1X1.3
	Working distance (mm)	59	72.3	59.5	44
Objective	Magnification	1X	3X	5X	10X
		Optional	Standard	Optional	Optional
	Numerical Aperture (N.A.)	0.03	0.07	0.11	0.18
	Depth of focus (m)	306	56	23	8
	Mass	70g	47g	59g	75g
QVP I/F BOX	Supply voltage	AC100 to 240V			
	Frequency	50/60Hz			
	Power capacity	45W			
	Mass	3800g			

Dimensions



Optional accessories



Objective ML1X (375-036)
Objective ML5X (375-034)
Objective ML10X (375-035)



Calibration gage (02AQC310)
- Gage for sharing the coordinates between the QVP and contact-type probe

Calibration chart (958448)
- Gage for calibrating a single QVP unit



Data processing unit

Dedicated data processing software VISIONPAK

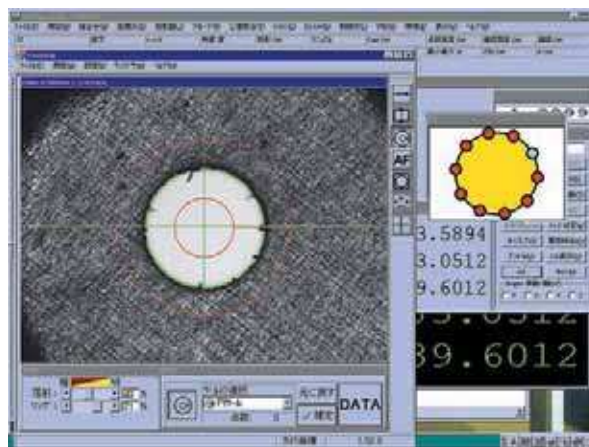
VISIONPAK operates under the Microsoft Windows operating system and is a general-purpose measurement program for coordinate measuring machines. It displays the image window when it detects a workpiece edge. After detecting an edge, it undertakes various calculations with the regular general-purpose measurement programs.

Wide variety of image processing functions

With the powerful image processing functions (tools) it can detect various forms of edges at high speed. It can measure in the height direction by means of its auto-focus function, and save the captured image as the image data (bitmap format) as well.

Outlier removal function

In ordinary micro-form measurement it is often difficult to remove burrs and dusts from the objective workpiece, resulting in an inevitable measurement error. In contrast, VISIONPAK can recognize, for example, the obstruction as an "outlier" and bypass it during measurement.



VISIONPAK Image Processing Tool



Simple tool

Used for detecting a single point on the edge pointed to by the arrow.



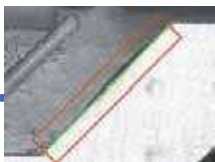
Manual tool

Used for detecting an optional position pointed to (clicked on) by the mouse.



Box tool

Used for multiple-point line measurement of an edge caught in the box



Centroid tool

Used for detecting the center of gravity of an optional form.



Circle tool

Used for multiple-point measurement of a circle for the objective circular edge. As with the box tool, it can collect data that is free from the effect of burrs and dust.



Edge self-tracing tool

By simply specifying the start point and measurement interval, the objective edge can be detected while automatically tracing an unknown geometry.



CF20

Centering Microscope for Coordinate Measuring Machines



- **Use the coordinate measuring machine as a large microscope**

The CF20 is a centering microscope that enables measurement of small holes and elastic bodies which are difficult for a touch trigger probe to measure. With the CF20 the coordinate measuring machine can be used as a large microscope.

- **Optional accessories to implement various evaluations**

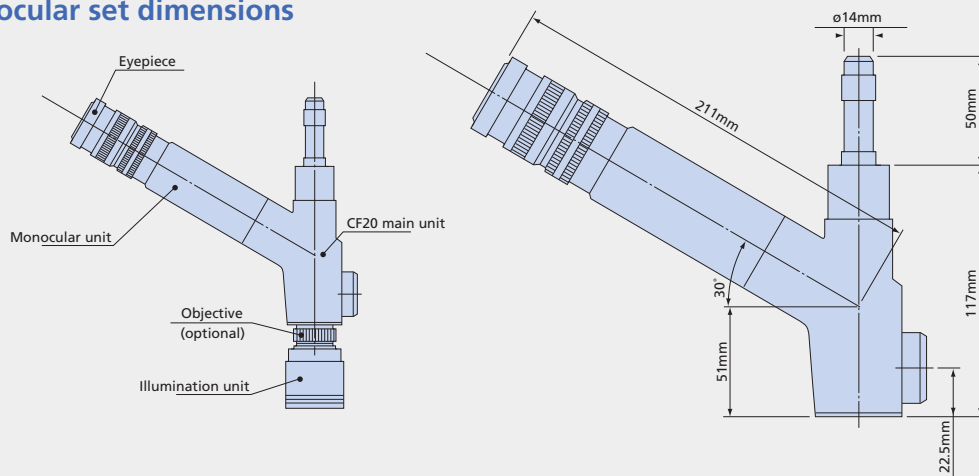
To cope with the size and form of a workpiece to be observed and measured, lenses of various magnifications and reticles for form comparison are provided.

- **CCTV monitor system**

The dedicated CCD camera can be mounted on the back of the CF20 main unit. Video signals from the camera can be displayed as an image on the external monitor. This is a great aid in relieving eye stress, especially if several hours of work must be done.



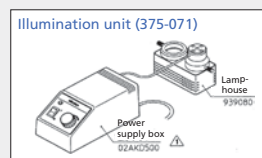
CF20 monocular set dimensions



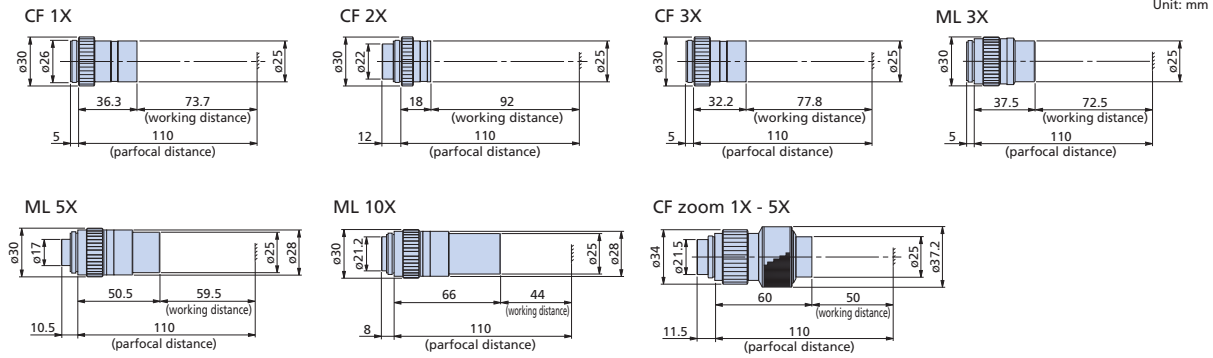
CF20 monocular set (375-201) 	CF20 binocular set (375-202) 	CF20 protractor eyepiece set (375-203) 	CF20 double image set (375-204) 	CF20 disc plate set (375-205)
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Specifications

Description	Specification	Accessory
CF20 monocular set (375-201)	CF10X eyepiece, field number 22 Cross hair and concentric circle reticle	1. Illumination unit (375-071)
CF20 binocular set (375-202)	CF10X eyepiece, field number 22 Cross hair and concentric circle reticle (right) Pupil distance adjustment: 51 - 76mm	2. Spare lamp (162151)
CF20 protractor eyepiece set (375-203)	CF10X eyepiece, field number 21 Measurement range: 360°, Angle index: 1° Minimum reading: 5' (vernier scale)	3. Lens cap
CF20 double image set (375-204)	CF10X eyepiece, field number 22	4. Tools
CF20 disc plate set (375-205)	CF10X eyepiece, field number 22 ISO metric/unify screws Cross hair and concentric circle reticle/ dotted line cross scale, ML 3X objective	5. Power cable
		6. Operation Manual
		7. Storage box



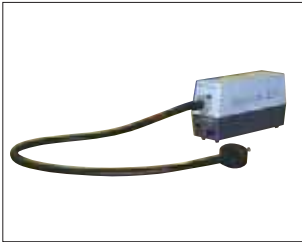
Objectives (optional)



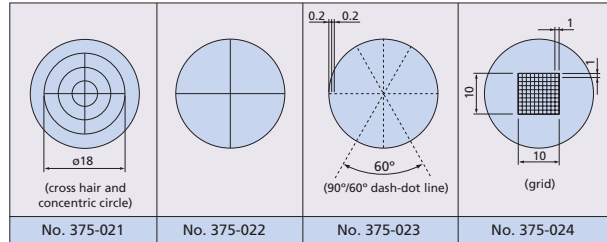
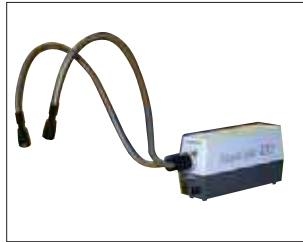
Order No.	Description	Numerical Aperture (N.A.)	Working distance W.D. (mm)	Resolution R (m)	Depth of focus of single objective lens ±D.F. (m)	Mass (g)
375-031	CF 1X	0.03	73.7	9.2	306	45
375-032	CF 2X	0.06	92	4.6	76	35
375-033	CF 3X	0.07	77.8	3.9	56	35
375-037	ML 3X	0.07	72.5	3.9	56	45
375-034	ML 5X	0.11	59.5	2.5	23	80
375-035	ML 10X	0.18	44.0	1.5	8	100
375-038	CF zoom 1X - 5X	1X	50	6.9	171	200
		3X		2.75	27	
		5X		2.75	27	

- Values for resolution and depth of focus of a single objective lens are calculated based on the reference wavelength (=0.55 m).
- The real field of view (mm) can be obtained from Field number/Objective magnification.

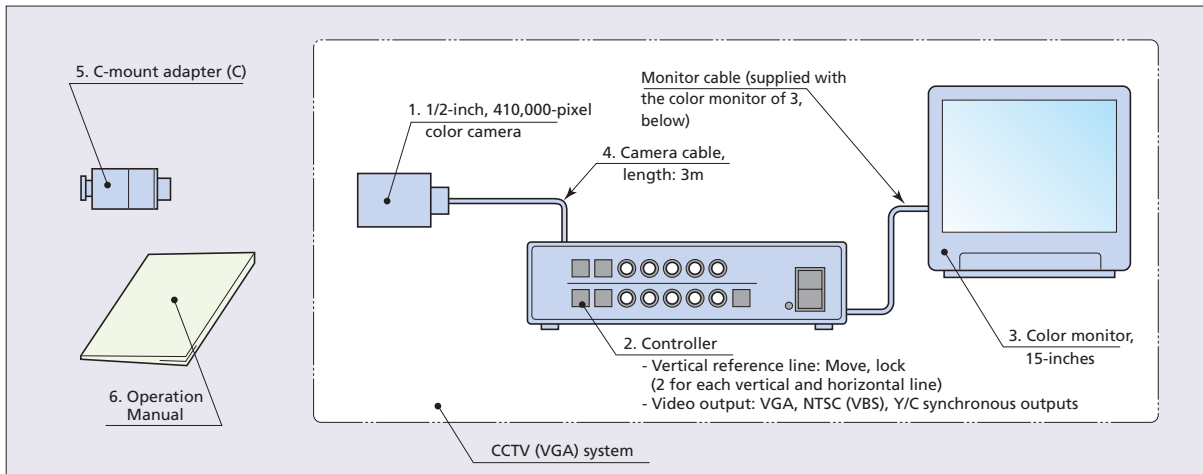
Fiber optic circular illumination unit (176-366)



Twin-fiber optic illumination unit (176-344)



CCTV Monitor System for CMM with CF20 [Order No. 320-053]



Ref. No.	Part No.	Description	Qty	Remark	
1	06AAV876	1/2-inch color camera	1	CCD	
2	06AAV875	Controller	1	Color TV (VGA) System No. 06AAV874, which includes the accessory set of Ref. Nos. 1 to 4 (common to the order No. 176-372 CCD Color TV System)	
3	06AAV877	Color monitor unit	1		Manufactured by SONY
4	06AAV878	Camera cable	1		Length: 3m
5	972031	C-mount adapter (C)	1		
6		User's Manual	1	Common to 176-372	

- Real field of view (mm) on the monitor can be obtained from CCD camera's imaging device pixels (VxH)/Objective magnification.

TP7M (high-accuracy)

High-Accuracy Touch Trigger Probe



- **High-accuracy touch trigger probes**

This is a high-accuracy touch trigger probe with a maximum repeatability of $2\sigma \leq 0.25\mu\text{m}$.

- **Enhancing the setup and measurement efficiency through automatic change of probe orientations**

Since the TP7M can be mounted on a probe head, such as the PH10M/PH10MQ that automatically changes the probe orientation, it can greatly reduce the preparation time for measurement and for actual measurement in comparison to a conventional-type scanning probe with a position that is fixed downward. In addition, the use of other probes, as advantaged by the probe change system, makes it possible to realize full automation in measuring various forms of machined parts.

- **Adaptive to long-type stylus**

The TP7M can mount a long stylus up to 180 mm long*. In combination with the longest extension of 200 mm equipped for the PH10M/PH10MQ, it can reach a position at a maximum distance of 380 mm.

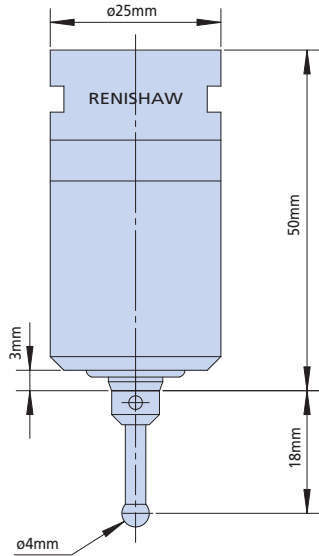
* This maximum length may vary with the coordinate measuring machine main unit being used and/or the material/diameter of the stylus itself.



TP7M Specifications

TP7M	Measuring direction	$\pm X, \pm Y, +Z$		
	Standard stylus	$\phi 4 \times 18\text{mm}$		
	Repeatability (2σ)	0.25 μm or less (When the standard stylus is used.)		
	Directionality (XY: 2D)	$\pm 0.25 \mu\text{m}$ or less		
	Required force to generate trigger signal	XY	0.02N (When the 50mm stylus is used.)	
		Z	0.15N (When the 50mm stylus is used.)	
	Amount of over-travel	XY	$\pm 16^\circ$	
		Z	$\pm 5\text{mm}$	
	Required force to achieve over-travel	XY	0.49N (When the 50mm stylus is used.)	
		Z	2.94N (When the 50mm stylus is used.)	
	Maximum stylus length	150mm		
	Stylus mounting method	M4 screw		
	Mass of a single unit	85g		
	Durability	10,000,000 times		
Probe head	Essential: PH10M/PH10MQ			
Applicable models	CNC coordinate measuring machines			

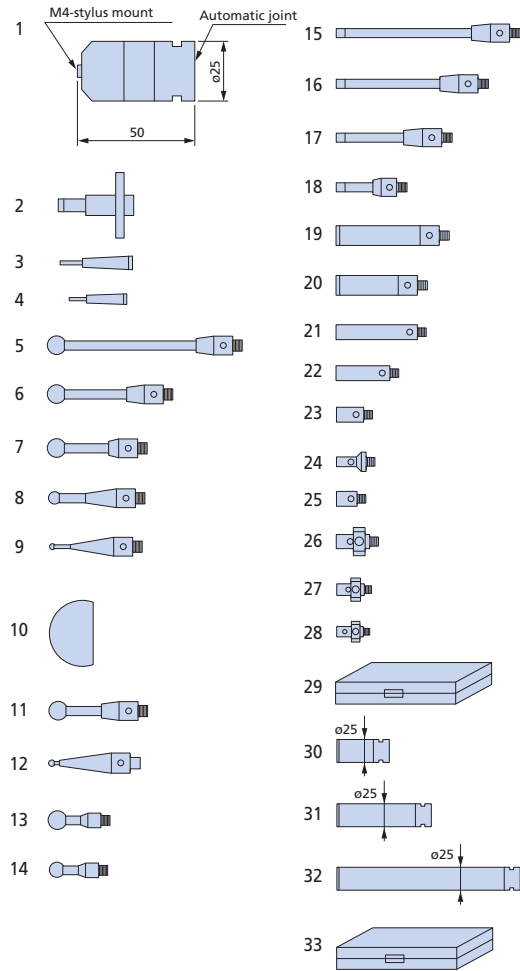
Dimensions



Set configuration [Order No. 916483]

Unit : mm

Unit	Ref. No.	Description	Part No.	Mass(g)	Qty	Remark
TP7M probe stylus set No. 916484	1	Touch trigger probe TP7M	916486	85	1	
	2	Joint key S10	174748	24	1	
	3	M4-stylus tool	181279	3.5	2	For attaching/detaching the stylus
	4	M2-stylus tool	153140	0.7	2	
	5	Stylus $\phi 8 \times 100$ (M4)	916488	6.8	1	
	6	Stylus $\phi 8 \times 50$ (M4)	916487	5.3	1	
	7	Stylus $\phi 4 \times 18$ (M4)	916491	2.2	1	Standard stylus
	8	Stylus $\phi 2 \times 19$ (M4)	916490	2.2	4	
	9	Stylus $\phi 1 \times 19.5$ (M4)	916489	2.5	1	
	10	Stylus $\phi 30$ ceramic (M3)	916492	15.3	1	
	11	Stylus $\phi 5 \times 21$ (M3)	163873	1.5	1	
	12	Stylus $\phi 0.5 \times 20$ (M3)	163871	1.0	2	
	13	Stylus $\phi 6 \times 10$ (M2)	160219	0.9	1	
	14	Stylus $\phi 3 \times 10$ (M2)	153136	0.4	5	
	15	Extension L100	181285	6.3	1	M4 male - M3 female
	16	Extension L75	181284	5.3	1	M4 male - M3 female
	17	Extension L50	181283	4.6	1	M4 male - M3 female
	18	Extension L20	181282	3.2	1	M4 male - M3 female
	19	Extension L50	181281	6.8	1	M4
	20	Extension L30	181280	5.1	1	M4
	21	Extension L30	160229	1.4	1	M2
	22	Extension L20	160228	0.9	1	M2
	23	Extension L10	160227	0.4	1	M2
	24	Adapter L9	181286	1.3	2	M4 male - M3 female
	25	Adapter L5	160231	0.6	5	M4 male - M3 female
	26	MS4-stylus center	916493	12	1	M4
	27	MS3-stylus center	168677	3.3	1	M3
	28	MS2-stylus center	160230	1.0	1	M2
	29	Wooden box	916494	700	1	
Extension set No. 916485	30	Probe extension PEM1	916495	65	1	L50
	31	Probe extension PEM2	916496	90	1	L100
	32	Probe extension PEM3	916497	150	1	L200
	33	Wooden box	916498	600	1	
	34	User's Manual	916499	100	1	



TP200

High-Accuracy Touch Trigger Probe



- **Compact high-accuracy touch trigger probes**

This touch trigger probe has an outside diameter as small as $\varnothing 13.5$ mm, which greatly contributes to probing complex portions of a workpiece. With the combined use of an appropriate probe extension it can probe even deeper locations.

- **Enhancing the setup and measurement efficiency through the automatic change of probe orientations**

Since the TP200 can be mounted on a probe head, such as the PH10M/PH10MQ that automatically changes the probe orientation, it can drastically reduce the time required to prepare for measurement and for actual measurement in comparison to a conventional-type scanning probe with a position that is fixed downward.

- **Automatic stylus change**

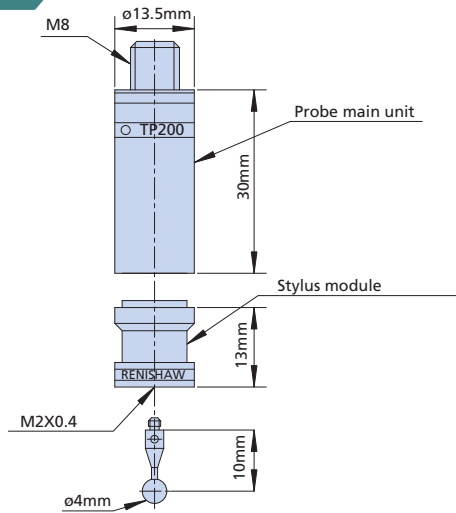
If the measurement cannot be performed by merely changing the probe orientation (such as when it is impossible to measure without replacing the normal stylus with one that has a different diameter or unique form), this automatic stylus change via the stylus change system allows full-automatic measurement to be completed without being interrupted mid-course. In addition, working with other probes, as advantaged by the probe change system, makes it possible to realize full automation in measuring various forms of machined parts.



TP200 specifications

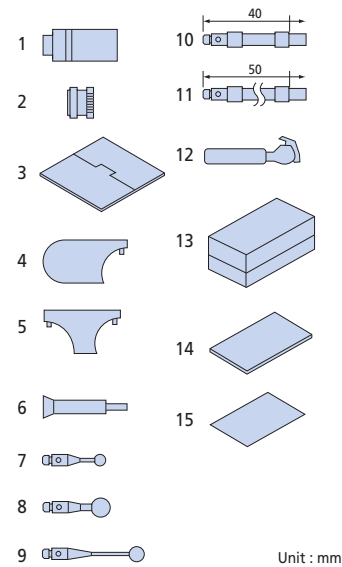
TP200	Measuring direction	$\pm X, \pm Y, \pm Z$	
	Repeatability (2σ)	0.3 μ m or less (with 10mm stylus), 0.4 μ m or less (with the 50mm stylus)	
	Directionality (XY: 2D)	± 0.4 μ m or less (with 10mm stylus), ± 0.8 μ m or less (with the 50mm stylus)	
	Directionality (XYZ: 3D)	± 0.65 μ m or less (with 10mm stylus), ± 1 μ m or less (with the 50mm stylus)	
	Required force to generate trigger signal	XY	0.02N (STANDARD/LOW FORCE), where a 50mm stylus is used.
		Z	0.07N (STANDARD/LOW FORCE), where a 50mm stylus is used.
	Amount of over-travel	XY	$XY \pm 14^\circ$
		Z	+4.5mm (with 0.07N), +3mm (with 0.15N)
	Required force to achieve over-travel	XY	0.35N (STANDARD FORCE)
			0.1N (LOW FORCE)
		Z	4N (STANDARD FORCE) 1N (LOW FORCE)
	Maximum stylus length	50mm (STANDARD FORCE)	
		30mm (LOW FORCE)	
	Maximum stylus mass	8g (STANDARD FORCE), 3g (LOW FORCE)	
	Stylus mounting method	M2 screw	
	Mass of a single unit	22g	
	Durability	10,000,000 times	
Probe head	Essential: PH10M/PH10MQ/MIH/PH1		
Applicable models	CNC coordinate measuring machines		
Note:	Any stylus less than $\varnothing 1$ mm should be used with the LOW FORCE module.		
SCR200 (optional)	Stylus module replacement accuracy	Repeated positioning accuracy: 1.0 μ m or less (through automatic change), when a 50mm stylus is used. *2.0 μ m or less at a manual replacement: when a 50mm stylus is used.	
	Number of stylus modules that can be mounted	Maximum 6 units	

Dimensions



Set configuration [Order No. 06AAL268]

	Ref. No.	Description	Part No.	Qty	Remark
Touch trigger probe TP200 set Order No. 06AAL268	A complete set of TP200 probe				
	1	TP200 probe	06AAL253	1	
	2	Stylus module (standard)	06AAL254	1	Standard measuring force (at over-travel)
	3	Cleaning tool	06AAL256	1	For cleaning the stylus module
	4	Single-ended wrench	161534	1	For attaching/detaching the probe (S1)
	5	Double-ended wrench	161535	1	For attaching/detaching the probe (S9)
	6	Stylus tool	153140	1	For attaching/detaching the stylus (S7)
	No. 06AAL251 Stylus set for TP200				
	7	Stylus $\phi 3 \times 10$ (M2)	153136	1	Standard stylus
	8	Stylus $\phi 6 \times 10$ (M2)	160219	1	
	9	Stylus $\phi 4 \times 20$ (M2)	160221	1	
	10	Extension 40mm (M2)	06AAL257	1	Carbon fiber
	11	Extension 50mm (M2)	06AAL258	1	Carbon fiber
	12	Carbon extension attachment tool	06AAL264	1	
	No. 06AAL252				
13	Wooden box	06AAL265	1	Stylus storage box	
14	User's Manual	06AAL623	1		
15	Certificate		1		



Unit : mm

Optional accessories

Stylus module automatic changer SCR200

Automatic stylus change system kit (Order No. 06AAL540)					
No.	Description	Part No.	Qty	Specification (use)	Mass (kg)
1	Stylus module (low measuring force)	06AAL255	1	For ball stylus less than $\phi 1$	0.01
2	Stylus module (standard)	06AAL254	3		0.01
3	SCR200 kit	06AAL267	1	With a rack mount kit	0.93
4	PL63	06AAM887	1	PI200-SCR200 connection cable	0.15



TP20

Touch Trigger Probe



• Compact touch trigger probes

This touch trigger probe has an outside diameter as small as $\varnothing 13.2$ mm, which greatly contributes to probing complex portions of a workpiece. With the combined use of an appropriate probe extension it can probe even deeper locations.

• Enhancing the setup and measurement efficiency through the automatic change of probe orientations

Since the TP20 can be mounted on a probe head such as the PH10M/PH10MQ that automatically changes the probe orientation, it can drastically reduce the time required to prepare for measurement and for actual measurement in comparison to a conventional-type scanning probe that has a position fixed downward (when it is mounted on the CNC coordinate measuring machine).

• Automatic stylus change

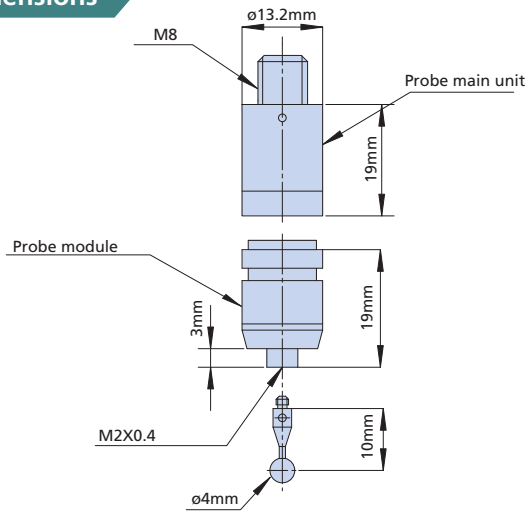
If the measurement cannot be achieved by simply changing the probe orientation (such as when it is not possible to make measurements without replacing the normal stylus with one having a different diameter or unique form), automatic stylus change via the stylus change system allows full-automatic measurement to be completed without mid-course interruption. In addition, the use of other probes as advantaged by the probe change system makes it possible to realize full automation in measuring various forms of machined parts (when it is mounted on the CNC coordinate measuring machine).



TP20 Specifications

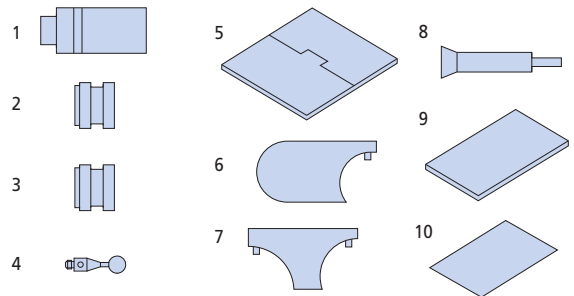
TP20	Measuring direction	$\pm X, \pm Y, \pm Z$	
	Repeatability (2σ)	0.35 μ m or less	
	Directionality (XY: 2D)	± 0.8 μ m or less (with the STANDARD FORCE 10mm stylus), ± 2.5 μ m or less (with the 50mm stylus)	
	Directionality (XYZ: 3D)	± 1 μ m or less (with the STANDARD FORCE 10mm stylus), ± 4 μ m or less (with the 50mm stylus)	
	Required force to generate trigger signal	XY	0.08N (STANDARD FORCE), with 10mm stylus 0.1N (MEDIUM FORCE), with 25mm stylus 0.1N (EXTENDED FORCE), with 50mm stylus
		Z	0.75N (STANDARD FORCE) 1.9N (MEDIUM FORCE) 3.2N (EXTENDED FORCE)
	Amount of over-travel	XY	$\pm 14^\circ$
		Z	+4.0mm (STANDARD FORCE) +3.7mm (MEDIUM FORCE) +2.4mm (EXTENDED FORCE)
	Required force to achieve over-travel	XY	0.2 to 0.3N (STANDARD FORCE) 0.2 to 0.4N (MEDIUM FORCE) 0.2 to 0.5N (EXTENDED FORCE)
		Z	3.5N (STANDARD FORCE) 7N (MEDIUM FORCE) 10 (EXTENDED FORCE)
	Maximum stylus length		50mm (STANDARD FORCE) 60mm (MEDIUM FORCE) 60mm (EXTENDED FORCE)
	Stylus mounting method		M2 screw
	Mass of a single unit		22g (probe body: 13g, probe module: 9g)
	Durability		1,000,000 times
Probe head		Essential: PH10M/PH10MQ/MIH/PH1	
Applicable models		Manual/CNC coordinate measuring machines	
MCR20 (optional)	Probe module replacement accuracy	Repeatability positioning accuracy: 1.0 μ m or less (through automatic change), when a 10mm stylus is used. *2.0 μ m or less at a manual replacement: when a 10mm stylus is used.	
	Number of stylus modules that can be mounted	Maximum 6 units	

Dimensions



Set configuration [Order No. 06AAV547]

Ref. No.	Description	Part No.	Qty	Mass	Specification (use)
1	TP20 probe main unit	06AAV542	1	13g	
2	Probe module [STANDARD]	06AAV543	1	9g	Measuring force (small)
3	Probe module [MEDIUM]	06AAV544	1	9g	Measuring force (medium)
4	ø4X10mm stylus	-	1	0.4g	Standard stylus
5	Cleaning tool	06AAL256	1	54g	For cleaning stylus module
6	Single-ended wrench	161534	1	5g	For attaching/detaching probe
7	Double-ended wrench	161535	2	5g	
8	Stylus tool	153140	1	1g	For attaching/detaching stylus
9	User's Manual	99MCA060	1	100g	
10	Certificate		1	1g	
				450g	Total mass including package



Optional accessories

Stylus module

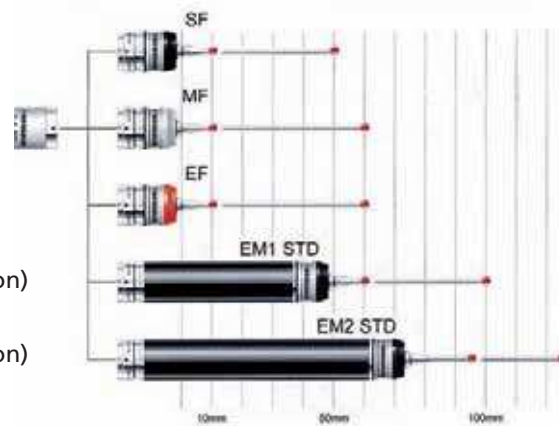
Standard force module

Medium force module

Extended force module

EM1-STD (Standard force module with extension)

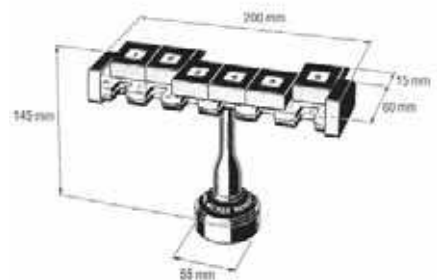
EM2-STD (Standard force module with extension)



The extension and probe module are integrated and cannot be separated.

Probe module automatic changing system MCR20

MCR20 set	Order No.	Qty	Mass	Accessories
	06AAV546	1	1.3kg	<ul style="list-style-type: none"> • ø2X30mm stylus 1 • Probe module (standard force) 2 • Mounting kit 1



TP2-5W

Compact Touch Trigger Probe



• Compact touch trigger probes

This touch trigger probe has an outside diameter as small as $\varnothing 13$ mm, which greatly contributes to probing complex portions of a workpiece. With the combined use of an appropriate probe extension it can probe even deeper locations.

• Enhancing the setup and measurement efficiency through the automatic change of probe orientation

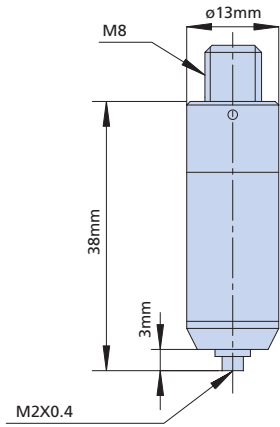
Since the TP2-5W can be mounted on a probe head such as the PH10M/PH10MQ that automatically changes the probe orientation, it can drastically reduce the time required to prepare for measurement and for actual measurement in comparison to a conventional-type scanning probe that has a fixed position downward. With the combined use of an appropriate probe extension it can probe even deeper locations (when it is mounted on the CNC coordinate measuring machine).



TP2-5W Specifications

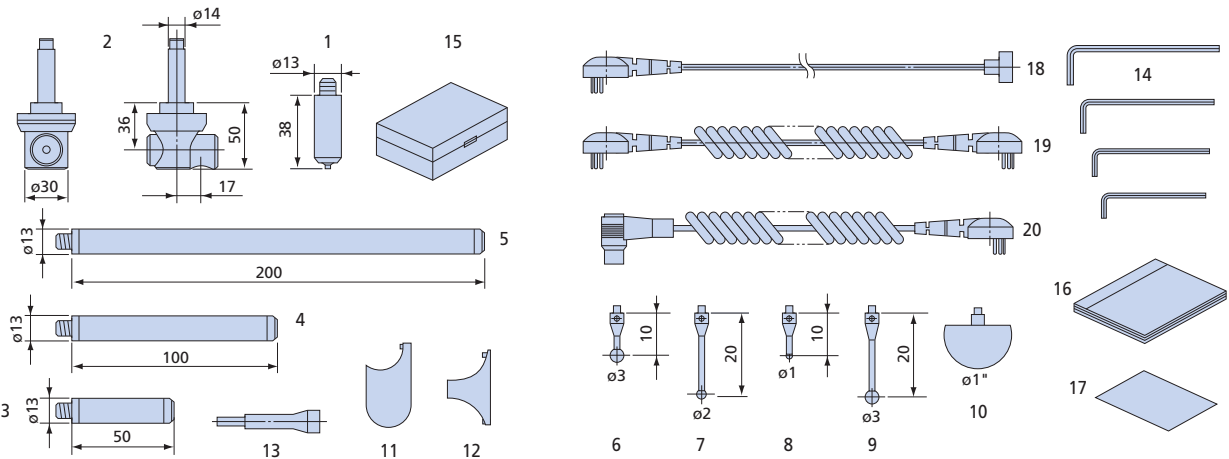
TP2-5W	Measuring direction		$\pm X, \pm Y, +Z$	
	Repeatability (2σ)		0.35 μ m or less	
	Directionality (XY: 2D)		± 0.8 μ m (with 10mm stylus), ± 2.5 μ m (with the 50mm stylus)	
	Directionality (XYZ: 3D)		± 1 μ m (with 10mm stylus), ± 4 μ m (with the 50mm stylus)	
	Required force to generate trigger signal	XY	0.07 to 0.15N (Variable. Standard: 0.07N)	
		Z	0.7N (when the X and Y axis are set to standard)	
	Amount of over-travel	XY	XY $\pm 14^\circ$, Z+4mm (when the required force to generate trigger signal is 0.07N)	
		Z	± 4 mm (when the required force to generate trigger signal is 0.07N), +3mm (at 0.15N)	
	Required force to achieve over-travel	XY	0.2 to 0.4N	
		Z	4N (when the required force to generate trigger signal is 0.07N)	
	Stylus mounting method		M2 screw	
	Mass of single unit		22g	
	Durability		1,000,000 times	
Probe head		Essential: PH10M/PH10MQ/MIH/PH1		
Applicable models		Manual/CNC coordinate measuring machines		

Dimensions



Set configuration

No.	Description	Part No.	Qty	Mass (kg)	Remark
1	TP2-5W	538414	1	0.022	
2	PH1 (ø14)	932877A	1	0.125	
3	Carbon fiber extension bar	06ABM152	1	0.024	L=50mm
4		06ABM153	1	0.057	L=100mm
5		06ABM154	1	0.086	L=200mm
6	Stylus	—	1	0.0004	ø3X10mm standard stylus
7		—	1	0.0004	ø2x20mm
8		—	1	0.0003	ø1x10mm
9		—	1	0.0005	ø3x20mm
10		135399	1	0.0044	Carbon fiber ball
11	Single-ended wrench	161534	1	0.005	For attaching/detaching the probe
12	Double-ended wrench	161535	1	0.005	For attaching/detaching the probe
13	MS2-stylus tool	153140	1	0.002	For attaching/detaching the stylus
14	Allen keys (4-piece set)	908961	1 for each	0.006	
15	Storage box	06AAN446	1	1.3	
16	User's Manual	154613	1	0.1	
17	Certificate		1	0.01	
18	Signal cable	932878	* See the table below.	0.2	5P-5P straight, 5m
19	Signal cable	935793	* See the table below.	0.05	5P-5P curl code
20	Signal cable	908462	* See the table below.	0.05	5P-12P curl code

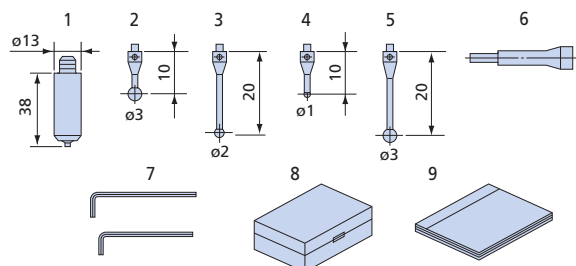


Set order No.	Configuration	Mass (kg)	Remark
06ABM328	No.1 - 18	1.948	With signal cable (5P-5P straight, 5m)
06ABM329	No.1 - 17, 19	1.798	With signal cable (5P-5P curl code)
06ABM330	No.1 - 17, 20	1.798	With signal cable (5P-12P curl code)
06ABM155	No.1 - 17	1.748	Signal cable: None

Unit : mm

TP2 kit [Order No. 916148]

No.	Description	Part No.	Qty
1	Touch trigger probe TP2-5W	538414	1
2	Stylus ø3X10mm	—	1
3	Stylus ø2X20mm	—	1
4	Stylus ø1X10mm	—	1
5	Stylus ø3X20mm	—	1
6	Stylus tool S7	153140	2
7	Allen keys (2 sizes)	916149	1 for each
8	Storage box	916150	1
9	User's Manual	154613	1



Unit : mm

MH20i

Touch Trigger Probe with Manual Probe Head



- **Touch trigger probe with manual probe head**

This series of touch trigger probes has a manually operable probe head for coordinate measuring machines. The probe module part has an outside diameter as small as $\varnothing 13.2$ mm, which greatly aids in probing complex portions of a workpiece. Other probe modules employing an extension either 50 mm long or 70 mm long are also provided.

- **Capable of positioning its orientation**

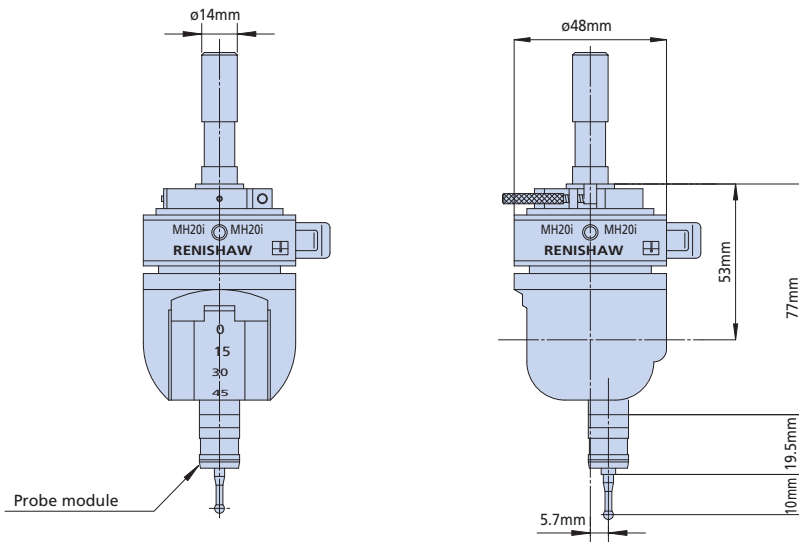
The probe head part of the MH20i has a structure that not only permits its position (probe orientation) to be manually changed but also provides a maximum of 168 orientations (at a positioning repeatability $\sigma \leq 1.5 \mu\text{m}$). Even for measurement of a complex three-dimensional form that requires repeated changes in the probe orientation, preliminary registration of required positions can eliminate re-calibration after each positional change, thereby broadly improving the measurement efficiency.



MH20i Specifications

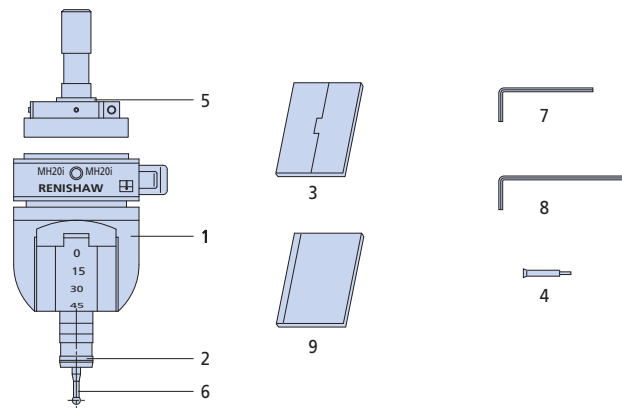
MH20i	Measuring direction	$\pm X, \pm Y, +Z$	
	Position change	Manually for A axis (vertical direction): 0 to 90° (at 15° increments), and for B axis (horizontal direction): $\pm 180^\circ$ (at 15° increments)	
	Repeated positioning accuracy	$\sigma \approx 1.5 \mu\text{m}$	
	Repeatability (2σ)	0.35 μm or less	
	Directionality (XY: 2D)	$\pm 0.8 \mu\text{m}$ or less (with the STANDARD FORCE 10mm stylus), $\pm 2.5 \mu\text{m}$ or less (with the 50mm stylus)	
	Directionality (XYZ: 3D)	$\pm 1 \mu\text{m}$ or less (with the STANDARD FORCE 10mm stylus), $\pm 4 \mu\text{m}$ or less (with the 50mm stylus)	
	Required force to generate trigger signal	XY	0.08N (STANDARD FORCE), with the 10mm stylus 0.1N (MEDIUM FORCE), with the 25mm stylus 0.1N (EXTENDED FORCE), with the 50mm stylus
		Z	0.75N (STANDARD FORCE) 1.9N (MEDIUM FORCE) 3.2N (EXTENDED FORCE)
	Amount of over-travel	XY	$\pm 14^\circ$
		Z	+4.0mm (STANDARD FORCE) +3.7mm (MEDIUM FORCE) +2.4mm (EXTENDED FORCE)
	Required force to achieve over-travel	XY	0.2 - 0.3N (STANDARD FORCE) 0.2 - 0.4N (MEDIUM FORCE) 0.2 to 0.5N (EXTENDED FORCE)
		Z	3.5N (STANDARD FORCE) 7N (MEDIUM FORCE) 10N (EXTENDED FORCE)
	Maximum stylus length		50mm (STANDARD FORCE) 60mm (MEDIUM FORCE) 60mm (EXTENDED FORCE)
	Stylus mounting method		M2 screw
Mass of a single probe unit		250g	
Durability		1,000,000 times	
Probe head		Not required	
Applicable models		Manual/CNC coordinate measuring machines	

Dimensions



Set Configuration

	Ref. No.	Description	Part No.	Qty	Mass (kg)	Remark
MH20i single unit Order No. 06ABN436	1	MH20i	06ABN469	1	0.25	
	2	Probe module	06AAV543	1	0.01	STANDARD TYPE
	3	Cleaning tool	06AAL256	1	0.05	For cleaning the stylus module
	4	MS2-stylus tool	153140	1	0.003	For attaching/detaching the stylus
MH20i set Order No. 06ABN470	5	Positioning shank	160589	1	0.15	
	6	Stylus	—	1	0.001	ø4X10 (standard stylus)
	7	Allen key (2mm)	06AAA943	1	0.001	
	8	Allen key (3mm)	06AAA944	1	0.001	
	9	Operation Manual	99MCA265J	1	0.1	



Optional accessories

Stylus module

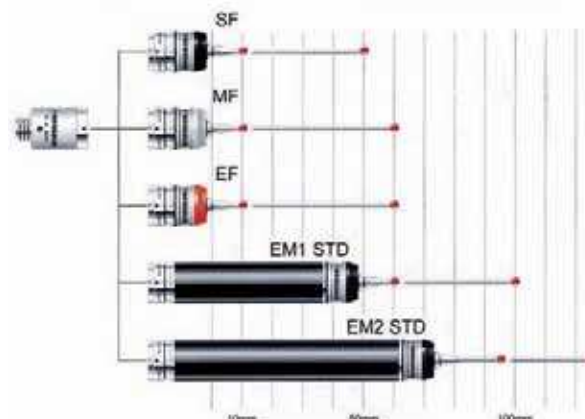
Standard force module

Medium force module

Extended force module

EM1-STD

EM2-STD



MH20

Touch Trigger Probe with Manual Probe Head



- **Compact touch trigger probe with manual probe head**

This trigger probe has a manually operable probe head for coordinate measuring machines. The probe module part has an outside diameter as small as $\varnothing 13.2$ mm, which greatly aids in probing complex portions of a workpiece. Other probe modules employing an extension either 50 mm long or 70 mm long are also provided.

- **Easy position change**

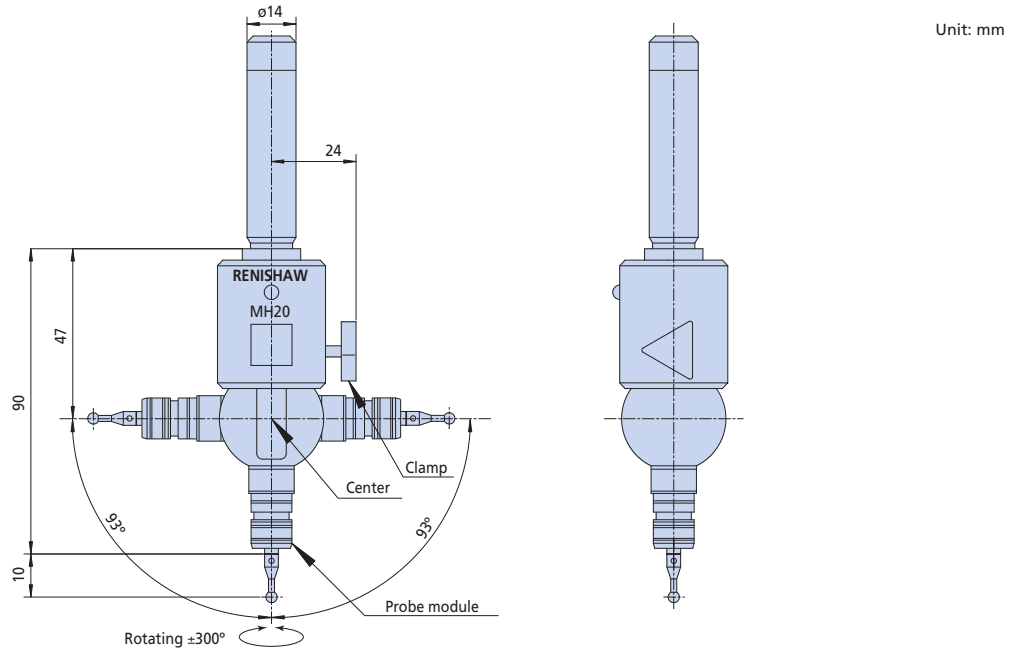
The operator can change the probe orientation in an optional direction by hand (simply loosen the knob on the right-hand side and change the position, then re-fasten the knob). No Allen key or other tools are required for the positional change.



MH20 Specifications

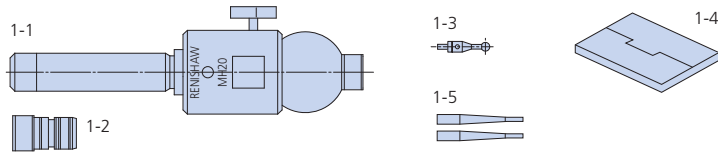
MH20	Measuring direction	$\pm X, \pm Y, +Z$	
	Position change	Manually for A axis (vertical direction): $\pm 93^\circ$, and for B axis (horizontal direction): To be fixed to optional direction in range of $\pm 300^\circ$	
	Repeatability (2σ)	0.35 μ m or less	
	Directionality (XY: 2D)	± 0.8 μ m or less (with the STANDARD FORCE 10mm stylus), ± 2.5 μ m or less (with the 50mm stylus)	
	Directionality (XYZ: 3D)	± 1 μ m or less (with the STANDARD FORCE 10mm stylus), ± 4 μ m or less (with the 50mm stylus)	
	Required force to generate trigger signal	XY	0.08N (STANDARD FORCE), with the 10mm stylus 0.1N (MEDIUM FORCE), with the 25mm stylus 0.1N (EXTENDED FORCE), with the 50mm stylus
		Z	0.75N (STANDARD FORCE) 1.9N (MEDIUM FORCE) 3.2N (EXTENDED FORCE)
	Amount of over-travel	XY	$XY \pm 14^\circ$
		Z	+4.0mm (STANDARD FORCE) +3.7mm (MEDIUM FORCE) +2.4mm (EXTENDED FORCE)
	Required force to achieve over-travel	XY	0.2 to 0.3N (STANDARD FORCE) 0.2 to 0.4N (MEDIUM FORCE) 0.2 to 0.5N (EXTENDED FORCE)
		Z	3.5N (STANDARD FORCE) 7N (MEDIUM FORCE) 10N (EXTENDED FORCE)
	Maximum stylus length	50mm (STANDARD FORCE) 60mm (MEDIUM FORCE) 60mm (EXTENDED FORCE)	
	Stylus mounting method	M2 screw	
	Mass of a single probe unit	22g (Probe body: 13g, Probe module: 9g)	
Durability	1,000,000 times		
Probe head	Essential: PH10M/PH10MQ/MIH/PH1		
Applicable models	Manual/CNC coordinate measuring machines		

Dimensions



Set Configuration

	No.	Description	Part No.	Qty	Mass (kg)	Remark
MH20-set standard configuration	1	1-1 MH20	06AAZ728	1	0.3	Probe head main unit
		1-2 TP20 standard module	06AAV543	1		Measuring force (small)
		1-3 Stylus	160217	1		ø4X10 (standard stylus)
		1-4 Cleaning kit	06AAL256	1		For cleaning the probe module connection
		1-5 MS2-stylus tool	153140	2		Stylus attachment tool
Order No. 06AAZ727	2	Operation Manual		1	0.1	
	3	Certificate		1	0.01	



PH10M/PH10MQ

Motorized Probe Head



- **Enhancing the measurement efficiency through automatic position change**

This probe head can automatically control the position of a probe attached at the end. (This position change can be performed, during manual operation, by simply specifying the angle through the supplied control box or the dedicated software, or by re-calling the position from memory, if it has stored for automatic position change.)

When a polyhedral object is measured with a probe without the change of position function, the following operation must be conducted: attach a cross-stylus, or multiple styli, on the mount in order to measure the top surface with one facing downward, and measure the side surface with one facing sideways. However, if the workpiece has a complex geometry, probing to the target position may be obstructed because the unused stylus can interfere with the workpiece. Also, the measuring operation in which the stylus needs be attached at the specified angle may become problematic if position change is not possible. Moreover, this automatic position change allows for measurement to be completed in much less time than the automatic stylus change method, reducing the total number of man-hours required to perform measurement with the coordinate measuring machine.

- **High-accuracy positioning with as many as 720 orientations**

Since the PH10M/PH10MQ can set its position to a maximum of 720 orientations, even one stylus can function as if 720 styli are attached. In addition, since this probe head has a repeatability to the same position as high as $2\sigma \leq 0.5\mu\text{m}$, it does not require re-calibration for measurement in which the same position must be repeatedly called.

- **Possible to mount various kinds of probe**

At the end of this head various probes, including but not limited to a touch trigger probe, scanning probe, vision probe, laser probe, and screw depth measuring probe, etc., can be mounted.

Furthermore, these probes can be easily replaced by means of the probe changer (optional), which achieves full-automatic measurement on a wide range of measurement objects.

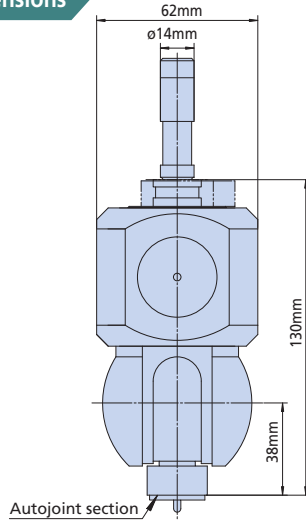
* Note that some probes is not compatible with this automatic probe change.



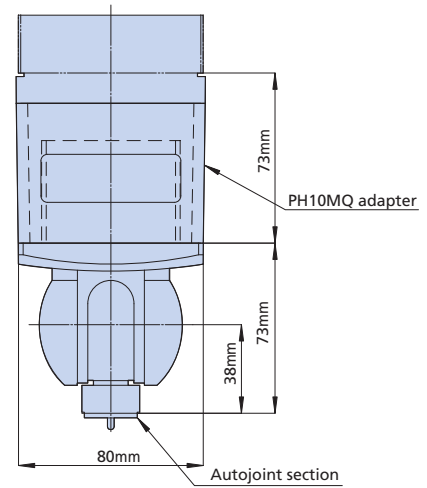
PH10M/PH10MQ specifications

Position change	Horizontal direction	$\pm 180^\circ$ (at 7.5° increments, 48 positions)
	Vertical direction	0 to 105° (at 7.5° increments, 15 positions)
Repeated positioning accuracy	$2\sigma \leq 0.5 \mu\text{m}$	
Mountable probe	MTP2000, TP7M, TP200, TP20, TP2-5W, QVP, SP25, SP600XE, MPP-10 Note that some combinations are prohibited on the same system.	
Extension	PEM1, PEM2, PEM3, PAA1, PAA2, PAA3 More than one extension cannot be joined for use. However, combined use of PAA+PFCF1, PAA1+PFCF2, and PAA1+PFCF3 are permitted. Use on an extension is not permitted for the WIZprobe/LC50/LC100/QVP.	
Applicable models	CNC coordinate measuring machines	

PH10M dimensions



PH10MQ dimensions



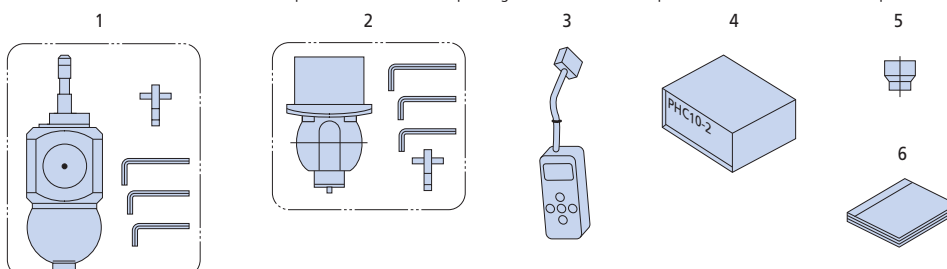
Extensions

PAA1	
PECF1	
PECF2	
PECF3	
PAA3	
PEM1	
PEM2	
PEM3	

Set configuration

No.	Description	Part No.	Qty	Remark	Mass (kg)
1	PH10M head	*	1		2.0
	Joint key S10	174748			
	Allen key (nominal 1.5)	908756			
	Allen key (nominal 2)	06AAA943			
	Allen key (nominal 2.5)	06AAA944			
2	PH10MQ head	*	1		2.0
	Joint key S10	174748	1		
	Allen key (nominal 1.5)	908756	2		
	Allen key (nominal 2.5)	06AAA944	1		
3	HCU-1	06AAN820	1	Controller for positioning the probe head	0.8
4	PHC10-2 (RS232C)	06AAR547	1	Interface with the machine-side CPU (for error display)	2.2
5	PAA1	909460	1	Adapter for mounting the TP200 onto the PH10M	0.06
6	User's Manual	99MCA034	1	User's Manual for PH10M head	0.1

* Each part number will differ depending on the CMM main unit/probe that uses it. Some additional parts are also available.





- **High-accuracy positioning in a maximum of 720 orientations**

The MIH has such a capability that permits its position (probe orientation) to be manually changed to maximum 168 kinds of orientations at a positioning repeatability of $\sigma \leq 1.5 \mu\text{m}$. For measurement of a complex three-dimensional form that requires repeated changes in the probe orientation, preliminary registration of required positions can eliminate re-calibration after each positional change, therefore improving the measurement efficiency at large. The current position can of course be confirmed on the LCD display of the MIH main unit.

- **Probe extensions up to 300 mm long**

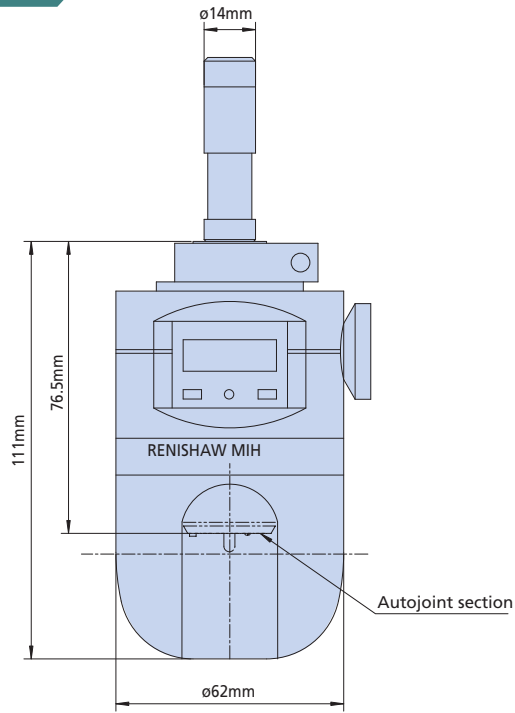
The MIH can employ any probe extension that is a maximum of 300 mm long. An example combination of the TP2-5W and a 50 mm stylus can extend the probe's reach to approximately 400 mm.



MIH specifications

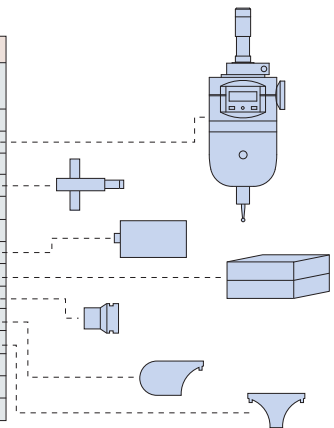
MIH	Position change	Horizontal direction	$\pm 180^\circ$ (at 7.5 increments, 48 positions)
		Vertical direction	0 to 105° (at 7.5 increments, 15 positions)
	Repeated positioning accuracy	$\sigma \leq 1.5 \mu\text{m}$	
	Mountable probe	TP200, TP20, TP2-5w	
	Extension	PAA1 (PAA1+PECF1, PAA1+PECF2, PAA1+PECF3), PAA2, PAA3	
	Applicable models	Manual coordinate measuring machines	

Dimensions



Set configuration

No.	Description	Part No.	Mass (kg)	Qty	Remark		
1	MIH head kit set Order No. 06AAB126	MIH head	06AAB127	1.5	1	Traveling angle: Horizontal (B axis) $\pm 180^\circ$ (7.5° steps, 48 positions) Vertical (A axis) 0 to 105° (7.5° steps, 15 positions) Spatial positioning accuracy: $\pm 0.3\text{mm}$ (where PAA1+TP2-5W+ $\phi 3$ stylus+EWL7.5 is used) Repeated positioning accuracy (σ): 1.5 μm (in the same case as above) Mass: Approx. 730g	
		Joint key S10	174748			1	For attaching the probe
		Allen key (nominal 2)	06AAA943			1	For adjusting the positioning block, or battery replacement
		Allen key (nominal 2.5)	06AAA944			1	For attaching the shank
		Battery PX28L	06AAB128			2	6V lithium cell (Manufacturer: Duracell)
		Wooden box for MIH	06AAB129			1	
2	PAA1	909460	0.06	1	Adapter for connecting the MIH and probe. Length: 32mm		
3	Single-ended wrench	161534	0.01	1	For fastening the TP2 and extension		
4	Double-ended wrench	161535	0.005	1	For fastening the TP2 and extension		
5	Positioning shank	160589	0.14	1	To be attached on the MIH head (Mitutoyo)		
6	Certificate		0.001	1			
7	User's Manual		0.05	1			



Optional accessories

Extensions

PECF1	
PECF2	
PECF3	
PEL3	



- **Manual probe head**

Manual probe head for use with the TP200, TP20, and TP2-5W.

- **Easy position change**

The operator can change the probe orientation to an optional direction by hand.

- **Extension**

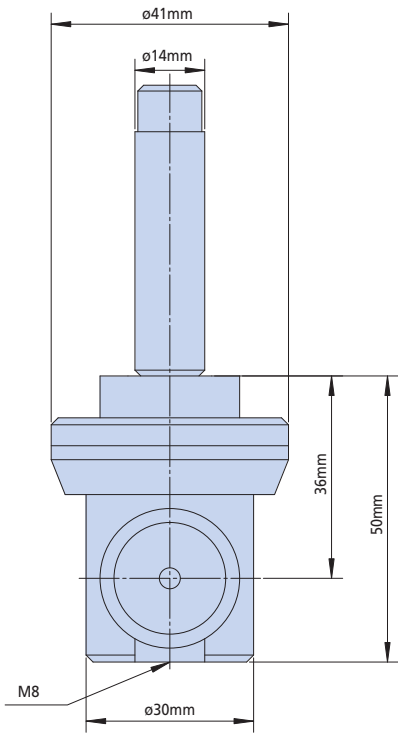
It is possible to insert a probe extension that is a maximum of 200 mm long.



PH1 specifications

Position change	Horizontal direction	360° (at 15° increments) Possible in a non-stop manner, if the head is rotated along with the $\varnothing 14\text{mm}$ shank unit.
	Vertical direction	$\pm 115^\circ$ (non-step)
Mountable probe	TP200, TP20, TP2-5W	
Extension	PECF1, PECF2, PECF3	
Applicable models	Manual/CNC coordinate measuring machines	

Dimensions (when mounted on the TP2-5W)



Optional accessories

Extensions

PECF1	50mm
PECF2	100mm
PECF3	200mm



An example connection of PECF3

ACR-3



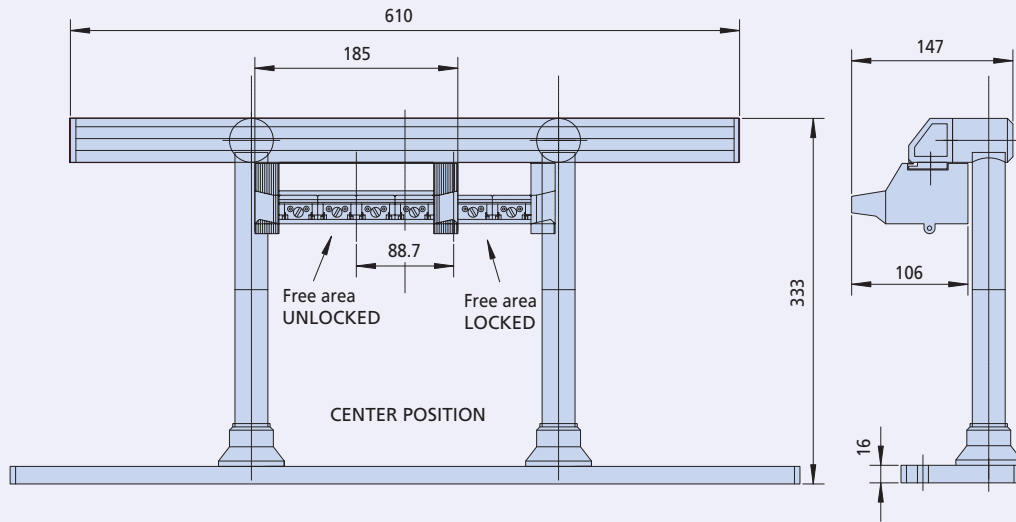
- **Necessity for automatic probe change**

The ACR3 is an automatic probe changer for use with the PH10M/PH10MQ. It is essential for full-automatic measurements where the currently employed probe does not have the capability of automatic stylus change but the stylus diameter or length must be occasionally changed, and where the contact-type probe and non-contact type probe are switched as required.

- **Simplified structure**

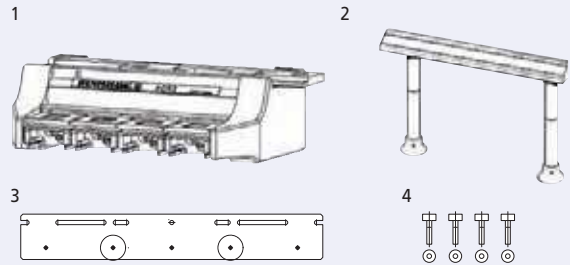
In comparison to the conventional automatic probe changer, which must have a dedicated motor built in to turn on and off the lock system, is expensive, and has poor durability, the ACR3 has a simplified structure and improved durability because it employs a new mechanism in which the automatic probe change is performed through the CNC coordinate measuring machine's own drive system.

Dimensions



Set configuration

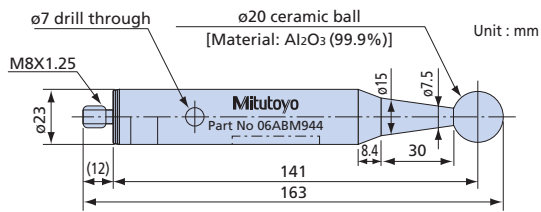
	No.	Description	Part No.	Qty	Mass (kg)	Remark
4-port system [Order No. 06ABP469]	1	ACR3	06ABN438	1	1.5	4-port rack
	2	MRS KIT2	06ABN607	1	3.5	Rack base
	3	Auxiliary plate	06ABG598	1	8	For fixture
	4	ACR3 attachment	406ABP467	1	0.05	Attachment
	5	User's Manual		1	0.1	
	6	Control ROM		1	0.01	Adaptive to ACR3
8-port system [Order No. 06ABP470]	1	ACR3	06ABN438	2	1.5	4-port rack
	2	MRS KIT2	06ABN607	1	3.5	Rack base
	3	Auxiliary plate	06ABG598	1	8	For fixture
	4	ACR3 attachment	406ABP467	1	0.05	Attachment
	5	User's Manual		1	0.1	
	6	Control ROM		1	0.01	Adaptive to ACR3



Ceramic Master Ball

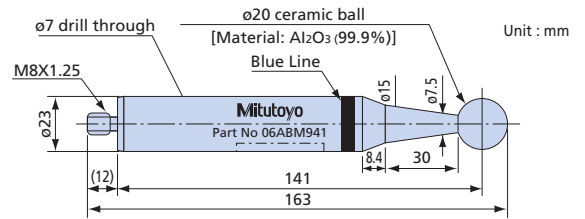
● Ceramic master ball (standard type)

- Ball sphericity: 0.13 μ m or less
- Ball diameter dimensional tolerance: $S\phi 20 \pm 0.01$ mm



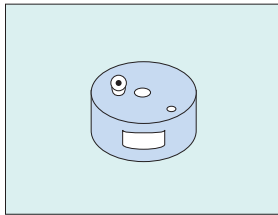
● Ceramic master ball (high-accuracy type)

- Ball sphericity: 0.08 μ m or less
- Ball diameter dimensional tolerance: $S\phi 20^0_{-0.02}$ mm

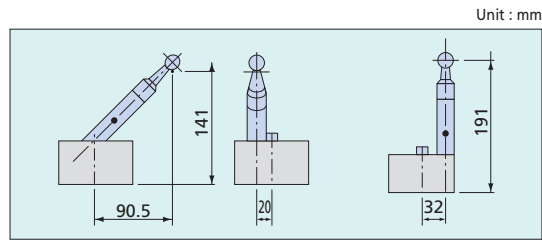


● Base

Base for a ceramic master ball



Base appearance



Ceramic ball attachment figure

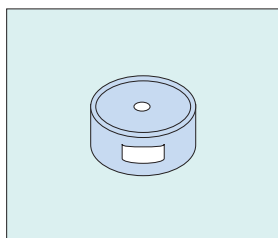
● Set break-downs

Set order No.	Set name	Ceramic master ball type	Inspection Certificate	Base	Calibration Certificate	Traceability System Diagram
06ABQ041A	A set	Standard	○	○	—	—
06ABQ041B	A3 set	Standard	○	○	○	○
06ABQ040A	B set	Standard	○	—	—	—
06ABQ040B	B3 set	Standard	○	—	○	○
06ABQ044A	C set	High accuracy	○	○	—	—
06ABQ044B	C3 set	High accuracy	○	○	○	○

Optional accessory for the Ceramic Master Ball

● Spacer

Spacer for the base



Spacer appearance

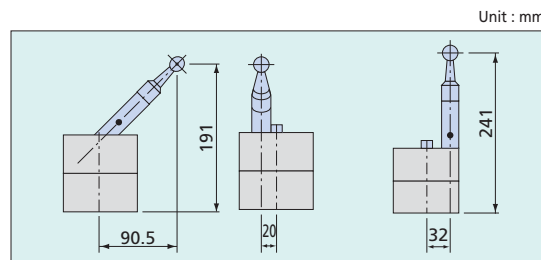


Figure of attaching to Ceramic Master Ball + Base

MPP-300Q/MPP-300 Page 2



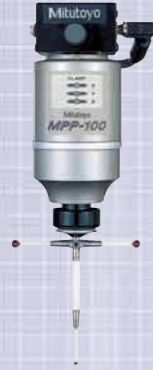
SP80 Page 4



SP25M Page 6



MPP-100 Page 8



QVP Page 10



CF20 Page 12



TP7M Page 14



TP200 Page 16



TP20 Page 18



TP2-5W Page 20



MH20i Page 22



MH20 Page 24



PH10M/PH10MQ Page 26



MIH Page 28



PH1 Page 30



ACR-3 Page 32





- Coordinate Measuring Machines
- Vision Measuring Systems
- Form Measurement
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