Mitutoyo

Probes for Coordinate Measuring Machines

COORDINATE MEASURING MACHINES

Mitutoyo

A wide range of probes supports various kinds of your measurement applications

Probes for Coordinate Measuring Machines

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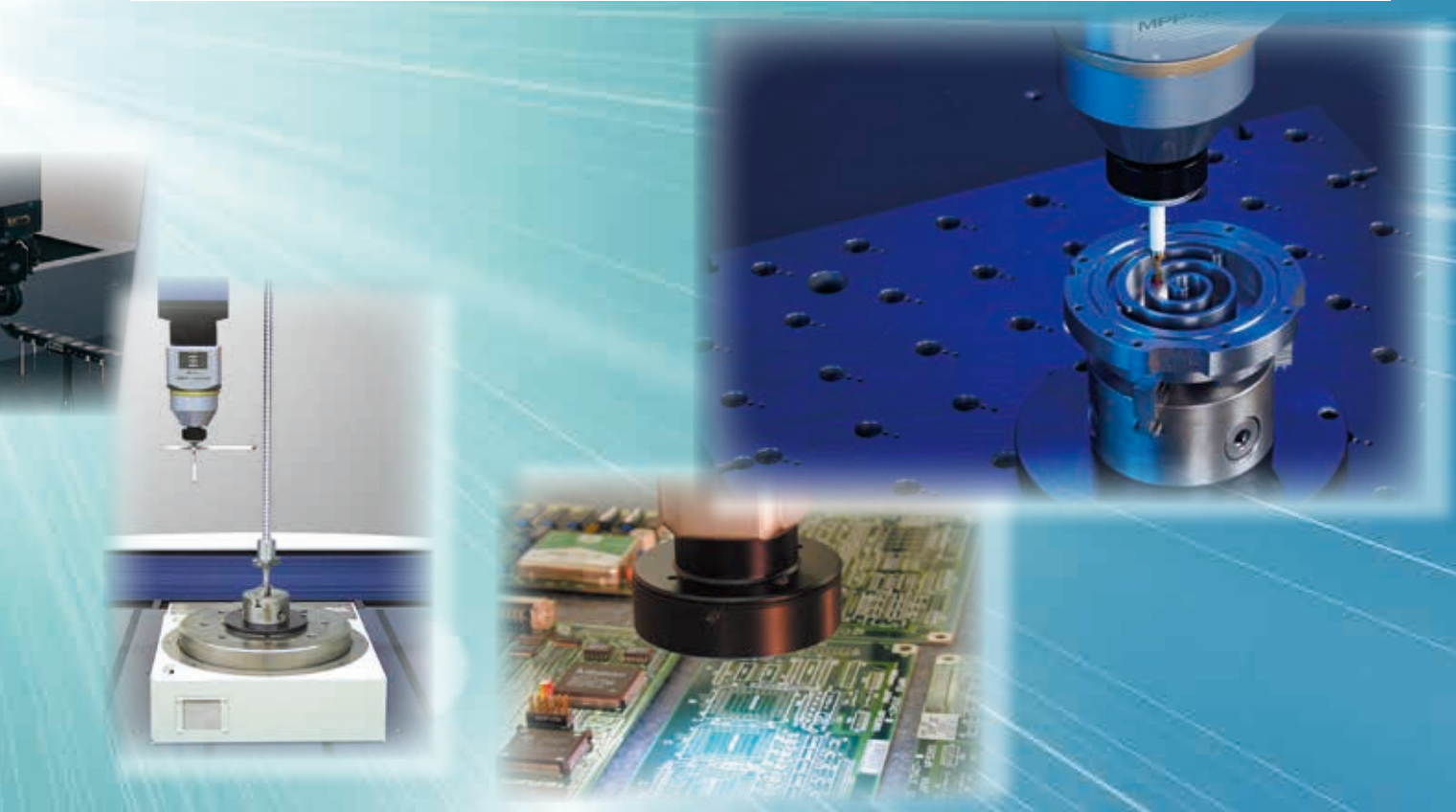
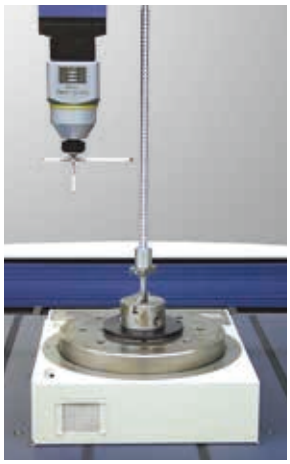
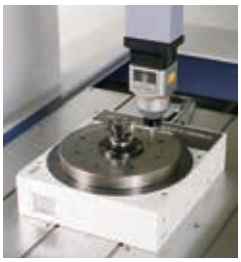


MPP-310Q Ultra High-Accuracy Scanning





• Fast scanning

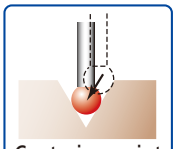
The MPP-310Q is a multi-functional probe designed for CNC coordinate measuring machines. It can not only perform a continuous path contact-type scanning measurement [a measurement method that implements a collection of a large amount of coordinate data while traveling along a continuous path in contact with the workpiece] at V2≤0.3µm (reference value when the LEGEX series is installed), but also high-accuracy point measurement of ≤0.1µm (on the LEGEX CMM series), and data collection from a centering point measurement (shown below).

• Omni-directional scanning

The MPP-310Q has internal high-accuracy scales with a minimum resolution of 0.01µm 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 needs only a small force to generate a trigger signal the moment the stylus actually comes into contact with the workpiece, may be apply several tens to several hundred grams of force in the over-travel period that immediately follows contact. In addition, some scanning probes from other manufacturers employ such a structure that the motor drive mechanism forcibly determines the probing position in order to permit the use of a longer stylus, necessitating the probe to actually produce a greater measuring force.
In contrast, the MPP-310Q 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.



Centering point measurement

•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.
Naturally, it takes an extended amount of time for a touch-trigger probe to measure such an object point by point if very many points are involved. In contrast, the MPP-310Q can, for example, complete a measurement in just a few seconds even if it is required to measure an inside diameter of 100 mm using 1000 measurement points. In addition, measurement can be pursued effectively while changing the scanning speed, depending on the measurement accuracy required.

• Optional units

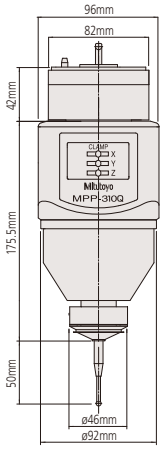
A wide variety of optional units, including rotary table MRT320 for synchronized scanning and the automatic stylus change system, is available.

MPP-310Q Specifications

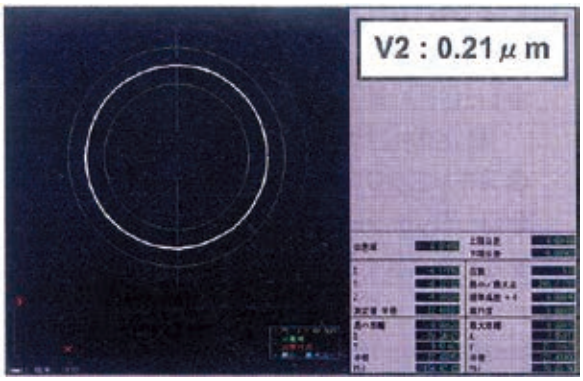
MPP-310Q	Measurement range	±1mm
	Resolution	0.01µm
	Max. permissible probing error	MPE_P≤0.45µm (LEGEX500/700/900: When the ø4x18mm stylus is used.)
	Max. permissible probing error during scanning	MPE_{THP}≤1.4µm (LEGEX500/700/900: When the ø4x18mm stylus is used.)
	Spring rate	0.2N/mm
	Max. stylus length	200mm for both vertical and horizontal *1
	Max. stylus mass	75g *1
	Stylus mount	M4 thread
	Max. tracing speed	120mm/s [for known geometry scanning]
	Air flow rate	30NL/min
	Probe head	N/A
	Applicable models	CNC CMM (LEGEX500/700/900/1200 series) *2
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.

*1 Increase in stylus length or stylus mass may reduce accuracy.
*2 Note that some probes are subjected to the limitation of mounting or unable to mount.

Dimensions



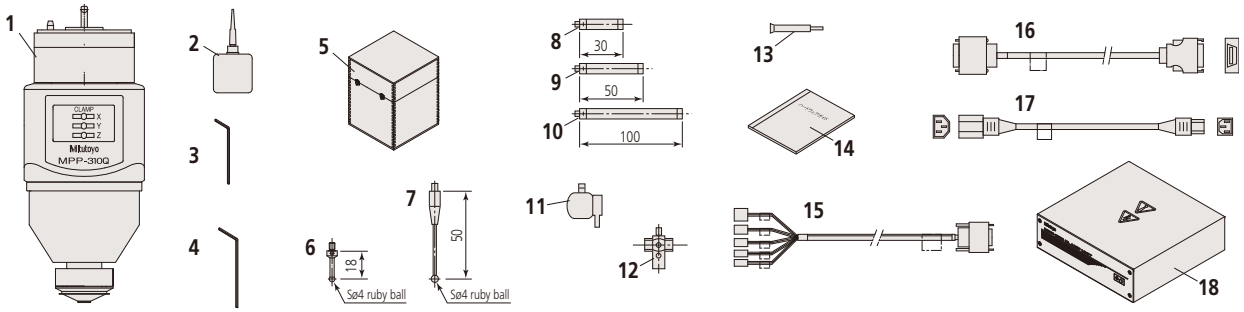
MPP-310Q



An example scanning measurement of a ring gage with the LEGEX series and MPP-310Q

Set configuration

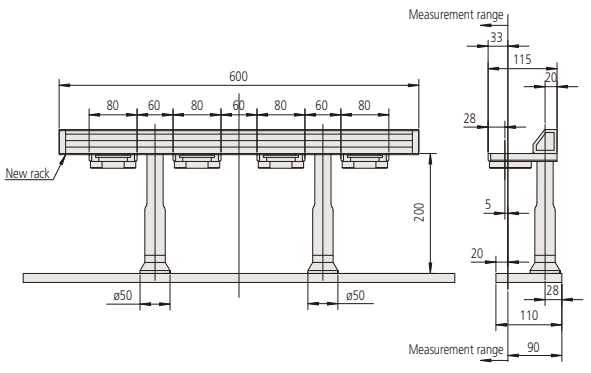
Unit	Ref. No.	Description	Qty	Mass (kg)		Remarks
MPP-310Q(S) Probe set	1	MPP-310Q probe main unit	1	1.78		Including one stylus mount assembly
	2	Damping oil	1	0.017		Silicon oil (2000CS)
	3	Allen wrench / GXL-20	1	0.0015		
	4	Allen wrench / GXL-30	1	0.0043		
	5	Storage box	1	1.5		Wooden box for storing MPP-310Q
MPP-310Q System (S)	6	MS4-4R13.5-S	1	0.0023		
	7	MS4-4R33C-S	5	0.0048		
	8	MS4-EXT30C	2	0.0051		M4-M4 ceramics Extension L=30mm
	9	MS4-EXT50C	1	0.0067	3.3	M4-M4 ceramics Extension L=50mm
	10	MS4-EXT100C	1	0.011		M4-M4 ceramics Extension L=100mm
	11	MS4-stylus knuckle	1	0.0145		
	12	MS4-stylus center	1	0.04		
	13	stylus tool	2	0.0035		For attaching/detaching M4 stylus
	14	MPP310Q Hardware Guide	1	0.15		English
	15	EXT CONTOUR cable A	1	0.3		
	16	EXT CONTOUR short cable	1	0.3		
	17	AC cable	1	0.11		For overseas specification
Clamp set	18	MPP-310Q clamp unit configuration (of desktop specification)	1	1.8		



Optional units Automatic Stylus Changer

Dimensions

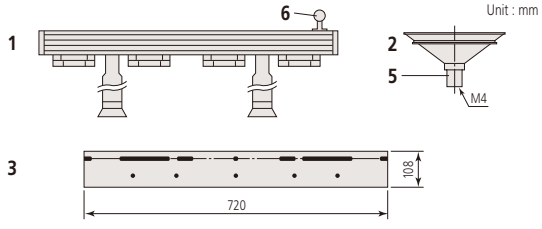
Unit : mm



Detail

Unit	Ref. No.	Description	Qty	Mass (kg)		Remarks
Automatic stylus change system	1	Auto-stylus change rack	1	5	13.1	Supplied with 4 ports for replacement.
	2	Stylus mount assembly	3	0.04		Used for installing a rack on the CMM base.
	3	Auxiliary plate	1	8		
	4	MS4-4R13.5-S	3	0.024		
	5	MS4-stylus center	3	0.012		For re-calibration
	6	Reference sphere	1	0.04		

Unit : mm



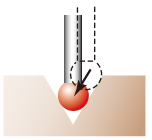
SP80 High-accuracy Scanning Probe Can Use Very Long Styli

• High accuracy achieved even with very long styli

The SP80 scanning probe is designed to achieve high measurement accuracy even when using styli up to 500 mm (in both the horizontal and vertical directions) in length. 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 a path in contact with the workpiece) but also high-accuracy point measurement as well as data collection from a centering point measurement (shown below).

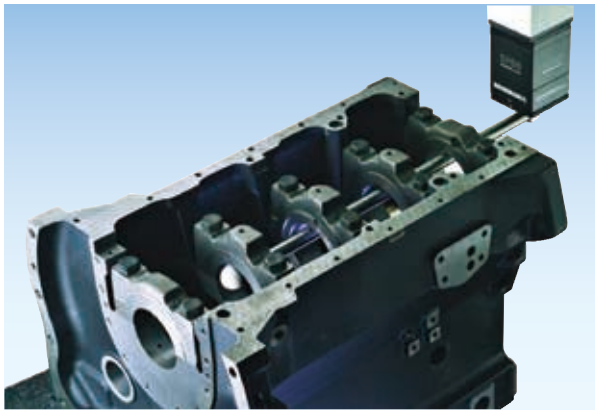
• Fast scanning

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. Naturally, it takes an extended amount of time for a touch-trigger probe to measure such an object point by point. In contrast, the MPP-300Q/300 can, for example, complete a measurement in just a few seconds, even if it is required to measure an inside diameter of 100 mm using 1000 measurement points. In addition, any measurement can be pursued effectively while changing the scanning speed, depending on the measurement accuracy required.


Centering point measurement

• Optional units

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

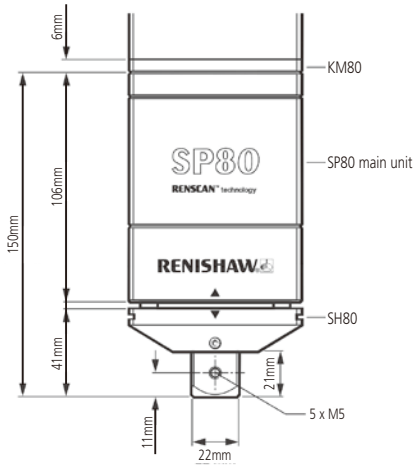


SP80 Specifications

SP80	Measurement range	±2.5mm
	Max. permissible probing error during scanning	MPE_{THP}≤2.0μm (CRYSTA-Apex S700/900: If the ø8x60mm stylus is used.)
	Spring rate	1.8N/mm
	Max. stylus length	500mm *1
	Max. stylus mass	500g
	Stylus mount	M5 thread
	Max. scanning speed	120mm/s [for known geometry scanning]
	Probe head	N/A
	Applicable models	CNC coordinate measuring machines *2

*1 Increase in stylus length or stylus mass may reduce accuracy.
*2 Note that some probes are subjected to the limitation of mounting or unable to mount.

Dimensions



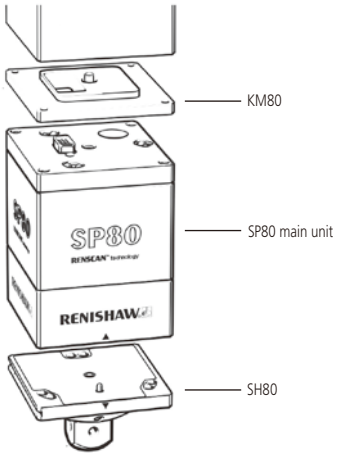
Set configuration

SP80 main unit

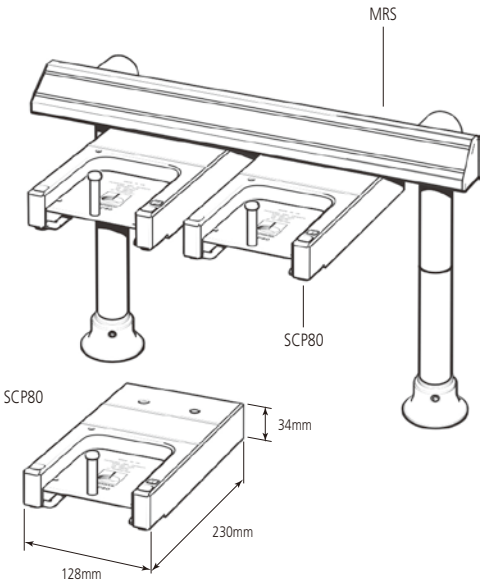
Description	Mass (kg)	Remarks
SP80 Probe kit #1	2.6	One SP80 main unit, SH80, KM80, and ø8X60mm stylus

Parts for SP80

Description	Mass (kg)	Qty
SP80 adapter	0.3	1
SP80 Probe cable	0.1	1
SP80 EXT cable	0.2	1
IU 80	0.51	1
SP80 Power Supply BOX	1	1
OPT200S-MPP2	0.2	1
OPT200 attachment	0.4	1
Control ROM (MAIN)	0.01	1
Control ROM (OPT)	0.01	1
Mass (kg)		3.73



Optional units Automatic Stylus Changer



SP80 stylus change set 1 (600mm-rail specifications)

Description	Unit	Mass (kg)
MRS kit #2	1	3.5
SH80	1	0.24
SCP80	2	2.1
Rack plate (auxiliary plate)	1	8
ACR3 attachment screw	1	0.05
Mass (kg)		13.89

SP80 stylus change set 2 (1000mm-rail specifications)

Description	Unit	Mass (kg)
MRS kit #3	1	3.7
SH80	3	0.48
SCP80	4	4.2
Rack plate (auxiliary plate)	1	8
ACR3 attachment screw	1	0.05
Mass (kg)		16.43

SP25M Compact High-accuracy Scanning Probe

• Compact high-accuracy scanning probes

The SP25M is a compact high-accuracy scanning probe with an outside diameter of ø25 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 a 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

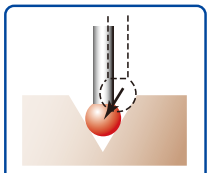
For a scanning measurement either of the following scanning methods can be selected: one in which the scanning progresses while automatically following an unknown geometry (unknown geometry scanning), and one in which scanning progresses based on the locus of the probe tip given beforehand (known geometry 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. Naturally, it takes an extended amount of time for a touch-trigger probe to measure such an object point by point if very many points are involved. In contrast, the SP25M can, for example, complete a measurement in just a few seconds even if it is required to measure an inside diameter of 100 mm using 1000 measurement points. In addition, it can pursue any measurement effectively while changing the scanning speed, depending on the measurement accuracy required.

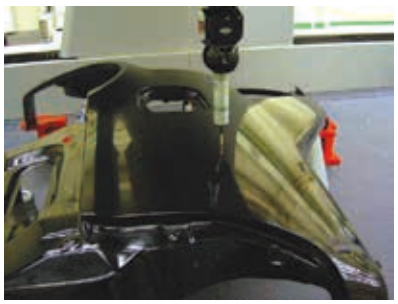
• Enhancing the setup and measurement efficiency through automatic change of probe orientations

Since the SP25M 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

An automatic stylus change system is available.


Centering point measurement

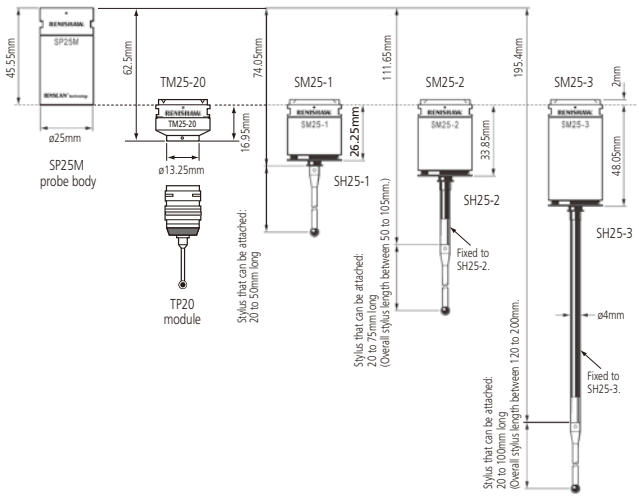


SP25M Specifications

SP25M	Measurement range	±0.5mm
	Max. permissible probing error	MPE_{THP}≤2.3µm (CRYSTA-Apex S700/900: If the ø4x50mm stylus is used.)
	Spring rate	0.4N/mm
	Amount of over travel	±2.0mm (XY) ±1.7mm (Z)
	Max. stylus length	200mm (When SM25-3 or SH25-3 is used.)*
	Stylus mount	M3 threaded
	Max. scanning speed	120mm/s [for known geometry scanning]
	Probe head	Essential: PH10M/PH10MQ
	Applicable models	CNC coordinate measuring machines

* Increase in stylus length or stylus mass may deteriorate the accuracy.

Dimensions

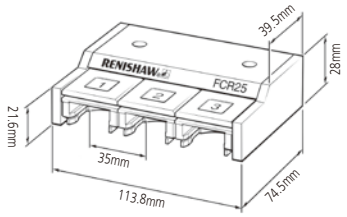


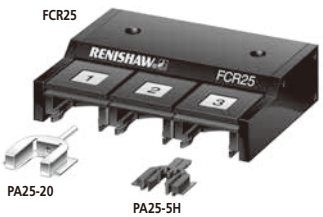
Configuration

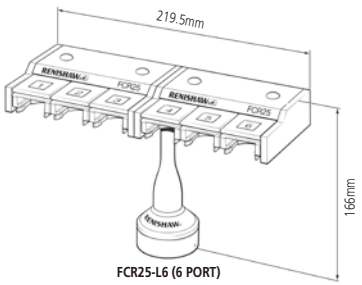
Description	Remarks
SP25M full combination kit	A complete set of SP25M, SM25-1/2/3, SH25-1/2/3,and TM25-20
SP25M probe kit #1	A complete set of SP25M, SM25-1, and SH25-1
SP25M probe kit #2	A complete set of SP25M, SM25-2, and SH25-2
SP25M probe kit #3	A complete set of SP25M, SM25-3, and SH25-3
Scanning module kit #1	A complete set of SM25-1 and SH25-1
Scanning module kit #2	A complete set of SM25-2 and SH25-2
Scanning module kit #3	A complete set of SM25-3 and SH25-3
Stylus holder SH25-1	
Stylus holder SH25-2	
Stylus holder SH25-3	
TM25-20 TP20 adapter kit	A set of TP20 standard force module and TM25-20
TM25-20 TP20 adapter	

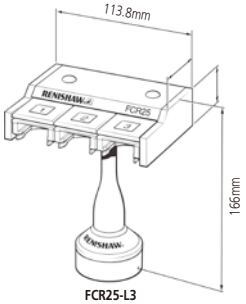
* TTP module (TM25-20, TP20 module) will be supported for MCOSMOS V2.4 or later releases.

Optional units Automatic Scanning Module Changer/Automatic Stylus Changer









* SP25M internally uses the high-power LED light source.
Exercise caution when handing, in accordance with the User's Manual.

* Can be mounted on the MRS rack.

SP600Q High-accuracy Scanning Probe

• Compact high-accuracy scanning probes

SP600Q is a high-accuracy scanning probe which can be mounted on the CRSTA-Apex S500 series. It performs not only scanning measurement (measurement method that collects a large amount of coordinate data while traveling along a path in contact with the workpiece), but also high-accuracy point measurement. Direct-mount of this probe on the Z spindle of CRYSTA-Apex S500 allows more effective usage of measurement space.

• 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. Naturally, it takes an extended amount of time for a touch-trigger probe to measure such an object point by point if very many points are involved. In contrast, the SP600Q can, for example, complete a measurement in just a few seconds even if it is required to measure an inside diameter of 100 mm using 1000 measurement points. In addition, it can pursue any measurement effectively while changing the scanning speed, depending on the measurement accuracy required.

• Optional units

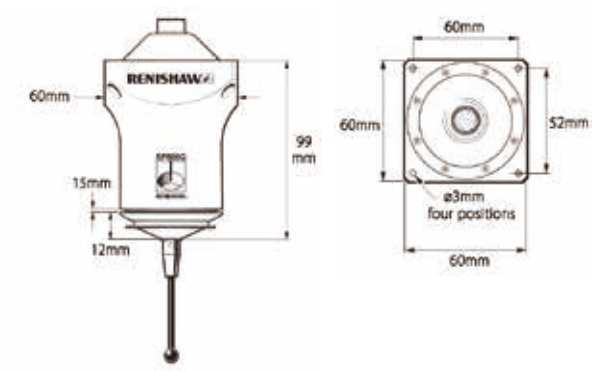
An automatic stylus change system is available.

SP600Q Specifications

SP600Q	Measurement range	±1mm (X,Y,Z)
	Min. reference displacement	0.15mm
	Spring rate	1.176N/mm (120gf/mm) (for each axis)
	Measuring force	0.17~1.18N (18~120gf) Varies depending on the probe displacement.
	Max. stylus mass	Max. 20g *1
	Max. stylus length	Max. 200mm *1
	Stylus mount	M4 thread *2
	Method of mounting	Directly mounted on ram *2

*1 Increase in stylus length or stylus mass may reduce the accuracy.
*2 The SP600Q probe must be mounted by a Mitutoyo service engineer. Note that a probe mounted or dismounted by the customer is not covered under warranty.

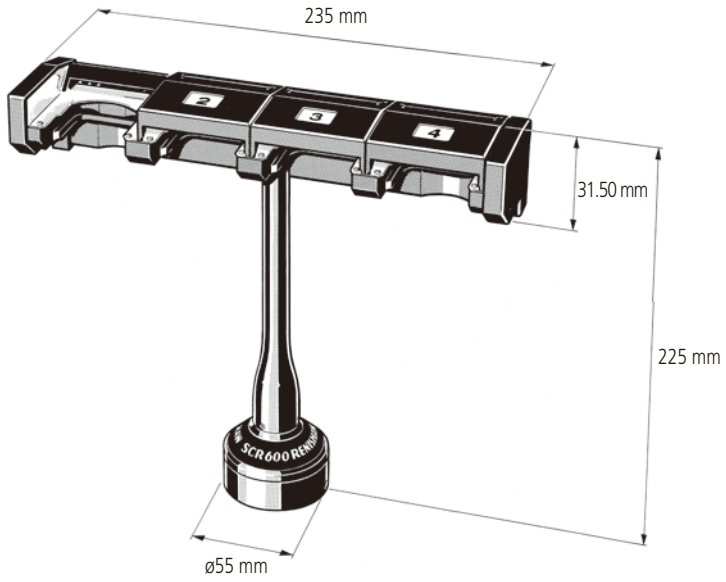
Dimensions



Configuration

Description	Qty	Remarks
A) Components supplied in a wooden case		
SP6000Q Probe	1	Scanning probe main unit
Stylus module	1	Mounted on the SP600Q main unit
Stylus	1	50mm-long ceramic stylus with an ø8mm ball tip
M4 stylus tool	1	Stylus attaching/d etaching tool
B) Accessories		
Stylus	1	50mm-long ceramic stylus with a ø4mm ball tip
Knuckle joint	1	MS4 Stylus knuckle
Stylus center	1	MS4 Stylus center
Extension	1	MS4-EX50C
Certificate	1	
User's Manual	1	

Optional units Stylus Changer SCR600



SurfaceMeasure Non-contact Line-Laser Probe

• High-speed scanning

SurfaceMeasure is a probe that captures coordinates data from a workpiece by shining a laser on the surface. This method allows ultra-fast data acquisition of 75,000 points/sec*.

*Applies to surfaceMeasure 606/610/1010.

• Advantage of non-contact measurement

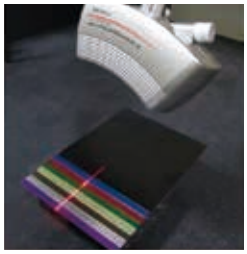
Non-contact measurement makes it possible to measure elastic bodies such as resin and thin-walled parts which are not suitable for contact measurement.

• Powder-sprayless measurement

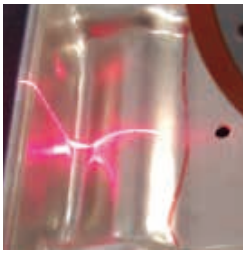
By automatically adjusting the laser intensity and camera sensitivity according to the environment and the workpiece material, the SurfaceMeasure has achieved powder-sprayless measurement, providing a simpler and more comfortable laser-scanning environment.

• Application examples

Obtained point-cloud data can be used for various purposes with optional software, such as editing, surface generation, comparing with CAD data, creating CAD data, etc.

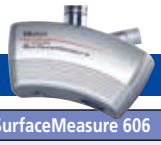
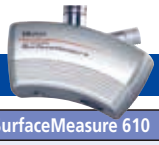
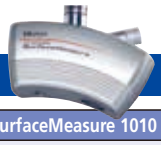


Measurement of color sample plate

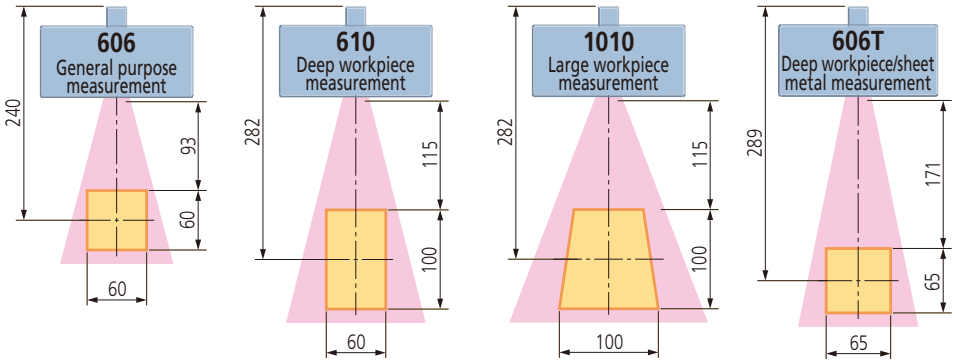


Measurement of shiny workpiece

SurfaceMeasure Specifications

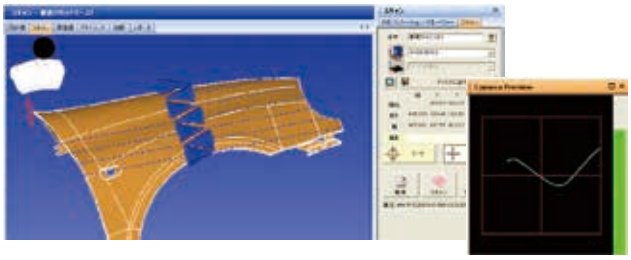

		SurfaceMeasure 606	SurfaceMeasure 610	SurfaceMeasure 1010	SurfaceMeasure 606T
Laser Class	EN/IEC	Class2 [EN/IEC 60825-1(2007)]			
	JIS	Class2 [JIS C 6802 : 2011]			
Stand-off		240mm	282mm		289mm
Measuring depth		60mm	100mm		65mm
Measuring range		60mm	60mm	Max.100mm	3×65mm
Max. Acquisition rate		75,000 point/sec			3×25,500 point/sec



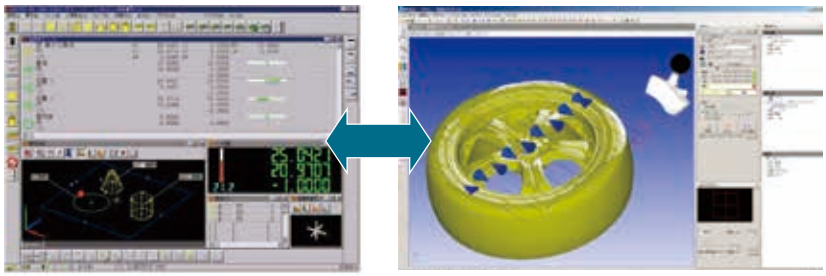
MSURF-S/MSURF-I

Scanning (MSURF-S)

Scanning paths can be created by simply defining three items: the scanning starting point, the scanning length, and the scanning width. These three items can be easily defined by using the joystick while checking the camera preview.



Since MSURF-S can be started from MCOSMOS, automatic measurements that merge "contact" and "non-contact" measurements can be executed.



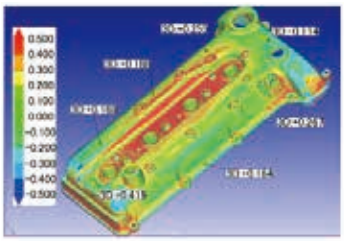
If the work coordinate system created in MCOSMOS is used, positioning by the software programs designed for processing point-cloud data is not required.

Note: If ACR3 is not used, the probe must be manually changed.

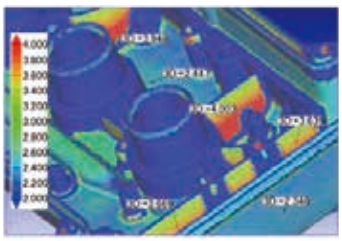
Inspection (MSURF-I)

• Planar shape comparison

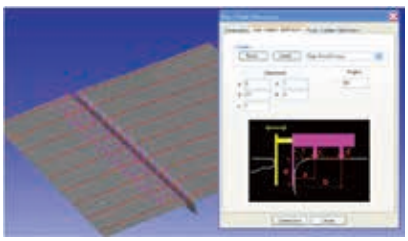
Point-cloud data or mesh data can be compared with CAD data, and the planar shape errors displayed on a color map.



Color map of errors



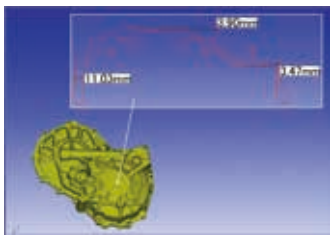
Color map of wall thickness



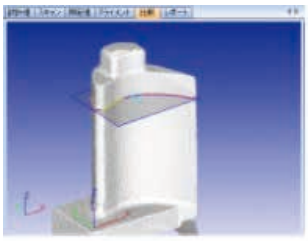
Evaluation of steps and gaps

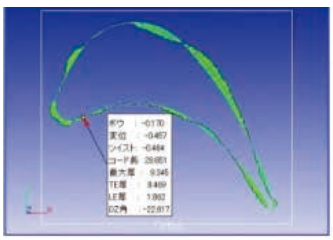
• Comparison of cross-sectional shapes

Point-cloud data / mesh data and CAD data can be cut at the specified position to compare cross-sectional shapes or compute angles, distances, radii, etc.



Cross-sectional evaluation (dimension computation)

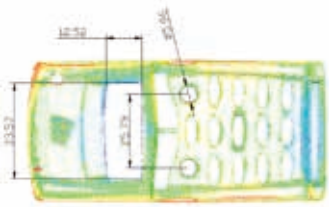




Turbine blade analysis (optional function)

• Feature-by-feature comparison

Various features can be detected from point-cloud data or mesh data and compare them to the design data.



Various kinds of elements computation

QVP Quick Vision Probe

• 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 a 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

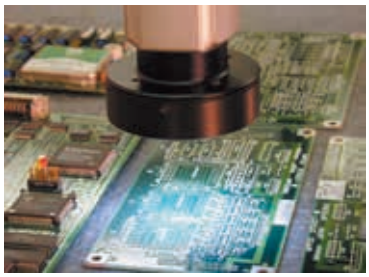
The QVP-captured image will have various automatic edge detections performed by the dedicated software, Visionpak, and then various calculation processes (calculation of dimensions and geometrical deviations) will be performed by the general-purpose measurement program, Geopak.

• 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% in 1% increments.

• Use with an Automatic Probe Changer

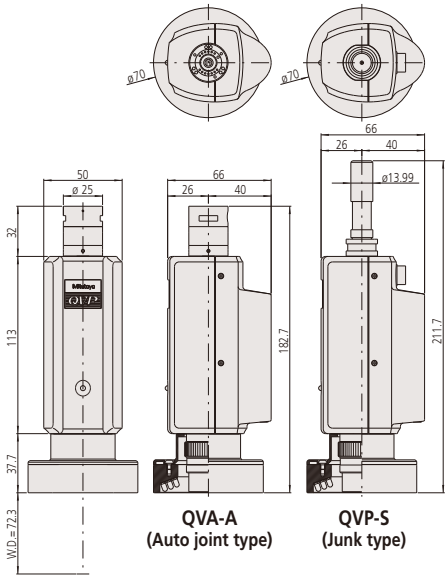
The QVP can also be mounted on an automatic probe changer, allowing full-automatic measurement with both contact and non-contact probes.



QVP Specifications

QVP main unit	CCD size		1/3 inch (B/W)			
	Optical tube magnification		0.375X			
	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: 315g, shank type: 390g			
	Optical magnification		0.375X	1.125X	1.815X	3.75X
	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		ML1X Optional	ML3X Standard	ML5X Optional	ML10X Optional
	Numerical Aperture (N.A.)		0.03	0.07	0.11	0.18
	Depth of focus (μm)		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



Unit : mm

Optional accessories

Objective ML1X (**375-036-2**)
Objective ML5X (**375-034-1**)
Objective ML10X (**375-039**)

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

Calibration chart
(**02AKN020**)
- Gage for calibrating a single QVP unit

Data processing unit

• Dedicated data processing software VISIONPAK

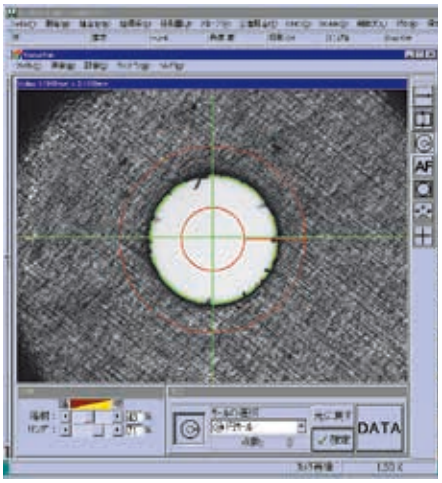
VISIONPAK operates under the Microsoft Windows operating system and is a general-purpose measurement program for coordinate measuring machines. It displays the image window when it detects a workpiece edge. After detecting an edge, it undertakes various calculations with the regular general-purpose measurement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

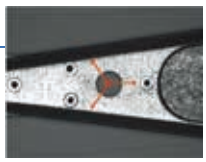
In ordinary micro-form measurement it is often difficult to remove burrs and dusts from the objective workpiece, resulting in an inevitable measurement error. In contrast, VISIONPAK can recognize, for example, the obstruction as an "outlier" and bypass it during measurement.



VISIONPAK Image Processing Tool

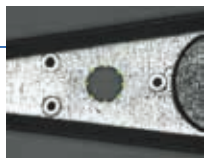
Simple tool

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



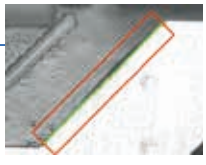
Manual tool

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

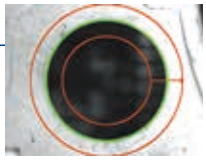


Centroid tool

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.

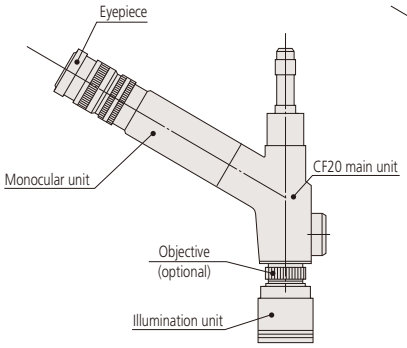
• Optional accessories to implement various evaluations

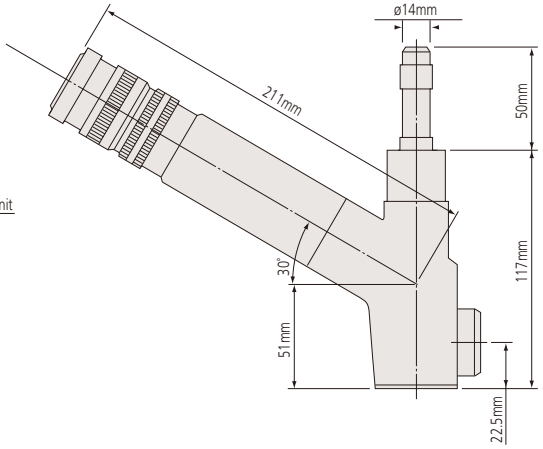
To cope with the size and form of a workpiece to be observed and measured, lenses of various magnifications and reticles for form comparison are provided.

• CCTV monitor system

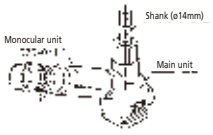
The dedicated CCD camera can be mounted on the back of the CF20 main unit. Video signals from the camera can be displayed as an image on the external monitor. This is a great aid in relieving eye stress, especially if several hours of work must be done.

CF20 monocular set dimensions

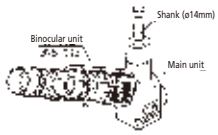




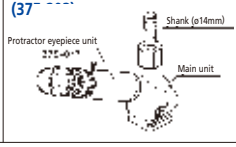
CF20 monocular set (375-201)



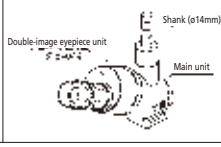
CF20 binocular set (375-202)



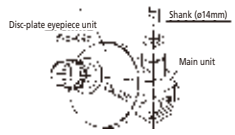
CF20 protractor eyepiece set (37



CF20 double image set (375-204)



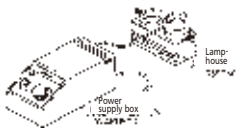
CF20 disc plate set (375-205)



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) 2. Spare lamp (162151) 3. Lens cap 4. Tools 5. Power cable 6. User's Manual 7. Storage box
CF20 binocular set (375-202)	CF10X eyepiece, field number 22 / Cross hair and concentric circle reticle (right) Pupil distance adjustment: 51 - 76mm	
CF20 protractor eyepiece set(375-203)	CF10X eyepiece, field number 21 / Measurement range: 360˚, Angle index: 1˚ Minimum reading: 5' (vernier scale)	
CF20 double image set(375-204)	CF10X eyepiece, field number 22	
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	

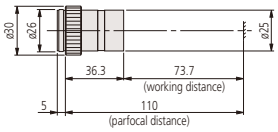
Illumination unit (375-071)



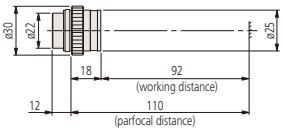
Objectives (optional)

Unit: mm

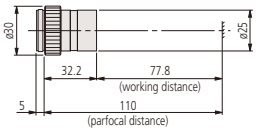
CF 1X



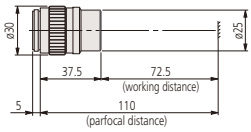
CF 2X



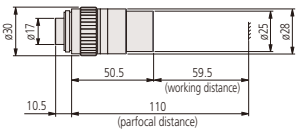
CF 3X



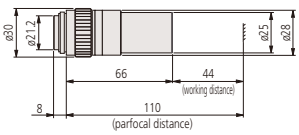
ML 3X



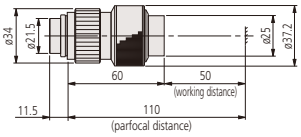
ML 5X



ML 10X



CF zoom 1X - 5X



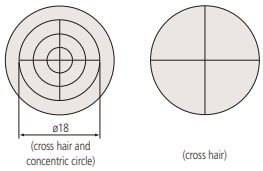
Order No.	Description		Numerical Aperture (N.A.)	Working distance W.D. (mm)	Resolution R (mm)	Depth of focus of single objective lens ±D.F. (mm)	Mass(g)
375-031	CF 1X		0.03	73.7	9.2	306	45
375-032	CF 2X		0.06	92	4.6	76	35
375-033	CF 3X		0.07	77.8	3.9	56	35
375-037-1	ML 3X		0.09	77	3.9	56	45
375-034-1	ML 5X		0.13	61	2.5	23	80
375-039	ML 10X		0.18	44	1.5	8	100
375-038	CF zoom 1X - 5X	1X	0.04	50	6.9	171	200
		3X	0.1		2.75	27	
		5X	0.1		2.75	27	

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

Fiber optic circular illumination unit (176-366)

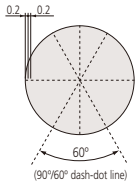
Twin-fiber optic illumination unit (176-344)

Unit: mm

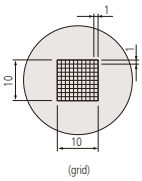


No. 375-021

No. 375-022

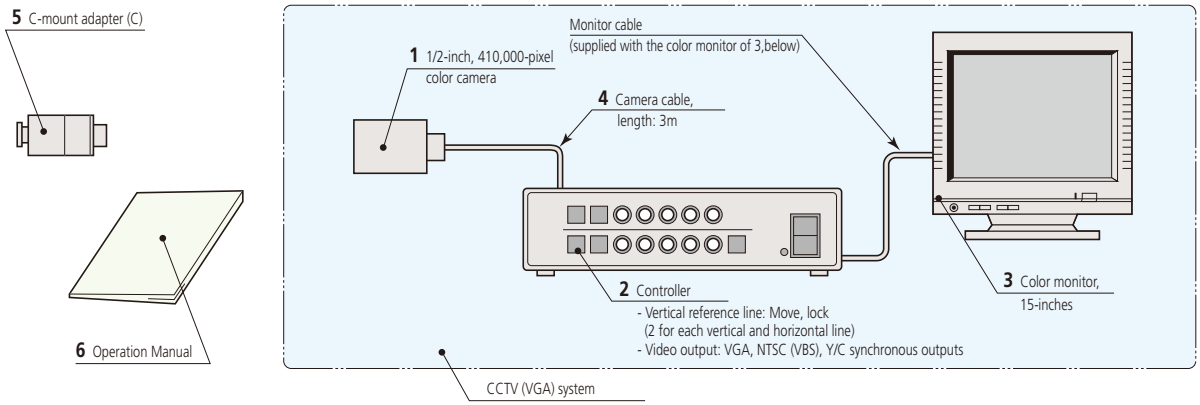


No. 375-023



No. 375-024

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



Ref. No.	Description	Qty	Remarks	
1	1/2-inch color camera	1	CCD	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)
2	Controller	1		
3	Color monitor unit	1	Manufactured by SONY	
4	Camera cable	1	Length: 3m	
5	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.

SURFTEST PROBE Surface Roughness Probe

• Roughness measurement function added to CNC CMM

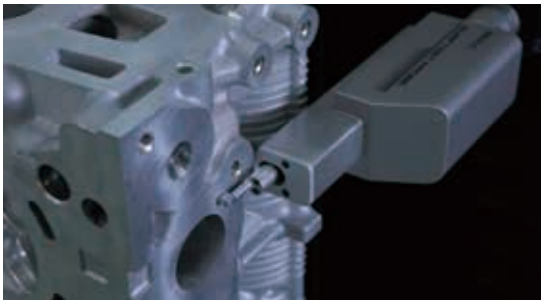
The SURFTEST PROBE is a probe that can measure surface roughness while mounted on a CNC coordinate measuring machine.
This probe uses a skid-type roughness detector that allows roughness measurement using a linear drive inside the probe. Dedicated software SURFPAK-SP is used for roughness measurement and analysis.

• Batch processing from dimensional measurement to roughness measurement

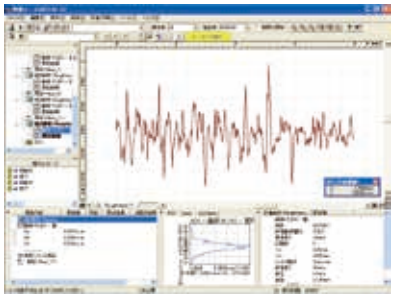
This probe allows contact roughness measurement without changing a workpiece setup on a CMM. If a SURFTEST probe is mounted on the PH10M/PH10MQ, roughness measurement of tilted surfaces is enabled by changing the probe orientation. The CMM can also use other CMM probes along with a SURFTEST probe, thus allowing fully automatic measurement from dimensions to surface roughness using the Auto Probe Changer ACR3, etc.

• Options

Thanks to the knowhow accumulated in the portable surface roughness tester SJ series, several types of surface roughness detectors are available to suit various types of workpiece.
A cleaning unit (option) is also available to clean the roughness detector should it become contaminated with coolant, etc. This allows improvement in reliability of roughness measurement.



SURFPAK-SP



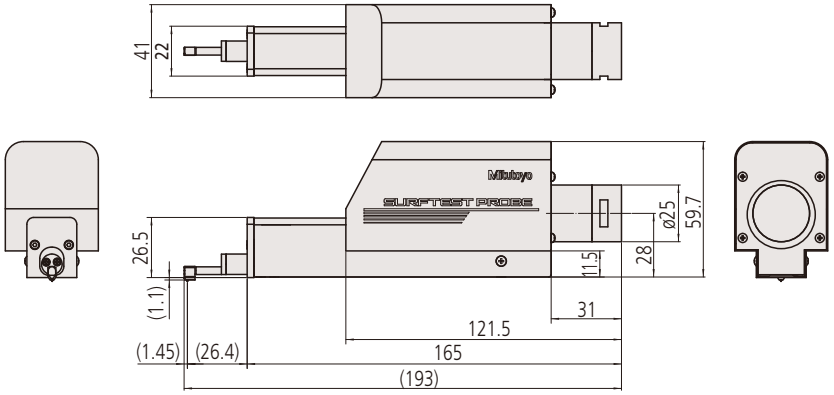
SURFPAK-SP is a software program specific to the SURFTEST surface roughness probe for a CMM, and allows surface roughness analysis conforming to standards such as ISO, JIS, ANSI and VDA. Working with MCOSMOS, fully automatic dimensional measurement and surface roughness measurement are enabled.

SURFTEST PROBE Specifications

SURFTEST PROBE	Measurement range	AUTO, 40, 100, 360μm
	Drive range	16mm
	Measuring speed	0.25, 0.5, 0.75mm/s
	Stylus tip radius	2μm
	Measuring force	0.75mN

Dimensions

Unit: mm



Configuration

Description	Qty
SURFTEST PROBE Set	1
SURFTEST PROBE main unit	
Storage box	
SURFTEST PROBE Interface unit	1
USB CBL	1
Hardware guide	1

Optional units

Essential options (SURFPAK-SP)

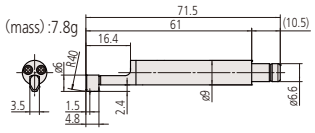
① Roughness detector	178-270 (0.75mN, 60° R2µm)
	178-280 (4mN, 90° R5µm)
② Roughness specimen	178-601 (mm)
	178-602 (inch/mm)

Option

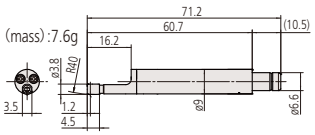
Part No.	Name
178-270	Roughness detector (0.75mN, 60° R2µm)
178-280	Roughness detector (4mN, 90° R5µm)
178-281	Roughness detector (4mN, 90° R10µm)
178-272	Small hole detector (0.75mN, 60° R2µm)
178-282	Small hole detector (4mN, 90° R5µm)
178-273	Extra small hole detector (0.75mN, 60° R2µm)
178-283	Extra small hole detector (4mN, 90° R5µm)
178-274	Deep groove detector (0.75mN, 60° R2µm)
178-284	Deep groove detector (4mN, 90° R5µm)
178-275	Gear-tooth surface detector (0.75mN, 60° R2µm)
178-285	Gear-tooth surface detector (4mN, 90° R5µm)

Optional parts

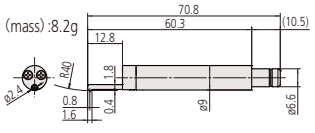
Part No.	Name
02AQJ101	Cleaning unit
02AQJ207	Calibration stage
02AQJ210	Support magnet (ACR3)



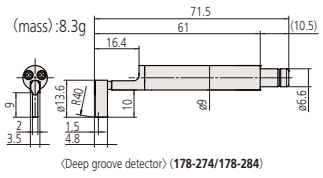
〈Roughness detector〉(**178-270/178-280/178-281**)



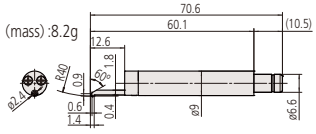
〈Small hole detector〉(**178-272/178-282**)



〈Extra small hole detector〉(**178-273/178-283**)



〈Deep groove detector〉(**178-274/178-284**)



〈Gear-tooth surface detector〉(**178-275/178-285**)

UMAP-CMM Micro Touch-trigger Probe

• A touch-trigger probe enabling measurement of very small and deep grooves and holes

This probe can measure a minute and deep hole, groove, or corner R that cannot be measured with conventional touch-trigger probes.
It can use a stylus with an ultra-small tip diameter of ø100µm or ø300µm, each extension length of which is 10mm or 16mm, achieving a very high aspect ratio. The probe can be mounted on the CRYSTA-Apex S series.

• Improvement in efficiency of setup and measurement through automatic change of a probe orientation

UMAP-CMM can be attached to a probe head such as the PH10M/PH10MQ, which features variable orientation, thus allowing fully automatic measurement of minute forms on a workpiece in arbitrary measuring directions.

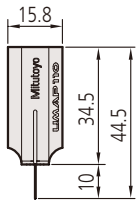
Note: A camera-mount type probe head cannot change orientation.

Stylus unit specification

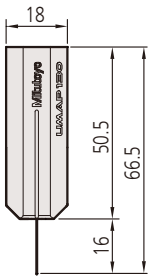
	UMAP110 Stylus unit	UMAP130 Stylus unit
Measuring direction	±X, ±Y, –Z	
Nominal ball tip diameter	ø100µm	ø300µm
Stylus nominal length	10mm	16mm
Stylus nominal diameter	ø80µm	ø200µm
Mass (including protection cover)	22g	39g
Measuring speed range*	1〜50µm/s	
Normal measuring speed	10µm/s	

* The measuring speed may differ depending on the CMM system.

Dimensions



UMAP110 Stylus unit



UMAP130 Stylus unit

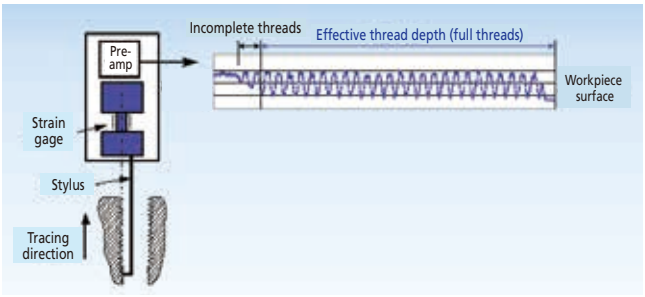
MPP-10 Effective Thread Depth Measurement Probe

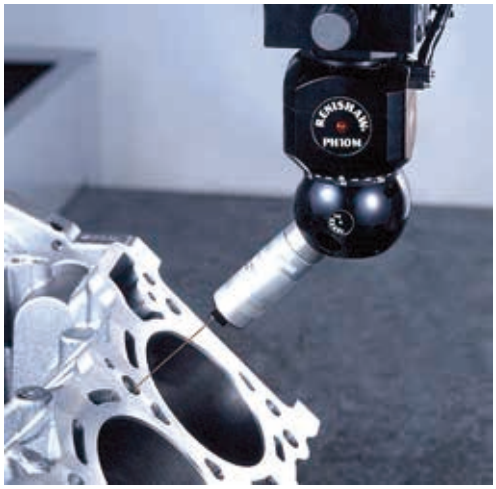
• Unique probe for measuring effective screw depth

Threaded holes, may not function well if the depth of full thread is insufficient, or extended machining time may be required, or the strength of the target workpiece may be affected if the depth is excessive. Therefore, it is very important to ensure that thread is of an appropriate effective depth. Today's general method of measuring the effective depth of a threaded hole is for the operator to manually screw a dedicated tool called a "screw gage" into the target hole to inspect the depth. However, since some automobile engine parts have more than 100 threaded holes, the screw gage method can consume a significant amount of time, contributing to excessive overhead. The MPP-10 is the only probe that has enabled automatic measurement of threaded hole effective depths using a CNC coordinate measuring machine.

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

Since the MPP-10 can be mounted on a probe head, such as the PH10M/PH10MQ, that automatically changes the probe orientation, it is capable of automatically measuring workpieces in which many threaded holes have been machined in various directions. 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.





MPP-10 Specifications

MPP-10	Threaded holes that can be inspected for depth		M4 - M20
	Maximum measurement depth	M4-M8 thread	30mm
		M4-M20 thread	60mm
	Maximum measuring speed	M4-M10 thread	10mm/sec
		M12-M20 thread	30mm/sec
	Probe outside diameter		ø25mm

TP7M High-Accuracy Touch-trigger Probe

• High-accuracy touch-trigger probes

This is a high-accuracy touch-trigger probe with a maximum repeatability of 2σ ≦ 0.25µm.

• 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.

• Suitable for use with long styli

The TP7M can mount a stylus up to 150 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 350 mm.

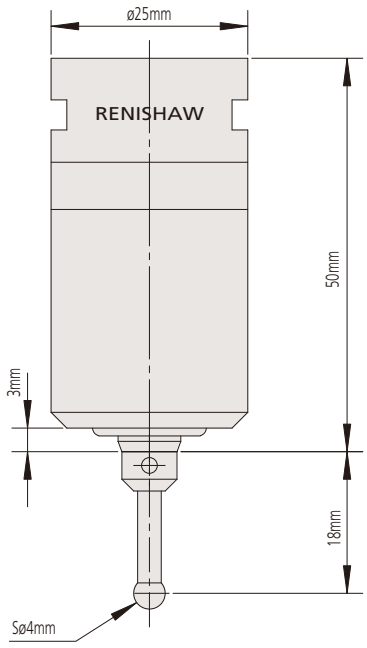
* This maximum length may vary with the coordinate measuring machine main unit being used and/or the material/diameter of the stylus itself.

TP7M Specifications

TP7M	Measuring direction		±X, ±Y, +Z
	Standard stylus		ø4X18mm
	Repeatability (2σ)		0.25µm or less (When the standard stylus is used.)
	Directionality (XY: 2D)		±0.25µm 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	±16°
		Z	±5mm
	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 thread
	Mass of a single unit		85g
	Durability		10,000,000 times
	Probe head		Essential: PH10M/PH10MQ
	Applicable models		CNC coordinate measuring machines

* Increase in stylus length or stylus mass may deteriorate the accuracy.

Dimensions



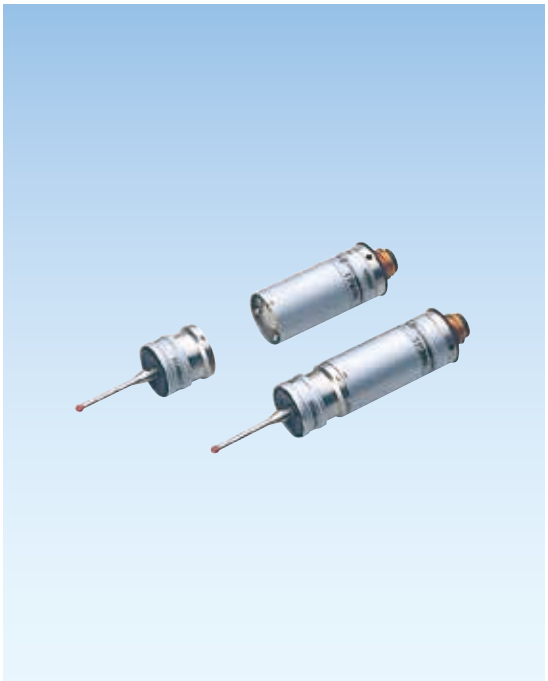
TP7M Set

Ref. No.	Description	Mass (g)	Qty
1	TP7M main unit	85	1
2	Joint key S10	24	1
3	M4 Stylus tool	3.5	2

Stylus set

Ref. No.	Description	Specification	Qty	Remarks
1	MS4-1R4.5-S	ø1×20mm (M4)	2	High-accuracy specification
2	MS4-2R8-S	ø2×20mm (M4)	2	High-accuracy specification
3	MS4-4R13.5-S	ø4×20mm (M4)	2	High-accuracy specification
4	MS4-4R33-S	ø4×50mm (M4)	1	High-accuracy specification
5	MS4-8R50C-S	Sø8×50mm (M4)	1	High-accuracy specification
6	MS4-8R100C-S	Sø8×100mm (M4)	1	High-accuracy specification
7	MS3-30C	Sø30 Ceramic ball (M3)	1	
8	MS4-EXT50C	L50 Extension (M4-M4)	2	
9	MS4-EXT30C	L30 Extension (M4-M4)	1	
10	MS4-M3EXT20	L20 Extension (M4-M4)	1	
11	MS4-M3EXT75C	L75 Extension (M4-M3)	1	
12	MS4-Stylus sensor	M4 Stylus center	1	
13	MS3-Stylus sensor	M3 Stylus center	1	
14	MS2-Stylus sensor	M2 Stylus center	1	
15	MS4-Stylus tool	M4 Stylus tool	2	
16	MS2-Stylus tool	M2, M3 Stylus tool	2	
17	MS4-M3 Adapter	M4-M3 Adapter (L9)	2	
18	MS3-M2 Adapter	M3-M2 Adapter (L5)	5	
19	Storage box		1	

TP200 Compact High-Accuracy Touch-trigger Probe



• Compact high-accuracy touch-trigger probes

This touch-trigger probe has an outside diameter as small as ø13.5 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.

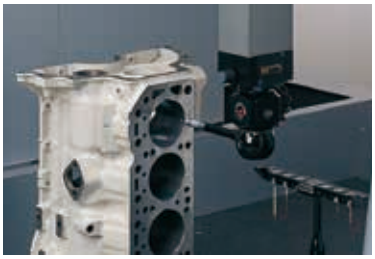
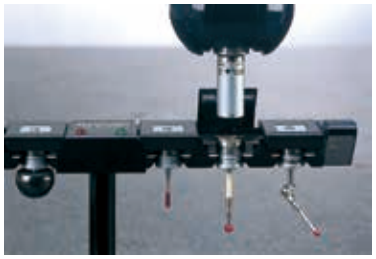
• Enhancing the setup and measurement efficiency through the automatic change of probe orientations

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 fully 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.



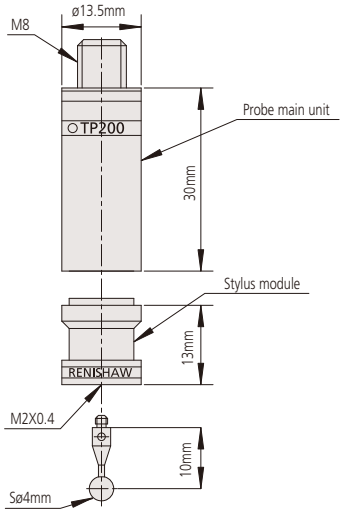




TP200 Specifications

TP200	Measuring direction		±X, ±Y, ±Z
	Repeatability (2σ)		0.3µm or less (with 10mm stylus), 0.4µm or less (with the 50mm stylus)
	Directionality (XY: 2D)		±0.4µm or less (with 10mm stylus), ±0.8µm or less (with the 50mm stylus)
	Directionality (XYZ: 3D)		±0.65µm or less (with 10mm stylus), ±1µm 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	±14°
		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		70mm (STANDARD FORCE)*
			30mm (LOW FORCE)*
	Maximum stylus mass		8g (STANDARD FORCE), 3g (LOW FORCE)
	Stylus mounting method		M2 thread
	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 ø1mm should be used with the LOW FORCE module.
SCR200 (optional)	Stylus module replacement accuracy		Repeated positioning accuracy: 1.0mm or less (through automatic change), when a 50mm stylus is used. *2.0mm or less at a manual replacement: when a 50mm stylus is used.
	Number of stylus modules that can be mounted		Maximum 6 units

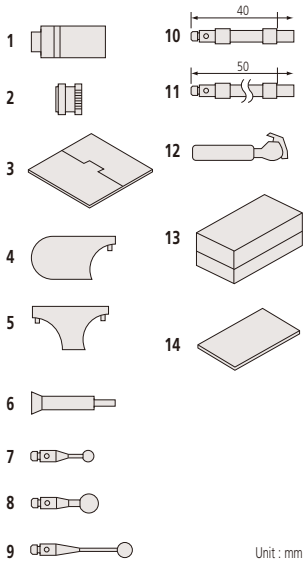
* ø1mm stylus should be used with the LOW FORCE module as well.

Dimensions



Set configuration

Unit		Ref. No.	Description	Qty	Remarks
Touch-trigger probe TP200 set	A complete set of TP200 probe	1	TP200 probe	1	
		2	Stylus module (standard)	1	Standard measuring force (at over-travel)
		3	Cleaning tool	1	For cleaning the stylus module
		4	Twin-ended wrench	1	For attaching/detaching the probe (S1)
		5	Double-ended wrench	1	For attaching/detaching the probe (S9)
		6	Stylus tool	1	For attaching/detaching the stylus (S7)
	Stylus set for TP200	7	MS2-4R10	1	Standard stylus Sø4X10(M2)
		8	MS2-6R10	1	Sø6X10(M2)
		9	MS2-4R20	1	Sø4X20(M2)
		10	MS2-EXT40G	1	Extension 40mm Carbon fiber
		11	MS2-EXT50G	1	Extension 50mm Carbon fiber
		12	Carbon extension attachment tool	1	
		13	Wooden box	1	Stylus storage box
		14	User's Manual	1	



Optional accessories Stylus module automatic changer SCR200

Automatic stylus change system kit (Order No. 06AAL540)

No.	Description	Qty	Specification (use)	Mass (kg)
1	Stylus module (low measuring force)	1	For ball stylus less than ø1	0.01
2	SCR200 kit	1	With a rack mount kit	0.93
3	PL63	1	PI200-SCR200 connection cable	0.15

TP20 Compact Touch-trigger Probe

• Compact touch-trigger probes

This touch-trigger probe has an outside diameter as small as ø13.2 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

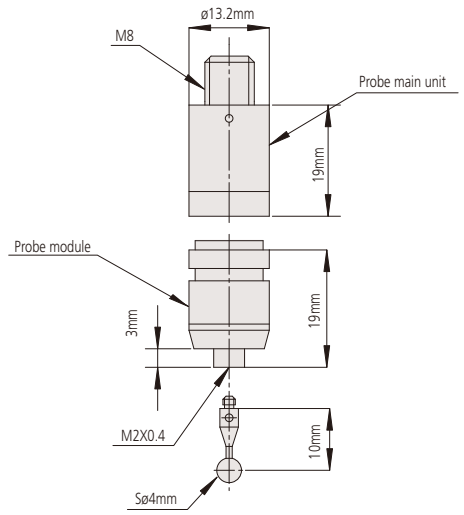
If the measurement cannot be achieved by simply changing the probe orientation (such as when it is not possible to make measurements without replacing the normal stylus with one having a different diameter or unique form), automatic stylus change via the stylus change system allows fully automatic measurement 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		±X, ±Y, +Z
	Repeatability (2σ)		0.35µm or less
	Directionality (XY: 2D)		±0.8µm or less (with the STANDARD FORCE 10mm stylus), ±2.5µm or less (with the 50mm stylus)
	Directionality (XYZ: 3D)		±1µm or less (with the STANDARD FORCE 10mm stylus), ±4µm 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
		Z	0.75N (STANDARD FORCE) 1.9N (MEDIUM FORCE)
	Amount of over-travel	XY	±14°
		Z	+4.0mm (STANDARD FORCE) +3.7mm (MEDIUM FORCE)
	Required force to achieve over-travel	XY	0.2 to 0.3N (STANDARD FORCE) 0.2 to 0.4N (MEDIUM FORCE)
		Z	3.5N (STANDARD FORCE) 7N (MEDIUM FORCE)
	Maximum stylus length		50mm (STANDARD FORCE)* 60mm (MEDIUM FORCE)*
	Stylus mounting method		M2 thread
	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
	Note:		Any stylus less than ø1mm should be used with the LOW FORCE module.
MCR20 (optional)	Probe module replacement accuracy		Repeatability positioning accuracy: 1.0mm or less (through automatic change), when a 10mm stylus is used. *2.0mm or less at a manual replacement: when a 10mm stylus is used.
	Number of stylus modules that can be mounted		Maximum 6 units

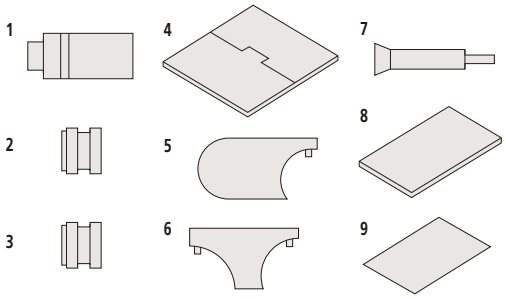
* Increase in stylus length or stylus mass may deteriorate the accuracy.

Dimensions



Set configuration

	Ref. No.	Description	Qty	Mass	Specification (use)
Touch-trigger probe TP20 set	1	TP20 probe main unit	1	13g	
	2	Probe module [STANDARD]	1	9g	Measuring force (small)
	3	Probe module [MEDIUM]	1	9g	Measuring force (medium)
	4	Cleaning tool	1	54g	For cleaning stylus module
	5	Single-ended wrench	1	5g	For attaching/detaching probe
	6	Double-ended wrench	2	5g	
	7	Stylus tool	1	1g	For attaching/detaching stylus
	8	User's Manual	1	100g	
	9	Certificate	1	1g	
				450g	Total mass including package



Optional accessories

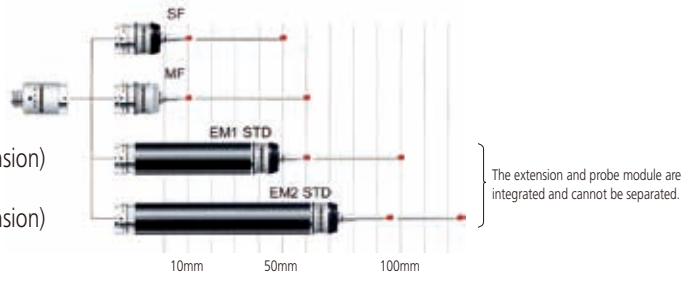
Stylus module

Standard force module

Medium force module

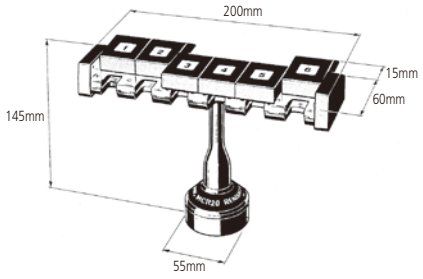
EM1 (Standard force module with extension)

EM2 (Standard force module with extension)



Probe module automatic changing system MCR20

MCR20 set	1	1.3kg	Accessories • ø2X30mm stylus • Probe module (standard force) • Mounting kit	 1 2 1



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 has an outside diameter as small as ø13.2 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

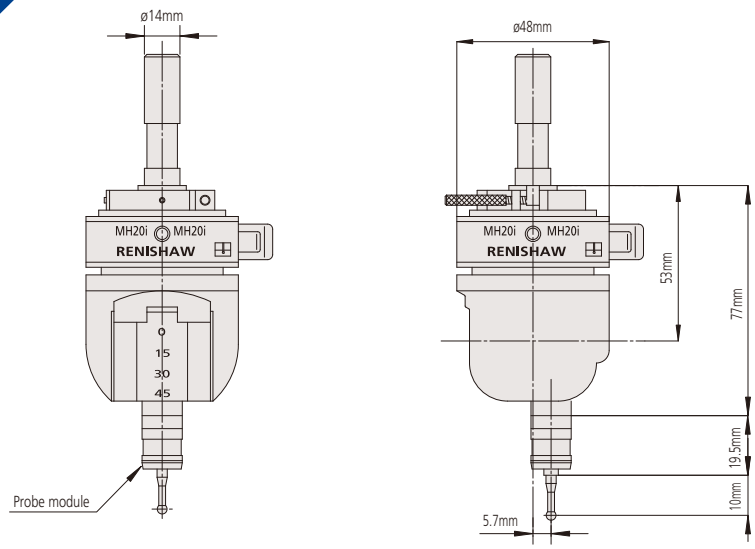
The probe head of the MH20i has a structure that not only permits its position (probe orientation) to be manually changed but also provides a maximum of 168 orientations (at a positioning repeatability $\sigma \leq 1.5\mu m$). Even for measurement of a complex three-dimensional form that requires repeated 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		±X, ±Y, +Z
	Position change		Manually for A axis (vertical direction): 0 to 90° (at 15° increments), and for B axis (horizontal direction): ±180° (at 15° increments)
	Repeated positioning accuracy		$\sigma \leq 1.5\mu m$
	Repeatability (2σ)		0.35µm or less (with the STANDARD FORCE 10mm stylus)
	Directionality (XY: 2D)		±0.8µm or less (with the STANDARD FORCE 10mm stylus), ±2.5µm or less (with the 50mm stylus)
	Directionality (XYZ: 3D)		±1µm or less (with the STANDARD FORCE 10mm stylus), ±4µm 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
		Z	0.75N (STANDARD FORCE) 1.9N (MEDIUM FORCE)
	Amount of over-travel	XY	±14°
		Z	+4.0mm (STANDARD FORCE) +3.7mm (MEDIUM FORCE)
	Required force to achieve over-travel	XY	0.2 to 0.3N (STANDARD FORCE) 0.2 to 0.4N (MEDIUM FORCE)
		Z	3.5N (STANDARD FORCE) 7N (MEDIUM FORCE) 10N (EXTENDED FORCE)
	Maximum stylus length		50mm (STANDARD FORCE)* 60mm (MEDIUM FORCE)*
	Stylus mounting method		M2 thread
	Mass of a single probe unit		250g
	Durability		1,000,000 times
	Probe head		N/A
	Applicable models		Manual/CNC coordinate measuring machines
	Note:		Any stylus less than ø1mm should be used with the LOW FORCE module.

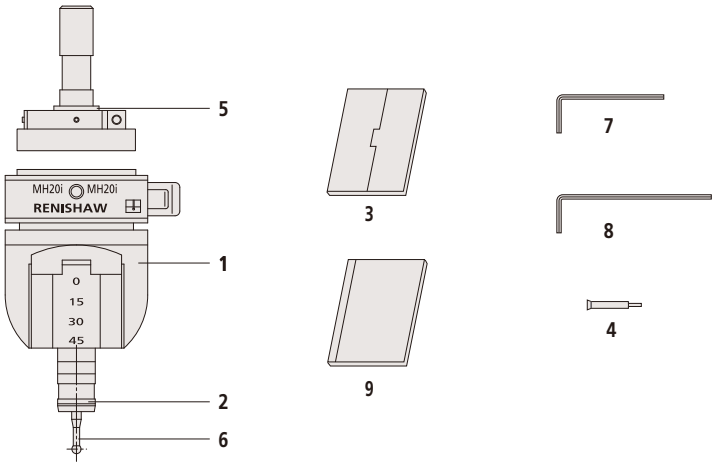
* Increase in stylus length or stylus mass may deteriorate the accuracy.

Dimensions



Set Configuration

Unit	Ref. No.	Description	Qty	Mass (kg)	Remarks
MH20i single unit	1	MH20i	1	0.25	
	2	Probe module	1	0.01	STANDARD TYPE
	3	Cleaning tool	1	0.05	For cleaning the stylus module
	4	MS2-stylus tool	1	0.003	For attaching/detaching the stylus
MH20i set	5	Positioning shank	1	0.15	
	6	Stylus	1	0.001	ø4X10 (standard stylus)
	7	Allen key (2mm)	1	0.001	
	8	Allen key (3mm)	1	0.001	
	9	User's Manual	1	0.1	



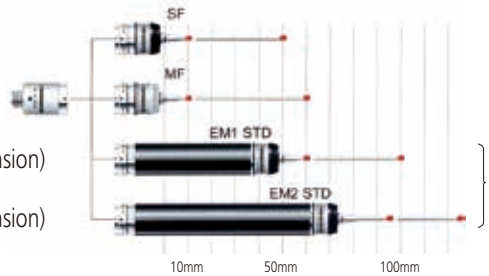
Optional accessories Stylus module

Standard force module

Medium force module

EM1 (Standard force module with extension)

EM2 (Standard force module with extension)



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

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 has an outside diameter as small as ø13.2 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 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.

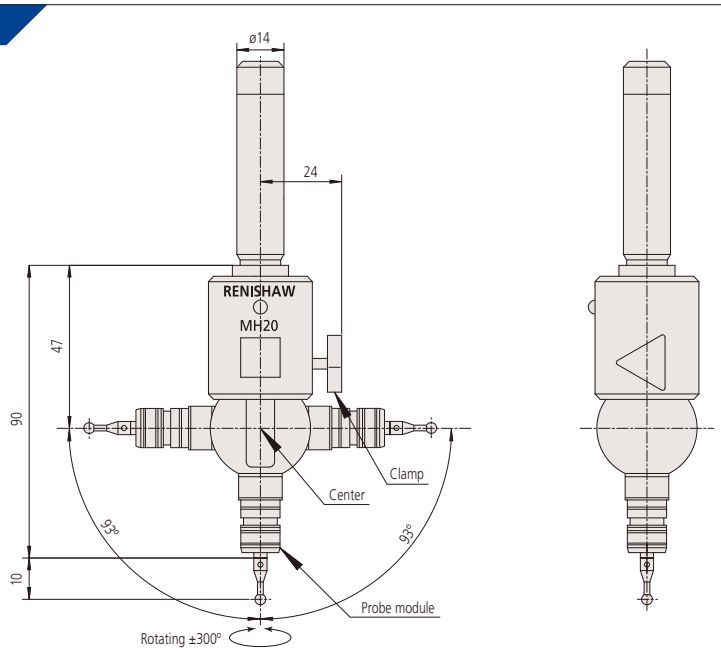
MH20 Specifications

MH20	Measuring direction		±X, ±Y, +Z
	Position change		Manually for A axis (vertical direction): ±93°, and for B axis (horizontal direction): Adjustment in range of ±300°
	Repeatability (2σ)		0.35µm or less (with the STANDARD FORCE 10mm stylus)
	Directionality (XY: 2D)		±0.8µm or less (with the STANDARD FORCE 10mm stylus), ±2.5µm or less (with the 50mm stylus)
	Directionality (XYZ: 3D)		±1µm or less (with the STANDARD FORCE 10mm stylus), ±4µm 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
		Z	0.75N (STANDARD FORCE) 1.9N (MEDIUM FORCE)
	Amount of over-travel	XY	±14°
		Z	+4.0mm (STANDARD FORCE) +3.7mm (MEDIUM FORCE)
	Required force to achieve over-travel	XY	0.2 to 0.3N (STANDARD FORCE) 0.2 to 0.4N (MEDIUM FORCE)
		Z	3.5N (STANDARD FORCE) 7N (MEDIUM FORCE)
	Maximum stylus length		50mm (STANDARD FORCE)* 60mm (MEDIUM FORCE)*
	Stylus mounting method		M2 thread
	Mass of a single probe unit		22g (Probe body: 13g, Probe modulel: 9g)
	Durability		1,000,000 times
	Applicable models		Manual/CNC coordinate measuring machines
	Note:		Any stylus less than ø1mm should be used with the LOW FORCE module.

* Increase in stylus length or stylus mass may deteriorate the accuracy.

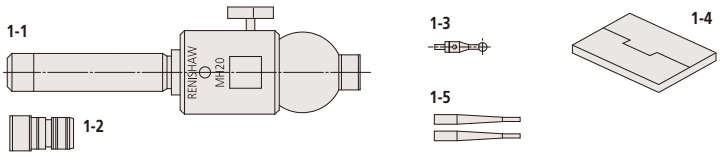
Dimensions

Unit : mm



Set Configuration

Unit	No.	Description		Qty	Mass (kg)	Remarks
MH20-set standard configuration	1	MH20 kit	**1-1** MH20	1	0.3	Probe head main unit
			1-2 TP20 standard module	1		Measuring force (small)
			1-3 Stylus	1		Sø4X10 (standard stylus)
			1-4 Cleaning kit	1		For cleaning the probe module connection
			1-5 MS2-stylus tool	2		Stylus attachment tool
	2	User's Manual		1	0.1	
	3	Certificate		1	0.01	



PH10M/PH10MQ Motorized Probe Head

• Enhancing measurement efficiency through automatic probe indexing

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 recalling the position from memory, if it was 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 the target point may be obstructed because the unused stylus would collide 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 indexing to 720 positions

Since the PH10M/PH10MQ can set the attached probe to a maximum of 720 different positions, 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 $2\sigma \leq 0.5\mu m$, it does not require re-calibration for measurement in which the same position must be repeatedly called.

• Possible to mount various kinds of probe

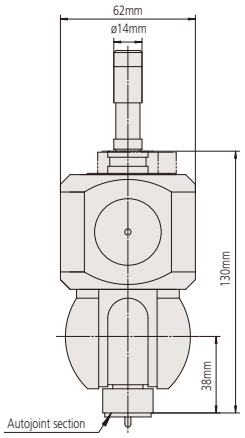
This head can mount various probes including, but not limited to, a touch-trigger probe, scanning probe, vision probe, laser probe, and thread depth measuring probe. Furthermore, these probes can be easily interchanged by means of the probe changer (optional), which enables fully automatic measurement on a wide range of measurement objects.

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

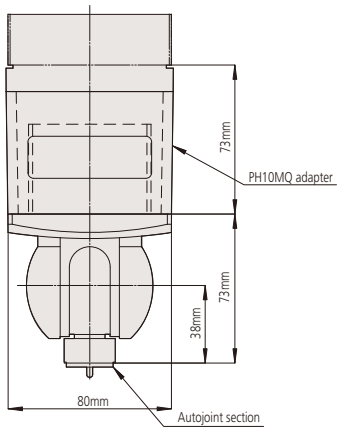
PH10M/PH10MQ Specifications

PH10M/PH10MQ	Position change	Horizontal direction	±180° (at 7.5° increments, 48 positions)
		Vertical direction	0 to 105° (at 7.5° increments, 15 positions)
	Repeated positioning accuracy	$2\sigma \leq 0.4\mu m$	
	Extension	PEM1, PEM2, PEM3, PAA1, PAA2, PAA3 More than one extension cannot be joined for use. However, combined use of PAA+PECF1, PAA1+PECF2, and PAA1+PECF3 are permitted. Use on an extension is not permitted for the Surface Measure 606/QVP.	
	Applicable models	CNC coordinate measuring machines	
	Durability	1,000,000 times	

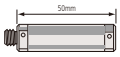
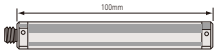
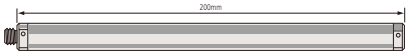
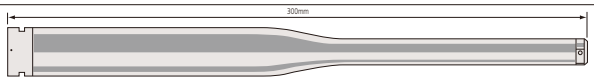
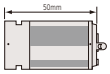
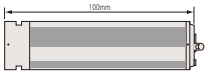
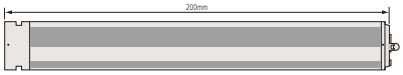
PH10M dimensions



PH10MQ dimensions

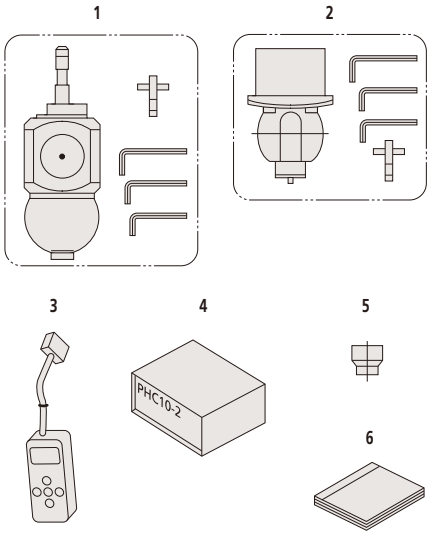


Extensions

Model	Dimension	Remarks
PAA1		For TP200/TP20
PECF1		For TP200/TP20
PECF2		For TP200/TP20
PECF3		For TP200/TP20
PAA3		For TP200/TP20
PEM1		For SP25M/TP7M
PEM2		For SP25M/TP7M
PEM3		For TP7M

Set configuration

No.	Description		Qty	Remarks	Mass (kg)
1	PH10M head set	PH10M head	1		2.0
		Joint key S10			
		Allen key (nominal 1.5)			
		Allen key (nominal 2)			
		Allen key (nominal 2.5)			
2	PH10MQ head set	PH10MQ head	1		2.0
		Joint key S10	1		
		Allen key (nominal 1.5)	2		
		Allen key (nominal 2.5)	1		
3	HCU-1		1	Controller for positioning the probe head	0.8
4	PHC10-2 (RS232C)		1	Interface with the machine-side CPU (for error display)	2.2
5	PAA1		1	Adapter for mounting the TP200 onto the PH10M	0.06
6	User's Manual		1	User's Manual for PH10M head	0.1



MIH Manual Probe Head

• High-accuracy positioning in a maximum of 720 orientations

The MIH permits the mounted probe orientation to be manually indexed to a maximum of 168 different positions with a repeatability of $2\sigma \leqq 0.15\mu m$. 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 overall. The current position can of course be confirmed on the LCD display of the MIH main unit.

• Probe extensions up to 300 mm long

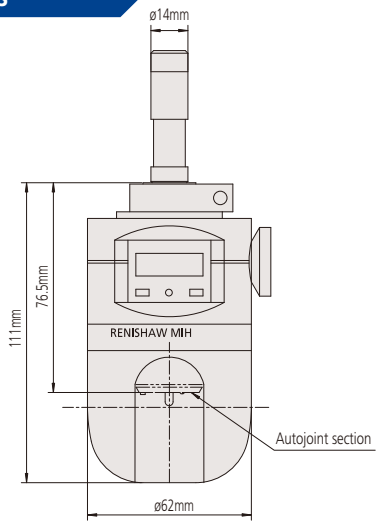
The MIH can employ any probe extension up to a maximum of 300 mm long. An example combination of the TP2-5W and a 50 mm stylus can extend the probe's reach to approximately 400 mm.

MIH Specifications

MIH	Position change	Horizontal direction	±180° (at 7.5 increments, 48 positions)
		Vertical direction	0 to 105° (at 7.5 increments, 15 positions)
	Repeated positioning accuracy	$\sigma \leqq 1.5\mu m$	
	Mountable probe	TP200*, TP20, TP-2-5W	
	Extension	PECF1, PECF2, PECF3	
	Applicable models	Manual coordinate measuring machines	

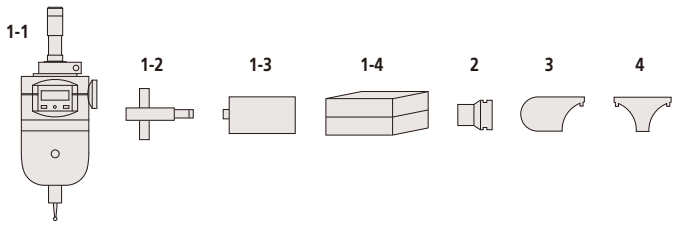
* Interface(PI200) is required separately.

Dimensions

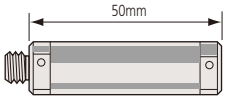
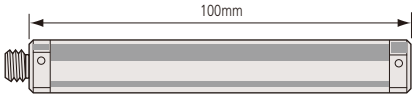
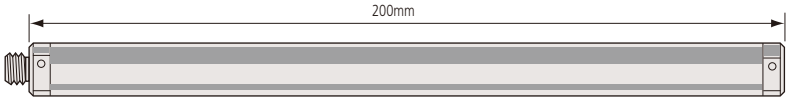


Set configuration

No.	Description		Mass (kg)	Qty	Remarks
1	MIH head kit set	**1-1** MIH head	1.5	1	Traveling angle:Horizontal (B axis) ±180° (7.5° steps, 48 positions) Vertical (A axis) 0 to 105° (7.5° steps, 15 positions)
					Spatial positioning accuracy: ±0.3mm (where PAA1+TP2-5W+ø3 stylus+EWL7.5 is used)
					Repeated positioning accuracy (σ): 1.5µm (in the same case as above)
					Mass: Approx. 730g
		1-2 Joint key S10		1	For attaching the probe
		Allen key (nominal 2)		1	For adjusting the positioning block, or battery replacement
		Allen key (nominal 2.5)		1	For attaching the shank
		1-3 Battery PX28L		2	6V lithium battery (Manufacturer: Duracell, Compatible battery 4SR44 (Manufacturer: Panasonic)
		1-4 Wooden box for MIH		1	
2	PAA1		0.06	1	Adapter for connecting the MIH and probe. Length: 32mm
3	Single-ended wrench		0.01	1	For fastening the TP2 and extension
4	Double-ended wrench		0.005	1	For fastening the TP2 and extension
5	Positioning shank		0.14	1	To be attached on the MIH head (Manufacturer: Mitutoyo)
6	Certificate		0.001	1	
7	User's Manual		0.05	1	



Optional accessories Extensions

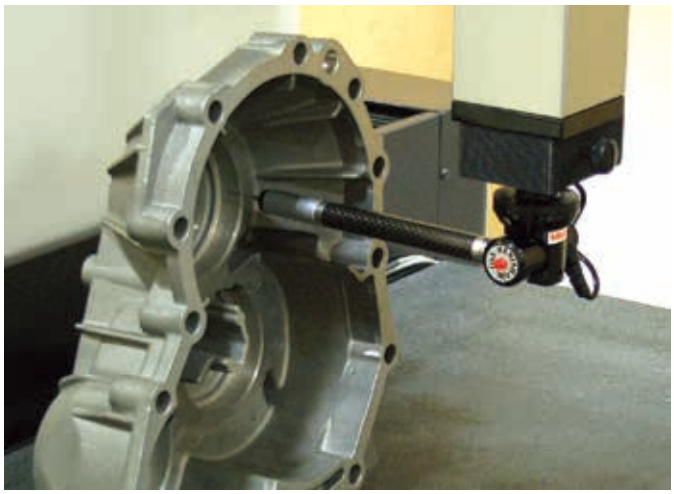
PECF1	
PECF2	
PECF3	

PH1 Manual Probe Head

• Manual probe head
Manual probe head for use with the TP200 and TP20.

• Easy position change
The operator can change the probe orientation by hand.

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



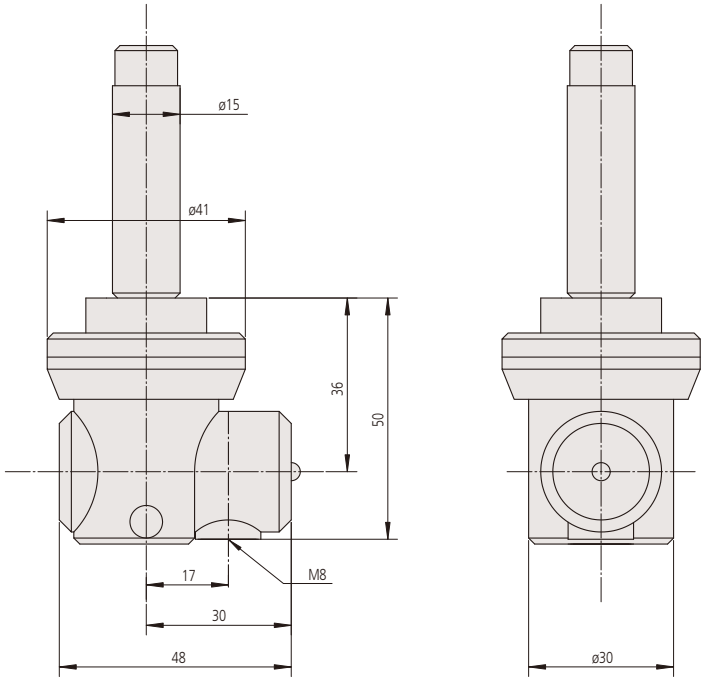
PH1 Specifications

PH1	Position change	Horizontal direction	360° (at 15° increments) Possible in a non-stop manner, if the head is rotated along with the ø14mm shank unit.
		Vertical direction	±115° (non-step)
	Mountable probe	TP200, TP20	
	Extension	PECF1, PECF2, PECF3	
	Applicable models	Manual/CNC coordinate measuring machines	

* Interface(PI200) is required separately.

Dimensions (when mounted on the TP2-5W)

Unit : mm



Optional accessories Extensions

PECF1	50mm
PECF2	100mm
PECF3	200mm

An example connection of PECF3

REVO High-speed 5-axis Control Scanning Head

• Ultra-high-speed 5-axis scanning

This scanning head allows ultra-high-speed scanning at up to 500mm/s. With simultaneous control of a total of 5 axes (3 axes <X, Y and Z> on a CMM and 2 axes <A and B> on REVO), the CMM can perform non-step scanning of complex forms on a workpiece.
Various measurement operations specific to REVO are also available.
The use of a rotary encoder allows unlimited angle positioning (at a resolution of 0.08 sec). This enables easy access to a complicated workpiece, leading to a reduction of programming and measuring time periods.
The REVO probe is only available on the dedicated CRYSTA-Apex EX 1200R series.

REVO Specifications

REVO	Rotation angle (Pitch angle)	Vertical (A-axis)	–5°～+120° (0.08 sec)
		Horizontal (B-axis)	∞ (0.08 sec)
	Maximum stylus length		500mm (Distance from probe rotation center to stylus tip)*

* An increase in the length and mass of a stylus may reduce the accuracy.

PH20 5-axis Control Touch-trigger Probe System

• Effective measurement of a complex workpiece using stylus movement

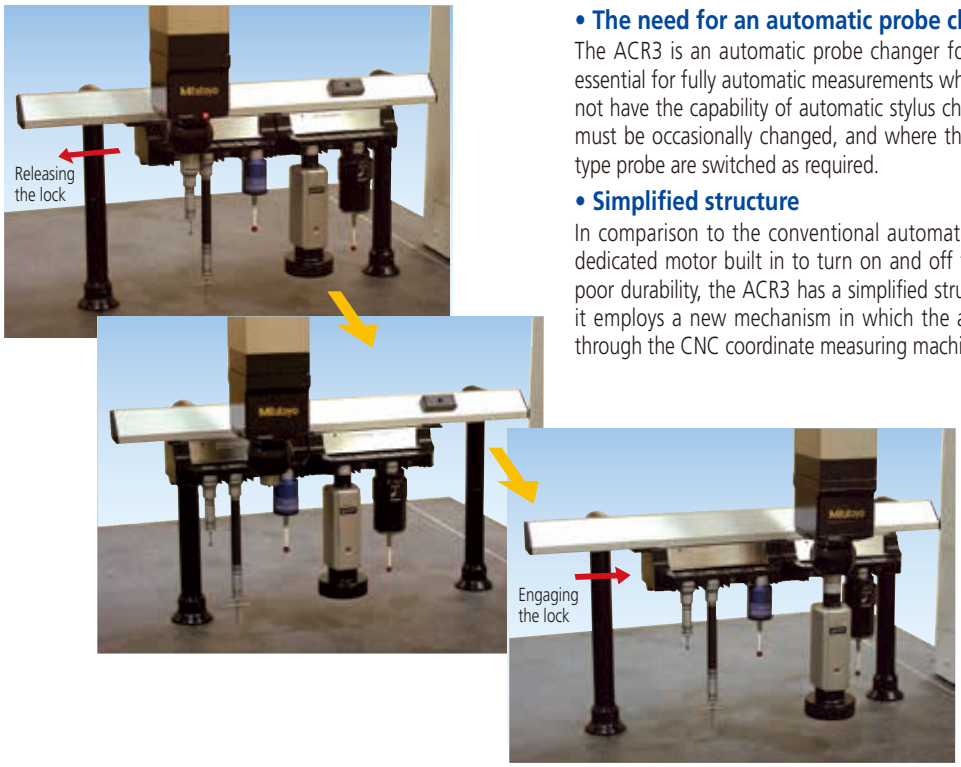
The PH20 head can position a touch-trigger probe at any angle, allowing unique "head touch" probing. This system has the advantage of measuring tilted surfaces and small, deep holes. There is no fear of interference from the stylus shank during measurement of a deep hole.
5-axis operation reduces the time required for probe rotational movements and supports 'head touch' operation for quick point measurement.
The system also supports the module changer using TP20 standard modules.
Even without the workpiece to be measured, a measurement program can be created on a PC using 3D CAD data. Compared to joystick operation, this makes for more efficient programming and also allows interference checking.
The PH20 probe is only available on the CRYSTA-Apex EX T series.

PH20 Specifications

PH20	Rotation angle (Pitch angle)	Vertical (A-axis)	–115°～+115° (0.08 sec)
		Horizontal (B-axis)	∞ (0.08 sec)
	Maximum stylus length		50mm※

* An increase in the length and mass of a stylus may deteriorate the accuracy.

ACR-3



• The need for an automatic probe changer

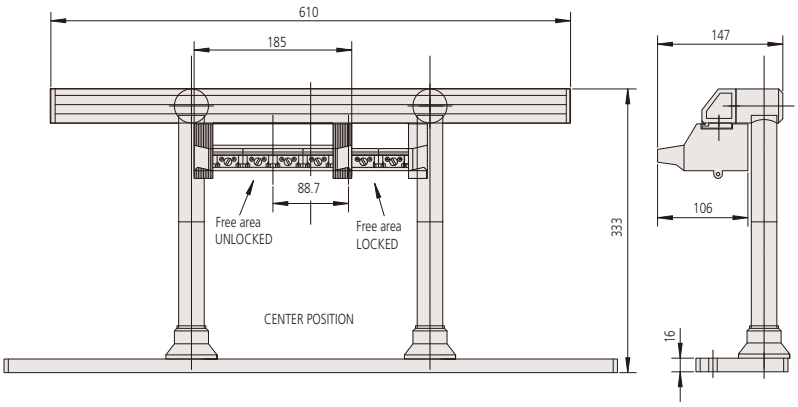
The ACR3 is an automatic probe changer for use with the PH10M/PH10MQ. It is essential for fully automatic measurements where the currently employed probe does not have the capability of automatic stylus change but the stylus diameter or length must be occasionally changed, and where the contact-type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

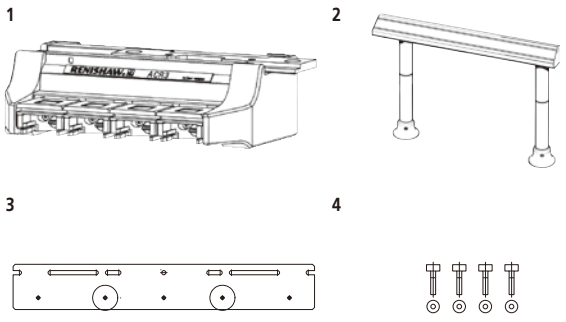
Dimensions

Unit : mm



Set configuration

Unit	Ref. No.	Description	Qty	Mass (kg)	Remarks
ACR3 4-port system	1	ACR3	1	1.5	4-port rack
	2	MRS KIT2	1	3.5	Rack base
	3	Auxiliary plate	1	8	For fixture
	4	ACR3 attachment	1	0.05	Attachment
	5	User's Manual	1	0.1	
	6	Control ROM	1	0.01	Adaptive to ACR3
ACR3 8-port system	1	ACR3	2	1.5	4-port rack
	2	MRS KIT2	1	3.5	Rack base
	3	Auxiliary plate	1	8	For fixture
	4	ACR3 attachment	1	0.05	Attachment
	5	User's Manual	1	0.1	
	6	Control ROM	1	0.01	Adaptive to ACR3



Quick guide to styli

The choice of stylus has an important effect on the accuracy of measurement obtainable from a CMM. Here is a quick guide on how to select a stylus.

The stylus is the part of a probe that makes contact with a workpiece, generally consisting of a stem and a ball tip. The probe functions by bringing the ball into contact with a workpiece to acquire a measurement from the resulting signal. The form and dimensions of a stylus need to be selected depending on the workpiece. In any case, it is important that a stylus has high rigidity and its tip shape is a practically perfect sphere.

• Selection of a stylus

It is recommended that a stylus be selected on the basis of the following factors to ensure the highest accuracy of measurement.

1. Choose the shortest stylus possible.

The longer a stylus, the more it will flex, and lower accuracy will result. Also, the positional accuracy of the probe is inversely proportional to the distance from the probe pivot to the stylus ball, therefore the shortest probe gives the highest accuracy.

2. Reduce the number of joints wherever possible.

The combination of styli and use of extensions will increase the possibility flexure. Use the fewest possible components for any application.

3. Use a ball tip as large as possible.

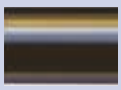
The use of a larger ball increases the clearance between the ball and stem, thus reducing the possibility of contact between the stem and workpiece (shanking). A larger ball also reduces the influence of the surface finish of a workpiece on measurement accuracy.

• Material

A stylus uses an appropriate material for its shaft, ball and other accessories according to the application. The following introduces the features and merits of commonly used materials.

1. Stem

To minimize flexure, the stem needs to be as stiff as possible. Mitutoyo offers the following materials:



• Tungsten carbide

This material provides excellent rigidity for small stem diameters, thus being optimal for most standard applications. Consideration should be given to the stylus mass in the case of large stem diameter and long stylus length.

• Stainless steel

Non-magnetic stainless steel stems offer the best stiffness to mass ratio.

• Ceramic

This material is mainly used for styli because of its high stiffness to mass ratio. It has excellent thermal stability and is not affected by the temperature environment, thereby allowing higher accuracy measurement.

• Carbon fiber

Carbon fiber is a material appropriate for long styli since the mass of a carbon fiber stylus is approximately 20% of that of a carbide stylus. Thanks to excellent thermal stability, a carbon fiber stylus is barely affected by the operating environment.

2. Ball Tip

Selection of the most suitable ball tip material involves taking the measuring procedure and workpiece material into account.

• Ruby

A ruby ball provides a particularly hard, smooth surface, featuring high compressive strength and excellent mechanical wiping.
A ruby is appropriate as a ball material for scanning diverse workpieces, but may cause abrasion during the scanning measurement of aluminum and cast iron. In this case, it is advisable to use other materials as listed below.

• Silicone nitride

Silicon nitride, which is similar to ruby, is a ceramic material that provides high hardness and strong resistance to abrasion. Since silicon nitride will not fuse with aluminum, so will not cause adhesive wear like ruby. However, it is recommended that a silicon nitride ball be used only for aluminum workpieces due to a marked susceptibility to abrasion on steel surfaces. Note: This material is available by custom order.

• Zirconia

Zirconia is a ceramic material that demonstrates a particularly outstanding hardness and has hardness and abrasion characteristics equivalent to a ruby. A zirconia ball is optimal for scanning cast iron workpieces because of its non-abrasive characteristics with this material. Note: This material is available by custom order.

• Calibration

Even if a stylus appropriate for a workpiece is selected, an accurate measurement result will not be obtained unless the probe to be used is calibrated prior to measurement, which involves probing a master reference sphere in a defined sequence so that the CMM software can establish the ball tip and probe/stylus characteristics.

• Calibration mechanism

The CMM calculates the center position and diameter of each stylus ball using the specific probe calibration program.
This program uses CMM measurements made of the reference sphere with each configured stylus ball to determine the true diameters of the balls and stores the measured data in the software. The precise diameter of the reference sphere is known from a previous calibration measurement and is also stored for use in the calculations. As a workpiece may be measured from every direction, a stylus is calibrated with measurements at multiple points on the reference sphere. A scanning system needs to obtain a large number of points for calibration. With these procedures observed, the effective diameter for each stylus ball and the center positions of the stylus balls in the machine coordinate system are set to enable accurate measurement.

• Notes on using styli

- Inaccuracies can occur depending on the stylus length and mass and the drive speed and acceleration of the probe. Due consideration should be given to the type of probe when setting measuring speed for long and/or heavy styli for scanning measurements.
- A disk stylus consists of the center section of a sphere and is used to measure edges and undercuts on a workpiece. This type of stylus is actually used only for X- and Y-direction measurement due to its shape. It cannot be used for Z-direction measurement. Also, this stylus must be used in conjunction with a stylus changer.
- There are restrictions on the use of a cylinder stylus, again because of its shape..
- For details about restrictions, contact a Mitutoyo sales office.
- Styli are classified in M2 to M5 series, which refers to the fixing thread size of a probe.
  The use of a conversion adapter, etc. may allow a stylus with a different thread size to be mounted. In this case, refer to the instruction manual of the probe on which to mount the stylus to select the stylus configuration compatible with the probe specification. Contact your local Mitutoyo sales office if you have any questions about the mounting method.

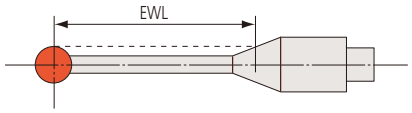
■ Product Identification on Styli for Coordinate Measuring Machines

From each Mitutoyo styli the approximate form can be identified (see below).

1 Ball styli

MS 2 - 0.5 R 3 C

- MS: Mitutoyo-manufactured stylus
- 2: Diameter of mounting screw
- 0.5: Diameter of ball tip
- R: Material of probe tip — R: ruby
- 3: Effective length (EWL)
- C: Material of bar — C: Ceramic; None: Other

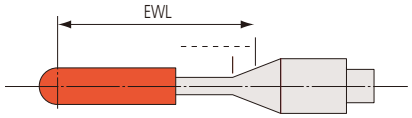


EWL: Effective working length is the distance from the centre of the ball to the point on the stem that is the same diameter as the ball.

2 Cylindrical styli

MS 2 - CY 3 R 6

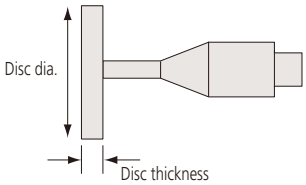
- MS: Mitutoyo-manufactured stylus
- 2: Diameter of mounting screw
- CY: Cylinder
- 3: Diameter of cylinder
- R: Material of probe tip — R: ruby; H: Carbide; -: other
- 6: Effective length (EWL)



3 Disc styli

MS 2 - DISC 12 - 2

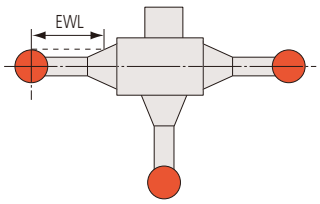
- MS: Mitutoyo-manufactured stylus
- 2: Diameter of mounting screw
- DISC: Disc
- 12: Diameter of disc
- 2: Thickness of disc
- Material of probe tip — R: ruby; -: material other than ruby



4 Cross-styli

MS 2 - STAR 2 R 2.5

- MS: Mitutoyo-manufactured stylus
- 2: Diameter of mounting screw
- STAR: Cross-stylus
- 2: Diameter of ball
- R: Material of probe tip — R: ruby; -: material other than ruby
- 2.5: Effective length (EWL)

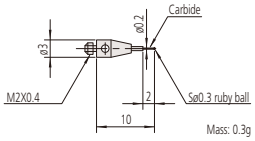


5 Other accessories

1. Point stylus	MS2-PO ("-H" will be added when the probe tip is carbide.)
2. Extension	MS2-EXT10 (the figure at the end represents the length. "G" is appended if the bar is carbon fiber, and "C" is appended if the bar is ceramic.)
3. Stylus knuckle	MS2-stylus knuckle (an adapter for turning the stylus to the optional angle.)
4. Stylus center	MS-stylus center (an adapter to allow the styli to be mounted so they can be oriented in directions crossing each other.)

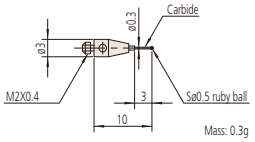
■ Stylus (Mounting Thread M2)

Order No. : 06ABN751
Description : MS2-0.3R2



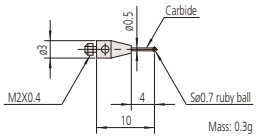
- Use with a measuring force 0.4N or less.
- Cannot be mounted on TP200.
- This stylus may have a short life compared with normal styli.

Order No. : 06ABN752
Description : MS2-0.5R3



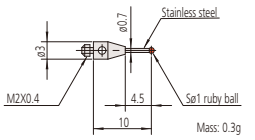
- This stylus may have a short life compared with normal styli.
- Not recommended for mounting on TP200, otherwise an input error may result.

Order No. : 06ABN753
Description : MS2-0.7R4

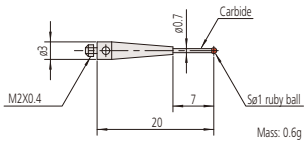


- This stylus may have a short life compared with normal styli.

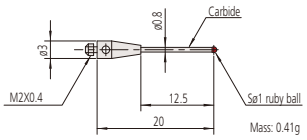
Order No. : 06ABN754
Description : MS2-1R4.5



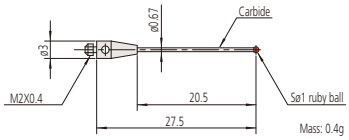
Order No. : 06ABN755
Description : MS2-1R7



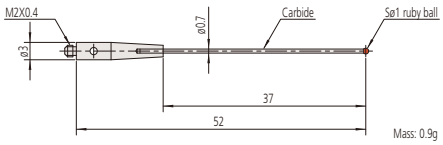
Order No. : 06ABN756
Description : MS2-1R12.5



Order No. : 06ABN757
Description : MS2-1R20.5

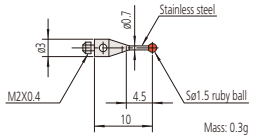


Order No. : 06ABF409
Description : MS2-1R37

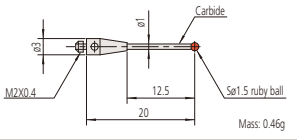


- Cannot be mounted on TP200.
- Not recommended for mounting on TP20, otherwise an input error may result.

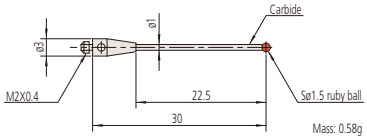
Order No. : 06ABN758
Description : MS2-1.5R4.5



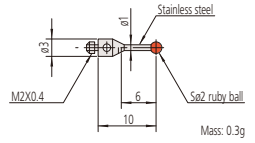
Order No. : 06ABN759
Description : MS2-1.5R12.5

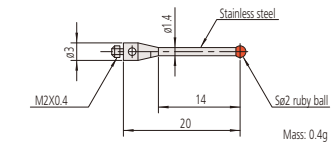
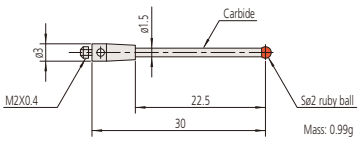
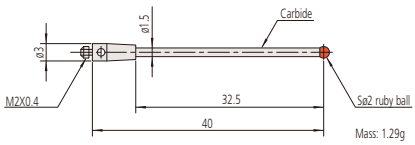
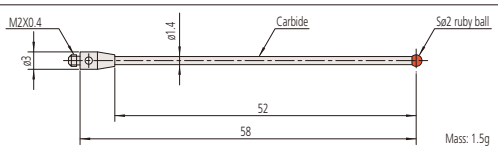
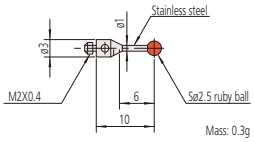
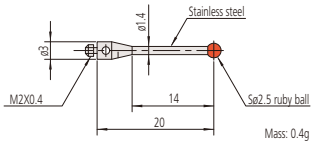
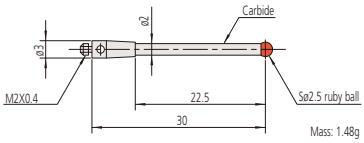
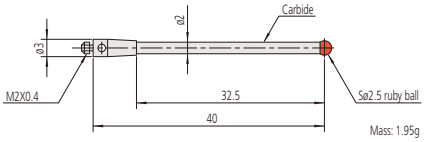
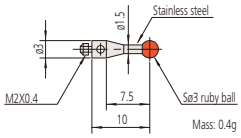
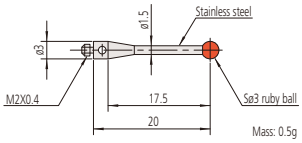
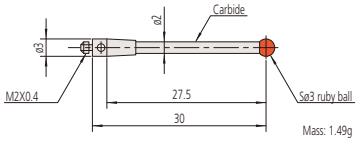
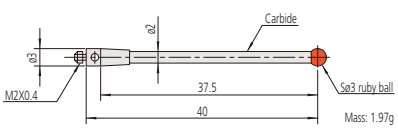
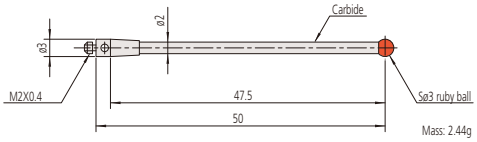


Order No. : 06ABN760
Description : MS2-1.5R22.5

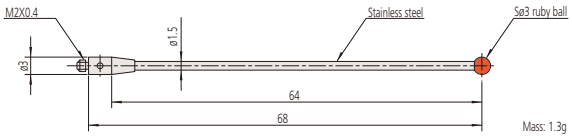


Order No. : 06ABN761
Description : MS2-2R6



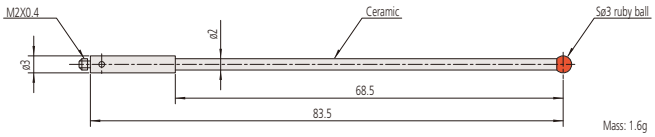
Order No. : 06ABN762 Description : MS2-2R14		
Order No. : 06ABN763 Description : MS2-2R22.5		
Order No. : 06ABN764 Description : MS2-2R32.5		• Cannot be mounted on TP200.
Order No. : 06ABF406 Description : MS2-2R52		• Cannot be mounted on TP200. • Not recommended for mounting on TP20, otherwise an input error may result.
Order No. : 06ABN765 Description : MS2-2.5R6		
Order No. : 06ABN766 Description : MS2-2.5R14		
Order No. : 06ABN767 Description : MS2-2.5R22.5		
Order No. : 06ABN768 Description : MS2-2.5R32.5		• Cannot be mounted on TP200.
Order No. : 06ABN769 Description : MS2-3R7.5		
Order No. : 06ABN770 Description : MS2-3R17.5		
Order No. : 06ABN771 Description : MS2-3R27.5		
Order No. : 06ABN772 Description : MS2-3R37.5		• Cannot be mounted on TP200.
Order No. : 06ABN773 Description : MS2-3R47.5		• Cannot be mounted on TP200. • Not recommended for mounting on TP20, otherwise an input error may result.

Order No. : 06ABF402
Description : MS2-3R64



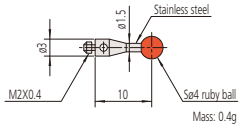
- Cannot be mounted on TP200.
- Not recommended for mounting on TP20, otherwise an input error may result.

Order No. : 06ABF405
Description : MS2-3R68.5C

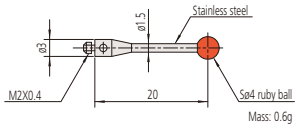


- Cannot be mounted on TP200.
- Not recommended for mounting on TP20, otherwise an input error may result.

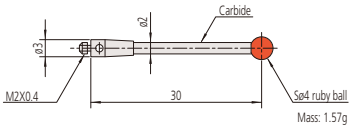
Order No. : 06ABN774
Description : MS2-4R10



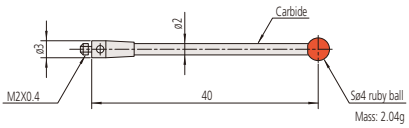
Order No. : 06ABN775
Description : MS2-4R20



Order No. : 06ABN776
Description : MS2-4R30

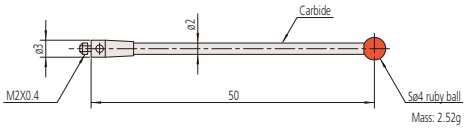


Order No. : 06ABN777
Description : MS2-4R40



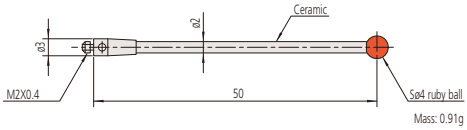
- Cannot be mounted on TP200.

Order No. : 06ABN778
Description : MS2-4R50

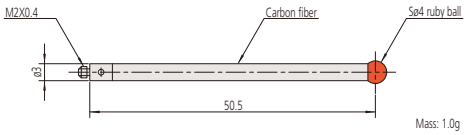


- Cannot be mounted on TP200.
- Not recommended for mounting on TP20, otherwise an input error may result.

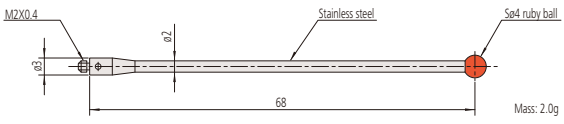
Order No. : 06ABN779
Description : MS2-4R50C



Order No. : 06ABQ341
Description : MS2-4R50.5G

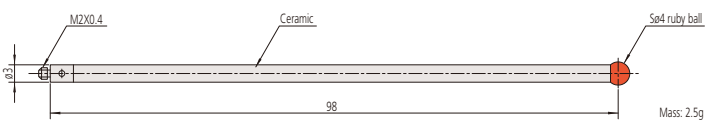


Order No. : 06ABF404
Description : MS2-4R68



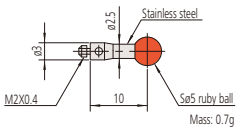
- Cannot be mounted on TP200.
- Not recommended for mounting on TP20, otherwise an input error may result.

Order No. : 06ABF410
Description : MS2-4R98C

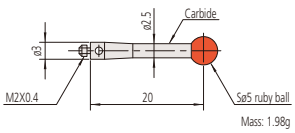


- Cannot be mounted on TP200.
- Not recommended for mounting on TP20, otherwise an input error may result.

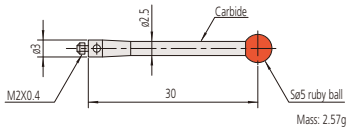
Order No. : 06ABN780
Description : MS2-5R10



Order No. : 06ABN781
Description : MS2-5R20

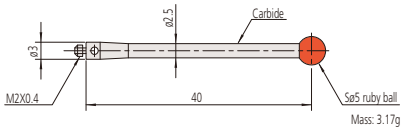


Order No. : 06ABN782
Description : MS2-5R30



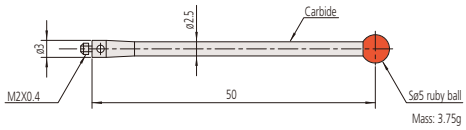
Order No. : 06ABN783
Description : MS2-5R40

- Cannot be mounted on TP200.

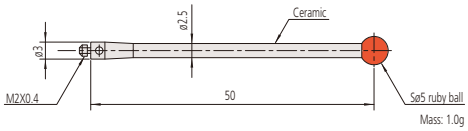


Order No. : 06ABN784
Description : MS2-5R50

- Cannot be mounted on TP200.
- Not recommended for mounting on TP20, otherwise an input error may result.

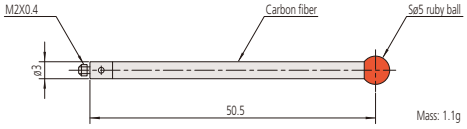


Order No. : 06ABN785
Description : MS2-5R50C



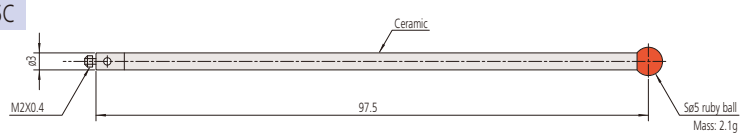
Order No. : 06ABQ342
Description : MS2-5R50.5G

- Not recommended for mounting on TP20, otherwise an input error may result.

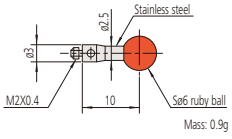


Order No. : 06ABF411
Description : MS2-5R97.5C

- Cannot be mounted on TP200.
- Not recommended for mounting on TP20, otherwise an input error may result.

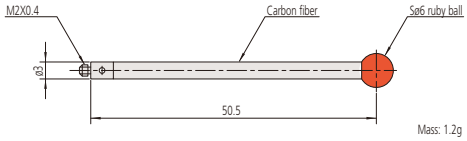


Order No. : 06ABN786
Description : MS2-6R10

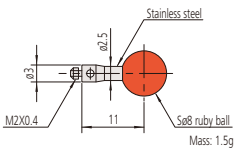


Order No. : 06ABN787
Description : MS2-6R50.5G

- Not recommended for mounting on TP20, otherwise an input error may result.

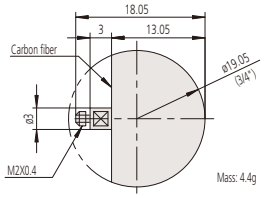


Order No. : 06ABN788
Description : MS2-8R11



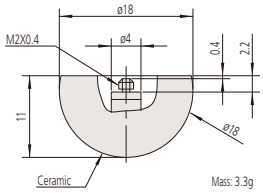
■ Stylus (Mounting thread M2)

Order No. : 135399
Description : MS2-19.05C 3/4inch

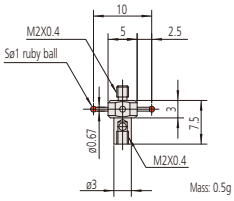


- Cannot be mounted on TP200.
- Not recommended for mounting on TP20, otherwise an input error may result.

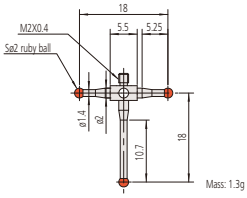
Order No. : 160225
Description : MS2-18C



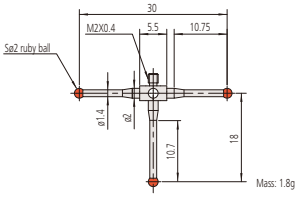
Order No. : 06ABN795
Description : MS2-STAR1R2.5



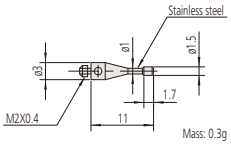
Order No. : 06ABN796
Description : MS2-STAR2R5.25



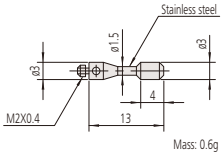
Order No. : 06ABN797
Description : MS2-STAR2R10.75



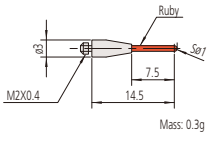
Order No. : 06ABN789
Description : MS2-CY1.5-1.7



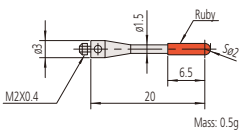
Order No. : 06ABN790
Description : MS2-CY3-4



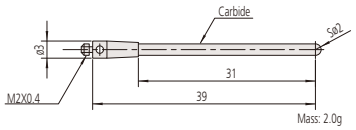
Order No. : 06ABN791
Description : MS2-CY1R7.5



Order No. : 06ABN792
Description : MS2-CY2R6.5

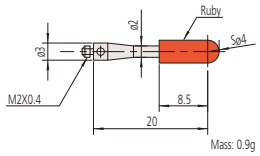


Order No. : 06ABN793
Description : MS2-CY2H31

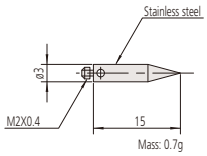


• Not recommended for mounting on TP200, otherwise an input error may result.

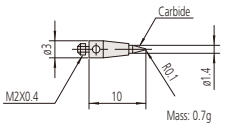
Order No. : 06ABN794
Description : MS2-CY4R8.5



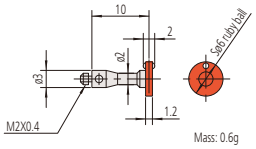
Order No. : 06ABN799
Description : MS2-PO



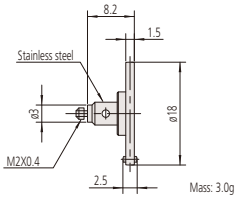
Order No. : 06ABN800
Description : MS2-PO-H



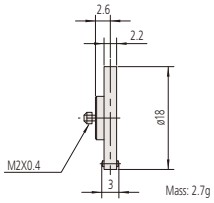
Order No. : 160214
Description : MS2-DISC6R2



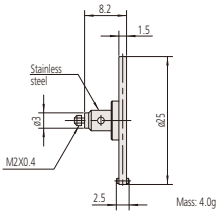
Order No. : 06AAL516
Description : MS2-DISC18-2.5



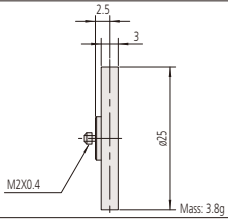
Order No. : 160215
Description : MS2-DISC18-3



Order No. : 06AAL517
Description : MS2-DISC25-2.5

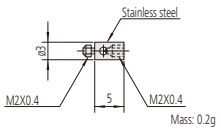


Order No. : 160226
Description : MS2-DISC25-3

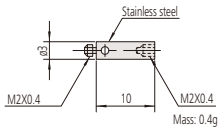


■ Stylus (Mounting thread M2)

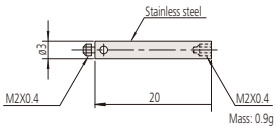
Order No. : 06ABP853
Description : MS2-EXT5



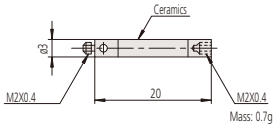
Order No. : 06ABN804
Description : MS2-EXT10



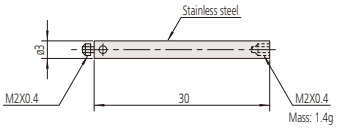
Order No. : 06ABN805
Description : MS2-EXT20



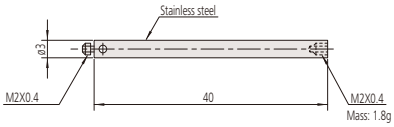
Order No. : 908884
Description : MS2-EXT20C



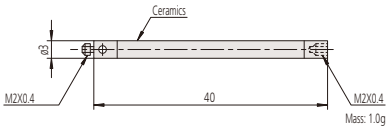
Order No. : 06ABN806
Description : MS2-EXT30



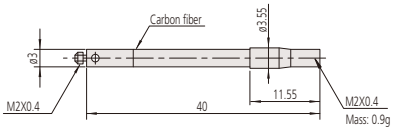
Order No. : 06ABN807
Description : MS2-EXT40



Order No. : 908885
Description : MS2-EXT40C

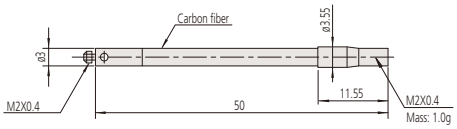


Order No. : 06AAL257
Description : MS2-EXT40G



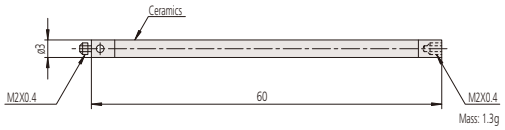
- For TP200
- For mounting stylus, attachment tools for carbon extension is required. (refer to page 60)

Order No. : 06AAL258
Description : MS2-EXT50G

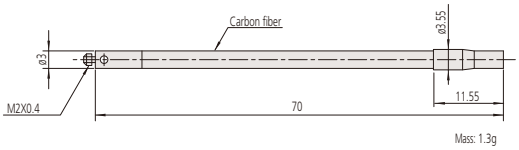


- For TP200
- For mounting stylus, attachment tools for carbon extension is required. (refer to page 60)

Order No. : 908886
Description : MS2-EXT60C

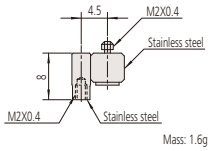


Order No. : 06ABN809
Description : MS2-EXT70G

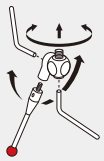


- Not recommended for mounting onTP200, otherwise an input error may result.
- Also for other probes it isrecommended to use in the vertical direction. Otherwise an input error may result depending on the drive speed or acceleration.
- For mounting stylus, attachment tools for carbon extension is required.(refer to page 60)

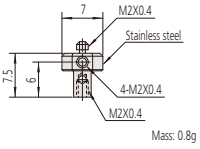
Order No. : 153142
Description : MS2-stylus knuckle



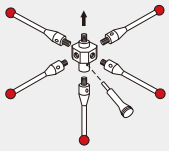
- Adapter for turning the stylus in the desired direction.



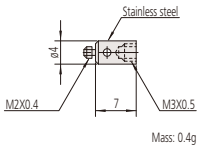
Order No. : 06ABN812
Description : MS2-stylus center



- Adapter for turning the stylus in one of the five directions.



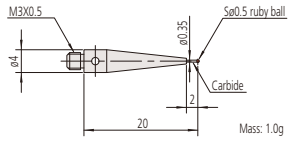
Order No. : 06ABN813
Description : MS2-M3 female-adapter



- This is an adapter for a probe, whose stylus attachment section is threaded to M2, to accept M3-threaded stylus.

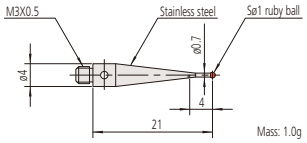
■ Stylus (Mounting thread dia.: M3)

Order No. : 06ABN816
Description : MS3-0.5R2

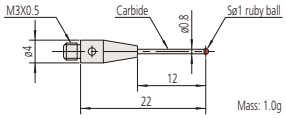


- Use with a measuring force 0.4N or less.
- This stylus may have a short life compared with normal styli.

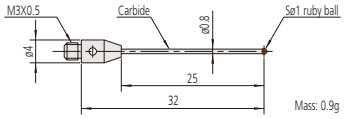
Order No. : 06ABN817
Description : MS3-1R4



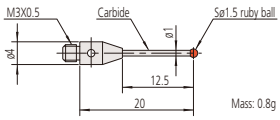
Order No. : 06ABF414
Description : MS3-1R12



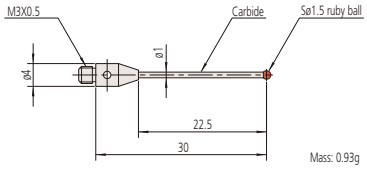
Order No. : 06ABF412
Description : MS3-1R25



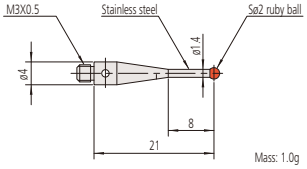
Order No. : 06ABN818
Description : MS3-1.5R12.5



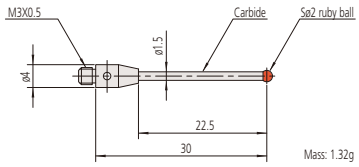
Order No. : 06ABN819
Description : MS3-1.5R22.5



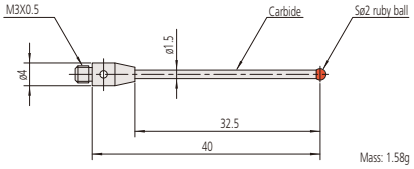
Order No. : 06ABN820
Description : MS3-2R8



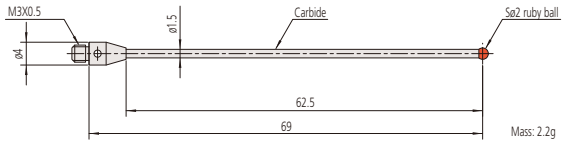
Order No. : 06ABN821
Description : MS3-2R22.5



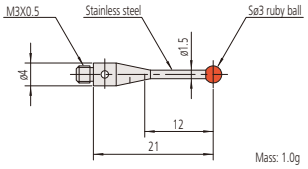
Order No. : 06ABN822
Description : MS3-2R32.5



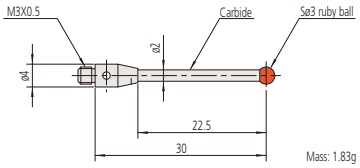
Order No. : 06ABF416
Description : MS3-2R62.5



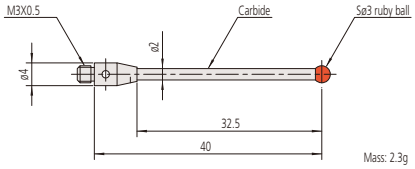
Order No. : 06ABN823
Description : MS3-3R12



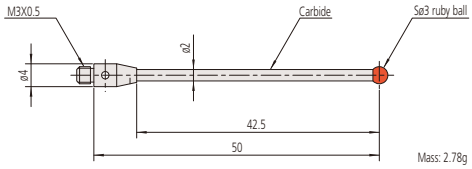
Order No. : 06ABN824
Description : MS3-3R22.5



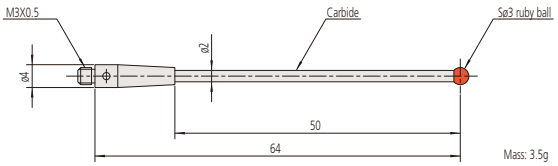
Order No. : 06ABN825
Description : MS3-3R32.5



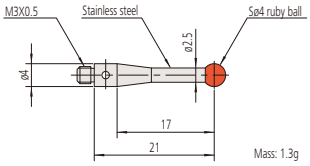
Order No. : 06ABN826
Description : MS3-3R42.5



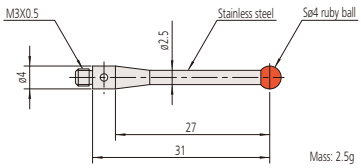
Order No. : 06ABF415
Description : MS3-3R50



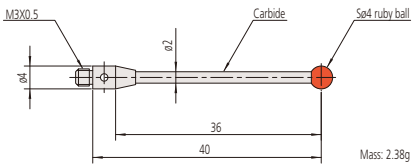
Order No. : 06ABN827
Description : MS3-4R17



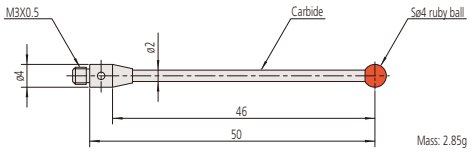
Order No. : 06ABN828
Description : MS3-4R27



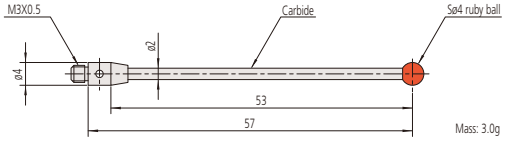
Order No. : 06ABN829
Description : MS3-4R36



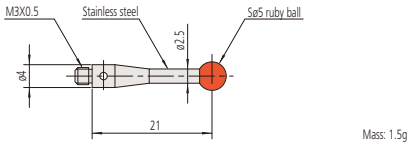
Order No. : 06ABN830
Description : MS3-4R46



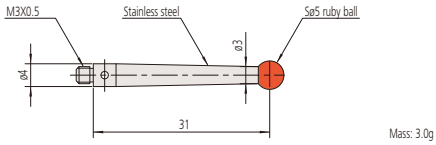
Order No. : 06ABF403
Description : MS3-4R53



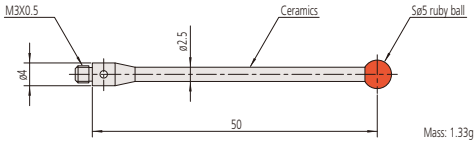
Order No. : 06ABN831
Description : MS3-5R21



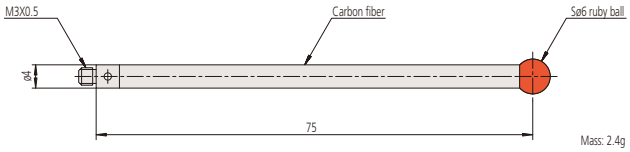
Order No. : 163874
Description : MS3-5R31



Order No. : 06ABN832
Description : MS3-5R50C

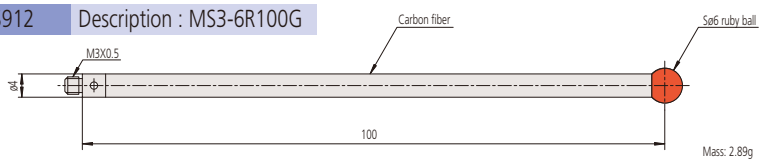


Order No. : 06ABS911
Description : MS3-6R75G



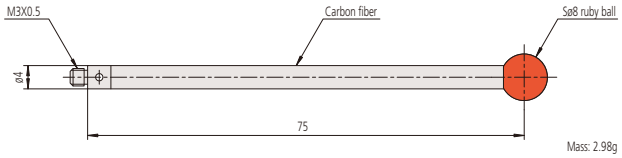
• For SP25M

Order No. : 06ABS912 Description : MS3-6R100G



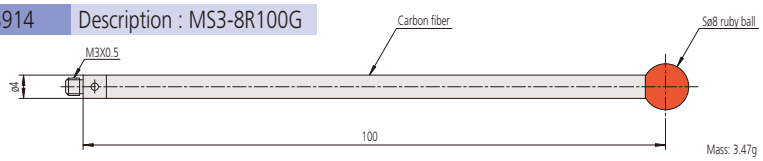
• For SP25M

Order No. : 06ABS913
Description : MS3-8R75G



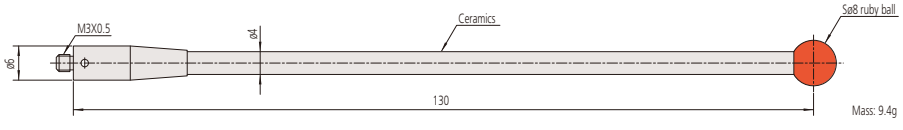
• For SP25M

Order No. : 06ABS914 Description : MS3-8R100G



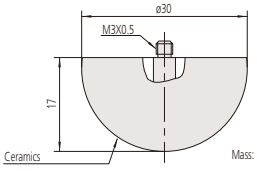
• For SP25M

Order No. : 06ABF407 Description : MS3-8R130C



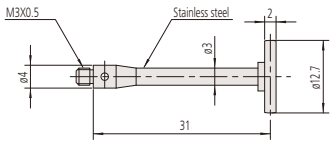
• Cannot be mounted on the old scanning probe models including MPP-2, MPP-2H, and MPP-5.
• Strongly recommended to use in the vertical position for touch-trigger probes. Otherwise an input error may result dependingon the drive speed or acceleration.

Order No. : 916492
Description : MS3-30C



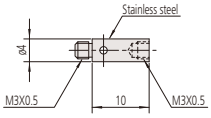
• Cannot be mounted on SP25M.

Order No. : 169011
Description : MS3-DISC12.7-2



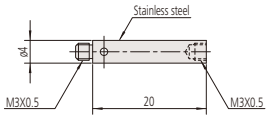
Mass: 4.0g

Order No. : 06ABN833
Description : MS3-EXT10



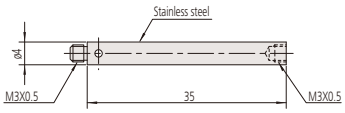
Mass: 0.9g

Order No. : 06ABN834
Description : MS3-EXT20



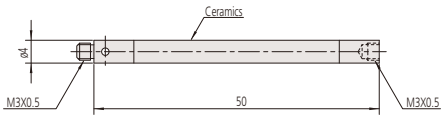
Mass: 1.6g

Order No. : 06ABN835
Description : MS3-EXT35



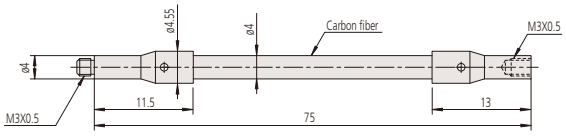
Mass: 2.9g

Order No. : 06ABN836
Description : MS3-EXT50C



Mass: 2.95g

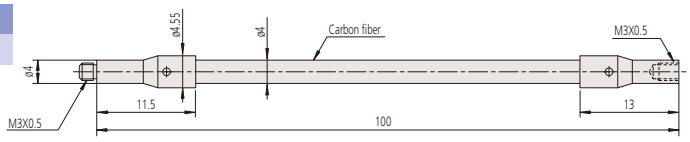
Order No. : 06ABS915
Description : MS3-EXT75G



Mass: 2.53g

• For SP25M

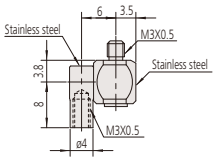
Order No. : 06ABS916
Description : MS3-EXT100G



Mass: 3.02g

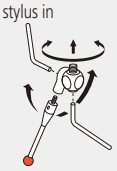
• For SP25M

Order No. : 06ABN838
Description : MS3-stylus knuckle

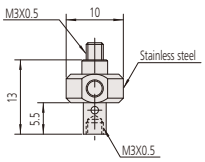


Mass: 3.7g

• Adapter for turning the stylus in the desired direction.

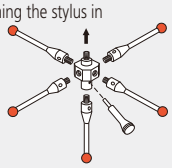


Order No. : 06ABN839
Description : MS3-stylus center

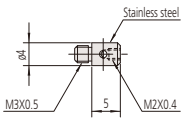


Mass: 2.4g

• Adapter for turning the stylus in one of the five directions.

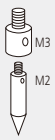


Order No. : 06ABN837
Description : MS3-M2 female-adapter

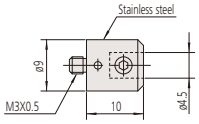


Mass: 0.6g

• This is an adapter for a probe, whose stylus attachment section is threaded to M3, to accept M2-threaded stylus.

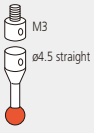


Order No. : 167234
Description : MS3-ø4.5-adapter



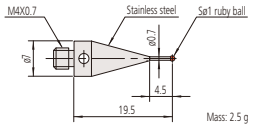
Mass: 2.3g

• This is an adapter for a probe, whose stylus attachment section is threaded to M3, to accept straight-shank type stylus.

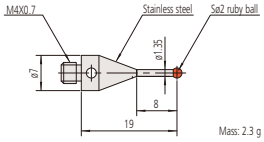


■ Stylus (Mounting thread M4)

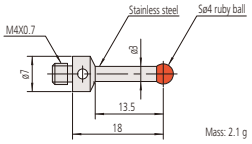
Order No. : 06ABN840
Description : MS4-1R4.5



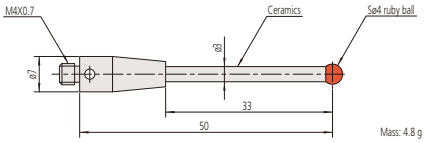
Order No. : 06ABN841
Description : MS4-2R8



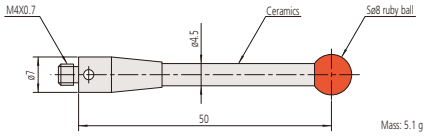
Order No. : 06ABN842
Description : MS4-4R13.5



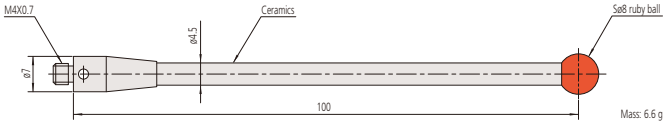
Order No. : 06ABQ149
Description : MS4-4R33C



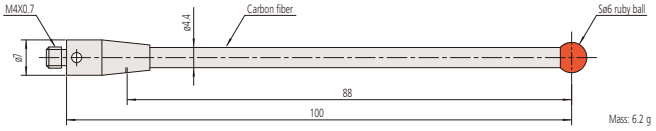
Order No. : 06ABN843
Description : MS4-8R50C



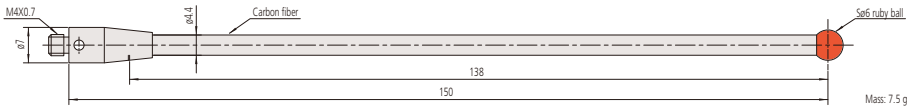
Order No. : 06ABN844
Description : MS4-8R100C



Order No. : 06ABN845
Description : MS4-6R88G

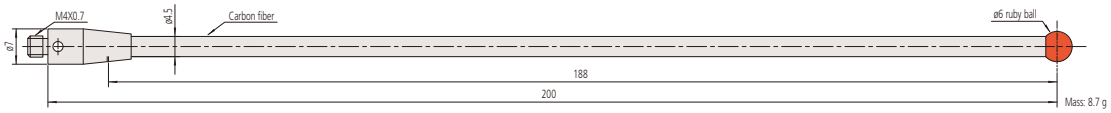


Order No. : 06ABN846
Description : MS4-6R138G

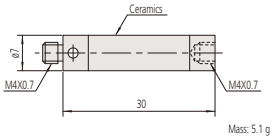


Order No. : 06ABN847
Description : MS4-6R188G

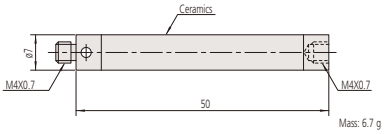
- Cannot be mounted on SP25M.



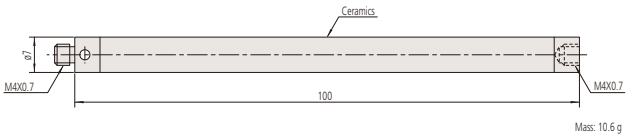
Order No. : 06ABN848
Description : MS4-EXT30C



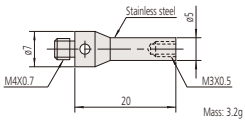
Order No. : 06ABN849
Description : MS4-EXT50C



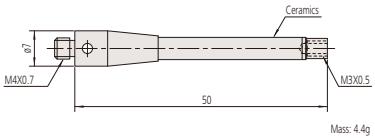
Order No. : 06ABN850
Description : MS4-EXT100C



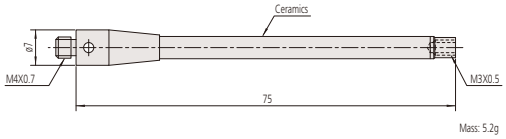
Order No. : 06ABN851
Description : MS4-M3EXT20



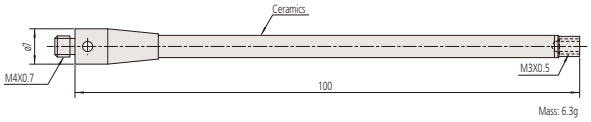
Order No. : 06ABN852
Description : MS4-M3EXT50C



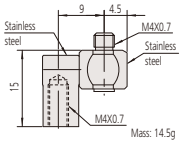
Order No. : 06ABN853
Description : MS4-M3EXT75C



Order No. : 06ABN854
Description : MS4-M3EXT100C

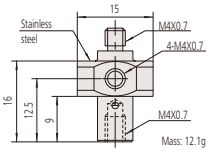


Order No. : 06AAD460
Description : MS4-stylus knuckle

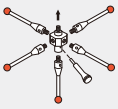


• Adapter for turning the stylus in the desired direction.

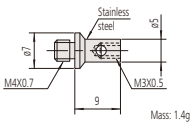
Order No. : 06ABN857
Description : MS4-stylus center



• Adapter for mounting the stylus in the five positions.

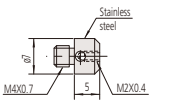


Order No. : 06ABN855
Description : MS4-M3 female-adapter



• This is an adapter for a probe, whose stylus attachment section is threaded to M4, accept M3-threaded stylus.

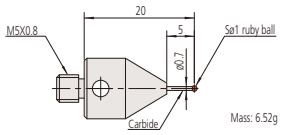
Order No. : 06ABN856
Description : MS4-M2 female-adapter



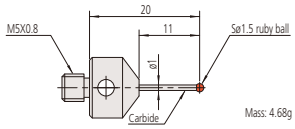
• This is an adapter for a probe, whose stylus attachment section is threaded to M4, accept M2-threaded stylus.

■ Stylus (Mounting thread M5)

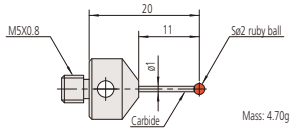
Order No. : 06ABS920
Description : MS5-1R5



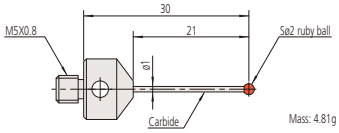
Order No. : 06ABS921
Description : MS5-1.5R11



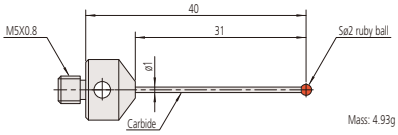
Order No. : 06ABS923
Description : MS5-2R11



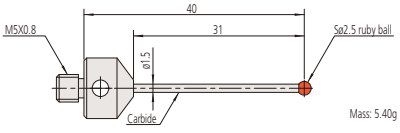
Order No. : 06ABS924
Description : MS5-2R21



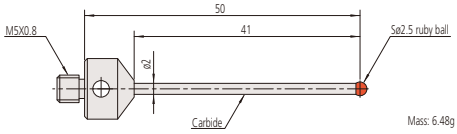
Order No. : 06ABS925
Description : MS5-2R31



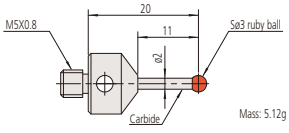
Order No. : 06ABS926
Description : MS5-2.5R31



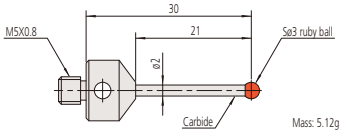
Order No. : 06ABS927
Description : MS5-2.5R41



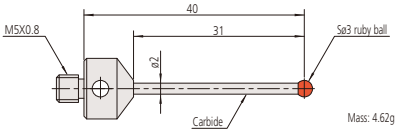
Order No. : 06ABS928
Description : MS5-3R11



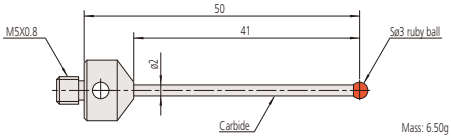
Order No. : 06ABS929
Description : MS5-3R21



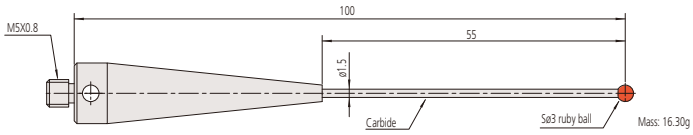
Order No. : 06ABS930
Description : MS5-3R31



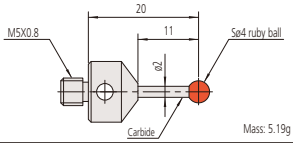
Order No. : 06ABS931
Description : MS5-3R41



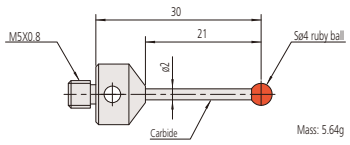
Order No. : 06ABS932
Description : MS5-3R55



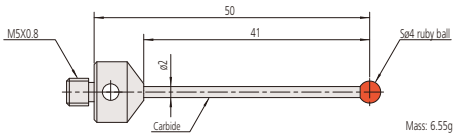
Order No. : 06ABS933
Description : MS5-4R11



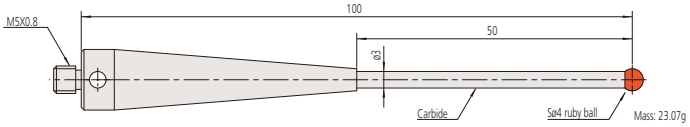
Order No. : 06ABS934
Description : MS5-4R21



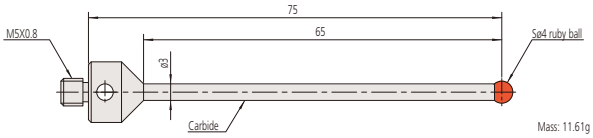
Order No. : 06ABS935
Description : MS5-4R41



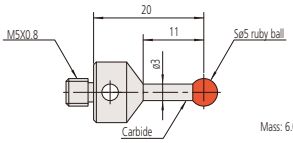
Order No. : 06ABS936
Description : MS5-4R50



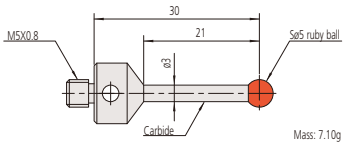
Order No. : 06ABS937
Description : MS5-4R65



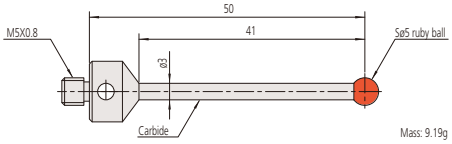
Order No. : 06ABS938
Description : MS5-5R11



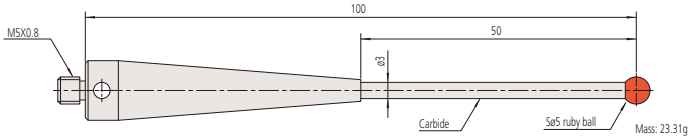
Order No. : 06ABS939
Description : MS5-5R21



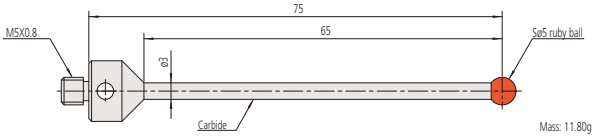
Order No. : 06ABS940
Description : MS5-5R41



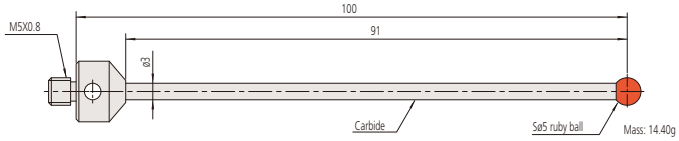
Order No. : 06ABS941
Description : MS5-5R50



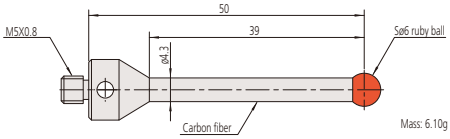
Order No. : 06ABS942
Description : MS5-5R65



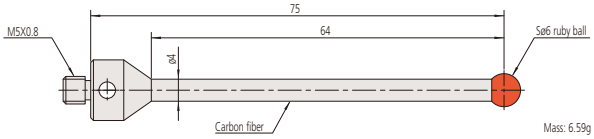
Order No. : 06ABS943
Description : MS5-5R91



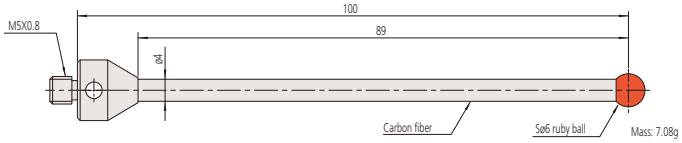
Order No. : 06ABS944
Description : MS5-6R39G



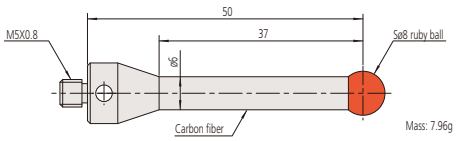
Order No. : 06ABS945
Description : MS5-6R64G



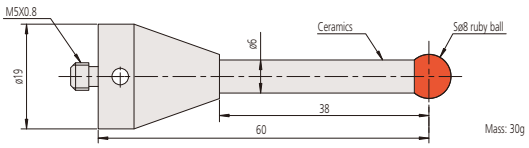
Order No. : 06ABS946
Description : MS5-6R89G



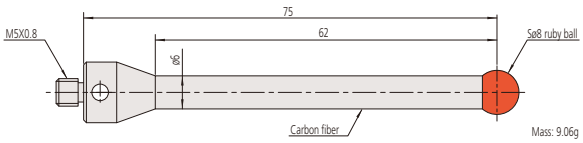
Order No. : 06ABS947
Description : MS5-8R37G



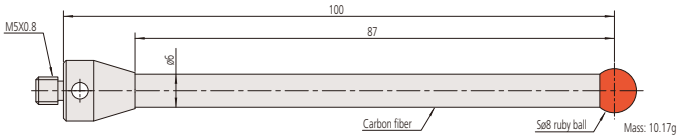
Order No. : 06ABU673
Description : MS5-8R38C



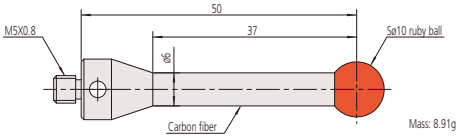
Order No. : 06ABS948
Description : MS5-8R62G



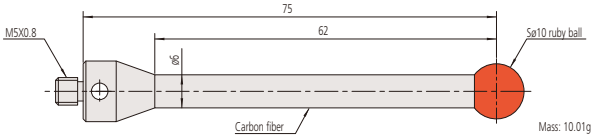
Order No. : 06ABS949
Description : MS5-8R87G



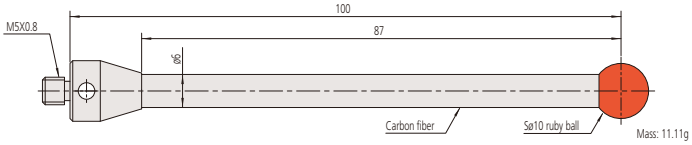
Order No. : 06ABS950
Description : MS5-10R37G



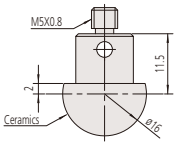
Order No. : 06ABS951
Description : MS5-10R62G



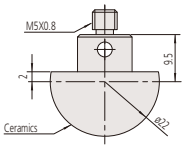
Order No. : 06ABS952
Description : MS5-10R87G



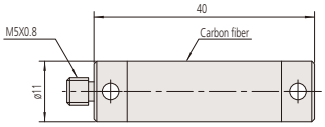
Order No. : 06ABS953
Description : MS5-16C



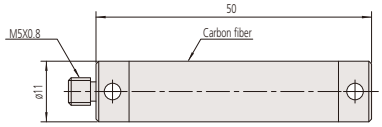
Order No. : 06ABS954
Description : MS5-22C



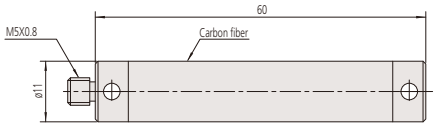
Order No. : 06ABS955
Description : MS5-EXT40G



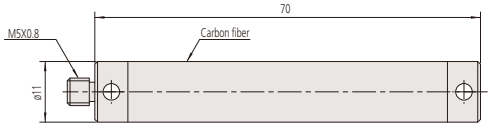
Order No. : 06ABS956
Description : MS5-EXT50G



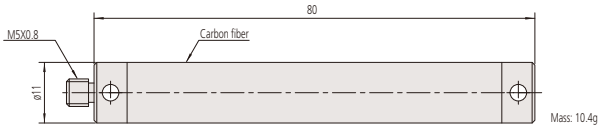
Order No. : 06ABS957
Description : MS5-EXT60G



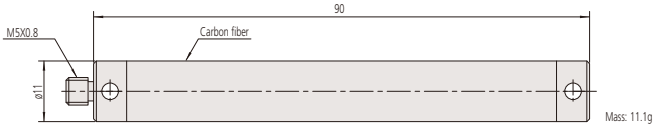
Order No. : 06ABS958
Description : MS5-EXT70G



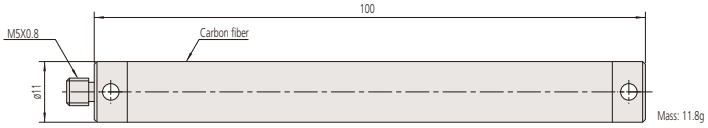
Order No. : 06ABS959
Description : MS5-EXT80G



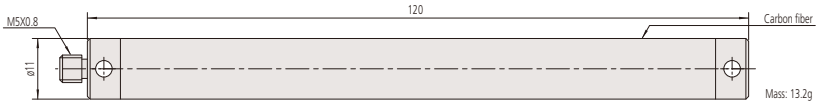
Order No. : 06ABS960
Description : MS5-EXT90G



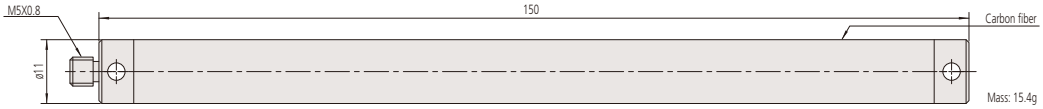
Order No. : 06ABS961
Description : MS5-EXT100G



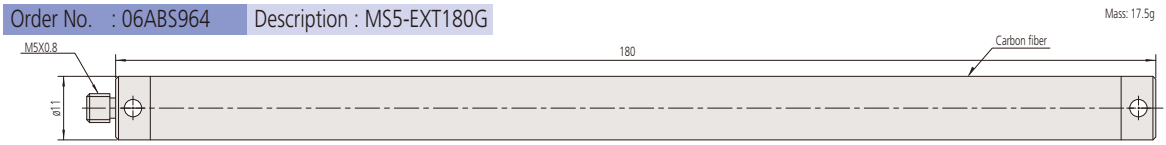
Order No. : 06ABS962
Description : MS5-EXT120G



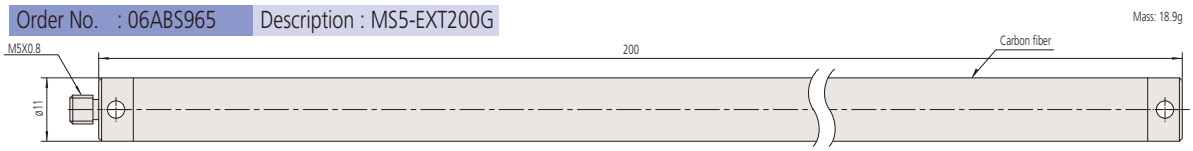
Order No. : 06ABS963 Description : MS5-EXT150G



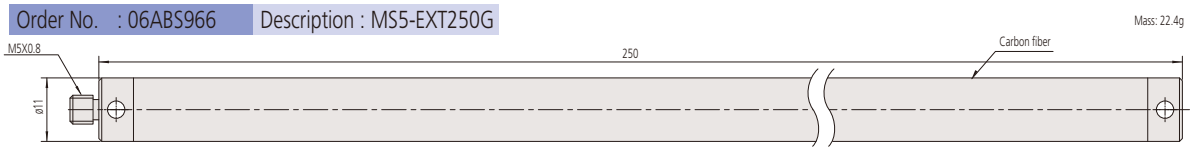
Order No. : 06ABS964 Description : MS5-EXT180G



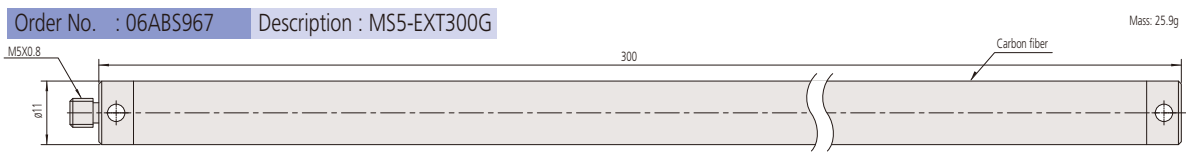
Order No. : 06ABS965 Description : MS5-EXT200G



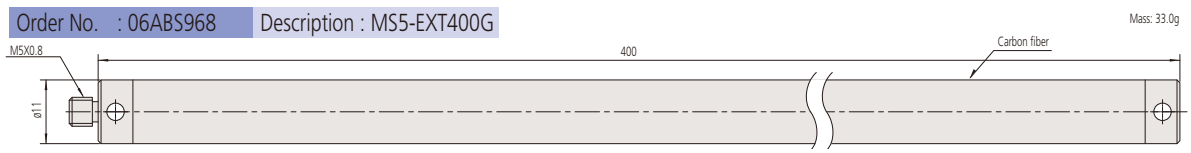
Order No. : 06ABS966 Description : MS5-EXT250G



Order No. : 06ABS967 Description : MS5-EXT300G

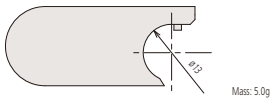
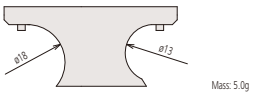
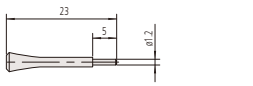
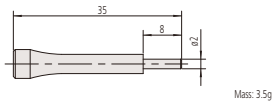
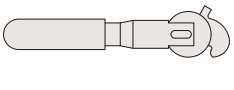


Order No. : 06ABS968 Description : MS5-EXT400G



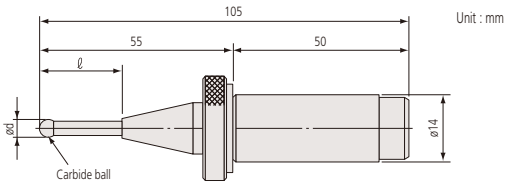
Attachment Tools

Unit : mm

Order No. : 161534 Description : Single-ended wrench		• Attachment tool for probes with the body diameter of ø13mm and probe extensions.
Order No. : 161535 Description : Double-ended wrench		• Attachment tool for probes with the body diameter of ø13mm or 18mm and probe extensions.
Order No. : 153140 Description : M2-stylus tool		• Stylus attachment/detachment tool for M2 and M3 mounting screws.
Order No. : 181279 Description : MS4-stylus tool		• Stylus attachment/detachment tool for M4 mounting screws.
Order No. : 06AAL264 Description : Attachment tool for carbon-fiber extensions		•Attachment/detachment tool for carbon-fiber extensions whose mounting thread is M2.

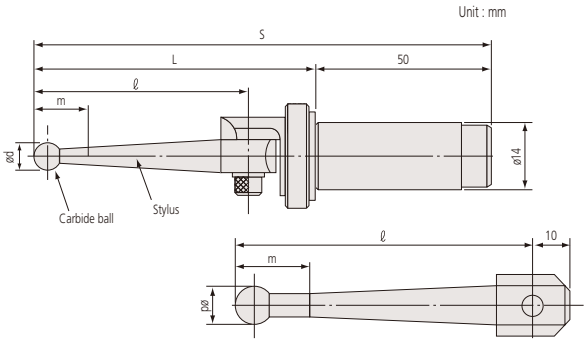
Probes for Manual Coordinate Measuring Machines

Ball probe



Order No.	ød	ℓ
932377A	2	6
932378A	3	11.5
932379A	5	22.5
932380A	6	28
532328	10	45

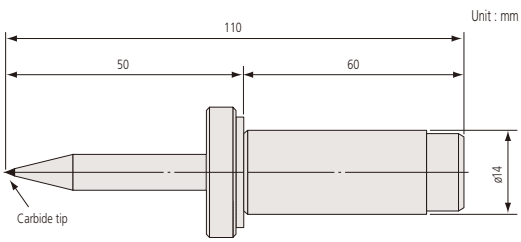
Universal probe



Set Order No.	ød	S	L	ℓ	m
932375A (932363)	2	127	77	53	6
932375B (932364)	3	130.5	80.5	56.5	9.5
932375C (932365)	5	137.5	87.5	63.5	16.5
932375D (932366)	10	154	104	80	20
932375E (932367)	15	211.5	161.5	137.5	27.5

( ) shows the part No. of each single unit of stylus.

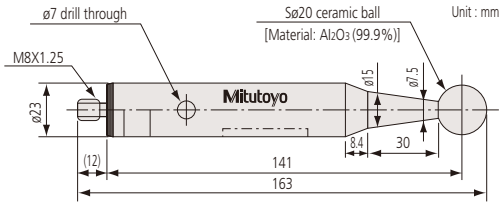
Point probe (Order No. 593467)



■ Ceramic Master Ball

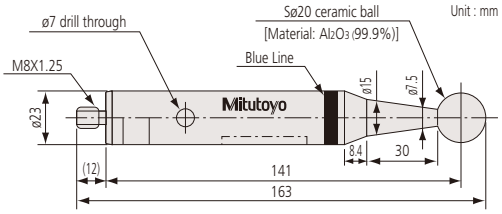
Ceramic master ball (standard type)

- Ball sphericity: 0.13μm or less
- Ball diameter dimensional tolerance: Sø20 $^{0}_{-0.1}$ mm



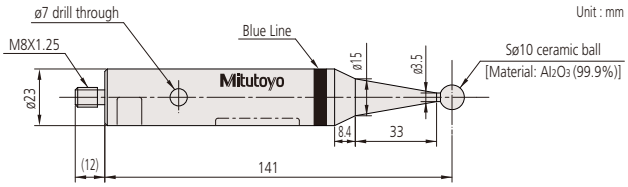
Ceramic master ball (high-accuracy type)

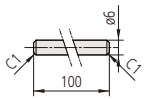
- Ball sphericity: 0.08μm or less
- Ball diameter dimensional tolerance: Sø20 $^{0}_{-0.1}$ mm



Ceramic master ball (high-accuracy type)

- Ball sphericity: 0.08μm or less
- Ball diameter dimensional tolerance: Sø10 $^{0}_{-0.1}$ mm

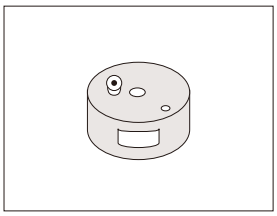




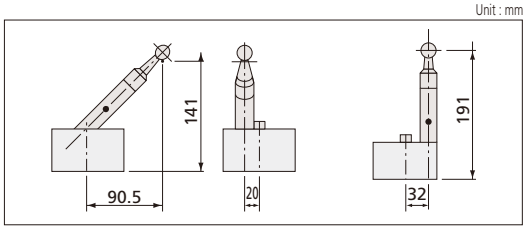
Wrench (rod)

Base

Base for a ceramic master ball



Base appearance



Ceramic ball attachment figure

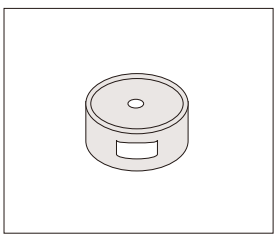
Set break-downs

Set order No.	Ball diameter (mm)	Ceramic master ball type	Inspection certificate	Base	Calibration certificate	Traceability System Diagram
06ABQ041A	20	Standard	○	○	–	–
06ABQ041B	20	Standard	○	○	○	○
06ABQ040A	20	Standard	○	–	–	–
06ABQ040B	20	Standard	○	–	○	○
06ABQ044A	20	High accuracy	○	○	–	–
06ABQ044B	20	High accuracy	○	○	○	○
06ADN586A	10	High accuracy	○	–	–	–
06ADN586B	10	High accuracy	○	–	○	○

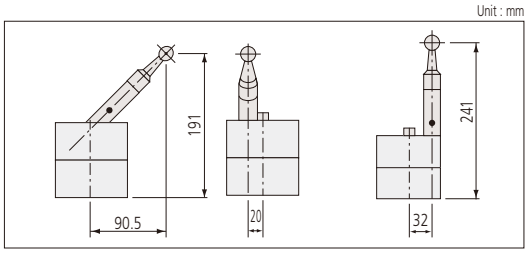
Optional accessory for the Ceramic Master Ball

Spacer

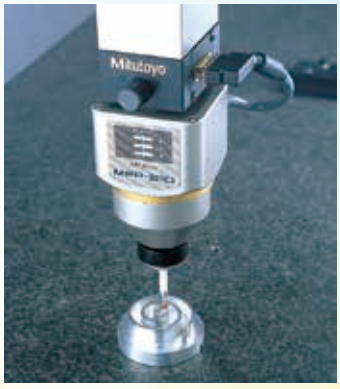
Spacer for the base



Spacer appearance



Attaching Spacer to Ceramic Master Ball + Base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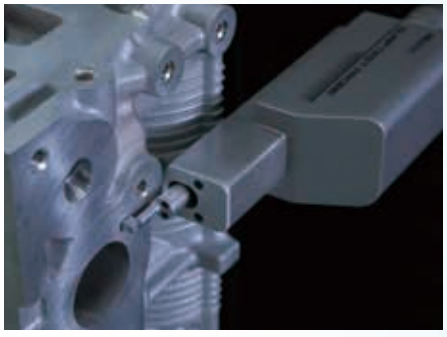

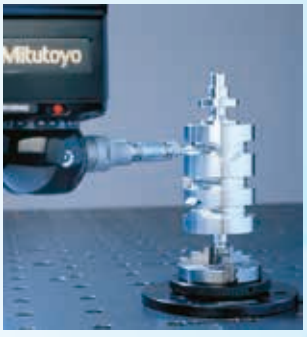
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