CMM products technical specification
H-1000-5050-17-A

RENISHAW
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Probing systems for co-ordinate measuring machines









Introduction









Renishaw's technology

Renishaw stands at the forefront of automated metrology, with the Group's products providing manufacturers with the ability to machine components accurately, and perform measurement traceable to international standards.

Probe technology, allows fast, highly repeatable measurements to be carried out on co-ordinate measuring machines (CMMs).

A wide range of automated probing systems has been developed to meet the needs of post-process inspection, for quality control.

During the manufacturing operation, probes used on computer numerically controlled (CNC) machine tools provide the measurement capability to automatically control the machining process. This eliminates the need for costly, time consuming manual procedures.

Renishaw gives extra capability to CNC machine tools and CMMs by enabling scanning and digitising of 3-dimensional (3D) forms to generate the necessary NC programs to produce either replica parts, or moulds and dies.

Renishaw has developed the Cyclone scanning machine and associated software, a cost-effective solution to stand-alone digitising.

The revolutionary manufacturing system, RAMTIC (Renishaw's automated milling, turning and inspection centre), maximises the potential of existing machine tools, enabling milling, turning and inspection on a single machine, together with automated loading and unloading of materials and tools.

CNC machine tools and CMMs benefit from regular volumetric checking by Renishaw's automated ball-bar and machine checking gauge.

Comprehensive machine calibration can be undertaken, when necessary, using Renishaw's innovative laser calibration systems.

Renishaw has developed linear scale, laser interferometer and encoder systems for fitting to a variety of machines, to provide axis displacement measurement. Dedicated lengths of rigid scale are not required, since Renishaw's approach has been to produce flexible scale that can be dispensed from a reel and cut to the required length.

Renishaw has also applied its innovatory approach to produce a Raman microscope and accessories for 2D spectral analysis of materials in a non-destructive manner.

From its leading market position, the Renishaw Group continues to expand its product range into ever increasing business sectors worldwide. Identifying and targeting new market opportunities has led to the continuous development and introduction of new, highly innovative products which significantly enhance the manufacturing capabilities in a wide range of industries.

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Introduction to CMM probing

CMMs are used for a wide variety of industry applications, especially for post-process inspection of manufactured components. Renishaw's probes and probing systems have become the industry choice for rapid and accurate inspection. CMMs, which act as a quality reference, use probing systems to replace traditional manually operated measuring instruments such as micrometers, vernier callipers and dedicated gauges.

Probe systems

Renishaw's probe systems are available in a wide variety of types to enable a best match for a particular application.

Fitting the probe on the CMM

The probe is mounted on the CMM via a probe head. The type of head is determined by the flexibility and automation required. Renishaw has designed a range of probe heads for manual and automated systems.

Motorised heads maximise probing efficiency and give a 3-axis CMM, 5-axis capability. A motorised head can also be used with Renishaw's autochange systems which allows rapid and automatic exchange of multiple probe types and extension combinations.

Advanced control

Traditionally, scanning has been limited to relatively slow machines but Renishaw's universal CMM controller family enables this function at speeds many times faster than was previously possible.

Accessories

The range of accessories enhances the basic system by offering additional capability such as stylus changing for the probe, probe sensor changing for multiple probe requirements and extension bars to provide access to deep features.

Renishaw supplies a comprehensive range of styli for component inspection and scanning applications which are available in a variety of profiles, sizes and fittings to best suit the probe employed and the components' features and dimensions.

To avoid the risk of compromising measurement performance, always use a replacement stylus from Renishaw!

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How to use this guide

This **TECHNICAL SPECIFICATIONS** document is intended to help you select the most appropriate probing system for your CMM. The probing system includes the probe with stylus, the method of attachment of the probe to the CMM by use of a probe head or simple shank, and the necessary probe/head controlling interfaces.

PROBE SYSTEM SELECTION

Before selecting the most appropriate probe system, you should clearly understand the scope of measurement applications to be addressed on your CMM. Renishaw's product range covers all types of probing requirements, from simple touch-trigger point measurement through to advanced part profile scanning. Where a standard product proves not to be ideal, Renishaw's custom design service is available to accommodate you requirements.

This technical specifications document is divided into sections that focus on the different parts of the probing system and indicates the particular benefits of each product. The technical information for each product is also given so that performance data can be compared where more than one product appears suitable.

STEP-BY-STEP SELECTION PROCEDURE

➤ **STEP 1 (See sections 5/6/7/8)**

SYSTEMS SUITABLE FOR YOUR CMM

Q? What type of CMM do you have or wish to purchase?

MANUAL CMM - go to sections 5/6 to see the family trees of probing systems that are suited to manual CMMs. Identify the probe(s) and probe head(s) that are of interest, and then proceed to steps 2 and 3 to find out more information on these products and finalise your selection.

DCC CMM - go to sections 7/8 to see the family trees of probing systems that are suited to DCC CMMs. Identify the probe(s) and probe head(s) that are of interest, and then proceed to steps 2 and 3 to find out more information on these products and finalise your selection.

Note: all probes shown in this document are suitable for use on DCC CMMs.

➤ **STEP 2 (See sections 2/3/4)**

PROBE SELECTION

Detailed information on each probe is given in one of three sections as described below.

CONTACT TRIGGER PROBES (Sections 2/3)

Discrete point, contact trigger probes (also called touch trigger probes) are ideal for inspection of 3 dimensional prismatic parts and known geometries. These probes are highly versatile and are suitable for a diverse range of applications, materials and surfaces, and there is a wide range of accessories available for them. The probes are segregated into two sections here - **probes without, and probes with, stylus module changing**. Stylus module changing is a very important consideration as it enables higher productivity and the ability to always select the best measurement solution for the application. A further distinction between contact trigger probes is their type of design. There are **kinematic probes and electronic probes** to choose from. Probe sizes vary due to the features of the probe. The larger kinematic probes are extremely robust and are very well suited to manual CMMs due to their large overtravel capability. The smaller probes are suited to applications where there is a need to access restricted spaces. Renishaw's electronic probes offer extended life suitable for high density point profile measurement and also permit higher accuracy than kinematic probes. Depending on the type of CMM and the level of utility required, there is a choice between shank mounted, M8 thread or autojoint mounted probes. Renishaw's autojoint mounted probes and extensions can be rapidly interchanged for increased flexibility and productivity.

CONTACT SCANNING PROBES (Section 4)

Scanning is ideal for the inspection of geometric forms and full profile measurement where thousands of data points can describe the form more fully than a few discrete points. A large amount of information can be collected in a very short time giving better direct results. Renishaw's range of fixed and indexable type scanning probes offers high accuracy, excellent robustness and low contact force scanning. All Renishaw scanning probes feature rapid interchange between stylus configurations to further increase flexibility and productivity.

➤ **STEP 3 (See sections 5/6/7/8)**

PROBE HEAD SELECTION

Having selected the probe type, refer again to the family trees (sections 5/6 for Manual CMMs or sections 7/8 for DCC CMMs) to see which probe head(s) are suitable.

MANUAL CMMs - are usually fitted with shank-mounted probes or manual probe heads. Renishaw offer varieties of manual probe heads which are segregated into sections 5/6 here detailing **manual probe heads with integral M8/autojoint or with integral TP20 stylus module mount.** A further design consideration is the choice of **fixed or articulating/indexing manual head types**. The type of probe head required can be determined by examining the features of each head and matching them to your requirements.

DCC CMMs - can be fitted with either manual or motorised probe head systems, so the choice must be made having considered the applications of the CMM. Motorised heads are segregated into sections 7/8 here detailing **servo type and indexing type motorised heads.** Fitting the probe on a CMM using a motorised head is the easiest way to vastly improve the capability of the CMM and maximise productivity. The indexing type motorised heads are designed to position the probe at one of 720 positions, in 7.5° steps, so probing can be carried out at many angles. The repeatability of the head means that these positions can be recalled at any time without the need for re-qualification. This can save a great deal of time for the operator, and encourages system optimisation by applying the probe to the surface at the best angle for the most accurate result. Servo type motorised heads provide almost unlimited angular positioning and are ideally suited to horizontal arm CMMs.

➤ **STEP 4 (See section 9)**

PROBE / PROBE HEAD, INTERFACE SELECTION

The probe data in sections 2/3/4 defines the electrical interface(s) compatible with the chosen probe. See section 9 for full details of probe interfaces.

The probe head data in sections 5/6/7/8 defines the type of controller required to integrate the probe head into the CMM. See section 9 for full details of probe head interfaces.

➤ **STEP 5 (See sections 11/12)**

EXTENSION BAR / SHANK SELECTION

For probes and probe heads that are shank mounted on the CMM, go to section 12 to choose the appropriate shank. Section 11 details a comprehensive range of extension bars to enhance the versatility of your probe system. Remember that **Renishaw offers a Custom Design Service** if the type of shank/extension you require is not a standard product.

➤ **STEP 6 (See sections 2/3/4/10)**

CHANGER SYSTEM SELECTION

Many of Renishaw's probes, when fitted to DCC CMMs, are capable of **rapid automatic interchange between stylus configurations or even between different types of probe**. Refer to sections 2/3/4 to see if your chosen probe has change rack compatibility, and for details of these highly productive systems. **Renishaw's autochange rack systems allow rapid exchange between probe sensors and extensions with the Renishaw autojoint** and are detailed in section 10.

➤ **STEP 7 (See section 13)**

ACCESSORIES

Check the accessories section 13, for other accessories available for your chosen probe system.

➤ **STEP 8 (See section 14)**

STYLUS SELECTION

Renishaw produces a wide range of styli designed to optimise measurement performance. A brief overview is given in section 14. **Please also see Renishaw's STYLI AND ACCESSORIES GUIDE (document H-1000-3200) for comprehensive details.**

Note: Section 15 contains a glossary of terms used in this document.

This document contains information on Renishaw's current CMM products range. If you require additional information on these and discontinued products, please visit our website: **www.renishaw.com**

TP7M / TP7M EP probes

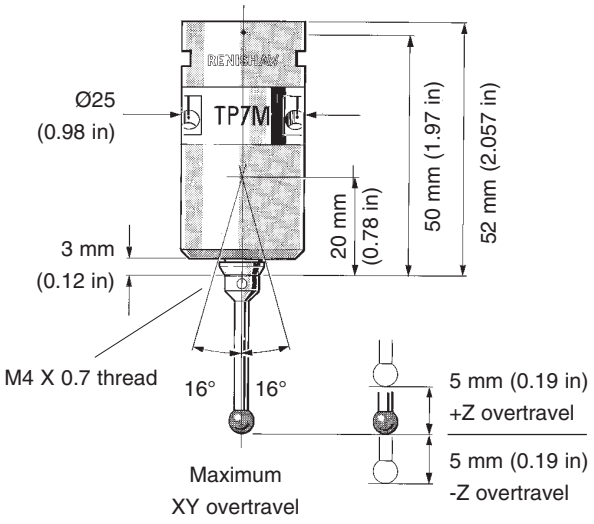
The TP7M range comprises electronic probes using strain gauge technology which gives higher accuracy than kinematic touch-trigger probes. Incorporating a multi-wired autojoint connection, the TP7M is compatible with the PH10M/PH10MQ motorised heads, PH6M fixed probe head, and the range of PEM extension bars.

The autojoint also allows fast probe changing, either manually or automatically, with a Renishaw autochange rack system.

The enhanced performance TP7M EP is capable of achieving a 3D accuracy of <0.6 µm tested to ISO 10360 Pt 2.

TP7M / TP7M EP features and benefits:

- Excellent repeatability and high precision 3D form measurement
- 6-way measuring capability (±X, ±Y, ±Z)
- Stylus reach up to 180 mm (7.08 in) using GF range
- Zero reseat errors and no lobing effect
- Fitment is to PH10M/PH10MQ or PH6M heads via the autojoint coupling which gives the capability of fast probe changing when used with a Renishaw autochange rack system



PI 7-2 probe interface

The PI 7-2 interface has two switchable levels of trigger sensitivity to accommodate differing applications. Please see section 9 for full details.

Specification summary		TP7M		TP7M EP	
PRINCIPAL APPLICATION		FMS and automated systems. Universal DCC and manual CMMs.		As TP7M but where high accuracy measurement is required.	
SENSE DIRECTIONS		6-way: ±X ±Y ±Z		6-way: ±X ±Y ±Z	
3D ACCURACY (test to ISO 10360 Pt 2) *		N/A		<0.6 µm	(<0.000024 in)
UNIDIRECTIONAL REPEATABILITY (2σ µm)	Trigger level 1	0.25 µm	(0.00001 in)	0.25 µm	(0.00001 in)
	Trigger level 2	0.25 µm	(0.00001 in)	0.25 µm	(0.00001 in)
XY (2D) FORM MEASUREMENT DEVIATION	Trigger level 1	±0.25 µm	(±0.00001 in)	±0.25 µm	(±0.00001 in)
	Trigger level 2	±0.50 µm	(±0.00002 in)	±0.50 µm	(±0.00002 in)
XYZ (3D) FORM MEASUREMENT DEVIATION	Trigger level 1	±0.5 µm	(±0.00002 in)	±0.5 µm	(±0.00002 in)
	Trigger level 2	±1.0 µm	(±0.00004 in)	±1.0 µm	(±0.00004 in)
TRIGGER FORCE (at stylus tip)	XY plane	0.02 N		0.02 N	
	Z axis	0.15 N		0.15 N	
OVERTRAVEL FORCE	XY plane	0.78 N		0.78 N	
	Z axis	11.75 N		11.75 N	
WEIGHT		85 g	(3.0 oz)	85 g	(3.0 oz)
MAX. EXTENSION (if on a PH10 series head)		200 mm	(7.87 in)	200 mm	(7.87 in)
MAX. RECOMMENDED STYLUS LENGTH (M4 styli range)		150 mm (5.9 in) steel – 180 mm (7.08 in) GF		150 mm (5.9 in) steel – 180 mm (7.08 in) GF	
MOUNTING METHOD		Multiwired autojoint		Multiwired autojoint	
SUITABLE INTERFACE		PI 7-2		PI 7-2	
AUTOMATIC PROBE CHANGING		Autochange rack		Autochange rack	

Above data applies for test conditions as follows: Stylus length 50 mm (1.97 in) Stylus velocity 240 mm/min (1.57 ft/min)

* Test performed on a CMM specification $U_3 = 0.48\ \mu m + L/1000$

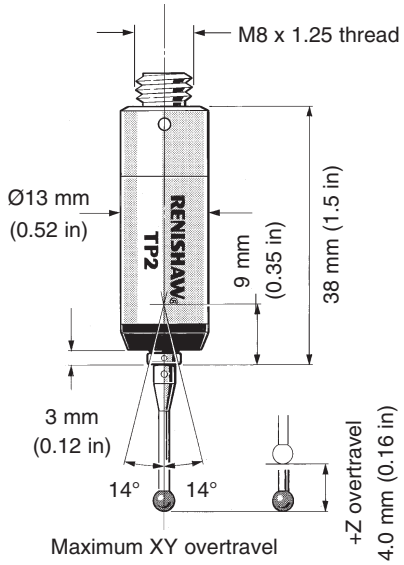
TP2-5W probe

The TP2-5W is one of Renishaw's best known products. It is a 13 mm (0.51 in) diameter standard kinematic touch trigger probe with an M8 thread mount. Its adjustable stylus force enables the probe to support a wide range of styli.

The TP2 is small, light and compatible with a wide range of accessories, and is suitable for manual and DCC CMMs.

TP2-5W features and benefits:

- Small, light, versatile probe
- Adjustable trigger force
- Compatible with M2 styli
- Compatible with the full range of Renishaw probe heads and accessories
- Suitable for manual and DCC CMMs

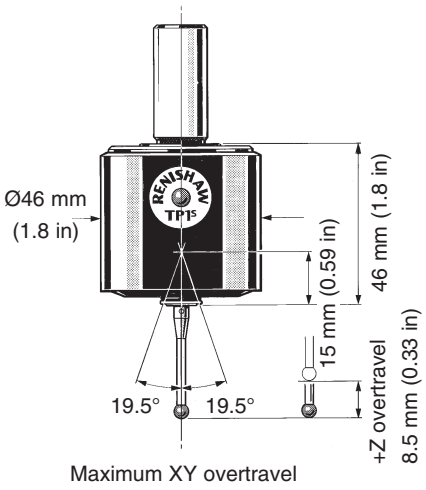


TP1 (S) probe

This large, robust kinematic probe has a high degree of overtravel and is shank mounted, making it ideal for use on manual CMMs. The probe signal is carried to the CMM via an external cable and the probe has adjustable stylus force to help optimise its performance.

TP1(S) features and benefits:

- Ideal for manual CMMs
- Robust
- Large overtravel range
- Large adjustable trigger force range
- Shank mounted



Specification summary	TP2-5 way		TP1(S)	
PRINCIPAL APPLICATION	Universal DCC and manual CMMs		Manual CMMs	
SENSE DIRECTIONS	5 axis ±X, ±Y, +Z		5 axis ±X, ±Y, +Z	
UNI-DIRECTIONAL REPEATABILITY MAX. (2σ) AT STYLUS TIP	0.35 µm	(0.000014 in)	0.5 µm	(0.00002 in)
PRE-TRAVEL VARIATION 360° (XY PLANE)	±0.8 µm	(±0.000032 in)	±2.0 µm	(±0.00008 in)
WEIGHT *Excluding shank & cable	22 g	(7.8 oz)	128 g*	(4.52 oz*)
STYLUS RANGE	M2		M3	
STYLUS FORCE RANGE (ADJUSTABLE)	0.07-0.15 N		0.1-0.5 N	
STYLUS FORCE (SET BY RENISHAW)	0.07-0.08 N		0.15 N	
STYLUS OVERTRAVEL: (TYPICAL)	XY PLANE +Z AXIS	±14.0° 4.0 mm (0.16 in) @ 0.07 N 3.0 mm (0.12 in) @ 0.15 N	±19.5° 8.5 mm (0.33 in) @ 0.1 N 5.0 mm (0.20 in) @ 0.5 N	
MAX. EXTENSION ON PH10 series	300 mm	(11.81 in)	N/A	
MOUNTING METHOD	M8 thread.		Shank to suit machine	
SUITABLE INTERFACE	PI 4-2, PI 7-2, PI 200, UCC		PI 4-2, PI 7-2, PI 200, UCC	

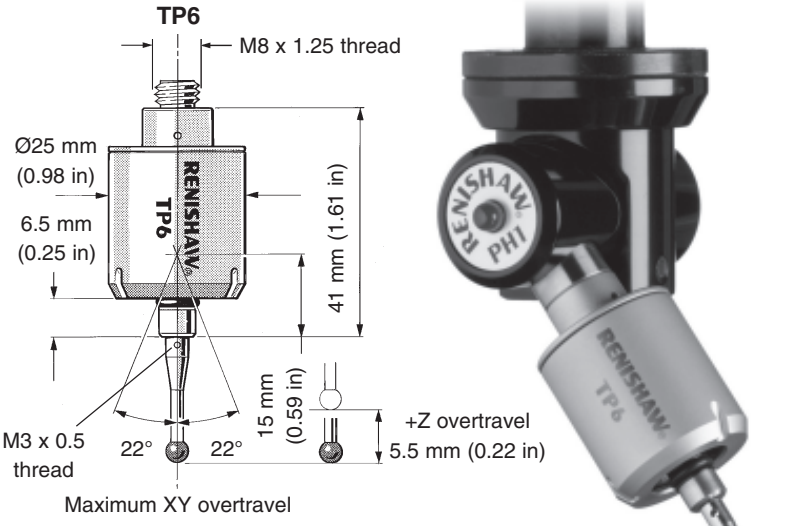
Above data applies to test conditions as follows: Stylus length 10 mm (0.39 in) [re TP2-5W] or 31 mm (1.22 in) [re TP1(S)]. Stylus velocity 480 mm/min (1.57 ft/min). Stylus force 0.07-0.08 N [re TP2-5W] or 0.15 N [re TP1(S)].

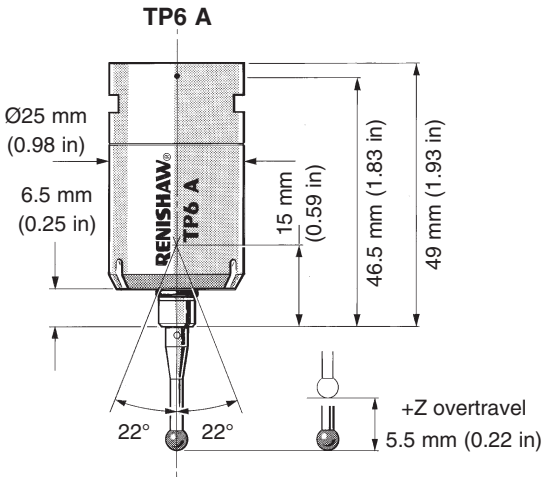
TP6 / TP6A probe

TP6 probes have better accuracy and can carry longer styli than the smaller TP2/TP20 probes. The TP6 is an M8 thread mounted probe while the TP6A has an autojoint, which means that it can be changed quickly and easily without the need to re-qualify stylus tips. The probe design is robust with large overtravel and adjustable trigger force.

TP6 / TP6A features and benefits:

- Autojoint or M8 version
- Long stylus carrying capability
- Large stylus overtravel
- Robust
- Adjustable trigger force range
- M3 stylus mount





Specification summary	TP6	TP6A
PRINCIPAL APPLICATION	Robust universal DCC and manual CMMs	As TP6 but with fast probe exchange without requalification
SENSE DIRECTIONS	5 axis ±X, ±Y, +Z	5 axis ±X, ±Y, +Z
UNI-DIRECTIONAL REPEATABILITY MAX. (2σ) AT STYLUS TIP	0.35 µm (0.000014 in)	0.35 µm (0.000014 in)
PRE-TRAVEL VARIATION 360° (XY PLANE)	±1.0 µm (±0.00004 in)	±1.0 µm (±0.00004 in)
WEIGHT	56 g (1.98 oz)	76 g (2.68 oz)
STYLUS RANGE	M3	M3
STYLUS FORCE RANGE (ADJUSTABLE)	0.11-0.3 N	0.11-0.3 N
STYLUS FORCE (SET BY RENISHAW)	0.11-0.13 N	0.11-0.13 N
STYLUS OVERTRAVEL : XY PLANE (TYPICAL) +Z AXIS	±22.0° 5.5 mm (0.22 in) @ 0.11 N 2.0 mm (0.08 in) @ 0.3 N	±22.0° 5.5 mm (0.22 in) @ 0.11 N 2.0 mm (0.08 in) @ 0.3 N
MAX. EXTENSION ON PH10 series	200 mm (7.87 in)	200 mm (7.87 in)
MOUNTING METHOD	M8 thread connector	Autojoint
SUITABLE INTERFACE	PI 4-2, PI 7-2, PI 200, UCC	PI 4-2, PI 7-2, PI 200, UCC

Above data applies to test conditions as follows: Stylus length 21 mm (0.83 in).
Stylus velocity 480 mm/min (1.57 ft/min). Stylus force 0.11-0.13 N

TP200 / TP200B modular probes

The TP200/TP200B are electronic probes using strain gauge technology, which gives higher accuracy than kinematic touch-trigger probes. They combine outstanding metrology performance with superior functionality to produce a highly versatile DCC CMM probing system with excellent productivity.

The TP200 system components are:

- TP200 probe body – the standard model
- TP200B probe body – a variant model with increased vibration tolerance
- TP200 stylus module – choice of fixed overtravel forces: 'SF' (standard force) or 'LF' (low force)

  There is also the 'EO' (extended overtravel) module, which has the same overtravel force as the 'SF' but provides increased operating range and protection in the probe Z axis
- PI 200 probe interface
- SCR200 stylus changing rack

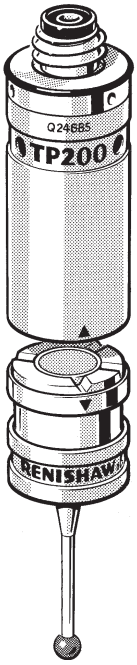


TP200 probe body

The TP200 probe incorporates micro strain gauge transducers, delivering excellent repeatability and accurate 3D form measurement even with long styli. The sensor technology gives sub-micron triggering performance and eliminates the lobing characteristics encountered with standard probes. The solid-state ASIC electronics within the probe ensure reliable operation over millions of trigger points.

TP200B probe body

The TP200B probe uses the same technology as TP200 but has been designed to have a higher tolerance to vibration. This helps to overcome the problem of 'air' trigger generation which can arise from vibrations transmitted through the CMM or when using longer styli with faster positioning speeds. Please note that we do not recommend the use of TP200B with the LF module or cranked/ star styli.



TP200 probe body

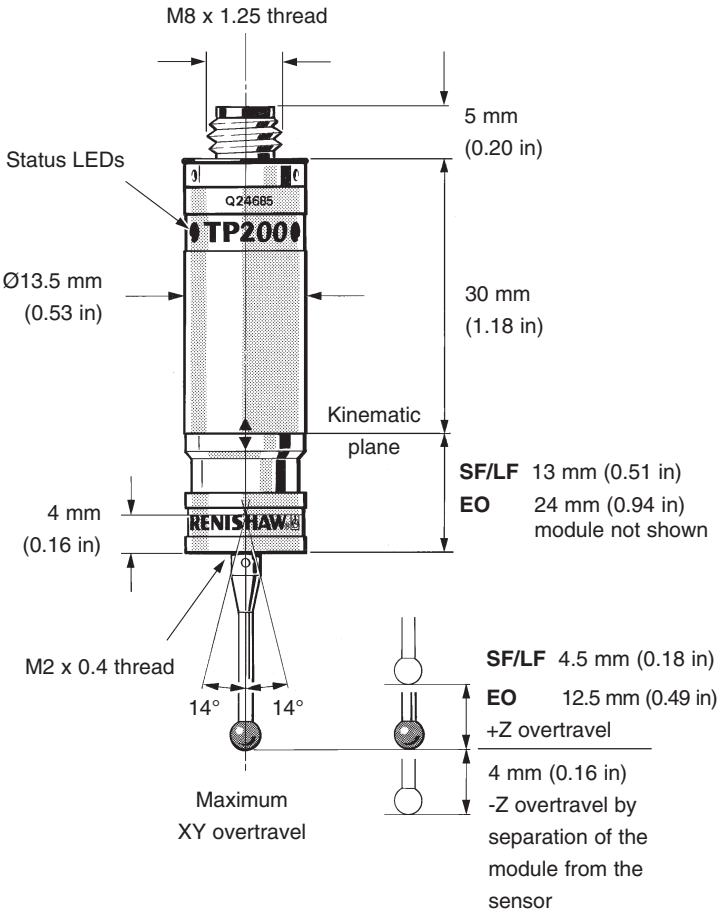
TP200 stylus module

TP200 stylus module

The stylus module is mounted on the probe via a highly repeatable magnetic kinematic joint, providing a rapid stylus changing capability and probe overtravel protection.

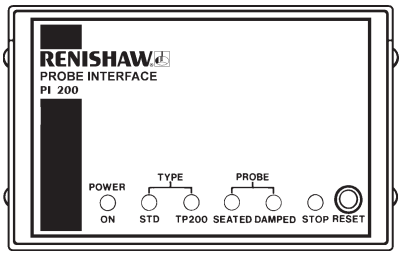
There are three modules available, with two different overtravel forces:

- The SF (standard force) module is suitable for most applications.
- The LF (low force) module is recommended for use with small precision ball styli or on delicate materials.
- The EO (extended overtravel) module is recommended for use when increasing the speed of the CMM may lead to stopping distances which exceed the overtravel range provided in the SF/LF modules. The EO module has an additional 8 mm (0.31 in) of overtravel in the probe Z axis to protect against damage to the sensor in such circumstances. Overtravel force is the same as the SF module.



PI 200 probe interface

The PI 200 is a unit capable of the automatic recognition and interfacing of TP200/B and also conventional touch trigger probes (TP2,TP6,TP20). Two switchable levels of probe trigger sensitivity are provided to accommodate differing applications. The PI 200 interface is covered fully in section 9.



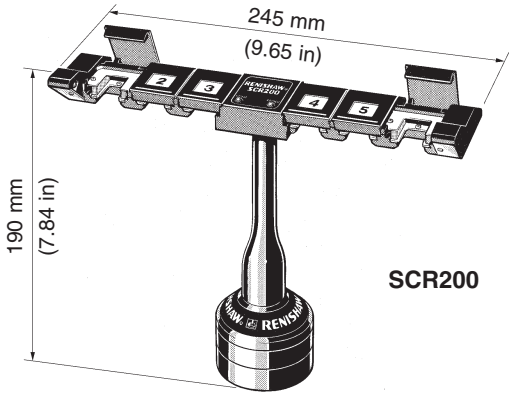
PI 200

SCR200 stylus changing rack

The SCR200 provides rapid, automatic changing of stylus modules without the need to re-qualify stylus tips. The SCR200 is powered entirely by the PI 200 and provides features to facilitate safe stylus changing.

MSR1 module storage rack

For manual storage of modules - see section 13.



SCR200

Probe maintenance

CK200 (Renishaw part number A-1085-0016) is a specialised cleaning material supplied for the removal of contamination from the location faces of the magnetically retained kinematic couplings of the TP20, TP200 and SP25M probe systems. The frequency of cleaning should be determined according to the conditions of use.

TP200 / TP200B features and benefits:

- Excellent repeatability and precision 3D form measurement
- Rapid exchange between stylus configurations without the need to re-calibrate
- 6 way measuring capability (±X, ±Y, ±Z)
- SF and LF modules to give overtravel force to suit the application
- EO module to give increased overtravel in probe Z axis
- Zero reseat errors and no lobing effect
- Suitable for intensive 'peck' or 'stitch' scanning
- Stylus reach up to 100 mm (3.99 in) GF range
- Module life of >10 million triggers
- Compact size
- Compatible with the full range of Renishaw probe heads and accessories



Specification summary			TP200		TP200B	
PRINCIPAL APPLICATION			DCC CMM where high accuracy measurement is required		As TP200 but where 'air' * trigger events occur	
SENSE DIRECTIONS			6-way: ±X ±Y ±Z		6-way: ±X ±Y ±Z	
UNIDIRECTIONAL REPEATABILITY (2σ µm)		Trigger level 1 Trigger level 2	0.4 µm 0.5 µm	(0.000016 in) (0.00002 in)	0.4 µm 0.5 µm	(0.000016 in) (0.00002 in)
XY (2D) FORM MEASUREMENT DEVIATION		Trigger level 1 Trigger level 2	±0.8 µm ±0.9 µm	(0.000032 in) (0.000036 in)	±1.0 µm ±1.2 µm	(0.00004 in) (0.000047 in)
XYZ (3D) FORM MEASUREMENT DEVIATION		Trigger level 1 Trigger level 2	±1.0 µm ±1.4 µm	(0.00004 in) (0.000056 in)	±2.5 µm ±4.0 µm	(0.0001 in) (0.00016 in)
REPEATABILITY OF STYLUS CHANGE		With SCR200 Manual	±0.5 µm ±1.0 µm	(±0.00002 in) max. (±0.00004 in) max.	±0.5 µm ±1.0 µm	(±0.00002 in) max. (±0.00004 in) max.
TRIGGER FORCE	XY plane Z axis	All modules All modules	0.02 N 0.07 N		0.02 N 0.07 N	
OVERTRAVEL FORCE (@ 0.5 mm displacement)	XY plane Z axis 	SF/EO module LF module SF/EO module LF module	0.2 - 0.4 N 0.1 - 0.15 N 4.9 N 1.6 N		0.2 - 0.4 N 0.1 - 0.15 N 4.9 N 1.6 N	
WEIGHT (probe sensor + module)			22 g	(0.8 oz)	22 g	(0.8 oz)
MAX. EXTENSION (if on a PH10 series head)			300 mm	(11.8 in)	300 mm	(11.8 in)
MAX. RECOMMENDED STYLUS LENGTH (M2 stylus range)		SF/EO module LF module	50 mm (1.97 in) steel - 100 mm (3.94 in) GF 20 mm (0.79 in) steel - 50 mm (1.97 in) GF		50 mm (1.97 in) steel - 100 mm (3.94 in) GF 20 mm (0.79 in) steel - 50 mm (1.97 in) GF	
PROBE MOUNTING METHOD			M8 thread		M8 thread	
SUITABLE INTERFACE			PI 200, UCC		PI 200, UCC	
STYLUS MODULE CHANGING RACK (automatic)			SCR200		SCR200	
STYLUS MODULE STORAGE RACK (manual)			MSR1		MSR1	

Above data applies for test conditions as follows: Stylus length 50 mm (1.97 in) Stylus velocity 480 mm/min (1.57 ft/min).

*Air trigger (or false trigger). The TP200B reduces probe triggers that may be caused by vibrations.

TP20 / TP20 NI modular probes

The TP20 is a 5-way or 6-way kinematic touch trigger probe. Its two piece design comprises a probe body and detachable stylus module(s), which gives the ability to change stylus configurations either manually or automatically without re-qualification of the stylus tips, providing significant time savings in inspection routines.

A direct replacement for the industry standard Renishaw TP2 probe, the TP20 probe system brings a range of new benefits to manual and DCC CMM applications, and can easily be retrofitted to existing TP2 installations.

The TP20 can be used on a wide range of Renishaw's manual or motorised probe heads, either by direct mounting using the standard M8 thread or, alternatively, by using a PAA# adaptor to connect to an autojoint.

The system components are:

- TP20/TP20 NI probe body
- TP20 stylus module – seven module variants allow for optimisation of performance to suit the application
- MCR20 module changing rack – automatic operation
- The TP20 probe system may be used with Renishaw's PI 4-2, PI 7-2 or PI 200 probe interfaces (see section 9)

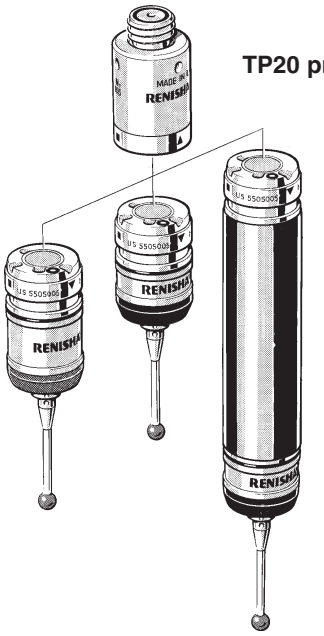
TP20 probe body

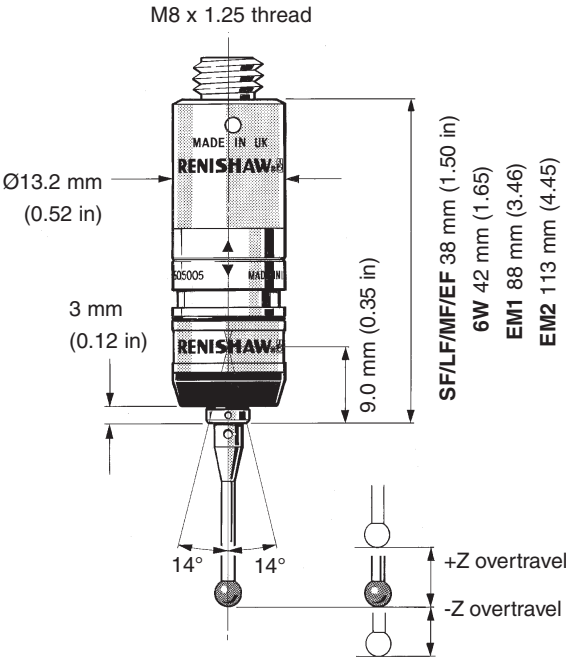
The TP20 probe body houses one half of the highly repeatable magnetic kinematic coupling that attaches the stylus module and body. The body also contains a magnetic proximity switch to inhibit triggering of the probe during automatic module changing with MCR20.

Note: If the probe is operated close to magnetised parts/clamping etc, the probe trigger may become inhibited. Countermeasures include the use of long styli, stylus extensions or body orientation to increase the distance to the magnetic source. Alternatively, use the TP20 NI probe body.

TP20 NI probe body

The TP20 NI probe differs from the TP20 body in that it is not affected by magnetic fields. However the probe trigger must be inhibited through software during change cycles using the MCR20.





+Z overtravel

SF/EM1/EM2 4.0 mm (0.16 in)
LF 3.1 mm (0.12 in)
MF 3.7 mm (0.15 in)
EF 2.4 mm (0.09 in)
6W 4.5 mm (0.177 in)

-Z overtravel

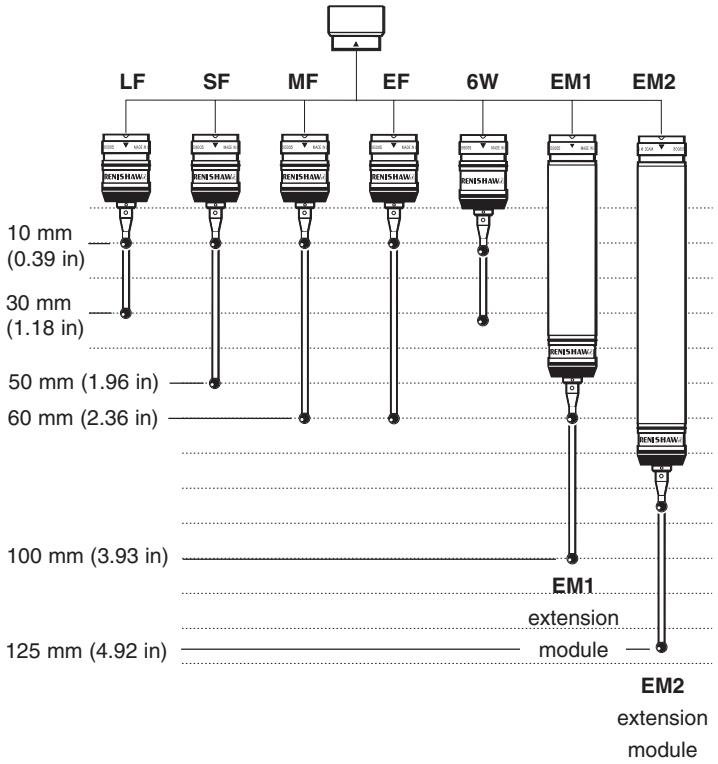
6W 1.5 mm (0.06 in)

TP20 stylus module

The TP20 stylus module houses the kinematic switching touch sensor mechanism, carries the stylus assembly and provides overtravel in ±X, ±Y and +Z axes (or ±Z in the case of TP20 6-way module). The stylus mounting thread accepts styli from the Renishaw M2 range.

A range of seven, application specific, stylus modules is available, being identified by coloured caps:

- **SF** - Standard force stylus module (black cap)
- **LF** - Low force stylus module (green cap)
- **MF** - Medium force stylus module (grey cap)
- **EF** - Extended force stylus module (brown cap)
- **6W** - 6-way stylus module (blue cap)
- **EM1 SF** - Standard force extension module
- **EM2 SF** - Standard force extension module



Stylus module comparison

MCR20 module changing rack

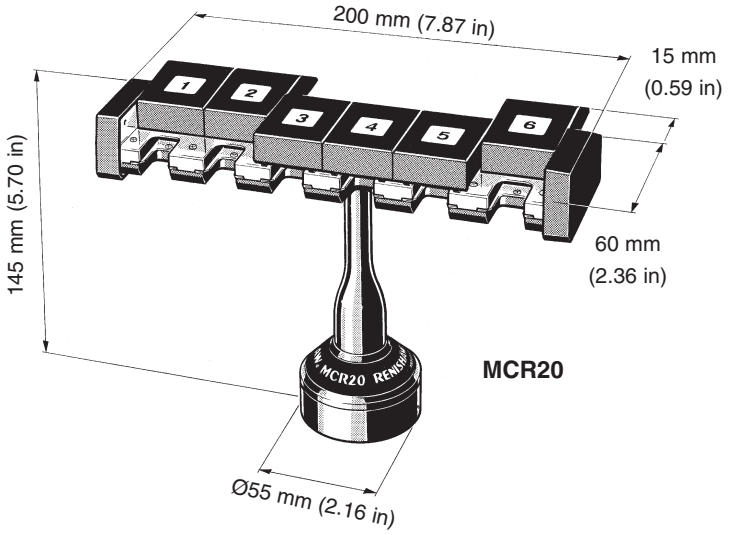
The MCR20 probe module changing rack is designed to securely store stylus modules ready for rapid automatic changing, whilst protecting mating surfaces from any airborne contaminants within the working environment.

MSR1 module storage rack

For manual storage of modules - see section 13.

Probe maintenance

CK200 (Renishaw part number A-1085-0016) is a specialised cleaning material supplied for the removal of contamination from the location faces of the magnetically retained kinematic couplings of the TP20, TP200 and SP25M probe systems. The frequency of cleaning should be determined according to the conditions of use.



MCR20

TP20 / TP20 NI features and benefits:

- A kinematic touch trigger probe system for manual and DCC CMMs
- Rapid exchange between stylus configurations without the need to re-calibrate
- A choice of seven stylus modules, giving 5-way or 6-way operation, allow optimisation of probe and stylus performance to the given application
- Easily retrofitted to all Renishaw standard probe heads (M8 or autojoint fitting) and compatible with existing TTP interfaces
- Metrology performance equivalent to industry proven TP2-5W probe
- Compatible with the full range of Renishaw probe heads and accessories



Specification summary (1)		TP20	TP20 NI
PRINCIPAL APPLICATION		DCC and Manual CMMs suitable for most applications	DCC and Manual CMMs where operation is within a magnetic field
SENSE DIRECTIONS	All modules except 6W 6W	±X, ±Y, +Z ±X, ±Y, ±Z	±X, ±Y, +Z ±X, ±Y, ±Z
PRE-TRAVEL VARIATIONLF	±0.6 µm (±0.000023 in) SF / EM1 / EM2 MF EF 6W	±0.6 µm (±0.000023 in) ±0.8 µm (±0.000032 in) ±1.0 µm (±0.000039 in) ±2.0 µm (±0.000079 in) ±1.5 µm (±0.000058 in)	 ±0.8 µm (±0.000032 in) ±1.0 µm (±0.000039 in) ±2.0 µm (±0.000079 in) ±1.5 µm (±0.000058 in)
UNIDIRECTIONAL REPEATABILITY 2σ at stylus tip	SF / LF / EM1 / EM2 MF EF 6W	0.35 µm (±0.000014 in) 0.50 µm (±0.000020 in) 0.65 µm (±0.000026 in) 0.80 µm (±0.000032 in)	0.35 µm (±0.000014 in) 0.50 µm (±0.000020 in) 0.65 µm (±0.000026 in) 0.80 µm (±0.000032 in)
REPEATABILITY OF STYLUS CHANGE (max)	With MCR20 Manual	±0.5 µm (±0.000020 in) ±1.0 µm (±0.000040 in)	±0.5 µm (±0.000020 in) ±1.0 µm (±0.000040 in)
STYLUS RANGE		M2	M2
PROBE MOUNTING METHOD		M8 thread	M8 thread
SUITABLE INTERFACE		PI 4-2, PI 7-2, PI 200, UCC	PI 4-2, PI 7-2, PI 200, UCC
STYLUS MODULE CHANGING RACK (automatic)		MCR20	MCR20
STYLUS MODULE STORAGE RACK (manual)		MSR1	MSR1

Above data applies for test conditions as follows: Stylus length 10 mm (0.39 in). Stylus velocity 480 mm/min (1.57 ft/min)

Specification summary (2)

Module	Application guide	Max extension on PH10 series head	Weight (Body and module)
SF **EM1** **EM2**	The standard force stylus modules, identified by black caps, are suited to the majority of applications.	300 mm (11.81 in) 300 mm (11.81 in) * 300 mm (11.81 in) *	22 g (0.77 oz) 28 g (0.98 oz) 30 g (1.05 oz)
LF	The low force stylus module, identified by a green cap, is suited to applications that require low trigger force, e.g. rubber seals.	300 mm (11.81 in)	22 g (0.77 oz)
MF	The medium force stylus module, identified by a grey cap, is for use where a higher trigger force than standard is required.	300 mm (11.81 in)	22 g (0.77 oz)
EF	The extended force stylus module is identified by a brown cap. Typically, this stylus module will only be required with large stylus assemblies, and where spurious 'air' triggers caused by machine vibration and acceleration, preclude the use of either SF, LF or MF modules.	300 mm (11.81 in)	22 g (0.77 oz)
6W	The 6-way stylus module, identified by a blue cap, has been designed for applications requiring measurement in the –Z direction, for example when measuring the width of undercuts.	300 mm (11.81 in)	25 g (0.88 oz)

* **Note:** Dependant on CMM used and operating conditions

Specification summary (3)

Module type and test stylus length	Trigger force		Overtravel force			Overtravel displacement		
	XY	Z	XY	+Z	-Z	XY	+Z	-Z
SF 10 mm	0.08 N	0.75 N	0.2-0.3 N	3.5 N	-	±14°	4.0 mm (0.16 in)	-
LF 10 mm	0.055 N	0.65 N	0.09 N	1.15 N	-	±14°	3.1 mm (0.12 in)	-
MF 25 mm	0.1 N	1.9 N	0.2-0.4 N	7.0 N	-	±14°	3.7 mm (0.15)	-
EF 50 mm	0.1 N	3.2 N	0.2-0.5 N	10.0 N	-	±14°	2.4 mm (0.09 in)	-
6W 10 mm	0.14 N	1.6 N	0.25 N	2.5 N	9.0 N	±14°	4.5 mm (0.18 in)	1.5 mm (0.059 in)
EM1 10 mm	0.08 N	0.75 N	0.2-0.3 N	3.5 N	-	±14°	4.0 mm (0.16 in)	-
EM2 10 mm	0.08 N	0.75 N	0.2-0.3 N	3.5 N	-	±14°	4.0 mm (0.16 in)	-

Above data applies for test conditions as follows: Stylus length as stated above. Stylus velocity 480 mm/min (1.57 ft/min)

SP25M compact scanning probe system

SP25M scanning probe

Only 25 mm (0.98 in) in diameter, and with a range of modules for high performance scanning and touch-trigger probing, the SP25M is the world's most compact and versatile scanning probe system.

The SP25M is actually two sensors in one, enabling scanning and touch-trigger probing in a single probe system. SP25M gives highly accurate scanning performance with stylus lengths from 20 mm to 400 mm (0.78 in to 15.75 in) using M3 stylus range. In addition, the ability to carry Renishaw's TP20 range of touch-trigger stylus modules means that the SP25M system enables best optimisation of the measurement solution to suit the application.

The SP25M's compact size and autojoint mounting make it compatible with the PH10M/MQ motorised probe heads and PH6M fixed probe head. It can also be mounted on a multiwired extension bar of up to 100 mm length. Together, this combination permits excellent reach and access to part features.

A unique pivoting design achieves exceptional dynamic performance. Four scanning modules have been designed to optimise scanning accuracy across a wide range of stylus lengths, avoiding most of the deterioration in performance seen in other types of scanning probe as stylus lengths increase.

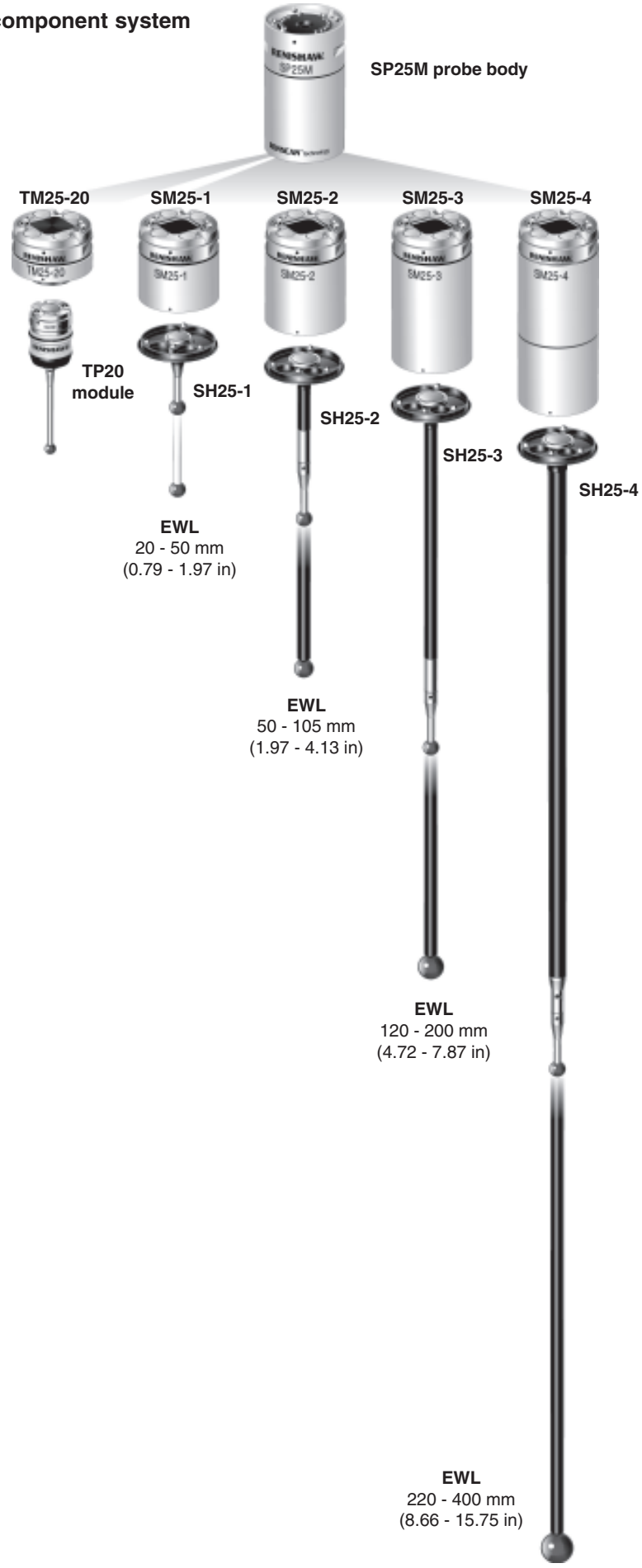


SM25-4 module can scan very deep features - shown here with 400 mm (15.75 in) stylus

SP25M features and benefits

- The world's most compact and versatile scanning probe system
- Two sensors in one - a scanning probe, and a touch trigger probe using TP20 stylus modules
- Rapid and repeatable interchange between highly modular system elements provides the most efficient solution to suit the measurement task
- Excellent scanning accuracy across the entire stylus range of 20 - 400 mm (0.78 - 15.75 in)
- Can be used with extension bars up to 100 mm for even greater reach
- Probe can be mounted on an articulating head, allowing access to many features with fewer styli
- Ultra-compact at Ø25 mm (Ø0.98 in) for superior part accessibility
- Isolated optical metrology technology gives unrivalled measurement performance, even with long styli
- Flexible change rack where ports can be easily configured to carry any system element
- Bump-stop crash protection in the Z axis, together with a detachable stylus holder for XY crash protection
- Low-cost, entry level kits available with ability to easily expand the system

SP25M modular component system



EWL - Effective working length

The SP25M system components

The SP25M probe body, which houses the isolated optical metrology transducer system, has autojoint compatibility with Renishaw's PH10M/MQ, and PH6M probe heads, extension bars and ACR1/3 sensor changers.

A range of four scanning modules SM25-1/-2/-3/-4 has been designed to provide optimised scanning performance over their specified stylus length ranges. The SP25M's innovative pivot-action motion, and the isolated optical metrology approach, mean that excellent accuracy is achieved over the entire stylus length range of 20 mm to 400 mm (0.78 in to 15.75 in).

SH25-1/-2/-3/-4 stylus holders provide the flexibility to have multiple stylus set-ups for each scanning module. The detachable stylus holder is located on the scanning module using a repeatable magnetic kinematic joint. It provides automatic stylus changing capability and directly carries Renishaw's M3 stylus range.

It is also possible to carry Renishaw's TP20 range of touch trigger probe modules by using the TM25-20 adaptor module mounted on the SP25M probe body.

Rapid and repeatable interchange between all system elements allows easy selection of best probe solution. This can be automated to maximise productivity by using the FCR25 flexible change rack.

The SP25M can be connected directly to the UCC2 controller while a daughtercard permits use with Renishaw's UCC1 controller. The AC3 interface card allows integration with other controllers.



SP25M with 100 mm (3.94 in) extension bar between PH10 head and probe body

Using SP25M as a scanning probe:

The probe body has one of the three scanning modules attached (SM25-1/-2/-3/-4) which have matching stylus holders (SH25-1/-2/-3/-4). Each combination is optimised to maintain high accuracy and low contact forces over their dedicated range of effective stylus lengths. These are:

- SM25-1 + SH25-1 = 20 mm - 50 mm (0.78 in -1.97 in) EWL
  by use of 20 mm - 50 mm (0.78 in - 1.97 in) stylus
- SM25-2 + SH25-2 = 50 mm - 105 mm (1.97 in - 4.13 in) EWL
  by use of 20 mm - 75 mm (0.78 in - 2.95 in) stylus
- SM25-3 + SH25-3 = 120 mm - 200 mm (4.72 in - 7.87 in) EWL
  by use of 20 mm - 100 mm (0.78 in - 3.94 in) stylus
- SM25-4 + SH25-4 = 220 mm - 400 mm (8.66 in - 15.75 in) EWL
  by use of 20 mm - 200 mm (0.78 in - 7.87 in) stylus



SP25M scanning

Using SP25M as a touch-trigger probe:

The probe body has the TM25-20 adaptor module attached, which directly carries any of Renishaw's TP20 range of stylus modules:

- TP20 LF/SF/MF/EF
- TP20 EM1/EM2
- TP20-6W



SP25M taking points with a TP20 module

Interfacing options

SP25M can be integrated:

- directly using the UCC2 controller (requires scanning upgrade)
- by using Renishaw's UCC1 controller (requires scanning upgrade) together with a SP25M/UCC1 daughtercard
- by using Renishaw's AC3 interface card (ISA Bus) within the machine builder's controller

Automation using the FCR25 flexible change rack

The full potential of the SP25M system is realised when the measurement routine is automated using the FCR25 flexible change rack, a passive triple-port unit capable of storing any of the system elements.

The FCR25 port stores the SM25-1/-2/-3/-4 and TM25-20 modules, but can instantly be configured to store the SH25-1/-2/-3/-4 stylus holders or TP20 modules by using the appropriate port adaptor insert: PA25-SH (for SH25-1/-2/-3/-4) or PA25-20 (for TP20 modules).

The FCR25 mounts directly on Renishaw's MRS modular rack system for multiple port solutions (3, 6, 9, 12, 15 etc). Alternatively, there is FCR25-L3 (3 port) and FCR25-L6 (6 port) stand-alone rack variants which are ideal where machine space is limited.



FCR25's mounted to the MRS



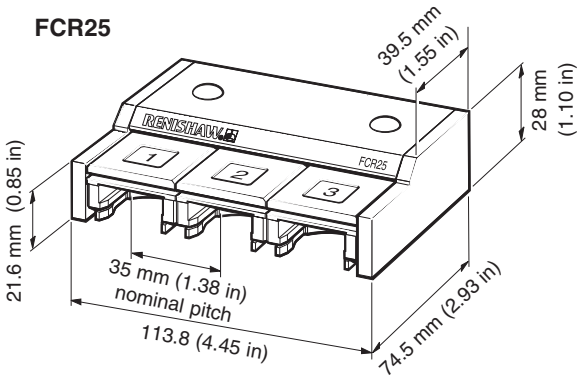
Probe maintenance

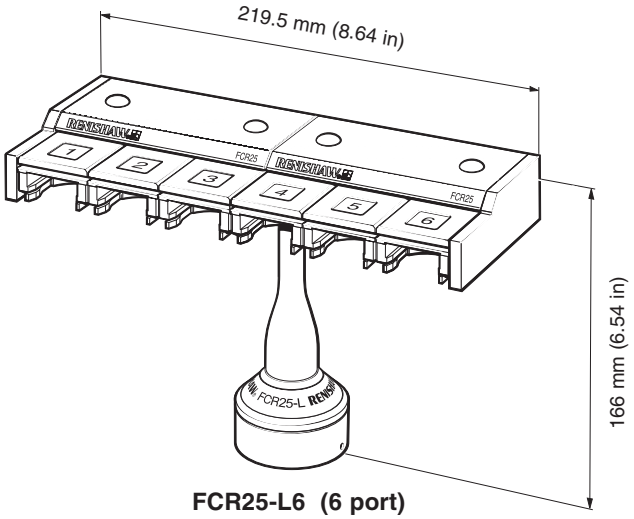
CK200 (Renishaw part number A-1085-0016) is a specialised cleaning material, for the removal of contamination from the location faces of the magnetically retained kinematic couplings of the TP20, TP200 and SP25M probe systems. The frequency of cleaning should be determined according to the conditions of use.



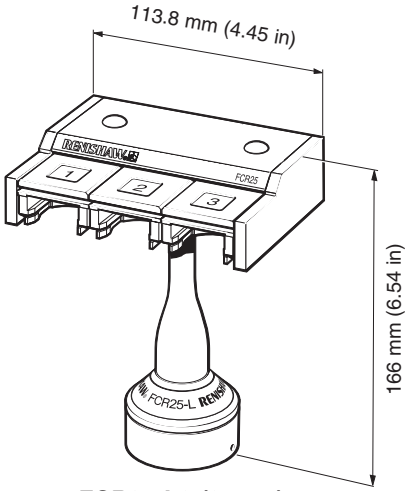
PA25-20

PA25-5H





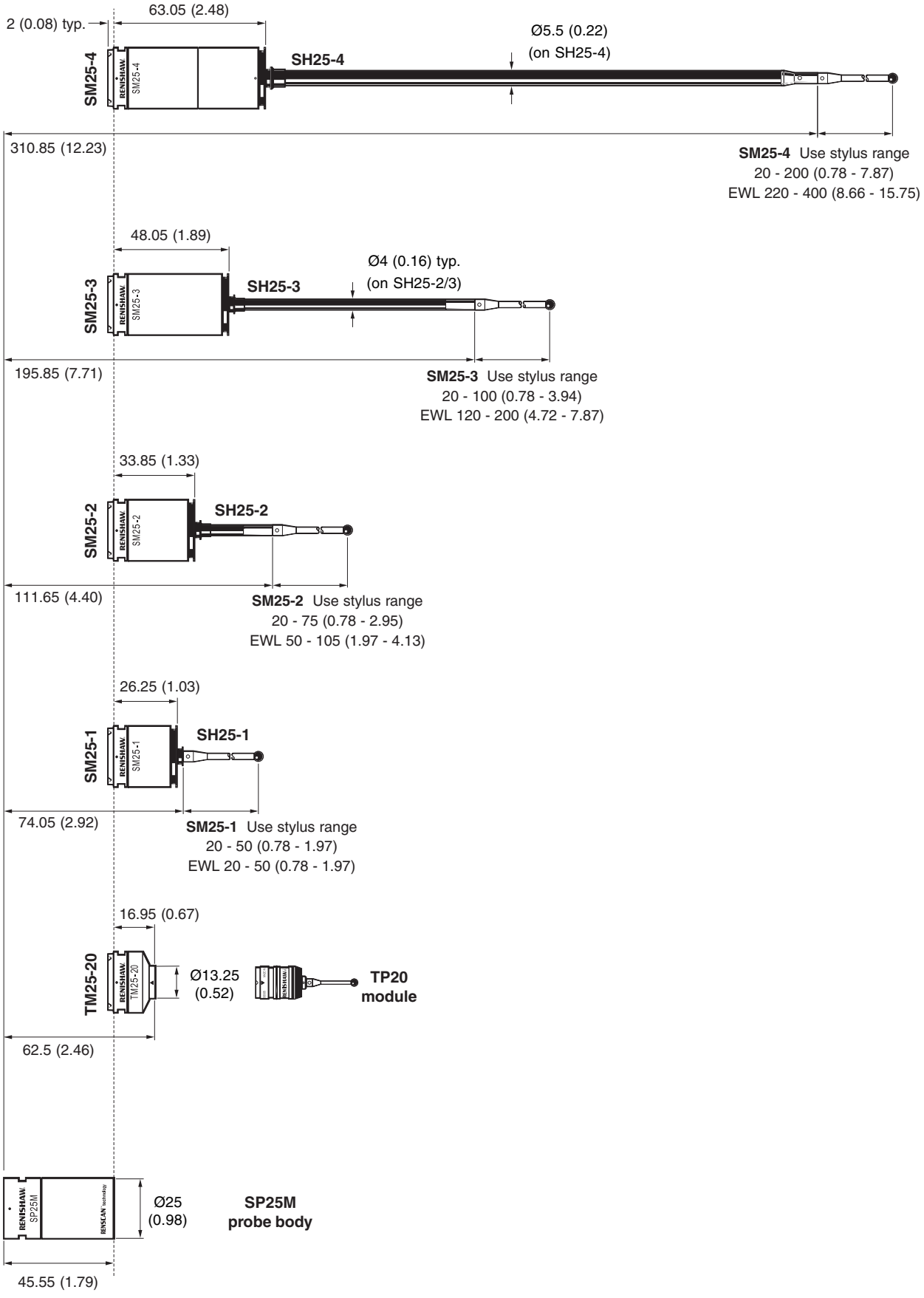
FCR25-L6 (6 port)



FCR25-L3 (3 port)

SP25M system component dimensions

dimensions mm (in)



Specification summary	SP25M	
PROBE ATTRIBUTES	Scanning with 3 axis measurement (X,Y,Z) Touch trigger probing using TP20 modules *	
MEASUREMENT RANGE	±0.5 mm (0.02 in) deflection in all directions in all orientations	
OVERTRAVEL RANGE (nom)	X,Y = ±2.0 mm (±0.08 in) min, +Z = 1.7 mm (0.07 in), -Z = 1.2 mm (0.05 in)	
RESOLUTION	Capable of <0.1 µm (<0.00004 in)	
SPRING RATE	Nominally 0.6 N/mm - when using module's shortest specified stylus Nominally 0.2 N/mm - when using module's longest specified stylus	
PROBE DIMENSIONS	Ø25 mm x length dependant on module used (see schematic above)	
WEIGHT:	SP25M body	65 g (2.29 oz)
	SM25-1 scan module	35 g (1.23 oz) including SH25-1, but excluding stylus
	SM25-2 scan module	40 g (1.41 oz) including SH25-2 but excluding stylus
	SM25-3 scan module	49 g (1.73 oz) including SH25-3 but excluding stylus
	SM25-4 scan module	71 g (2.50 oz) including SH25-4 but excluding stylus
	TM25-20 TTP module	40 g (1.41 oz) including TP20 STD module, but excluding stylus)
EFFECTIVE STYLUS LENGTH RANGE (Note: Always observe the specified stylus range for the scanning module being used)	SM25-1 + SH25-1 = EWL 20 mm - 50 mm (0.78 in - 1.97 in) using 20 mm - 50 mm stylus SM25-2 + SH25-2 = EWL 50 mm - 105 mm (1.97 in - 4.13 in) using 20 mm - 75 mm stylus SM25-3 + SH25-3 = EWL 120 mm - 200 mm (4.72 in - 7.87 in) using 20 mm - 100 mm stylus SM25-4 + SH25-4 = EWL 220 - 400 mm (8.66 in - 15.75 in) using 20 mm - 200 mm stylus Note: uses Renishaw's M3 range of styli	
MOUNTING	Multiwired autojoint - compatible with PH10M/MQ and PH6M probe heads, extension bars and ACR1/3 sensor changers.	
CRASH PROTECTION	±X, ±Y, -Z via break out of module or stylus holder +Z via integral bump-stop design	
SIGNAL OUTPUTS	non-linear and non-orthogonal analogue outputs – rate, gain and resolution are not fixed	
POWER SUPPLY	+12 V (±5%) , -12 V (+10% / -8%), 5 V (+10% / -13%) dc at probe	
PROBE CALIBRATION	Requires that a non-linear, third order polynomial calibration is used	
CHANGE RACK OPTIONS	FCR25	triple port unit(s) which mount to MRS
	FCR25-L3/6	3/6 port standalone racks
INTERFACE OPTIONS	Directly into UCC2 (requires scanning upgrade) or into the UCC1 using an SP25M/UCC1 daughtercard (scanning upgrade required) or AC3 interface card. Interface for TP20 also required if applicable. (See page 3-6)	

*** Note:** Please refer to page 3-4 for TP20 specification information



SP25M's modular design approach is the key to high accuracy and user flexibility

SP80 - ultra high accuracy scanning probe

The SP80 is a passive scanning probe using digital scale and readheads which enable a system resolution of 0.02 µm (0.00000079 in). This gives exceptional scanning performance, even with long styli.

The SP80 can carry styli up to 500 mm (19.69 in) long and 500 g (176.35 oz) mass, including star configurations. Unbalanced star configurations do not require counterbalancing. Kinematic stylus holder changing allows for the repeatable re-location of the stylus, optimises stylus arrangements for each feature, and overcomes the need for re-qualification.

The SP80 has a kinematic mount that provides a repeatable connection to the mating plate mounted on the quill (KM80), allowing the probe to be easily removed.

Kinematic stylus holders provide crash protection in the XY plane, and a bump-stop prevents damage to the probe in the Z axis.

Note: Please see the accessories page 13-4 for details of adaptor plates PHA80 and PHA3 which permit rapid interchange between SP80 and PH10MQ indexing motorised head.

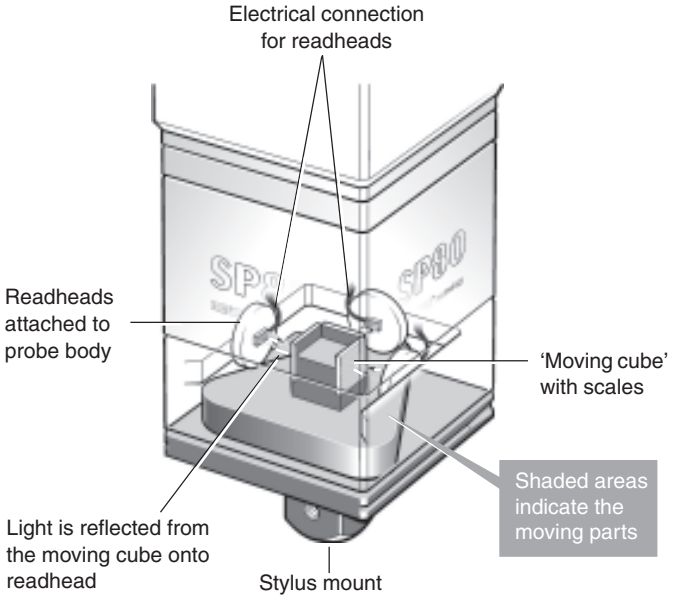


Isolated optical metrology system

Using an isolated optical metrology system, SP80 directly measures the deflection of the whole mechanism, thus providing outstandingly accurate position sensing.

The isolated optical metrology system can detect sources of variable error such as thermal and dynamic effects. In contrast, probes with displacement sensors mounted to stacked axes suffer from latency under changing inertial loads, and cannot detect thermal growth in their mechanisms.

The readheads for each axis are fixed to the body of the probe, and measure the deflection in each direction. Any inter-axis errors caused by the arc motion of each pair of parallel-acting springs are directly measured by the sensor system. Isolated optical metrology systems have no moving wire connections.



Isolated optical metrology

SP80 probe body

The sensor mechanism comprises an arrangement of three sets of parallel springs, one for each body axis, set in a cube - hence the body shape. The motion of the stylus is coupled to a 'moving cube' holding graduated reflective scales - again one for each axis. The readheads are mounted on the wall of the probe and the light projected from them is reflected from the moving scales. This method of motion detection does not require any form of moving wire connection.

Interface options

Interfacing the SP80 to a CMM can be achieved by:

- Using an SP80 daughtercard for direct UCC1 or UCC2 integration
- Using a Renishaw PCI counter card (CC6) and the Renishaw interpolator unit IU80
- Using interface cards designed by the machine builder and used in conjunction with an IU80
- Using a countercard and interpolator unit designed by the machine builder

The IU80 conditions the probe signal to provide a digital industry standard EIA RS422 quadrature scale output, which can be accepted by CMM controllers.

Please contact Renishaw for full information on the methods detailed above.

KM80 quill mount

This is fixed to the quill and provides rapid and repeatable kinematic mounting of the SP80 body to the CMM.

SH80 stylus holder

The detachable stylus holder is located on the probe body using a repeatable kinematic joint and magnets. It provides automatic stylus changing capability and has an M5 stylus mount attachment. For additional flexibility, this may be rotated by adjusting a grub screw, and does not need to be removed from the probe body to make the adjustment.

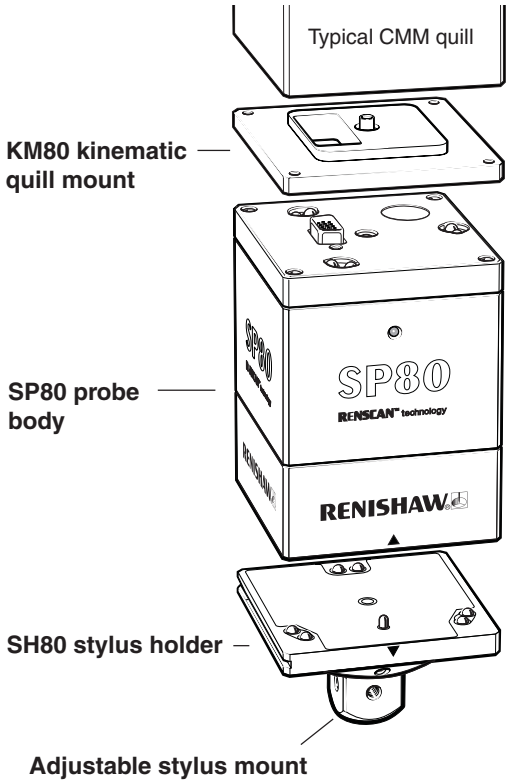
SCP80 stylus changing port

The SH80 stylus holder can be removed automatically and replaced on the probe body using an SCP80 mounted on a modular rack system (MRS). The SCP80 has a spring loaded mechanism which has been designed to ease the stylus holders away from the probe body. Using the SCP80, the SP80 pull-off force is reduced to less than 20 N.

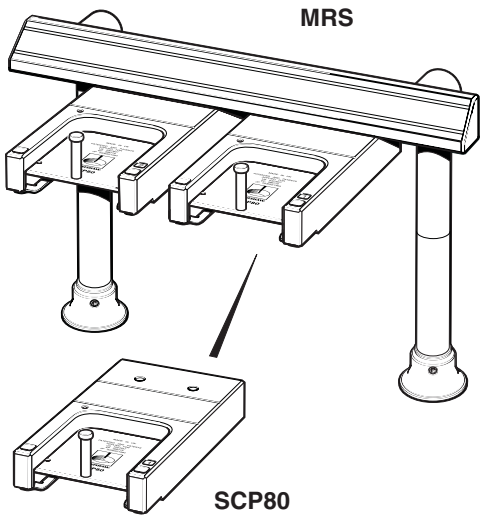
PHA3 and PHA80

The PHA3 and PHA80 adaptor plates enable rapid interchange between PH10MQ (using PHA3) and SP80 (using PHA80) on the same CMM.

SP80 probe kit



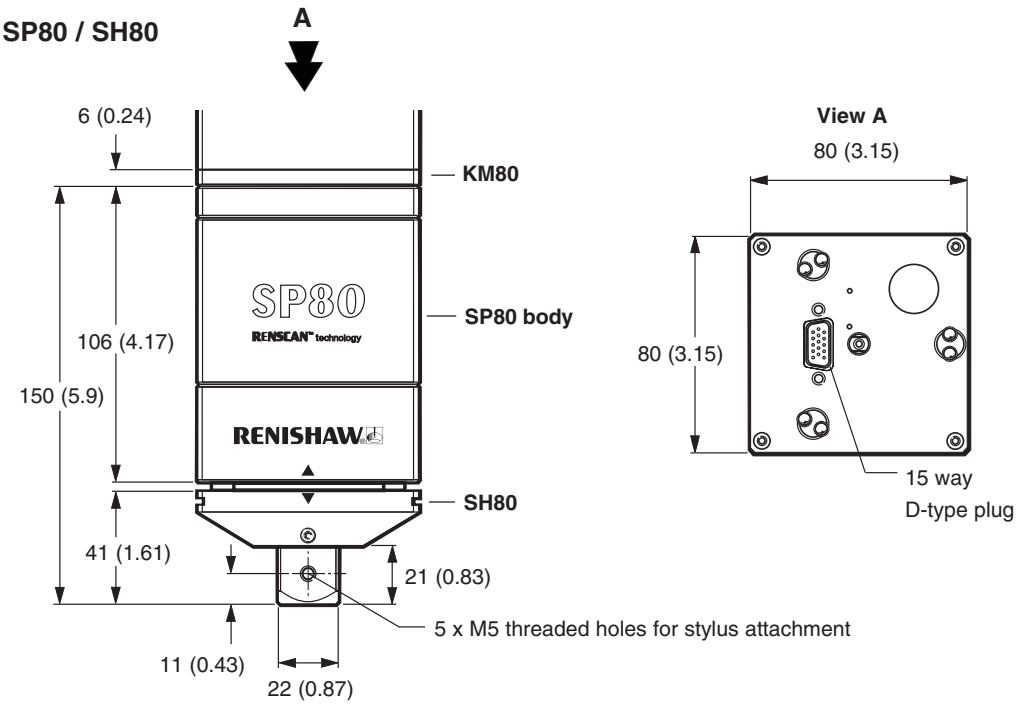
Two SCP80s mounted on an MRS



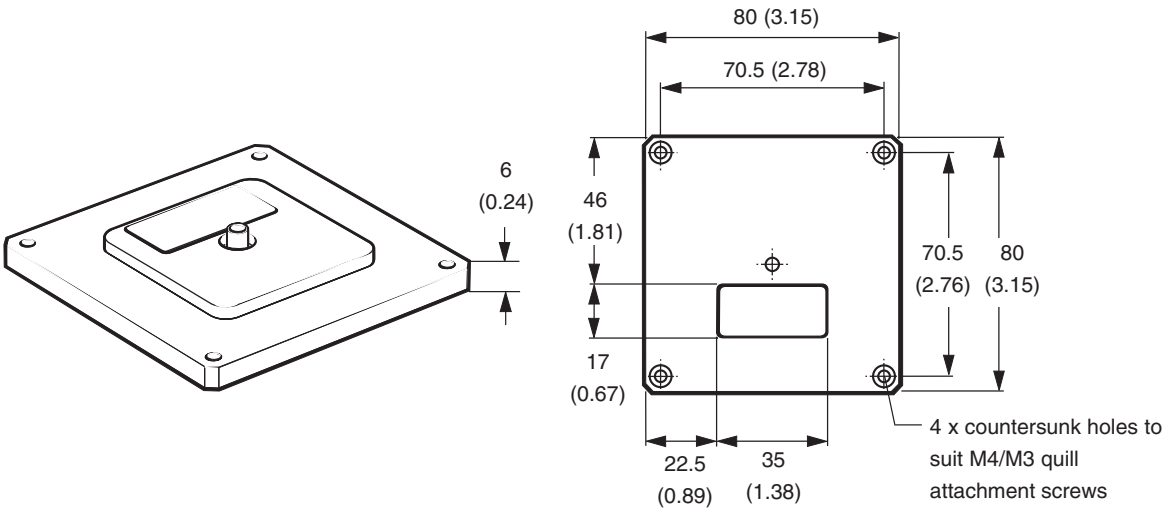
SP80 system component dimensions

dimensions mm (in)

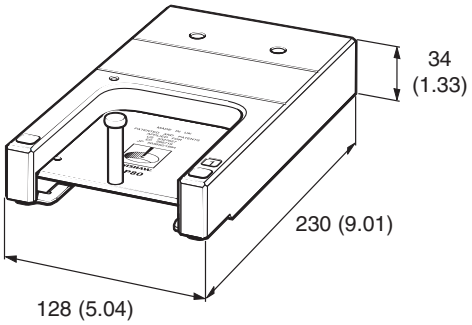
SP80 / SH80



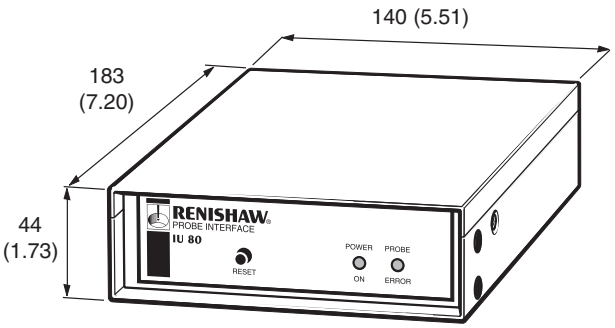
KM80



SCP80



IU80



SP80 features and benefits:

- Ultra-high accuracy measurement, provided by digital scale and readheads
- Long styli carrying capability for access to deep features
- Isolated optical metrology for direct accurate measurement of stylus deflection
- Kinematic stylus changing for system flexibility
- Low inertia mechanism for excellent dynamic response
- Bump-stop crash protection in the Z axis, together with a detachable stylus holder for XY crash protection
- No motors, therefore improved thermal stability and reliability

Specification summary	**SP80**
PROBE ATTRIBUTES	Ultra-high accuracy scanning probe with three axis measurement (X, Y, Z)
ORIENTATION	Vertical
SIZE	80 mm (3.15 in) square body, 150 mm (5.9 in) long including stylus holder
QUILL MOUNTING	80 mm (3.15 in) kinematic quill mount (KM80) as standard Shank mount (SM80) and other custom made adaptor plates available - contact your nearest Renishaw supplier for details
MEASUREMENT RANGE	±2.5 mm (±0.12 in) X, Y, Z (three axis measurement)
OVERTRAVEL RANGE	X and Y protected by a kinematic break out joint on SH80 +Z has a mechanical 'bump-stop'
RESOLUTION OF SCALES	0.02 µm (0.00000079 in)
SPRING RATE	Approximately 1.8 N/mm (X, Y, Z)
WEIGHT	SP80 probe: 860 g (30.33 oz) excluding mount and stylus holder SH80 stylus holder: 185 g (6.5 oz) KM80 quill mount: 110 g (3.88 oz)
PULL OFF FORCE OF MODULE	< 20 N when using SCP80, otherwise approximately 80 N
PROBE POWER SUPPLY	+9 V to +18 V, max 300 mA dc
SYSTEM POWER SUPPLY (inc. IU80)	+5 V ±0.25 V @ 1 A max dc
SP80 PROBE OUTPUTS (X, Y, Z)	1.5 V ±0.25 V p-p. analogue quadrature signal (about 2.5 V Ref.)
INTERFACING OPTIONS	The options are: • Using an SP80 daughtercard for direct UCC1 or UCC2 integration • Using a Renishaw PCI counter card (CC6) and the Renishaw interpolator unit (IU80) • Using an interface card designed by the machine builder and used in conjunction with an IU80 • Using a countercard and interpolator unit designed by the machine builder.
CHANGE RACK SYSTEM	SCP80 single port unit(s) mounted to the MRS

SP600, SP600M and SP600Q scanning probes

The SP600 (shank mounting), SP600M (multi-wired autojoint mounting) and SP600Q (fixed in-quill mounting) are highly reliable analogue probes which are ideal for profile scanning and measurement on CMMs.

The SP600 family of scanning probes allow large amounts of data to be rapidly gathered for inspection and digitising purposes. Axis movement in each direction (X, Y and Z) is ±1 mm (±0.04 in) (in all orientation positions on a PH10) and stylus lengths up to 300 mm (11.81 in) can be used with the SH600 stylus holder.

The SH600 provides overtravel protection, and allows rapid and repeatable interchange between stylus configurations. This can be automated by using the SCR600 stylus change rack or alternatively, individual SCP600 stylus change ports mounted to a MRS.

The probe design gives an excellent self centring figure of <5 µm (<0.0002 in); a measure of its ability to return to zero mechanically when not in contact with the part. This low figure, although irrelevant to the probe's accuracy, enables the use of small deflections and therefore low contact forces. The probe output always gives its precise position relative to the probe body.

Low mass, high structural stiffness and friction-free viscous damping give excellent dynamic performance characteristics.

SP600 probe

The SP600 allows simple fixed mounting via a Renishaw shank.

SP600M probe

The SP600M is mounted via an autojoint and can therefore be orientated by use with Renishaw's PH10M or PH10MQ motorised probe heads. Rapid interchange with other autojoint probes is possible by using a Renishaw ACR1 or ACR3 autochange rack system.

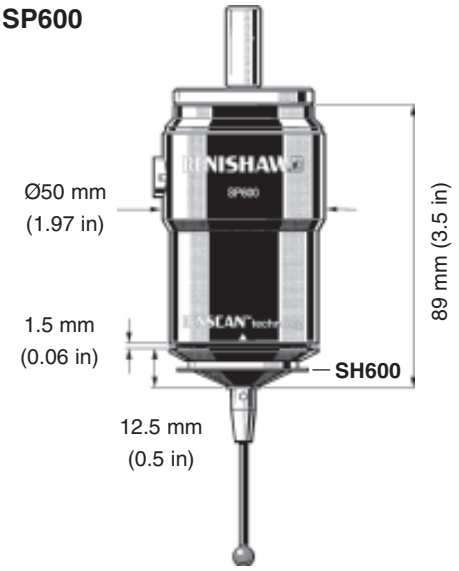
CAUTION

When using a SP600M with a PH10MQ a PEM25 extension bar is required to achieve A = 97.5° or A = 105° in all B-axis postions.

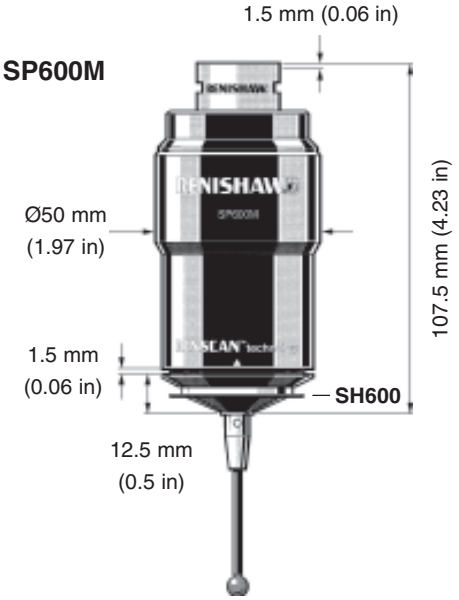
SP600Q probe

Compact in size, the SP600Q mounts directly onto the quill of the CMM. Together with the significant reduction in size, the SP600Q provides a more cost-effective scanning option to CMM users with small working area requirements.

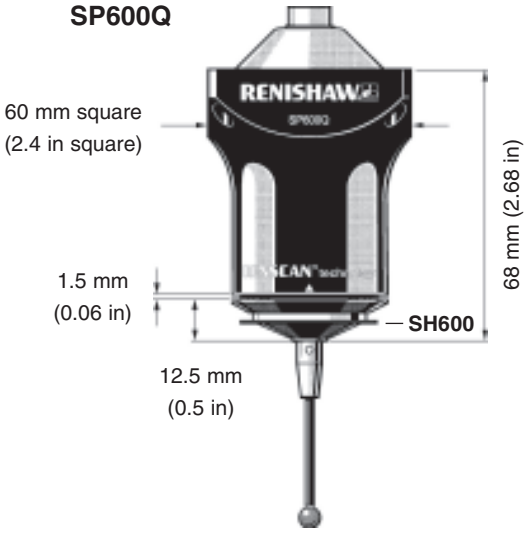
SP600



SP600M



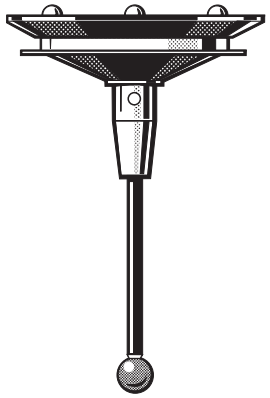
SP600Q



SH600 STD / SH600 EXT stylus holders

The SH600 stylus holder provides overtravel protection, and allows rapid and repeatable interchange between stylus configurations. This can be automated by using the SCR600 stylus change rack or, alternatively, individual SCP600 stylus change ports mounted on a MRS.

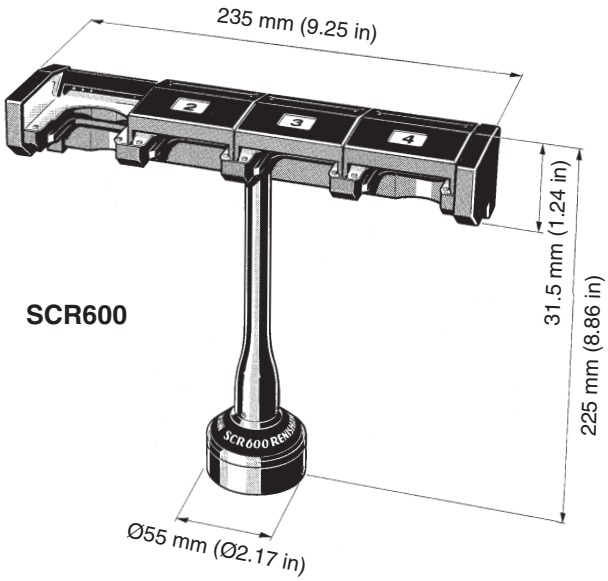
There are two variants, SH600 STD and SH600 EXT, the difference being the stylus carrying capacity. The STD can carry up to 200 mm (7.87 in) and the EXT up to 300 mm (11.9 in) long stylus.



SH600

SCR600 stylus change rack

The SCR600 is a passive stylus change rack for use with the SP600 probe family, and requires no electrical connections. It is protected from overtravel (in the probe entry direction) by a mechanism in the base which can be manually reset. It houses up to four SH600 stylus holders per rack and any number of racks can be used in a system.



SCR600

SCP600 stylus change port

The SCP600 has passive operation like the SCR600 and mounts on the MRS. This allows flexibility for users to configure multiple ports, to suit the application.



SP600 family features and benefits:

- High speed scanning up to 300 mm/s (11.8 in/s), fast point measurement and high frequency response
- Low probing forces give maximum application flexibility
- Three variants; SP600, SP600M and SP600Q allows the ideal probe match to suit the CMM
- Extremely robust design will withstand moderate collisions
- Fast interchange between stylus configurations permits the best solution for the application and increases productivity - automatic changing with either SCR600 or SCP600 mounted on MRS
- Compatible with Renishaw's autochange rack systems to allow changing between Renishaw's other probes fitted with an autojoint
- Excellent product life with a MTBF in excess of 50,000 hours gives low cost of ownership



Specification summary		SP600, SP600M and SP600Q
PRINCIPAL APPLICATION		High speed, contact form scanning and fast point measurement applications
PROBE ATTRIBUTES		3 axis measurement X, Y, Z Linear and parallel motion in all axes
MEASUREMENT RANGE		±1 mm (±0.04 in) X, Y, Z in any attitude using a 300 mm (11.8 in) stylus
OVERTRAVEL RANGE		±X, ±Y and -Z are protected by a kinematic break out joint on the SH600 +Z is protected by a bump-stop design
RESOLUTION		0.1 µm (0.000004 in) with optional AC2 interface card 1.0 µm (0.00004 in) with optional AC1 interface card
SPRING RATE		1.2 N/mm (7.05 ozf) nominal (X,Y,Z)
STYLI	Thread	M4 standard range
	Length	200 mm (7.87 in) maximum using SH600 STD 300 mm (11.8 in) maximum using SH600 EXT
	Mass	20 g (0.7 oz) maximum
POWER SUPPLY		+12 V to -12 V, 5 V (±10%)
OUTPUTS (X, Y, Z)		Analogue proportional Voltage output scaling: 4 V/mm to 8.5 V/mm (dependant on stylus)
WEIGHT	SP600	172 g (6.1 oz) excluding shank
	SP600M	216 g (7.6 oz)
	SP600Q	299 g (10.5 oz)
MOUNTING	SP600	Adaptors to suit clutch, shank adaptor or CMM shank
	SP600M	Multiwired autojoint
	SP600Q	Direct quill mounting to the CMM
SUITABLE INTERFACE		Directly into UCC or AC1 or AC2 interface cards (ISA bus)
CHANGING RACK OPTIONS		SCR600 4 port rack SCP600 single port unit(s) mounted to the MRS

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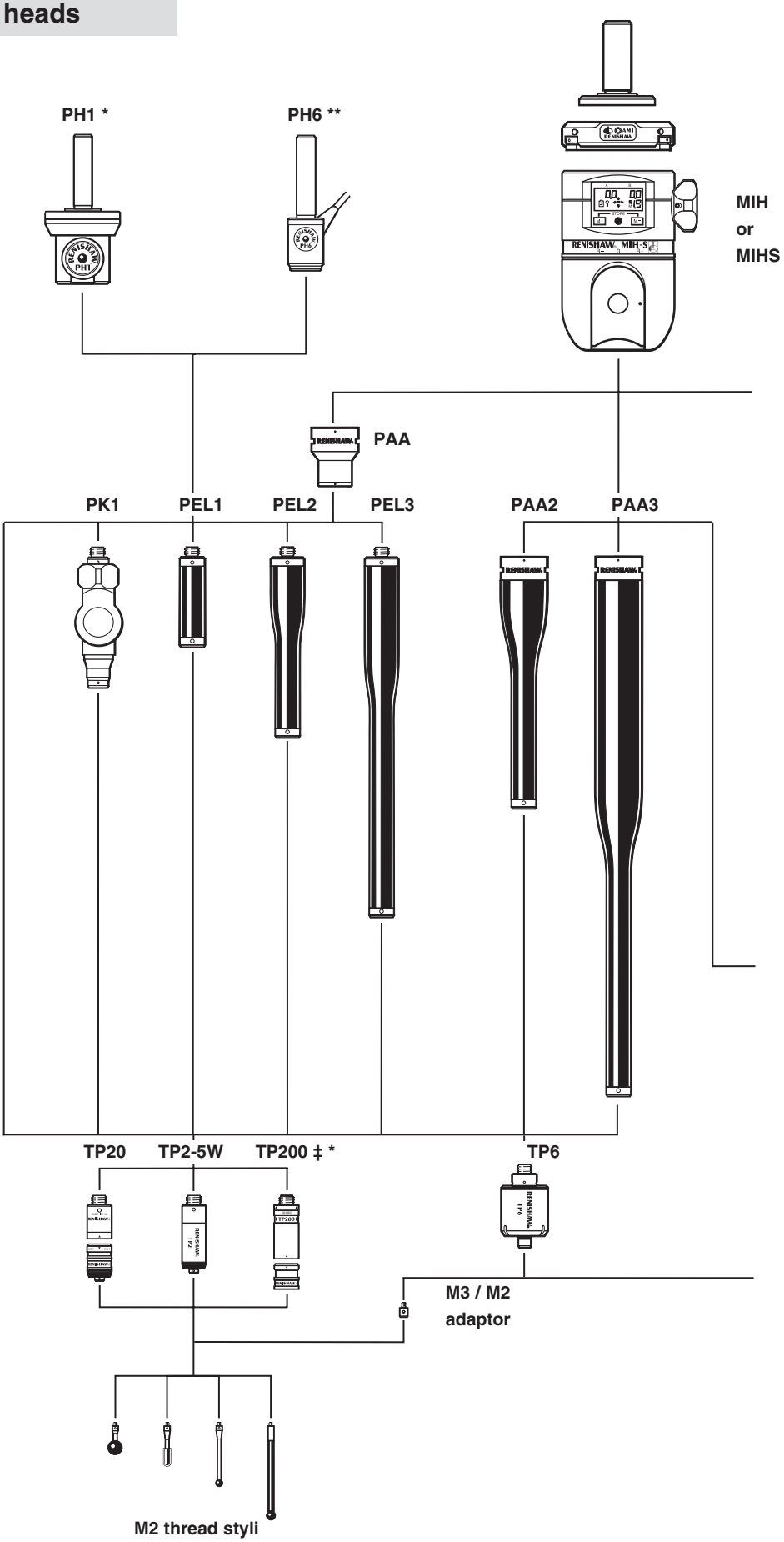








Manual probe heads

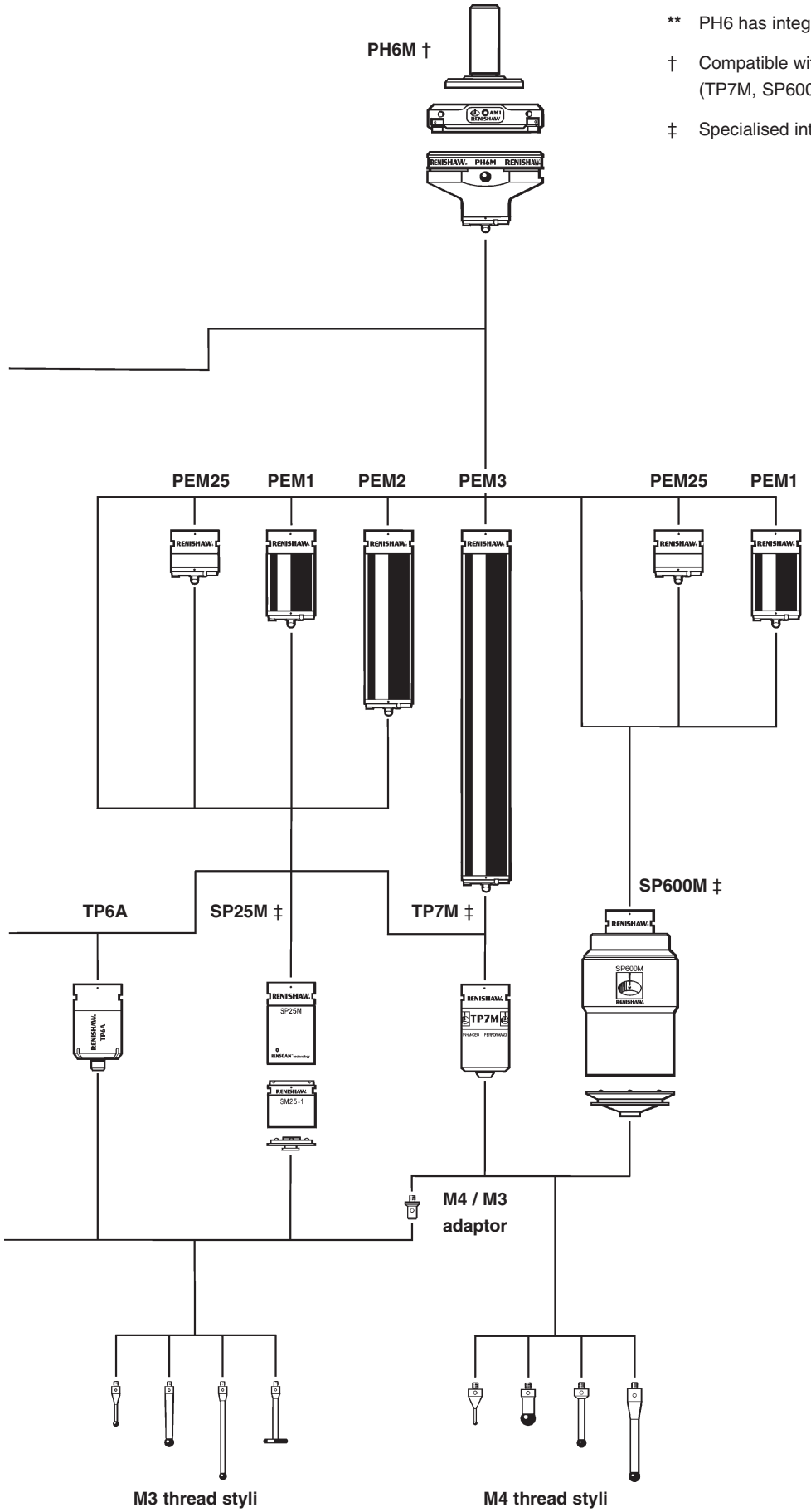


* PH1 is not compatible with TP200

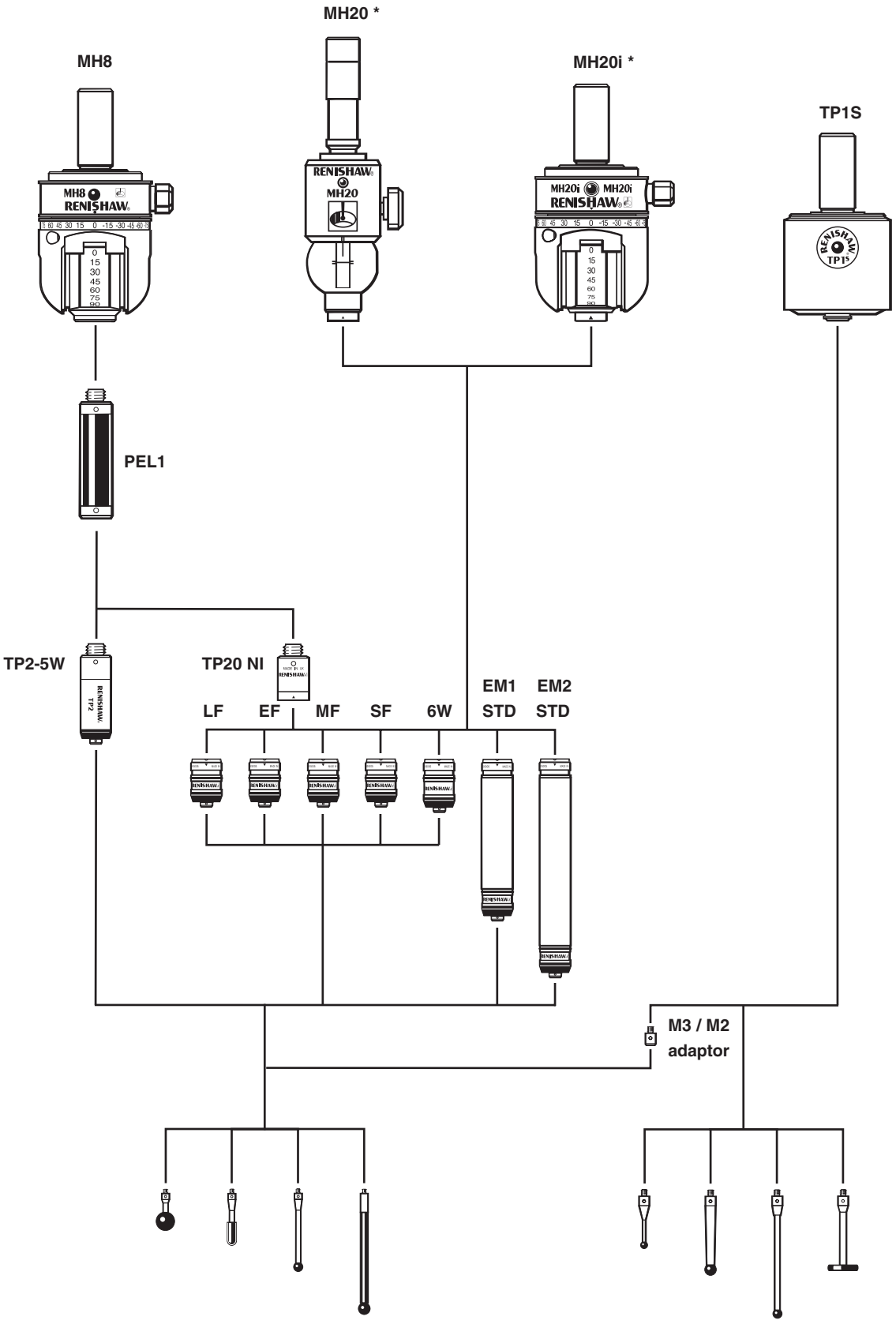
** PH6 has integral cable

† Compatible with multiwired systems (TP7M, SP600M and SP25M)

‡ Specialised interface required



* MH20/MH20i are covered in section 6



MIH manual indexing probe head

The MIH is a versatile manual indexing probe head. It has programmable indexing positions using 7.5° increments and has an autojoint probe mount for fast repeatable probe changing. These features can increase the productivity of a manual CMM.

MIH-S manual indexing probe head

The MIH-S is an enhanced version of the MIH which enables the feedback of positional status to the PC over an RS232 serial communication link, via the MIH-SI interface.

This enables the CMM computer to:

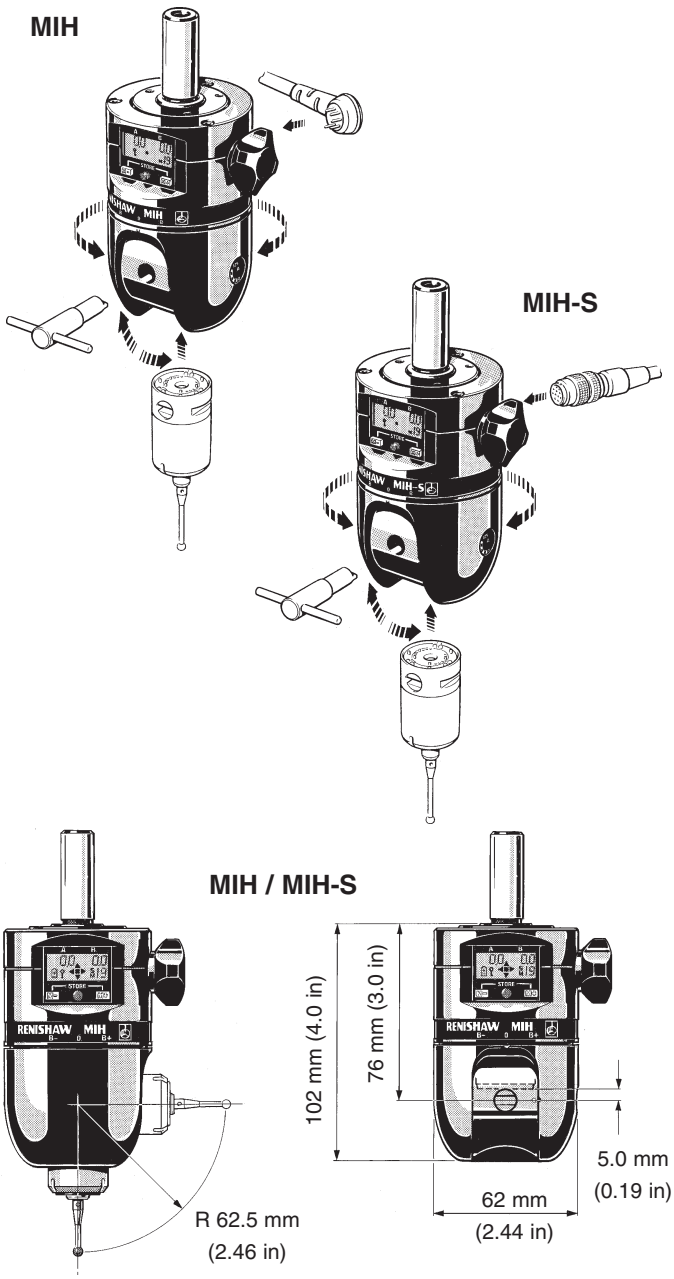
- Verify that the MIH-S has been moved to the correct position and locked into place.
- Identify the locked position of the MIH-S.

Measurement performance, functionality and dimensions are the same as for the MIH.

MIH features and benefits:

- Repeatable indexing in 720 positions
- An integral LCD enables easy programming of probe orientation positions
- 20 probe positions can be memorised
- Compatible with most Renishaw probes (excluding all multi-wire e.g. TP7M)
- Capable of carrying up to 300 mm (11.81 in) extension for deep part measurement

Please refer to page 5-3 for probe compatibility information



Specification summary	MIH and MIH-S
PROBE MOUNTING	Autojoint (Note: There is no multiwire capability)
PROBE STATUS INDICATION	LED
CABLE CONNECTION	**MIH -** 5 pin DIN 180 socket **MIH-S -** 12 pin Hirose
A AXIS INDEXING	0° to 105° in 7.5° steps = 15 positions
B AXIS INDEXING	±180° in 7.5° steps = 48 positions
WEIGHT	580 g (20.5 oz)
REPEATABILITY OF POSITION (2σ)	1 µm (0.00004 in) when used with a TP6A and 21 mm (0.83 in) stylus
MAXIMUM EXTENSION BAR	300 mm (11.8 in)
MAXIMUM RECOMMENDED TORQUE	0.45 Nm
SUITABLE PROBE INTERFACE	PI 4-2, PI 200 or PI 7-2
MIH-S HEAD INTERFACE	Uses MIH-SI interface (RS232 communication)

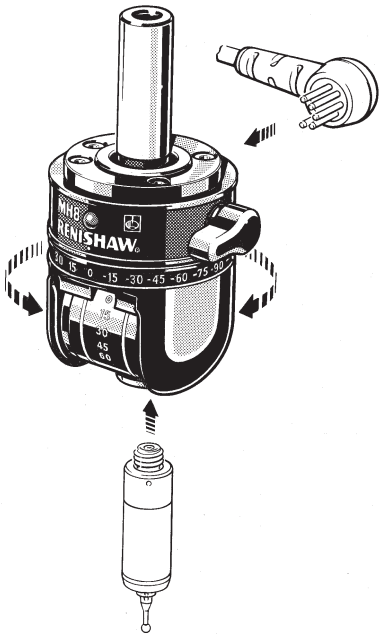
MH8 manual indexing probe head

The MH8 is a compact, indexing probe head that is designed for use on small manual CMMs.

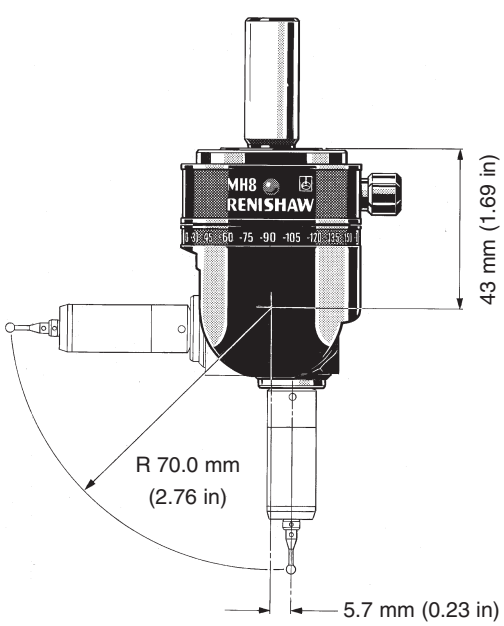
It is compatible with TP20, TP6 and TP2 probes.

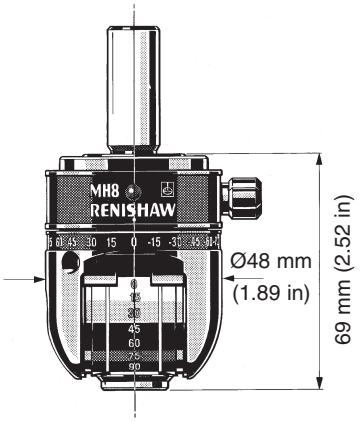
MH8 features and benefits:

- Universal M8 thread for probe connection
- Repeatable indexing in 168 positions
- The CMM operator need only qualify the required probe positions once during set up
- 50 mm (1.97 in) probe extension bar can be fitted to extend measurement capability



Please refer to page 5-3 for probe compatibility information





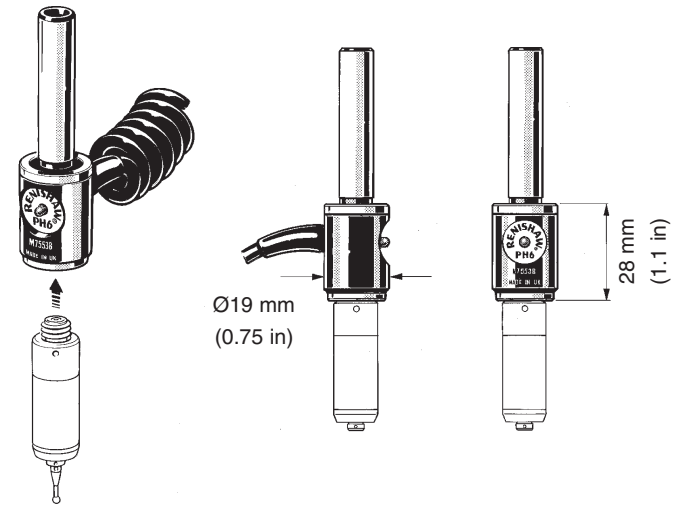
Specification summary	MH8
PROBE MOUNTING	M8 thread
PROBE STATUS INDICATION	1 LED
CABLE CONNECTION	5 pin DIN 180° socket
A AXIS INDEXING	0° to 90° in 15° repeatable steps = 7 positions
B AXIS INDEXING	±180° in 15° repeatable steps = 24 positions
WEIGHT	205 g (7.2 oz)
REPEATABILITY OF POSITION (2σ)	1.5 µm (0.00006 in) TP2 and 10 mm (0.39 in) stylus fitted
MAXIMUM EXTENSION BAR	50 mm (1.96 in) PEL1 only
SUITABLE PROBE INTERFACE	PI 4-2, PI200

PH6 fixed probe head

A compact, vertical probe head with a mount for M8 thread probes.

PH6 features and benefits:

- Universal M8 thread for probe connection
- Shank mounted
- Integral cable
- Simple to fit to a CMM

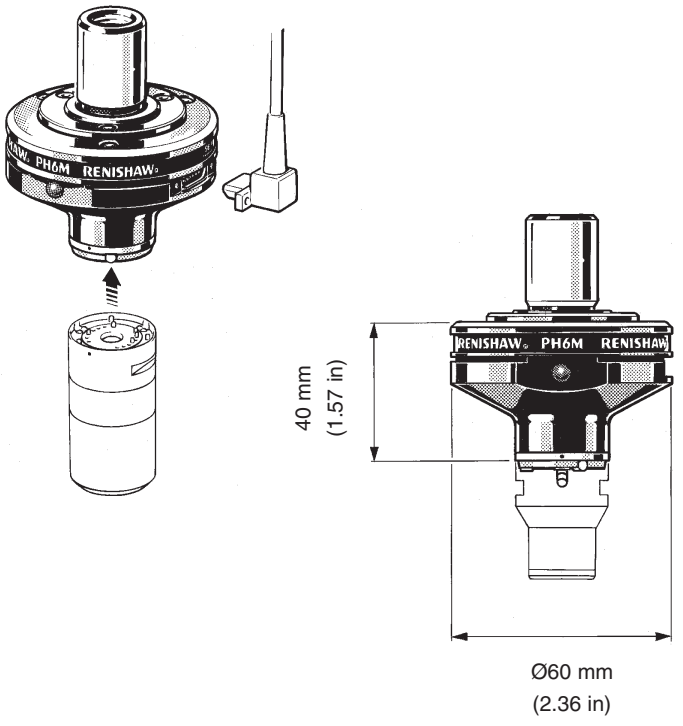


PH6M fixed probe head

The PH6M is the multi-wired version of the PH6 and is fitted with an autojoint.

PH6M features and benefits:

- Fixed, vertical probe head
- Autojoint for fast, repeatable probe changing
- Compatible with the complete Renishaw multi-wire probe range and standard probes with autojoint adaptors and extension bars



Please refer to page 5-3 for probe compatibility information

Specification summary	PH6	PH6M
PROBE MOUNTING	M8 thread	Autojoint (full multi-wire capability)
PROBE STATUS INDICATION	1 LED	1 LED
CABLE CONNECTION	Hard wired 5 core cable	Micro 'D' connector for multi-wire cable fitment
WEIGHT *	48 g (1.76 oz)	160 g (6.1 oz)
PROBE CHANGE REPEATABILITY (2σ)	N/A	1 µm (0.00004 in) at 50 mm (1.97 in) from autojoint
SUITABLE PROBE INTERFACE	PI 4-2, PI 200	PI 4-2, PI 200, PI 7-2

* Excluding shank & cable

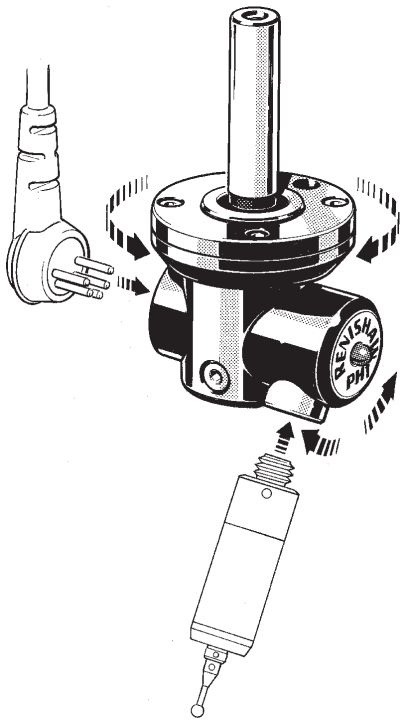
PH1 manual articulating probe head

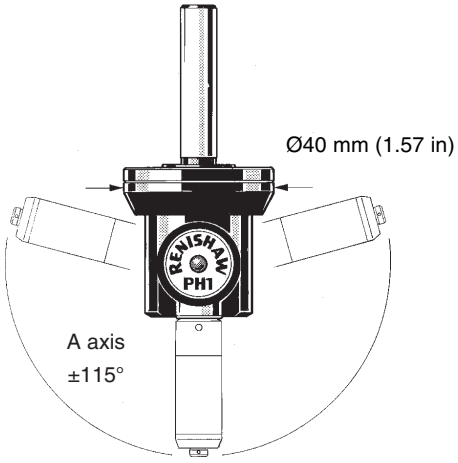
A manual probe head with non-repeatable indexing in the B axis and ±115° rotation in the A axis. The probe is shank mounted to the CMM.

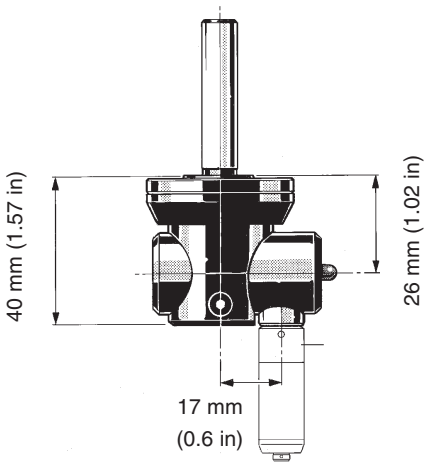
PH1 features and benefits:

- Adjustable in both the A and B axes
- Limited overtravel protection
- M8 thread probe mount that is offset from the mounting shank Z-axis

Please refer to page 5-3 for probe compatibility information







Specification summary	PH1
PROBE MOUNTING	M8 thread (excluding TP200)
PROBE STATUS INDICATION	1 LED
CABLE CONNECTION	5 pin DIN 180° socket
OVERTRAVEL BREAK LOAD	Adjustable from 0.2 N to locked solid
A AXIS ARTICULATION	Swivel of ±115° locked with hexagonal key (3 mm A/F)
B AXIS INDEXING	15° steps through 360° (non-repeatable)
WEIGHT *	125 g (0.28 lb)
SUITABLE PROBE INTERFACE	PI 4-2

* Excluding shank & cable

MH20 manual articulating probe head with integral TP20 module mount

The MH20 is a compact probe head with fully adjustable orientation.

The integral TP20 kinematic stylus module mount enables repeatable stylus module changing, without the need for re-qualification, providing head adjustment has not taken place. It is compatible with the full range of TP20 stylus modules, which comprises 5-way module versions with either length or trigger force options, plus a 6-way module. Multiple stylus configurations are easily interchanged allowing quick and easy access to work piece features.

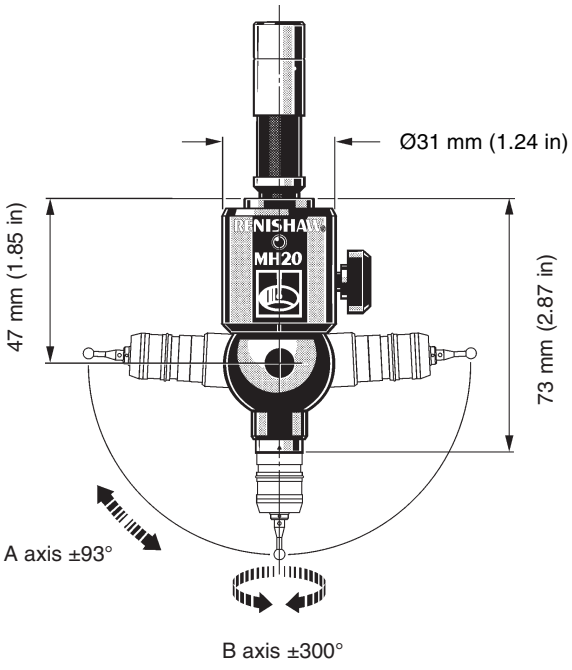
The head is pre-mounted with a customer-specified shank to suit the CMM and features a red LED which indicates probe status.



MH20 features and benefits:

- Fast repeatable stylus module changing to improve productivity
- Ultra compact design that maximises CMM working volume
- Infinite positioning within the range of the head to optimise access to complex parts.
- TP20 compatibility ensures a wide range of stylus configurations are easily interchanged enhancing flexibility

Please refer to page 5-3 for probe compatibility information



Specification summary	MH20
PROBE MOUNT	TP20 kinematic
PROBE STATUS INDICATION	1 LED
CABLE CONNECTION	5 pin DIN socket
RANGE OF ARTICULATION	A axis ±93° B axis ±300°
MAXIMUM LOAD	EM2 extended module - 94.5 mm (3.72 in)
WEIGHT WITHOUT SHANK	100 g (3.53 oz)
MOUNTING	MS/T range of shanks
DUAL AXES LOCK	Single rotary thumbwheel
OPERATING TEMPERATURE RANGE	10 °C to 40 °C (50 °F to 104 °F)
STORAGE TEMPERATURE RANGE	-10 °C to 70 °C (14 °F to 158 °F)
SUITABLE PROBE INTERFACE	PI 4-2

Note: The MH20 is compatible with the MSR1 module storage rack, but not with the MCR20 module change rack.

MH20i manual indexing probe head with integral TP20 module mount

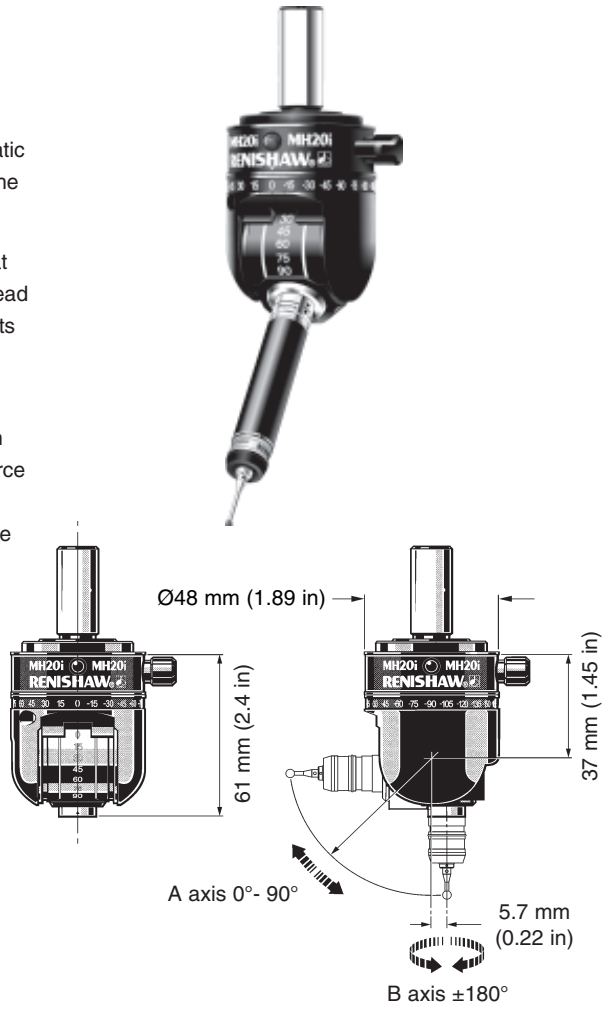
The MH20i is a manual probe head with two axis adjustable indexing. Compact in design, it features an integral TP20 kinematic mount that enables repeatable stylus module changing without the need for re-qualification.

The MH20i offers 168 repeatable index positions which are set at 15° increments to maximise flexibility and productivity. Easy to read scales permit rapid re-orientation to pre-qualified positions, and its lock/unlock feature allows ease of positioning and eliminates unnecessary wear.

It is compatible with the full range of TP20 stylus modules, which comprises 5-way module versions with either length or trigger force options, plus a 6-way module. Multiple stylus configurations are easily interchanged allowing quick and easy access to work piece features.

MH20i features and benefits:

- Enhanced inspection capability from adjustable probe orientation with 168 repeatable index positions set at 15° increments
- Repeatable TP20 stylus module changing in each pre-qualified position without the need for re-qualification significantly enhances productivity
- TP20 compatibility, providing a wide range of force and length options to optimise machine performance and access capability
- Easy-to-read scales allow rapid re-orientation



Please refer to page 5-3 for probe compatibility information

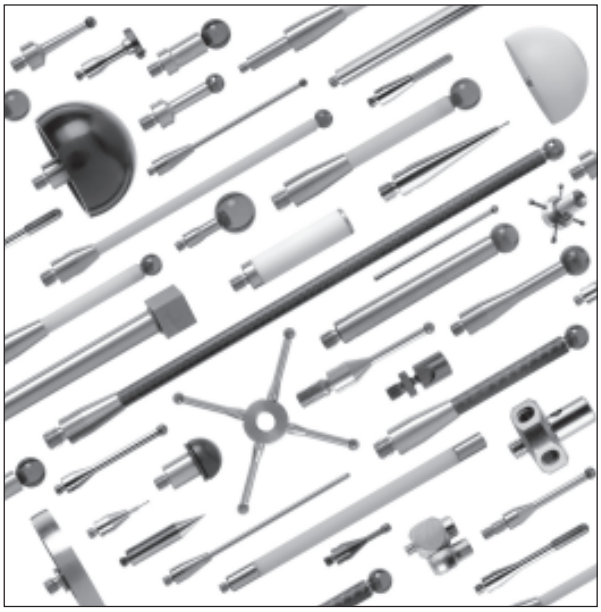
Specification summary	MH20i
PROBE MOUNT	TP20 kinematic
POSITIONAL REPEATABILITY (2σ)	1.5 µm (0.00006 in) at stylus tip with TP20 SF stylus module and 10 mm (0.39 in) styli
POSITIONAL REPEATABILITY (2σ)	2.5 µm (0.0001 in) at stylus tip with TP20 EM2 stylus module and 20 mm (0.78 in) styli
PROBE STATUS INDICATION	1 LED
CABLE CONNECTION	5 pin DIN socket
A AXIS INDEXING	0° to 90° in 15° repeatable steps = 7 positions
B AXIS INDEXING	±180° in 15° repeatable steps = 24 positions
MAXIMUM LOAD	EM2 extended module – 94.5 mm (3.72 in)
WEIGHT WITHOUT SHANK	210 g (7.41 oz)
MOUNTING	MS range of shanks
DUAL AXES LOCK	Single lock lever
OPERATING TEMPERATURE RANGE	10 °C to 40 °C (50 °F to 104 °F)
STORAGE TEMPERATURE RANGE	-10 °C to +70 °C (14 °F to 158 °F)
SUITABLE PROBE INTERFACE	PI 4-2

Note: The MH20i is compatible with the MSR1 module storage rack, but not with the MCR20 module change rack.






RENISHAW
PROBE INTERFACE
PI 200



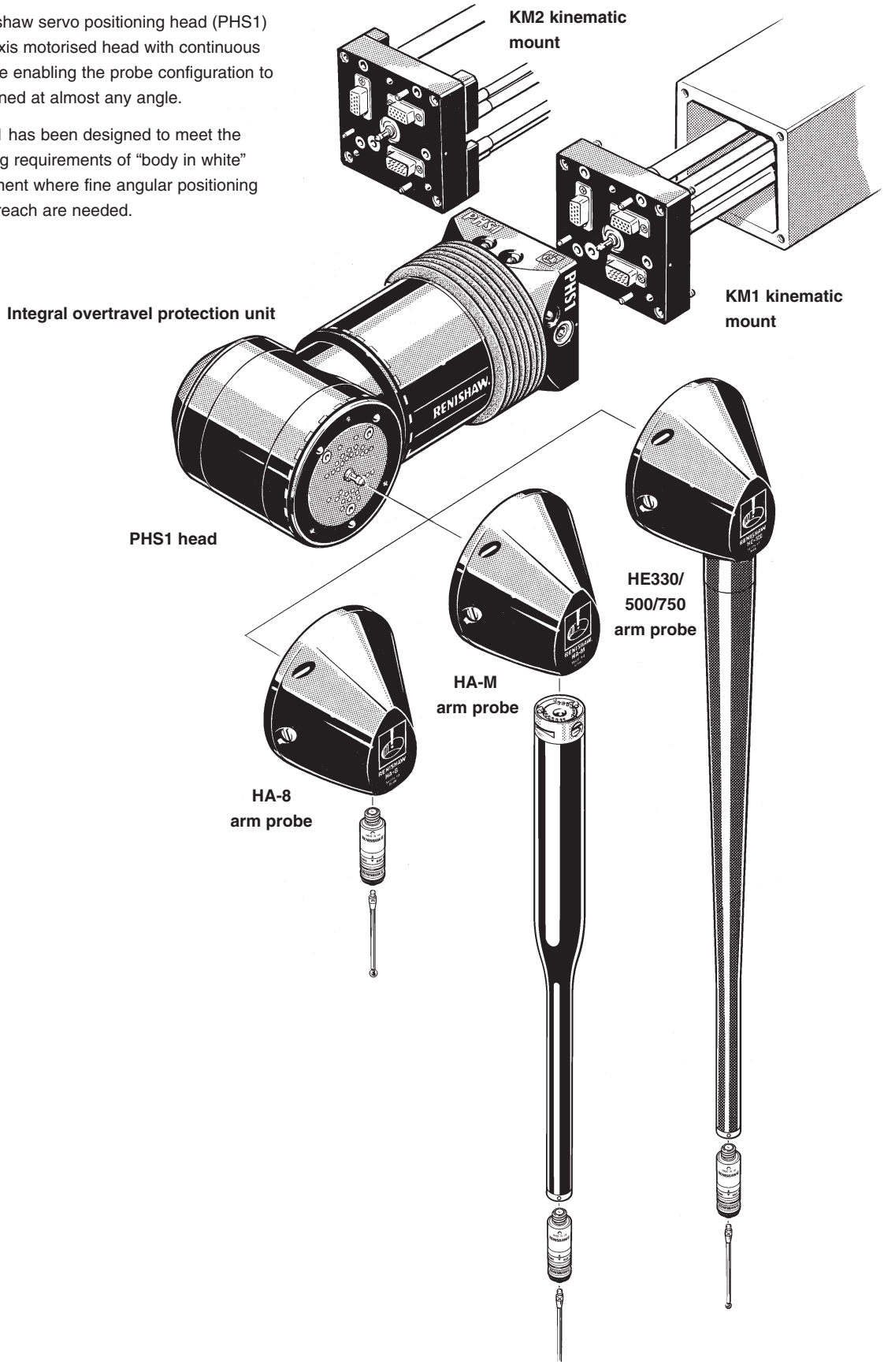


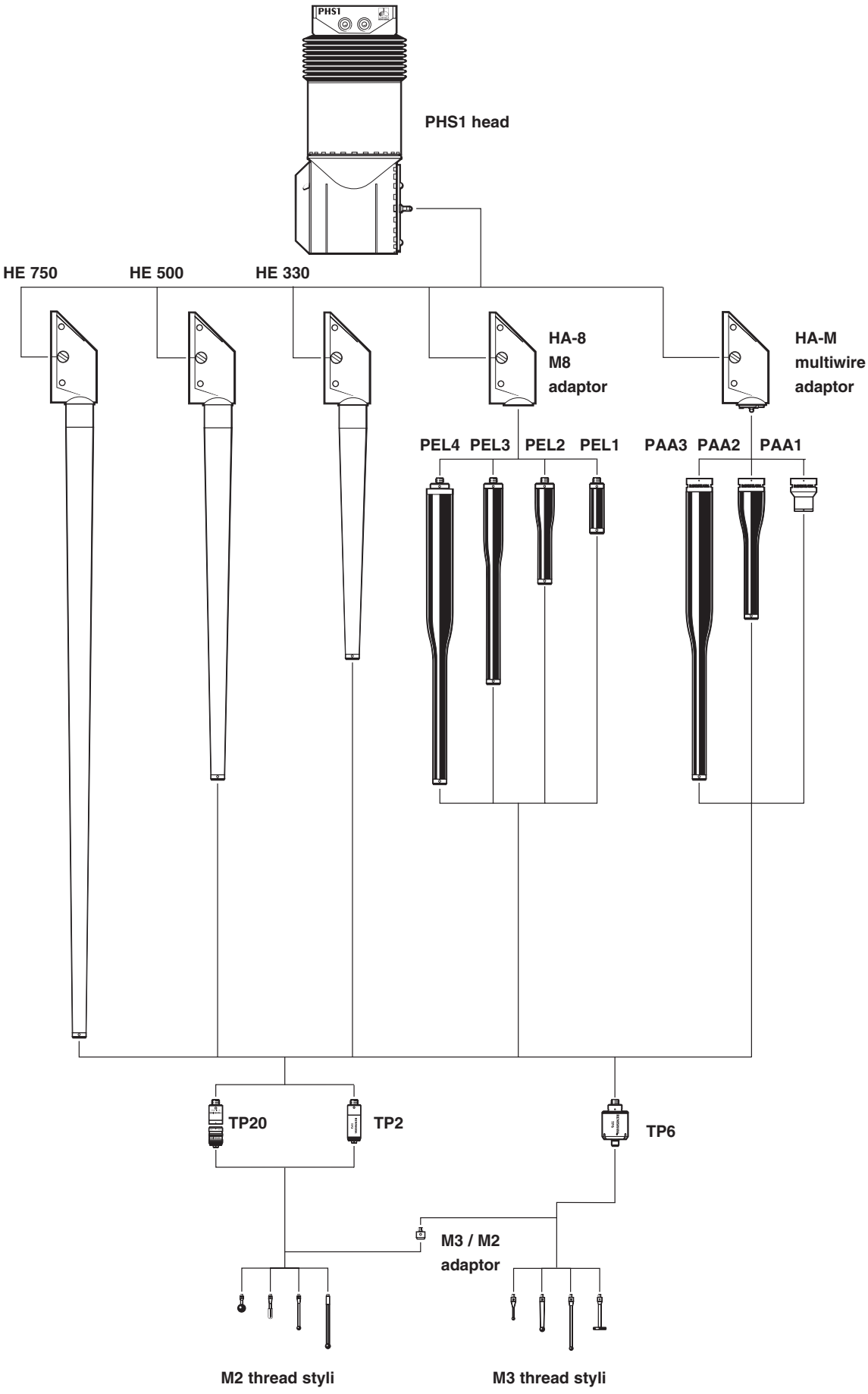


PHS1 motorised (servo type) probe head

The Renishaw servo positioning head (PHS1) is a two axis motorised head with continuous servo drive enabling the probe configuration to be positioned at almost any angle.

The PHS1 has been designed to meet the demanding requirements of “body in white” measurement where fine angular positioning and long reach are needed.




PHS1
PHS1 head
HE 750
HE 500
HE 330
HA-8
M8
adaptor
HA-M
multiwire
adaptor
PEL4
PEL3
PEL2
PEL1
PAA3
PAA2
PAA1
TP20
TP2
TP6
M3 / M2
adaptor
M2 thread styli
M3 thread styli

PHS1 head kit

The PHS1 head is not locked into position in the same manner as an indexing head. Instead, it is driven to approximately the required position and when a probing point is taken, the axes of the head latch simultaneously with the axes of the CMM to give accurate probe readings.
The PHS1 head is controlled directly via a PC interface card in the CMM controller, and requires full integration by the equipment supplier. Full information is given in the PHS1 Programmers guide (PD-2100-9015).
A range of different probes can be fitted and automatically exchanged. These include touch trigger probes and non-contact scanning probes.

Extra long extensions allow the Renishaw trigger probes to measure otherwise inaccessible features.

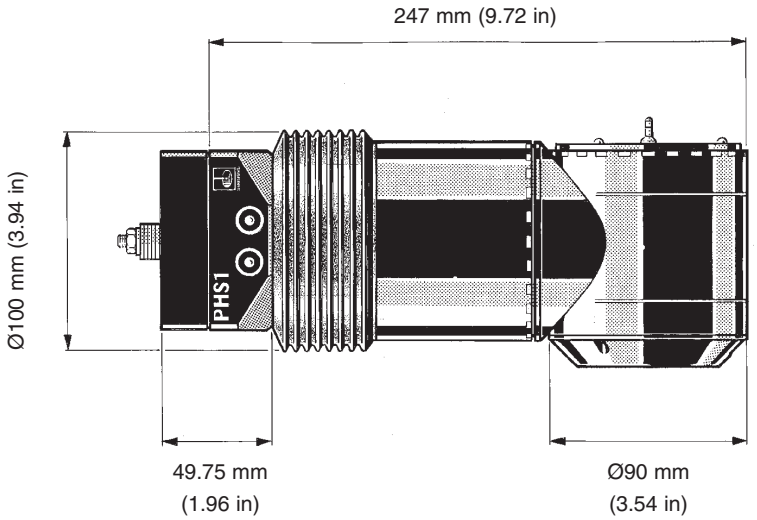
A kinematic mount (KM1/KM2) allows quick fixing of the head to the machine and fast changeover to other heads.

PH10M or PH10T heads can be fitted (via a PHA1, PHA2 or a PHA3 probe head adaptor - details on request) instead of PHS1 in applications where existing parts need to be inspected without the need to re-write the programs for PHS1.

The head is protected by a built-in overtravel protection unit that can be configured to stop the machine in the event of a collision.

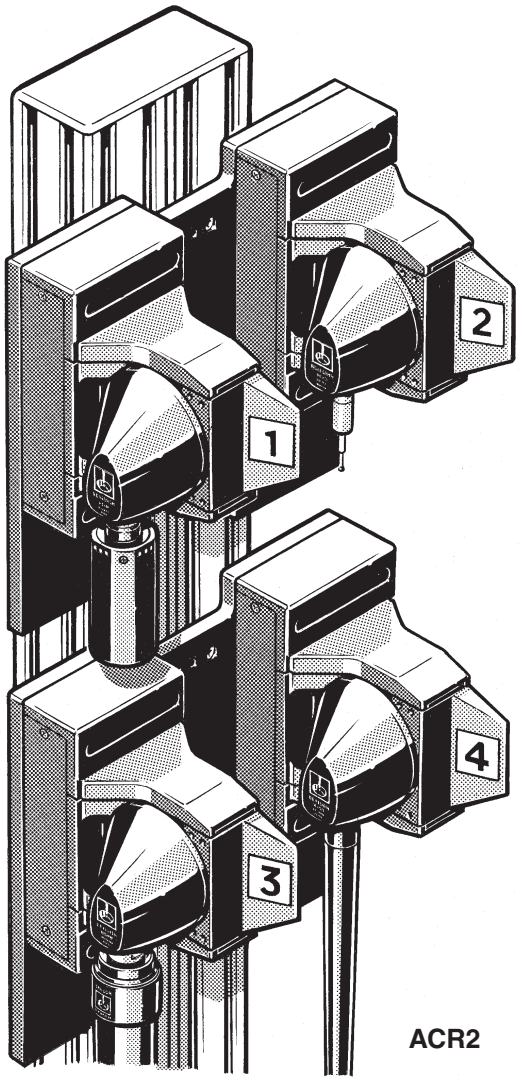
An air supply to the head is recommended for axis motor cooling and optimum metrology performance.





PHS1 system features and benefits:

- Repeatable exchange of PHS1 probe heads via KM1/KM2
- Easy interchange with Renishaw's PH10M/T motorised head systems
- Two-axis servo operated with ±184° variable positioning capability in both axes
- Orientation to almost any angle
- Long reach up to 750 mm (29.53 in)
- Automatic probe changing
- Accommodation of a range of sensors – trigger probes and non-contact scanning probes



ACR2

ACR2 port pair kit

The ACR2 autochange rack is an extension arm changing system for the PHS1 servo positioning head system.

It allows probe extensions or probe adaptors to be exchanged to suit the probing task required without manual intervention.

Its modular construction and simple operation enable any number of racks to be positioned on a pillar within the machine volume.

The rack is passive, all locking and unlocking of adaptors and extensions is done by the motion of the CMM.

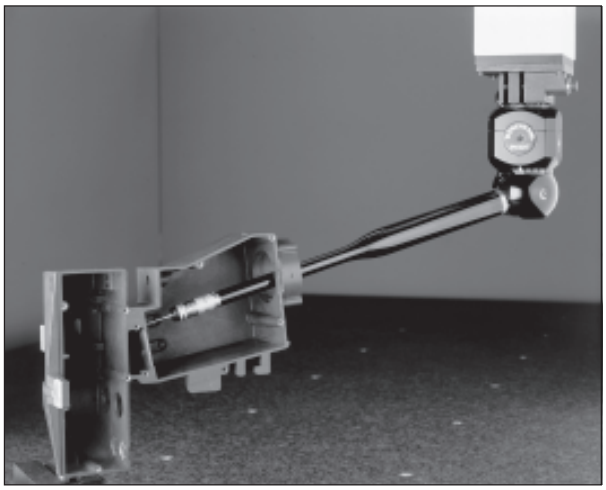
Specification summary	PHS1
OPERATING TEMPERATURE	15 °C to 40 °C (50 °F to 104 °F)
WEIGHT (inc. probe extension and kinematic joint)	<3 kg (<6.61 lb)
CARRYING CAPABILITY	Combined probe and extension mass of 1 kg (2.20 lb)
MAXIMUM TORQUE	2 Nm
MECHANICAL CLUTCH SLIP	3 Nm ±0.5 Nm
MOVEMENT SPEED	150°s^{-1} maximum, 120°s^{-1} typical
ARM ROTATION ANGLE	D axis ±184° E axis ±184°
ANGULAR RESOLUTION	0.2 arc sec (equivalent to 0.1 µm at 100 mm radius)
COLLISION PROTECTION	Signal for head protection with kinematic overtravel unit
SUITABLE HEAD INTERFACE	PC interface card and UCC2 controller
CHANGE RACK SYSTEM	ACR2

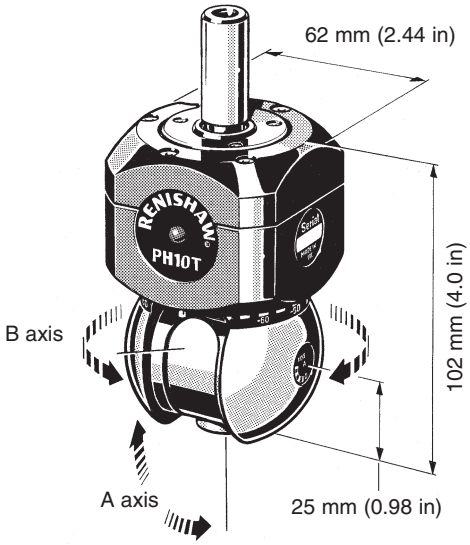
PH10T motorised indexing probe head

The PH10T is a motorised indexing head that mounts and re-orientates the probe. The PH10T can be repeatably orientated to any one of 720 positions.

All M8 thread probes can be fitted directly onto the mount of the PH10T. The PH10T is operated by the PHC10-2 and is compatible with other Renishaw M8 threaded products.

The AM1 adjustment module permits the correction of the alignment of the probe head to the machine and is fitted between the head and the shank.



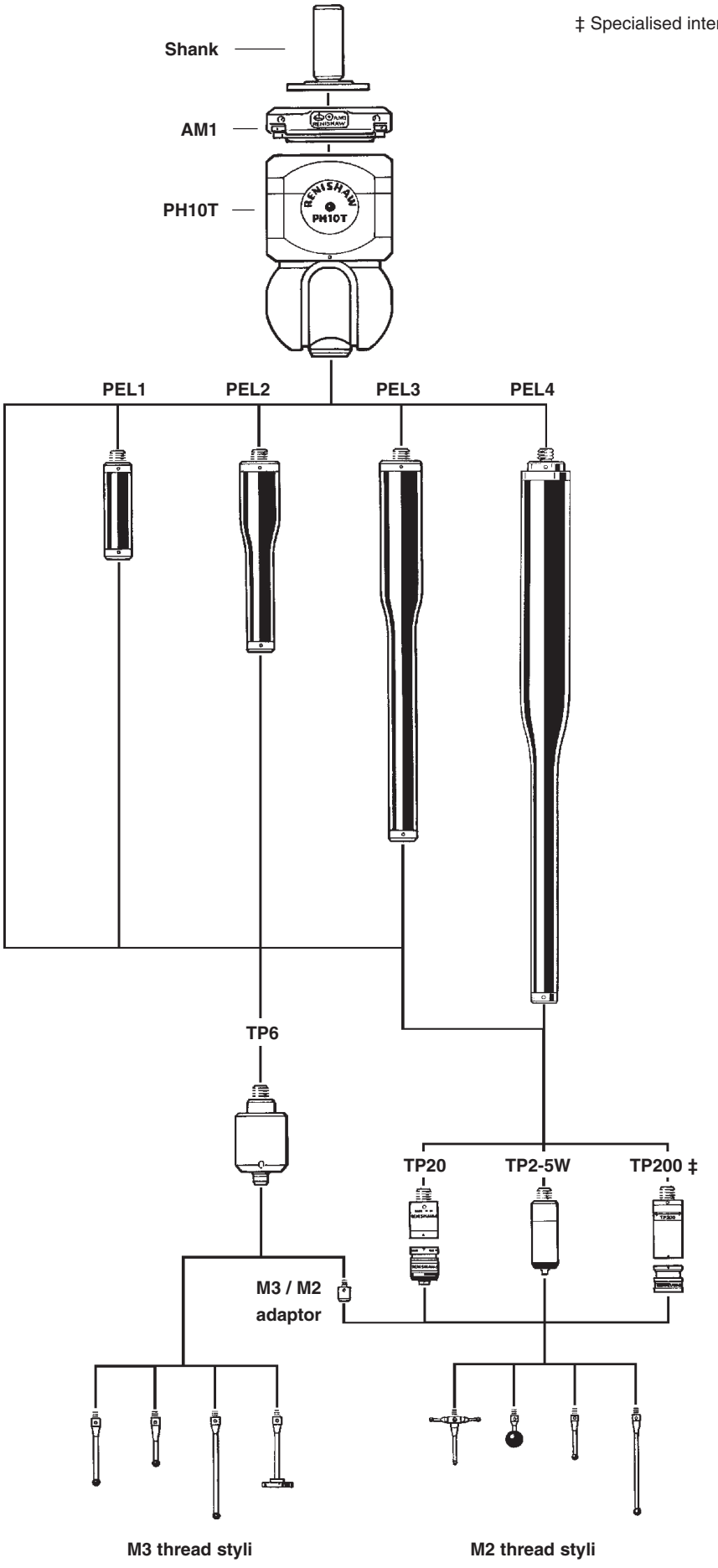


PH10T features and benefits:

- Compatible with M8 thread probes
- Compatible with PEL range of extension bars up to 300 mm (11.81 in) long
- 720 repeatable positions at 7.5° increments
- Shank-mounted

Specification summary		PH10T
REPEATABILITY OF POSITION* (2σ) *At constant temperature		<0.5 µm (<0.00002 in) specified at a distance of 48 mm (1.89 in) - equivalent to a TP2 and PS1R stylus
ACCURACY OF STEP SPACING FROM THEORETICAL POSITION		±0.24 mm (0.009 in) using TP6 and 21 mm stylus (A-5000-5335)
CYCLE TIME	7.5° STEP MAXIMUM 90° MOVE	2.5 seconds 3.5 seconds
TOTAL ANGULAR MOVEMENT	A AXIS B AXIS	0° to 105° in 7.5° steps ±180° in 7.5° steps
TOTAL NUMBER OF POSITIONS		720
MAXIMUM OUTPUT TORQUE		0.45 Nm
MAXIMUM EXTENSION BAR LENGTH (WITH TP2/TP200)		300 mm (11.8 in)
HEAD MOUNTING		Shank to suit CMM (MS range)
WEIGHT (excluding shank)		645 g (22.7 oz)
WORKING TEMPERATURE RANGE		10 °C to 40 °C (50 °F to 104 °F)
PROBE MOUNTING FACILITY		M8 thread
PROBE HEAD CONTROLLER		PHC10-2
HAND HELD CONTROL UNIT		HCU1

‡ Specialised interface required



PH10M / PH10MQ motorised indexing probe heads

The PH10M and PH10MQ are versatile motorised indexing heads that incorporate the Renishaw autojoint with multiwire capability. This allows PH10M/MQ heads to carry long extension bars and sophisticated multiwired probes such as SP25M and TP7M. There are 720 repeatable positions, set at 7.5° increments to provide probe orientation.

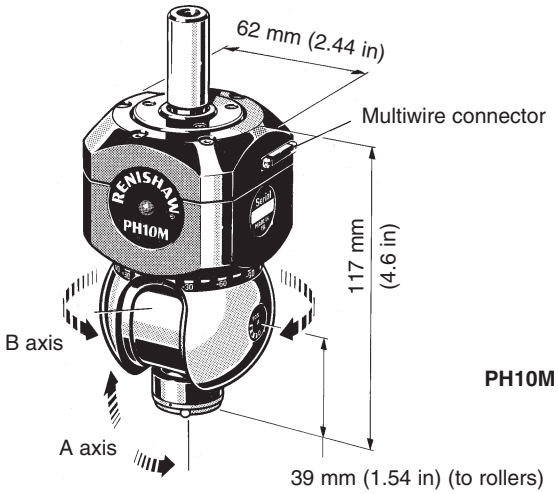
The highly repeatable, kinematic autojoint allows rapid probe or extension bar changing without the need for re-qualification.

The PH10MQ is a variant that allows the motorised head to be attached directly to the quill with the 'cube' of the head inside the quill itself. This option provides a neater and shorter probe mount, with only the swivel protruding from the quill.

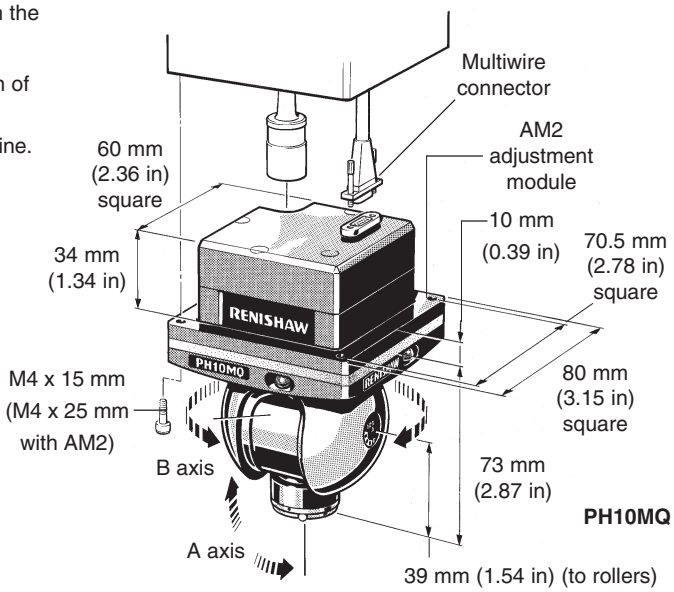
The AM1 and AM2 adjustment modules permit correction of alignment of the probe head to machine and are fitted between the probe head and the shank/quill of the machine.

PH10M / MQ features and benefits:

- Autojoint mount, repeatable probe positioning
- Rapid automatic probe interchange via ACR1 or ACR3
- Full multi-wire capability
- 720 repeatable positions at 7.5° increments
- Torque capable of lifting 300 mm (11.81 in) long extension bar



PH10M



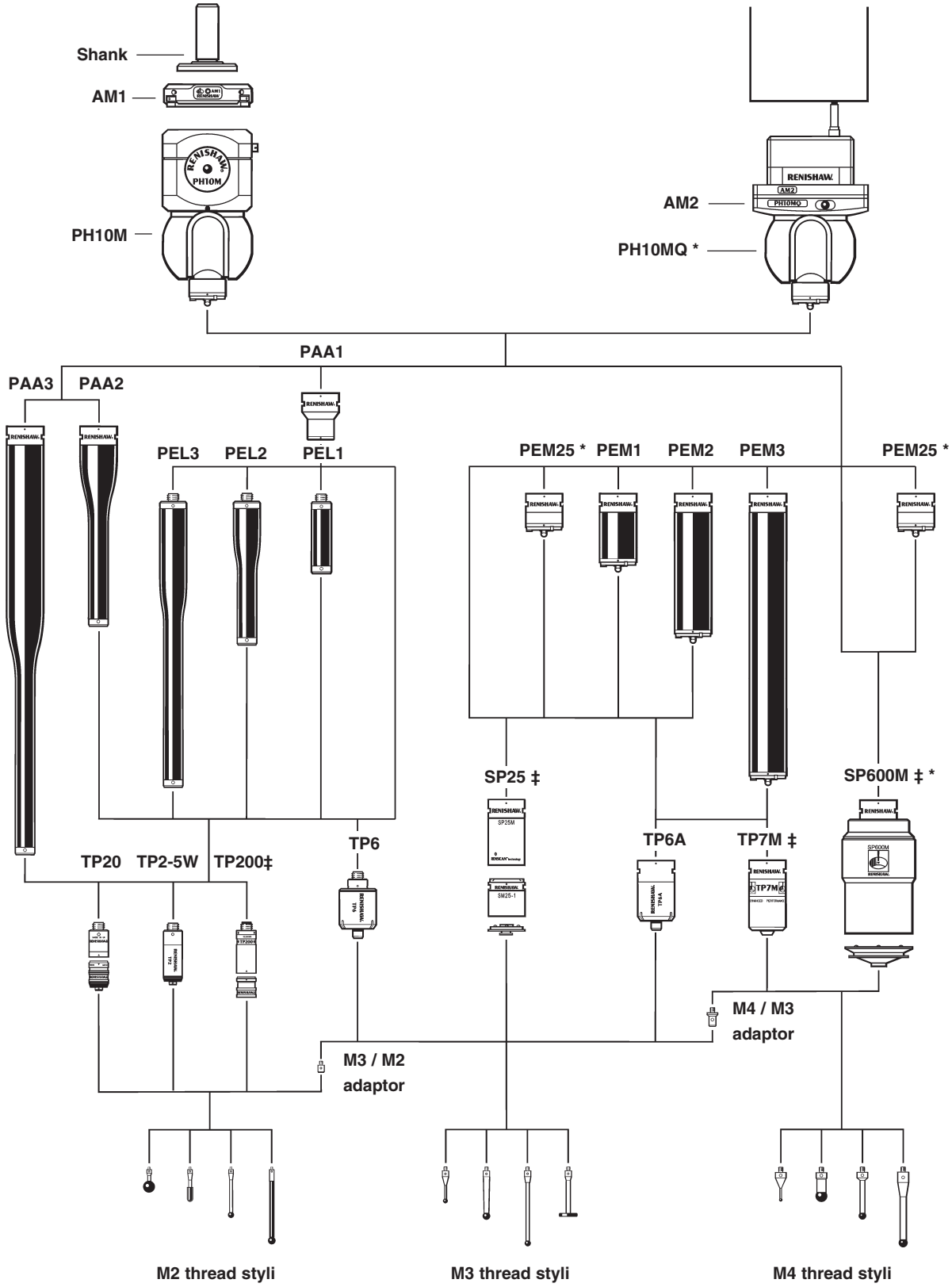
PH10MQ

Specification summary		PH10M / PH10MQ
REPEATABILITY OF POSITION* (2σ) *At constant temperature		<0.5 µm (<0.00002 in) specified at a distance of 62 mm (2.44 in) - equivalent to a TP6A and 21 mm stylus (A-5000-3553)
ACCURACY OF STEP SPACING FROM THEORETICAL POSITION		±0.3 mm (0.012 in) using TP6A and 21 mm stylus (A-5000-5335)
CYCLE TIME	7.5° STEP MAXIMUM. 90° MOVE	2.5 seconds 3.5 seconds
TOTAL ANGULAR MOVEMENT	A AXIS B AXIS	0° to 105° in 7.5° steps ±180° in 7.5° steps
TOTAL NUMBER OF POSITIONS		720
MAXIMUM OUTPUT TORQUE		0.45 Nm
MAX. EXTENSION BAR LENGTH	PAA3 extension Carbon fibre extension	300 mm (11.8 in) 450 mm (17.7 in) (please contact Renishaw for more details)
HEAD MOUNTING		PH10M shank to suit CMM PH10MQ direct to quill (M3/M4 screws)
WEIGHT (excluding shank)		PH10M 645 g (22.7 oz) PH10MQ 730 g (25.7 oz)
WORKING TEMPERATURE RANGE		10 °C to 40 °C (50 °F to 104 °F)
PROBE MOUNTING FACILITY		Autojoint
PROBE HEAD CONTROLLER		PHC10-2 (PHC1050 card for UCC controller)
HAND HELD CONTROL UNIT		HCU1
CHANGE RACK SYSTEM		ACR1, ACR3

Note: Please see the accessories page 13-4 for details of adaptor plates PHA3 and PHA80 which permit rapid interchange between PH10MQ and SP80 scanning probe.

‡ Specialised interface required

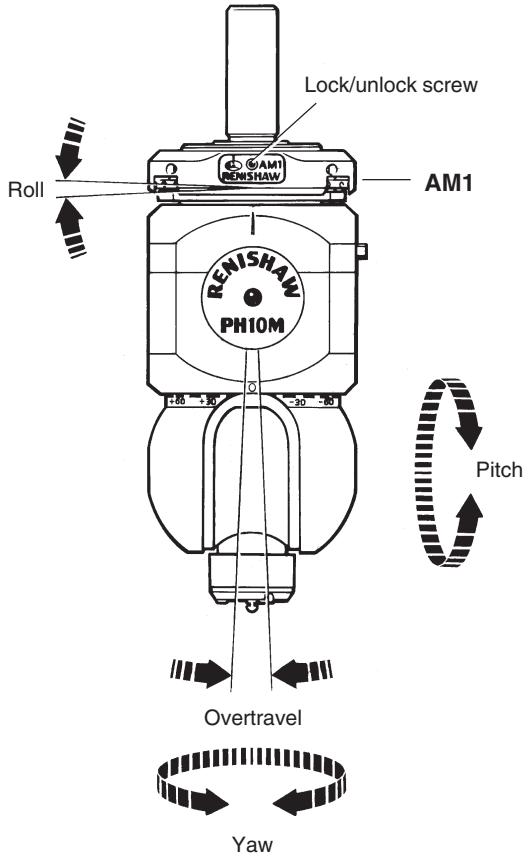
* **NOTE:** When using a SP600M with a PH10MQ a PEM25 extension bar is required to achieve A = 97.5° or A = 105° in all B-axis postions



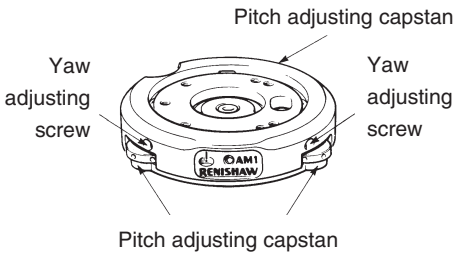
AM1 adjustment module for PH10T/M, PH6M and MIH

The AM1 adjustment module has been designed for use with the PH6M and MIH manual probe heads and the PH10T/M motorised probe heads. It provides quick and accurate angular alignment of the probe head with the CMM's axes and/or the autochange rack.

In addition, the quick release mechanism allows the head to be removed for storage and subsequently replaced without further alignment. Built in overtravel protection decreases the risk of head damage.



AM1 adjustment module for
PH10T/M - PH6M - MIH

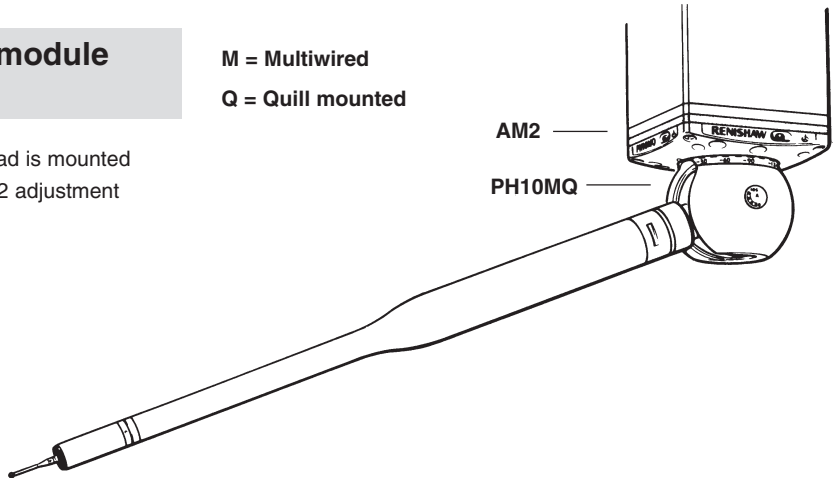


AM2 adjustment module for PH10MQ

PH10MQ motorised probe head is mounted directly to the quill via the AM2 adjustment module.

M = Multiwired

Q = Quill mounted



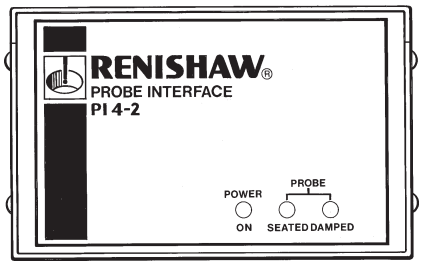
Specification summary	AM1	AM2
SIZE	60 x 15.5 mm (2.36 x 0.61 in) nominal	80 x 10 mm (3.15 x 0.39 in) nominal
ADJUSTMENT	±2° in pitch and roll * (recommended) ±4.5° in yaw	±1° in pitch and roll * (recommended) ±1° in yaw
OVERTRAVEL	±3.5° in pitch and roll	0°
MOUNTING	Mounts to quill using shank Alternatively direct to quill using OEM adaptor	Mounts direct to quill
WEIGHT	150 g (5.29 oz)	48 g (1.96 oz)

* up to ±5.5° in pitch and roll is possible but this is at the expense of overtravel

PI 4-2 probe interface

Application - TP1, MIP, TP2, TP6, TP6A, TP20, SP25M (when using TP20)

The PI 4-2 is the basic interface for standard touch trigger probes that allows for a PICS or SSR output, the supply voltage being automatically detected. The unit is usually free standing but can be rack mounted.

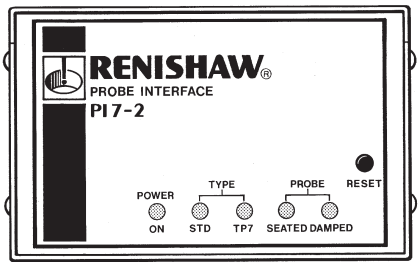


PI 7-2 probe interface

Application - TP7M + TP2, TP6, TP6A, TP20

The PI 7-2 is a dual purpose interface designed to process signals from the TP7M strain gauge probe and standard touch trigger probes.

Special autoselecting electronics within the interface allow exchange of these probes without any changes to the interface.

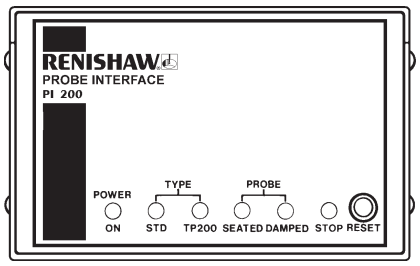


PI 200 probe interface

Application - TP200 + TP2, TP6, TP6A, TP20, SP25M (when using TP20)

The PI 200 is a dual purpose interface designed to process signals from the TP200 strain gauge probe and standard touch trigger probes.

Special autoselecting electronics within the interface allow exchange of these probes without any changes to the interface.



Specification summary	**PI 4-2 / PI 7-2 / PI 200**	
POWER SUPPLY	85-264 V 47-66 Hz	
CURRENT CONSUMPTION (AT 240 V)	less than 200 mA	
ENVIRONMENT		
STORAGE	-10 to 70 °C (14 to 158 °F)	
OPERATION	10 to 50 °C (50 to 122 °F)	
DIMENSIONS		
HEIGHT	88 mm (3.46 in)	2'U'
WIDTH	146 mm (5.75 in)	1/3 of a 19 in rack
DEPTH	183 mm (7.19 in)	
WEIGHT	1.6 kg (55.9 oz)	
COMPATIBILITY		
OUTPUT	Product interconnection system (PICS) or SSR	
CABLES	Refer to Renishaw subsidiary, distributor or CMM manufacturer	

PHC10-2 head controller

The PHC10-2 head controller receives instructions from the CMM controller and controls the head functions and reports system status to the CMM:

a) Drives PH10 to position sent either from the HCU1 or CMM.

b) Checks and reports position.

c) Flags up errors e.g. failure to reach position, obstruction before or after locking etc. Probe triggering signals are routed through the controller to the probe interface.



Specification summary		PHC10-2
DATA TRANSMISSION		RS232 IEEE (only available to special order)
USER DEFINABLE PARAMETERS		
SERIAL		Baud rate 300 - 19200
PARALLEL		address, parallel poll bit
VOLTAGE RANGE		85-264 V 47/66 Hz
CURRENT CONSUMPTION (at 240 V)		less than 500 mA
INPUT CONNECTORS		15 way 'D'
PROBE OUTPUT CONNECTORS		7 pin DIN or 9 way 'D' type
DIMENSIONS	HEIGHT	88 mm (3.46 in) 2 'U'
	WIDTH	289.3 mm (11.4 in) 2/3 of a 19 in rack
	DEPTH	220 mm (8.66 in)
WEIGHT		2.86 kg (101 oz)
MAXIMUM CABLE LENGTH		50 m (164 ft)
HAND HELD CONTROL UNIT		HCU1 only

HCU1 hand held control unit

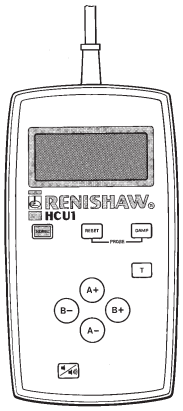
The HCU1 hand control and display unit is used with the PHC10-2 to drive the PH10 probe head position.

It is useful for setting up a component, operator controlled inspection and teach-cycle programming. Features include two speed action (jog and rapid move), two axis head display, transmit button for teach cycle, status and error LEDs.

Features

a) Manual control of head movements

b) LCD dot matrix showing : Head position, system status, and error analysis.



IS1-2 interface selector

The IS1-2 interface selector is a fully automatic system for use on CMM installations requiring multiple sensor types (e.g. SP25M – scanning probe, TP7M – touch trigger probe, OTP6M – optical trigger probe, etc). The unit functions by identifying which probe has been fitted to the probe head and switches the probe signal / power lines to the appropriate interface.

The system comprises a standalone or rack-mountable interface selector. The IS1-2 has four separate channel outputs. These outputs allow any combination of the following Renishaw probes to be integrated into one automated system:

- SP25M
- SP80
- SP600
- OTP6M*
- TP7M
- TP2/TP6/TP20/TP200*

* These probes can be incorporated into a multiple sensor system consisting of any one of the other probe systems specified without the necessity to use an IS1-2 unit. Please contact Renishaw for further details.

The IS1-2 is also fully compatible with Renishaw's ACR1 and ACR3 probe exchange systems, the PH10M range of motorised heads and the PHS1 motorised servo head system using the Renishaw product interconnection system (PICS).

A set of four programming modules are supplied pre-installed within the IS1-2 unit which identify the probe in use. These are TP7M, SP600M, SP80 and SP25M modules. The remaining modules are supplied loose and can be installed by the user. TP2, TP6, TP20, TP200 have an integral identification system and therefore do not require a module.

Plugging the required product module into the respective channel selector socket ensures that the probe connections are made to the correct IS1-2 output port.

Third party probes, that carry the female autojoint, will require specific identification resistors to be fitted within the female autojoint. Special modules to permit the recognition of these probes by the IS1-2 will also be required.



UCC2 universal CMM controller system

The UCC2 controller together with its associated products- the SPA2 servo power amplifier and the MCU1 joystick, form a comprehensive CMM control system. This system is a sophisticated integrated motion controller that precisely controls CMM motion, including comprehensive scanning capabilities and automated probe calibration.

With UCC2 operating through an SPA2, the CMM motion control is smooth, fast and accurate, permitting irregular contours to be easily followed thanks to the 'move blending' software.

The UCC2 has three levels of operating capability: touch-trigger probing, digitising and full scanning capability which includes Renishaw's patented RenscanDC™.

Future hardware and software upgrades can be carried out easily, with function enhancements available by email or telephone support. Software enhancements are simply applied, as the control software is loaded at boot up. Additional new products require only plug-in daughtercards.

All new probes and heads will be available with a controller interface option that will also include any appropriate calibration or set-up software.

The UCC2 controller is housed in a standard rack-mountable enclosure and is connected to the host PC via a conventional Ethernet link. It does not contain user application software.

The SPA2 servo power amplifier is housed in a standard rack-mountable enclosure and the cables necessary to connect it to the UCC2 are supplied as part of the kit.

The MCU1 machine control unit (joystick) is an ergonomically designed unit suitable for both hand held or table based operation. It is supplied with a 5-metre cable as standard but other cable lengths or extensions can be used.

Scanning with UCC2

The UCC2 scanning capability provides a choice of scanning techniques:

- Known part adaptive scanning, with sophisticated scanning routines that include :
- Cylinder scan (a helical scan path that can adapt to cones and spheres, as well as cylinders. It will also adapt to out-of-round and out-of-position parts).
- Gasket scan (a known path scan constructed from a series of lines and arcs).
- Grid scan (a 3D scan of a pre-defined area)
- Automatic find centre:- Utilisation of a scanning probe to automatically find the centre of a groove or conical hole
- Advanced data filtering
- Advanced analogue probe calibration

UCC2 features and benefits:

- Capable of smooth, fast and accurate blending of CMM motion control
- Close integration between probing and the CMM optimises system measuring performance
- Closed-loop known part scanning includes cylinder, gasket and grid routines
- Available with three levels of operating capability: touch-trigger probing, digitising and full scanning capability including Renishaw's patented RenscanDC™
- Integrated control of all Renishaw standard touch trigger probe systems and stylus changing
- Full future product compatibility using plug-in daughtercards
- I++ DME server application



RenscanDC™ – the ultimate scanning performance from your CMM

Renishaw's patented RenscanDC™ system enables measurement at extremely high speeds, but with the accuracy of low speed measurement.

The traditional conflict between accuracy and scanning speed is resolved by RenscanDC's feature based approach, which follows two steps:

1. Measure the feature at slow speed to establish an accurate measurement. Repeat measurement at high speed to identify errors introduced at high speed.
2. UCC2 automatically computes the dynamic error at each point around the feature to derive a dynamic correction map.

All subsequent parts can be measured at high speed and the application of dynamic corrections will provide low-speed accuracy at the fast measurement speeds.

UCC2 technical specification

- 19" 3U standard rack-mountable enclosure with 5 expansion slots for option cards and a 6th expansion slot that conforms to the PCI specification.
- Simple Ethernet link to the PC via a crossover LAN cable.
- Internal error-map
- 4-axis control.
- Scale inputs:- Renishaw RGH22, RGH24, RGH41 and other digital scales are directly supported. Analogue scales can be supported via an external interface.
- Uncommitted Binary I/O:- 6 inputs and 7 outputs available as standard
- Comprehensive joystick interface
- TP20, TP200/SCR200, SP600 and SP25M interfaces available as standard
- The following option cards are available :-
  - SP80 interface
  - PH10 motorised head interface
  - PHS1 motorised head interface
  - PICS/RS232 auxiliary product interface
  - Additional axis; can be configured as a rotary table or dual drive interface. More than one can be fitted in a controller
  - Temperature sensor inputs (24)



Operational

- Touch-trigger (standard)
- Digitising (optional upgrade)
- Scanning (optional upgrade), includes RenscanDC™
- I++DME server (optional upgrade)

Specification summary	UCC2	
POWER SUPPLY	85 to 132 V ac, 170 to 264 V ac, 47 to 63 Hz, 150 W	
ENVIRONMENT	STORAGE	-10 °C to 70 °C (14 °F to 158 °F)
	OPERATION	10 °C to 50 °C (50 °F to 122 °F) local to UCC
DIMENSIONS	HEIGHT	127 mm (5.0 in)
	WIDTH	435 mm (17.1 in)
	DEPTH	330 mm (129.9 in)
WEIGHT	8 kg (17 lb) - without cables and option boards	
EMERGENCY STOP	Category ‘2’ (subject to integration)	

SPA2 servo power amplifier for UCC2

The SPA2 is a 4-channel digital servo power amplifier with an integral power supply. The design has been optimised to work with the UCC2 CMM controller and all the necessary interconnection cables are provided in the kit.

When the SPA2 is used with the UCC2 controller and MCU1 joystick, you have an ideal retrofit package.

For each amplifier channel, there are individual software controls for all the tuning parameters including offset, gain, integral and proportional settings. The motor and tacho polarities can also be inverted by software.

The power supply can be set to provide a voltage output from 12 V to 60 V. The maximum total output power is 600 W and each channel can deliver 10 A peak or 5 A continuous.

As well as the servo power amplifiers, the unit contains all the relays to control the motor engaging process. It also contains all the necessary hardware to implement a category '2' emergency stop system.

With mounting brackets, the system may be housed in a 3U high x 19 in wide, rack mountable enclosure.



Specification summary	SPA2	
POWER SUPPLY	Input	85 to 132 V ac, 170 to 264 V ac, 47 to 63 Hz, 650 W maximum
	Output	12 to 60 V dc, 10 A maximum
EMERGENCY STOP	Catagory '2' (subject to integration)	
DIMENSIONS	HEIGHT	127 mm (5.0 in)
	WIDTH	435 mm (17.13 in)
	DEPTH	330 mm (12.9 in)
WEIGHT	8 kg (17 lb)	
ENVIRONMENT	STORAGE	-10 °C to 70 °C (14 °F to 158 °F)
	OPERATION	10 °C to 50 °C (50 °F to 122 °F)

MCU1 multi-functional hand control unit

The MCU1 is a multi-functional hand control unit that provides complete CMM control.

Designed for use with the UCC range of controllers, the MCU1 is housed in an ergonomically styled enclosure that allows for hand held (suitable for both right and left handed operators) or table mounted operation.

The MCU1 is supplied as standard with a 5 metre cable, other cable lengths and/or extensions can be used.

A large LCD screen gives status information and allows for interaction with the metrology program.



The MCU1 can be used to:-

- Control the motion of your CMM's axes
- Index your motorised head
- Operate your rotary table
- Operate as a computer mouse
- Allow navigation through operating software from its menu system
- Customisation of part or all of the LCD screen is permitted

The control switches included on the MCU1 are as follows:

- An industry standard emergency stop switch
- A speed control that controls the move speeds in an automatic move from 0 to 100%
- A "joystick enable" switch which can be programmed to work in several modes including as a "dead-mans-handle"
- A 3-axis joystick
- Fast / slow joystick speed
- Individual axis locks
- "Start/stop program" switch
- "Engage servos" switch
- "Probe override" switch
- A "mode" switch to scroll through the various operating modes:- CMM, motorised head, rotary table etc.
- An orientation switch that switches the joystick axes around to suit the direction you are facing the machine
- Take point" (way point) switch
- "Cancel last point" switch
- An "axis system" switch that can switch joystick motion between, machine, part and stylus co-ordinate systems
- Four uncommitted function switches F1 to F4

A MCU1 docking port is also available that allows the MCU1 to be stored on the side of a cabinet, CMM bed or any other non-horizontal surface.

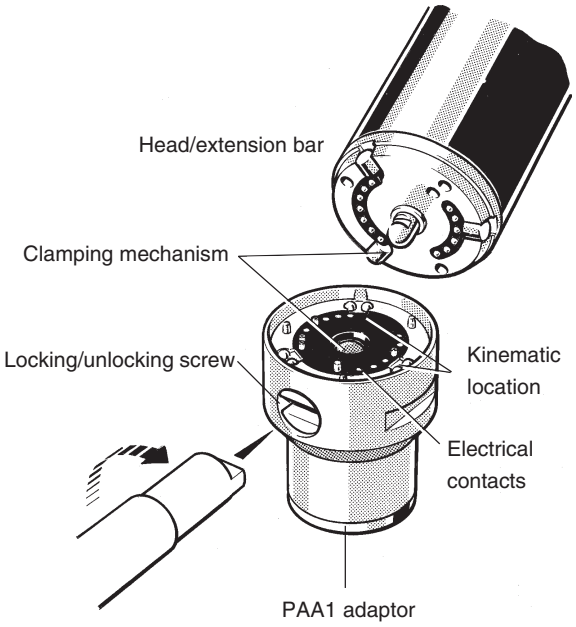
Autochange system

The autojoint

The essential feature of Renishaw's autochange systems is the autojoint itself. This is a highly repeatable kinematic joint, one half of which is attached to the probe head, the other is attached to an adaptor, extension bar or probe.

Locking and unlocking the autojoint is achieved either manually, using an autojoint key or, automatically, using either the ACR1 or ACR3 autochange rack systems. In all cases, the connection repeatability eliminates the need for probe requalification after each probe exchange.

In addition to mechanical repeatability, the autojoint carries thirteen electrical connections, known as the Renishaw Multiwire. These carry not only simple two wire TTP signals but also the more demanding signals from analogue scanning and non contact laser probes, providing the benefit of the complete Renishaw range.



Specification summary	Autojoint
FITTING	Ø25 mm (Ø0.98 in)
CONNECTION REPEATABILITY	1 µm (0.00004 in) at stylus tip, 50 mm (2 in) from autojoint

ACR1 autochange rack

The ACR1 system is a fully integrated 8-port probe autochange system. It is mounted within the machine's working envelope and allows probe/stylus combinations to be exchanged automatically from heads **and** extension bars, without the need for re-qualification.

ACR1 has been revised to allow on-site configuration of the ports to accommodate extra large probes such as optical sensors.

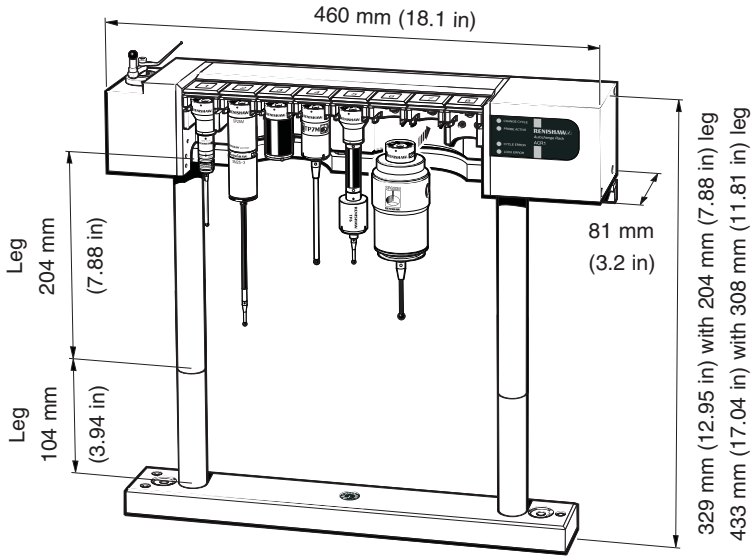
It is also possible to use the ACR3 to autochange between the head and probe (please see page 10-3).

For further assistance in choosing your system, please see H-1000-3032/ H-1000-3033 autochange systems brochure.

Note:
This system can be mounted both horizontally (as shown) or vertically.

The example shows the flexibility which substantially increases the usefulness and effectiveness of the CMM.

Legs are constructed from 104 mm and 204 mm (4.09 in and 8.03 in) modules.



ACR1 autochange rack with adjustable base

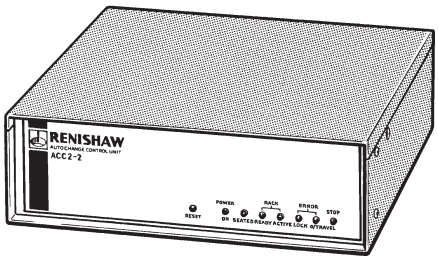
Specification summary	ACR1
NUMBER OF PORTS	8
DIMENSIONS without legs	460 x 100 x 81 mm (18.1 x 3.9 x 3.2 in)

ACR1 key benefits:

- on-site port configuration facility
- horizontal and vertical mounting
- removal of probes from extension bars
- crash protection system

ACC2-2 autochange controller for ACR1

The ACC2-2 is the RS232 only version of the ACR1 autochange controller. For IEEE support please contact Renishaw.



Specification summary	ACC2-2		
DATA TRANSMISSION	Serial RS232		
USER DEFINABLE PARAMETERS	Serial Parallel	Baud Rate 300 - 19200 address, parallel poll bit	
VOLTAGE RANGE	85-264 V	50/60 Hz	
DIMENSIONS	HEIGHT WIDTH DEPTH	88 mm (3.43 in) 289.3 mm (11.4 in) 220 mm (8.58 in)	2 'U' 2/3 of a 19 in rack
WEIGHT	3.85 kg	(136 oz)	

ACR3 autochange rack

Renishaw's ACR3 autochange rack is a passive, 4-port probe changing system. It is fitted to Renishaw's modular rack system (MRS) which has been designed to provide a platform for Renishaw's latest range of stylus and probe changing racks.

The ACR3 uses the motion of the CMM to lock/unlock the autojoint between the probe head and the probe/extension. ACR3 is therefore a passive mechanical design without the need for rack motors or electrical interfacing.

Integration with the metrology software is required (please consult your machine supplier for details).

All Renishaw probes and extension bars fitted with the autojoint can be carried. Some third party probes that incorporate the Renishaw autojoint can also be used with ACR3. (Please consult your machine supplier for details).

For additional flexibility, two four port units can be linked to provide an eight port system.

The total swept volume along the MRS during a change cycle is:

1 x ACR3	275 mm (10.27 in)
2 x ACR3s linked	460 mm (18.33 in)

The extruded rail of the MRS is available in different lengths 400/600/1000 mm (15.8/23.6/39.4 in) to suit the number and combination of changer requirements. In addition the height of the MRS can easily be upgraded after installation allowing further flexibility to meet application needs. For more details on the MRS please refer to section 13-1. Additionally an ACR3 data sheet H-1000-2024, and autochange systems brochure H-1000-3032/H-1000-3033 are available.

ACR3 features and benefits:

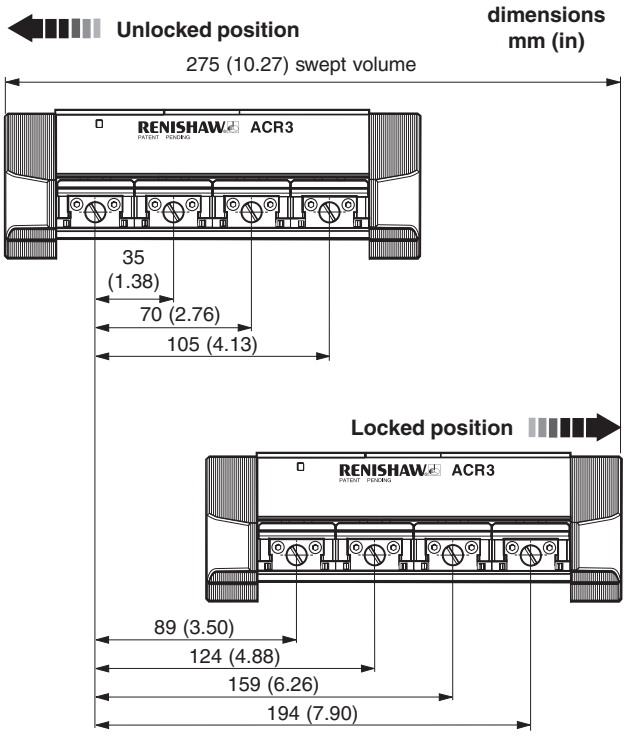
- 4 ports
- rapid exchange between autojointed products
- can be configured to provide 8 ports
- simple installation/operation



ACR3 4-port system mounted to MRS



ACR3 and two SCP600's mounted to MRS



4-port ACR3 operating envelope

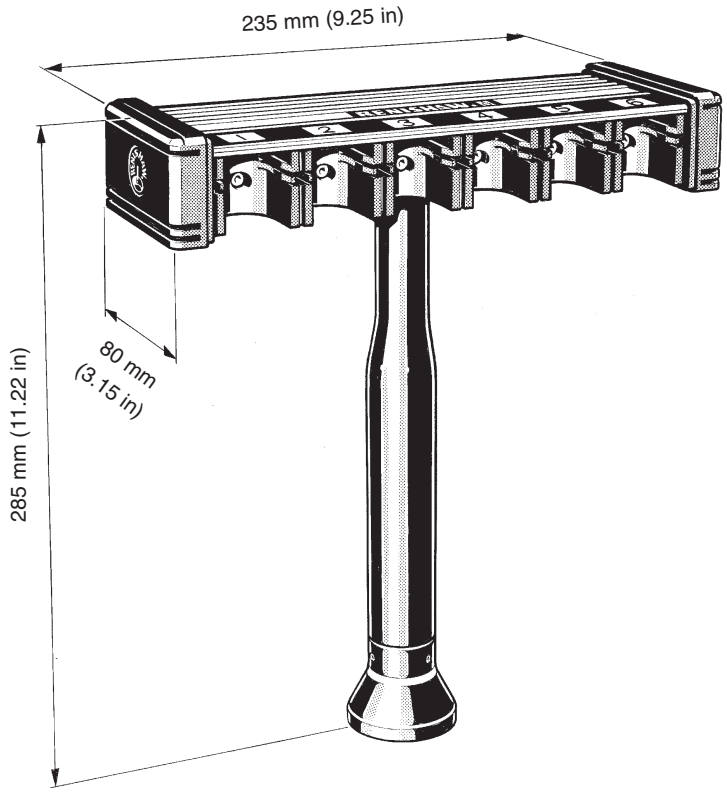
MAPS manual autojoint probe stand

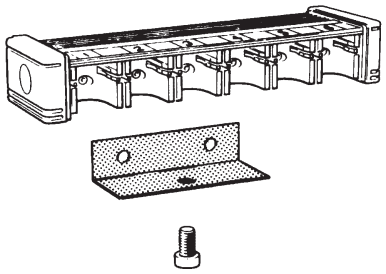
Renishaw's manual autojoint probe stand (MAPS) is a low cost storage rack capable of holding up to six combinations of autojointed probes, extension bars and accessories.

The stand can be mounted directly onto the table of a CMM (or any suitable surface) using the leg mount.

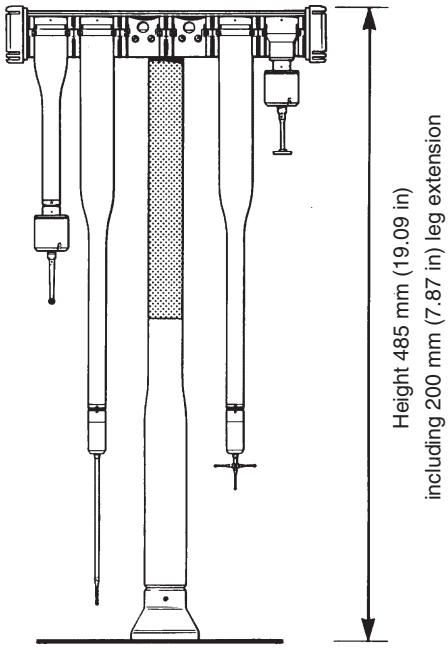
Standard ACR1 autochange rack legs (100 mm and 200 mm long) are compatible with this stand and can be stacked to accommodate longer probe extensions with longer stylus extensions.

As an alternative to the leg mount, a wall mounting bracket is available to enable the stand to be mounted to a cabinet, wall or any vertical surface.





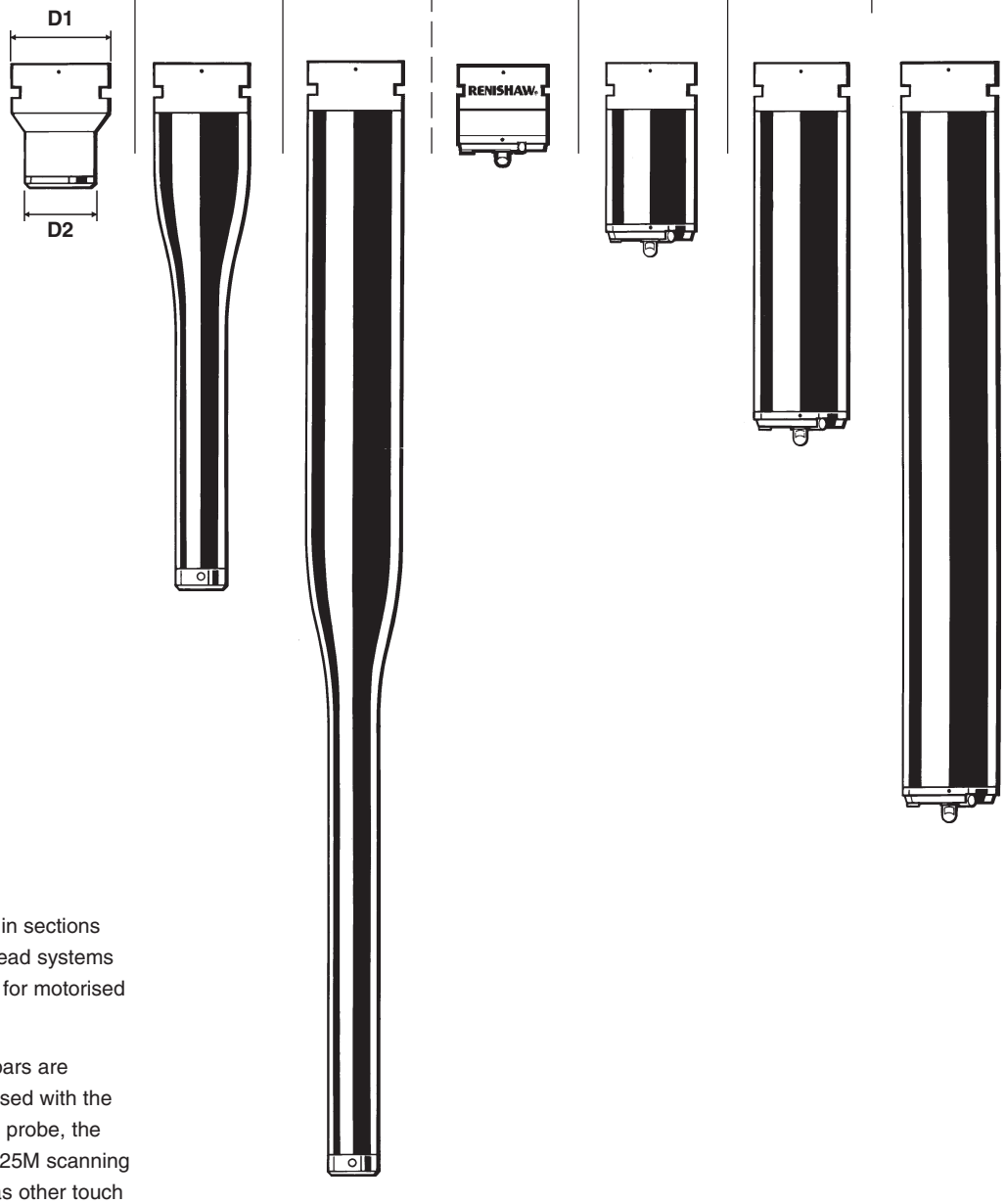
Wall mounting bracket with bolt



Specification summary	MAPS	
DIMENSIONS	HEIGHT	285 mm (11.22 in) without leg extensions
	DEPTH	80 mm (3.15 in)
	WIDTH	235 mm (9.13 in)
ADDITIONAL LEGS	HEIGHT	100 mm (3.95 in), or 200 mm (7.87 in)
MOUNTING	Single leg or wall bracket	

Extension bars - autojoint type

	AUTOJOINT TO M8 THREAD			AUTOJOINT TO AUTOJOINT			
	PAA1	**PAA2**	**PAA3**	**PEM25**	**PEM1**	**PEM2**	**PEM3**
Material	Steel	Aluminium	Aluminium	Steel	Aluminium	Aluminium	Aluminium
Effective length	32 mm (1.26 in)	140 mm (5.51 in)	300 mm (11.81 in)	25 mm (0.98 in)	50 mm (1.97 in)	100 mm (3.94 in)	200 mm (7.87 in)
D1	∅24.95 mm (0.98 in)	∅24.95 mm (0.98 in)	∅24.95 mm (0.98 in)	∅24.95 mm (0.98 in)	∅24.95 mm (0.98 in)	∅24.95 mm (0.98 in)	∅24.95 mm (0.98 in)
D2	∅17.8 mm (0.70 in)	∅13 mm (0.51 in)	∅13 mm (0.51 in)	∅24.95 mm (0.98 in)	∅24.95 mm (0.98 in)	∅24.95 mm (0.98 in)	∅24.95 mm (0.98 in)
Weight	57 g (2.01 oz)	85 g (2.10 oz)	144 g (5.08 oz)	60 g (2.11 oz)	64 g (2.26 oz)	93 g (3.66 in)	147 g (5.18 oz)

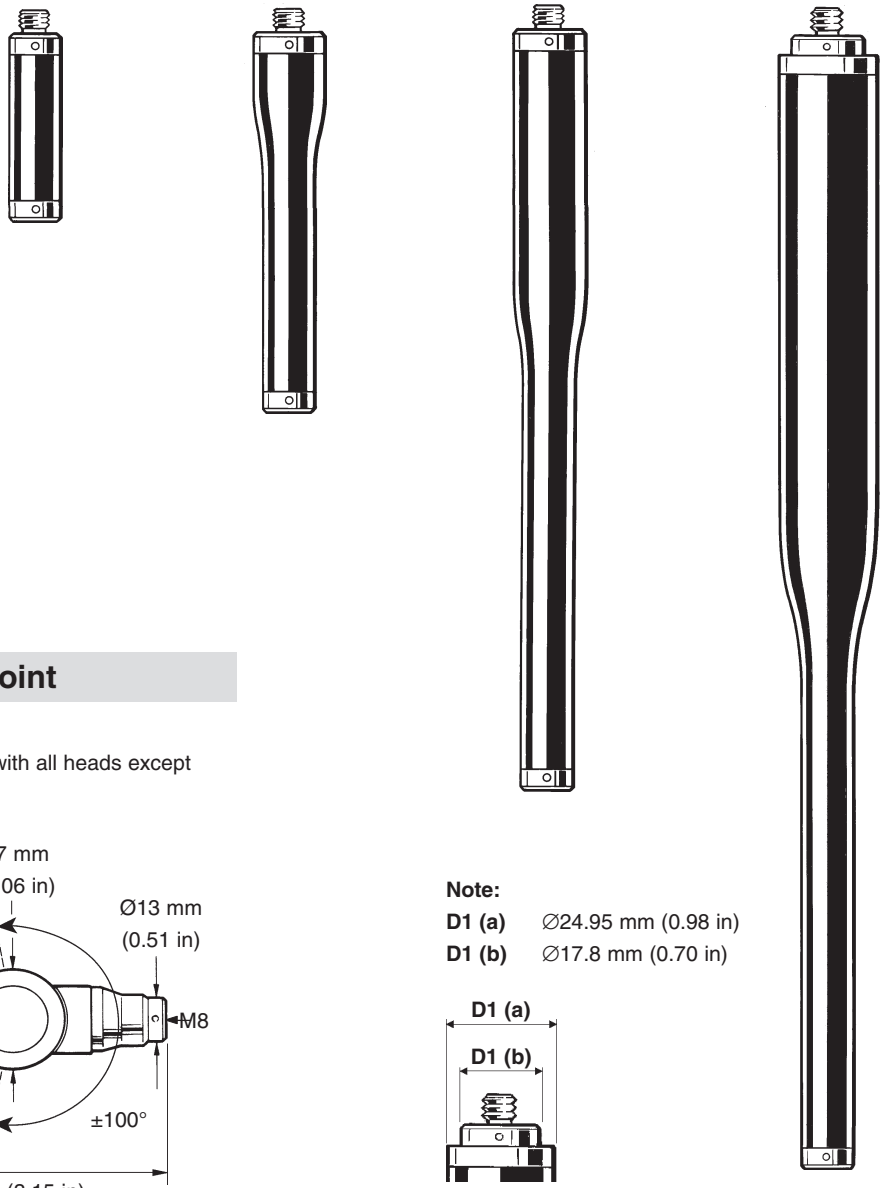


Note:
Check suitability in sections 5/6 for manual head systems and sections 7/8 for motorised head systems.

PEM extension bars are designed to be used with the TP7M multiwired probe, the SP600M and SP25M scanning probes, as well as other touch trigger probes using an adaptor.

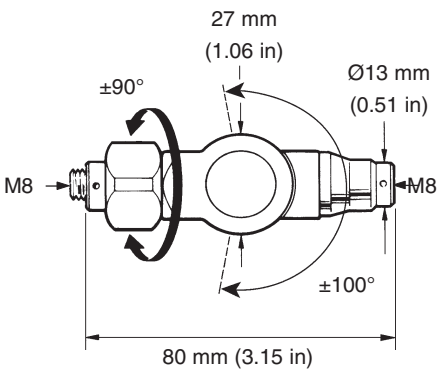
Extension bars - M8 to M8 type

	PEL1	PEL2	PEL3	PEL4
Material	Aluminium	Aluminium	Aluminium	Aluminium
Effective length	50 mm (1.97 in)	100 mm (3.94 in)	200 mm (7.87 in)	300 mm (11.8 in)
D1	Ø13 mm (0.51 in)	Ø18 mm (0.71 in)	Ø18 mm (0.71 in)	See note below
D2	Ø13 mm (0.51 in)	Ø13 mm (0.51 in)	Ø13 mm (0.51 in)	Ø13 mm (0.51 in)
Weight	24 g (0.85 oz)	57 g (2.01 oz)	86 g (3.03 oz)	135 g (4.76 oz)



PK1 knuckle joint

The PK1 can be used with all heads except MH20 and MH20i.



Note:
D1 (a) Ø24.95 mm (0.98 in)
D1 (b) Ø17.8 mm (0.70 in)

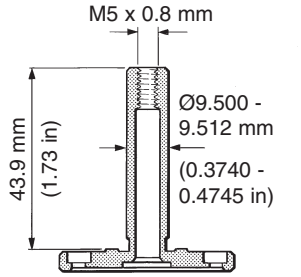
PEL4

Shanks (except PH6 and MH20)

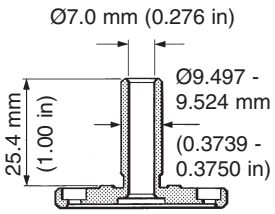
Shanks are used to mount the probe head to the quill of the machine.

The shanks detailed below are suitable for all Renishaw manual and motorised probe heads (except PH6 and MH20), as well as the TP1 probe. The correct shank must be chosen to suit the mounting facility of your CMM.

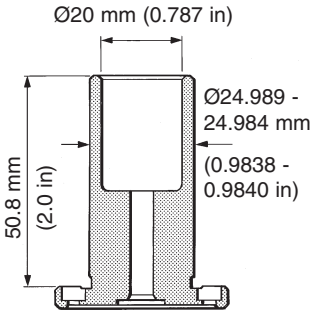
Standard base diameter is 41.35 mm - 41.45 mm (1.62 in - 1.63 in).



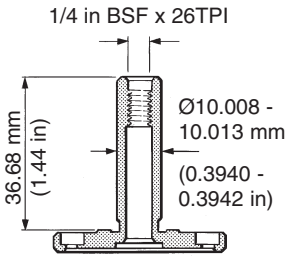
MS1



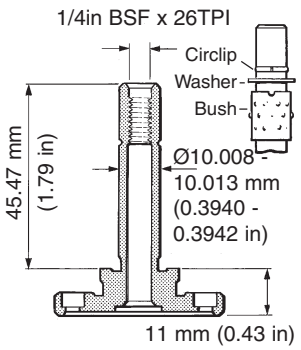
MS2



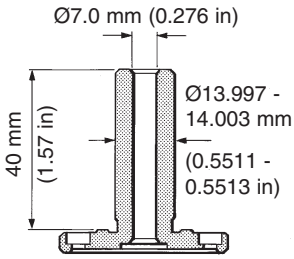
MS3



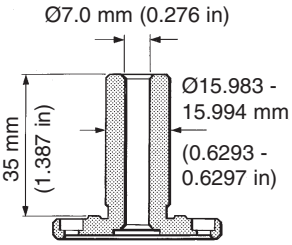
MS4



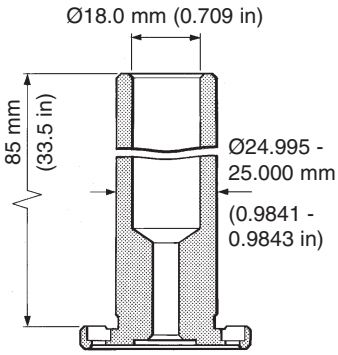
MS5



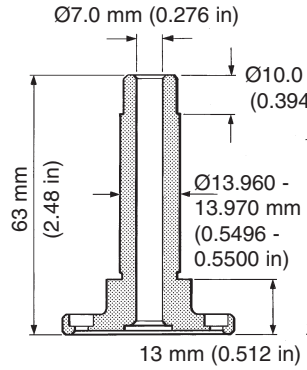
MS6



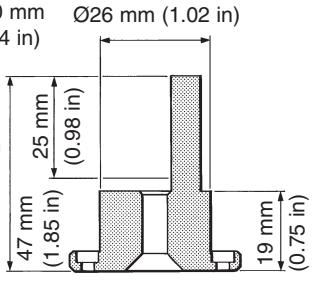
MS7



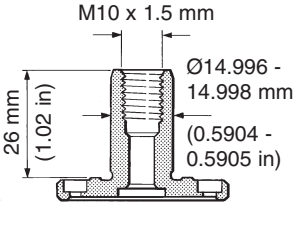
MS8



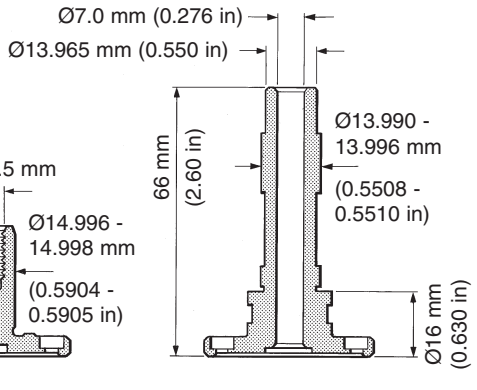
MS9



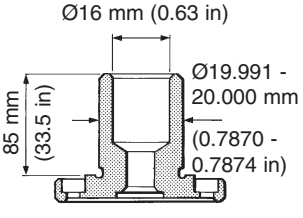
MS10



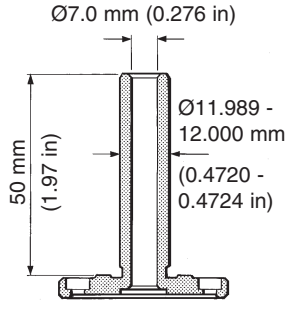
MS11



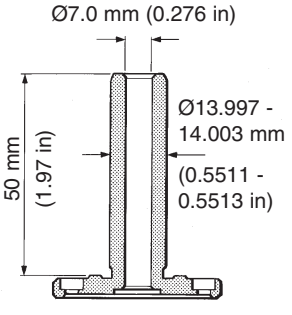
MS12



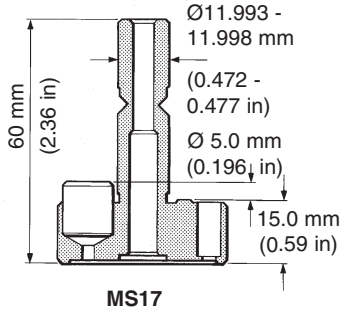
MS13



MS14



MS15

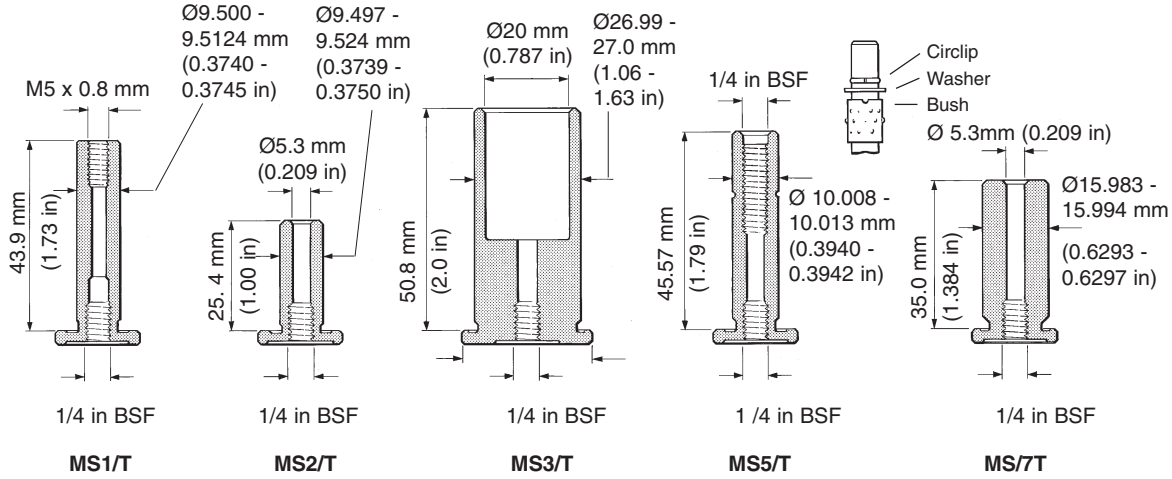


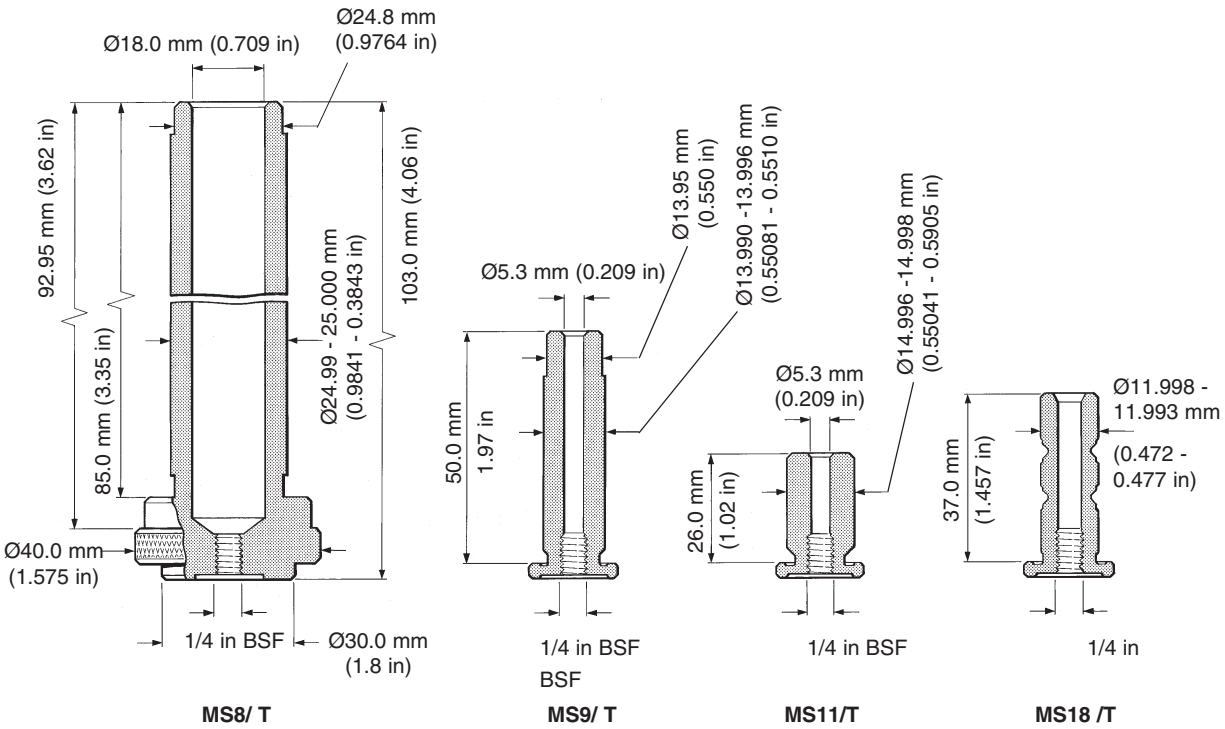
MS17

Shanks (for PH6 and MH20 only)

The shanks detailed on this page are suitable for the PH6 and MH20 manual probe heads only.

Standard base diameter is 18.9 mm - 19.1 mm (0.74 in - 0.75 in) unless otherwise stated.





Probing systems for
co-ordinate measuring machines













MRS modular rack system

Renishaw's modular rack system (MRS) allows customisation of probe and stylus changing racks to optimise CMM functionality.

The MRS is a modular system designed to provide a platform for Renishaw probe and stylus changing racks. It comprises a rail and two leg assemblies, and is available in three different standard rail lengths, 400 mm, 600 mm and 1000 mm (15.7 in, 23.6 in and 39.4 in) to suit a number of changer requirements.

The MRS rail can also be placed at different heights from the CMM's bed by using multiple MRS legs to allow the required clearance for long styli and extension bars.

The standard interconnecting MRS legs supplied (4 per kit) are each 125 mm (4.92 in) long. A maximum recommended leg length of 500 mm (19.68 in) can be achieved by purchasing additional legs. These are available in either 62.5 mm or 125 mm (2.46 in or 4.92 in) lengths. The rack is mounted on the CMM bed via two MRS feet attached to the legs.

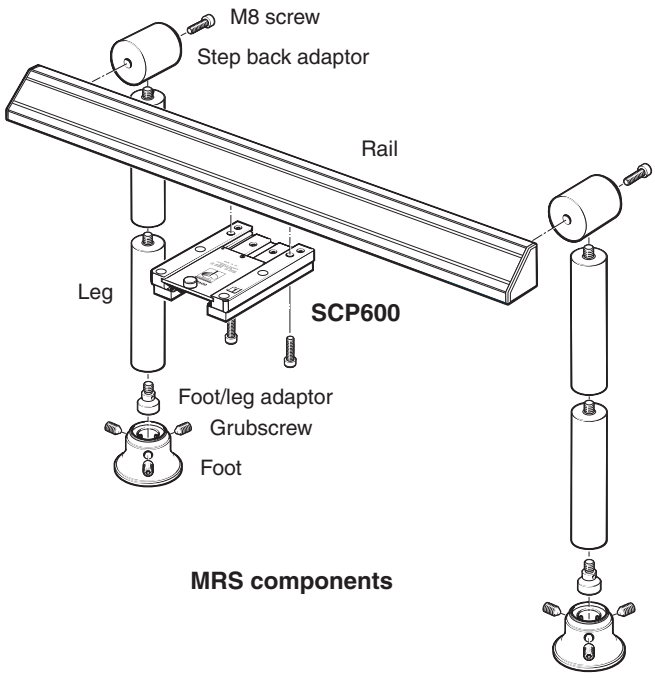
Where heavier rack system configurations are to be used e.g. multiple SCP80s mounted to a 1000 mm (39.37 in) rail length, the MRS system can be upgraded by using the optional heavy duty legs which are Ø60 mm x 350 mm long (Ø2.36 in x 13.78 in long). These legs mount beneath the standard legs/feet and are attached to the CMM bed.

The MRS is compatible with the following Renishaw change rack systems:

- FCR25 (flexible change rack for SP25M)
- SCP80 (stylus change port for SP80)
- SCP600 (stylus change port for SP600/SP600M/SP600Q)
- ACR3 (autochange rack)



MRS with SCP600



MRS components

MRS heavy duty legs

Where an MRS installation has numerous SCP80s containing heavy stylus arrangements, or vertical stylus arrangements exceeding 190 mm, it is recommended that the optional MRS heavy duty leg kits are used to provide additional rigidity/height.

These kits are purchased separately to match the number of legs used in the MRS installation. The heavy duty leg kit stands 330 mm (13 in) tall and is positioned between the CMM table and the standard MRS leg assembly.

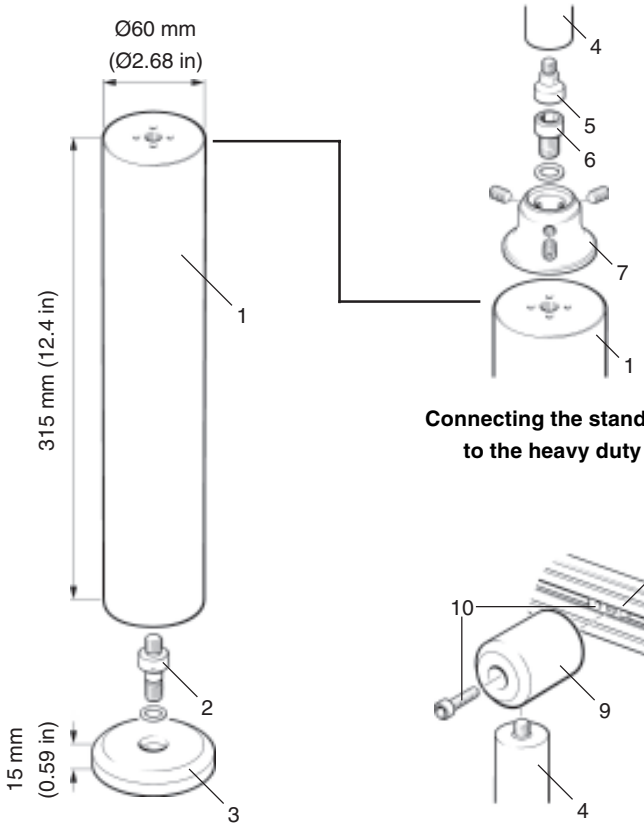
Note: The MRS heavy-duty leg kit part number is A-4192-0020 and comprises one heavy duty leg assembly. Therefore, two kits are required for a typical MRS installation.

MRS heavy duty leg kit

1. Heavy duty leg
2. Double-ended threaded stud *
3. Footplate

Standard MRS kit parts

4. Standard MRS leg
5. Leg to foot adaptor
6. M10 bolt
7. MRS foot
8. MRS rail
9. Step back adaptor
10. Tee nut and bolt



Connecting the standard leg to the heavy duty leg

MRS heavy duty leg kit

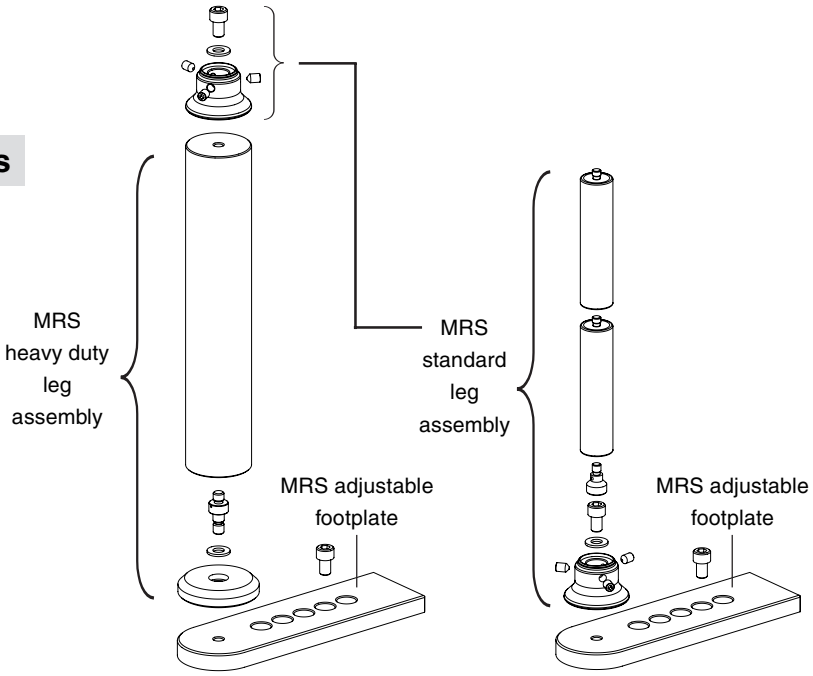
Step back adaptor arrangement

* Two sets of double ended threaded studs are provided to suit different CMM table configurations. The thread sizes supplied are M10, M8 and M6. Alternatively, 3/16 " UNC and 5/16 " UNC can be provided on request to your Renishaw supplier.

MRS adjustable footplates

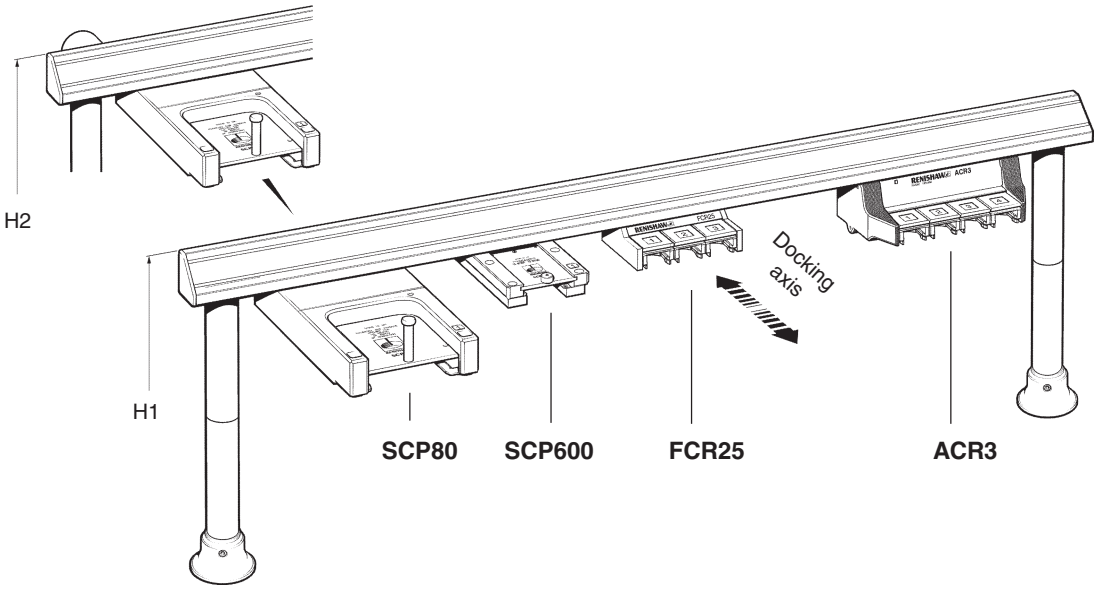
By using the optional MRS adjustable footplates, the MRS rail can also be placed at different positions on the CMM's table thereby ensuring that a maximised working volume can be achieved. The MRS adjustable footplates can be used with the MRS standard leg and the MRS heavy duty leg arrangements. The range of adjustment is via four boltholes in steps: 25/50/75/100 mm (0.98/1.97/2.95/ 3.94 in).

Note: The MRS adjustable footplates kit part number is A-4192-0702 and comprises two footplates.



MRS adjustable footplate arrangements with standard and heavy duty MRS leg arrangements

Detail showing alternative leg arrangement using step back adaptor



Specification summary		MRS Kit 1	MRS Kit 2	MRS Kit 3
RAIL LENGTH Note: allow additional 10 mm (0.40 in) for plastic end caps		400 mm (15.75 in)	600 mm (23.62 in)	1000 mm (39.40 in)
NUMBER OF LEGS REQUIRED (RECOMMENDED)		2	2 ‡	2 ‡
MAXIMUM USEABLE RAIL LENGTH				
With two legs mounted to underside of rail (as shown)		320 mm (12.60 in)	520 mm (20.47 in)	920 mm (36.22 in)
With legs mounted via step back adaptor (see detail)		400 mm (15.75 in)	600 mm (23.62 in)	1000 mm (39.40 in)
HEIGHT TO TOP OF RAIL (using legs supplied with MRS kit)				
With two legs mounted to underside of rail (as shown)		325 mm (12.8 in)	325 mm (12.8 in)	325 mm (12.8 in)
With legs mounted via step back adaptor (see detail)		317 mm (12.5 in)	317 mm (12.5 in)	317 mm (12.5 in)
HEIGHT OF ADDITIONAL SINGLE LEG		62.5 mm (2.46 in) 125 mm (4.92 in)	62.5 mm (2.46 in) 125 mm (4.92 in)	62.5 mm (2.46 in) 125 mm (4.92 in)
HEIGHT OF ADDITIONAL HEAVY DUTY SINGLE LEG Ø60 mm (2.36 in)		330 mm (12.99 in)	330 mm (12.99 in)	330 mm (12.99 in)
HEIGHT OF ADDITIONAL ADJUSTABLE FOOTPLATE		16 mm (0.630 in)	16 mm (0.630 in)	16 mm (0.630 in)
DISTANCE FROM PORT CENTRE TO LEG CENTRE (in docking axis)				
D1 = with legs mounted to underside of rail (as shown)	FCR25	41 mm (1.61 in)	41 mm (1.61 in)	41 mm (1.61 in)
	ACR3	56 mm (2.20 in)	56 mm (2.20 in)	56 mm (2.20 in)
	SCP600	69.2 mm (2.72 in)	69.2 mm (2.72 in)	69.2 mm (2.72 in)
	SCP80	134 mm (5.27 in)	134 mm (5.27 in)	134 mm (5.27 in)
D2 = with legs mounted via step back adaptor (see detail)	FCR25	94 mm (3.70 in)	94 mm (3.70 in)	94 mm (3.70 in)
	ACR3	109 mm (4.29 in)	109 mm (4.29 in)	109 mm (4.29 in)
	SCP600	122.2 mm (4.81 in)	122.2 mm (4.81 in)	122.2 mm (4.81 in)
	SCP80	187 mm (7.36 in)	187 mm (7.36 in)	187 mm (7.36 in)
RAIL LENGTH REQUIRED PER CHANGER UNIT	FCR25 *	115.8 mm (4.56 in)	115.8 mm (4.56 in)	115.8 mm (4.56 in)
	ACR3 **	280 mm (11.02 in)	280 mm (11.02 in)	280 mm (11.02 in)
	SCP600 *	87 mm (3.42 in)	87 mm (3.42 in)	87 mm (3.42 in)
	SCP80 *	133 mm (5.24 in)	133 mm (5.24 in)	133 mm (5.24 in)

* includes 2 mm (0.08 in) extra allowance per unit ** includes 5 mm (0.20 in) extra allowance per unit

‡ centre leg may be required in certain applications

PHA3 and PHA80

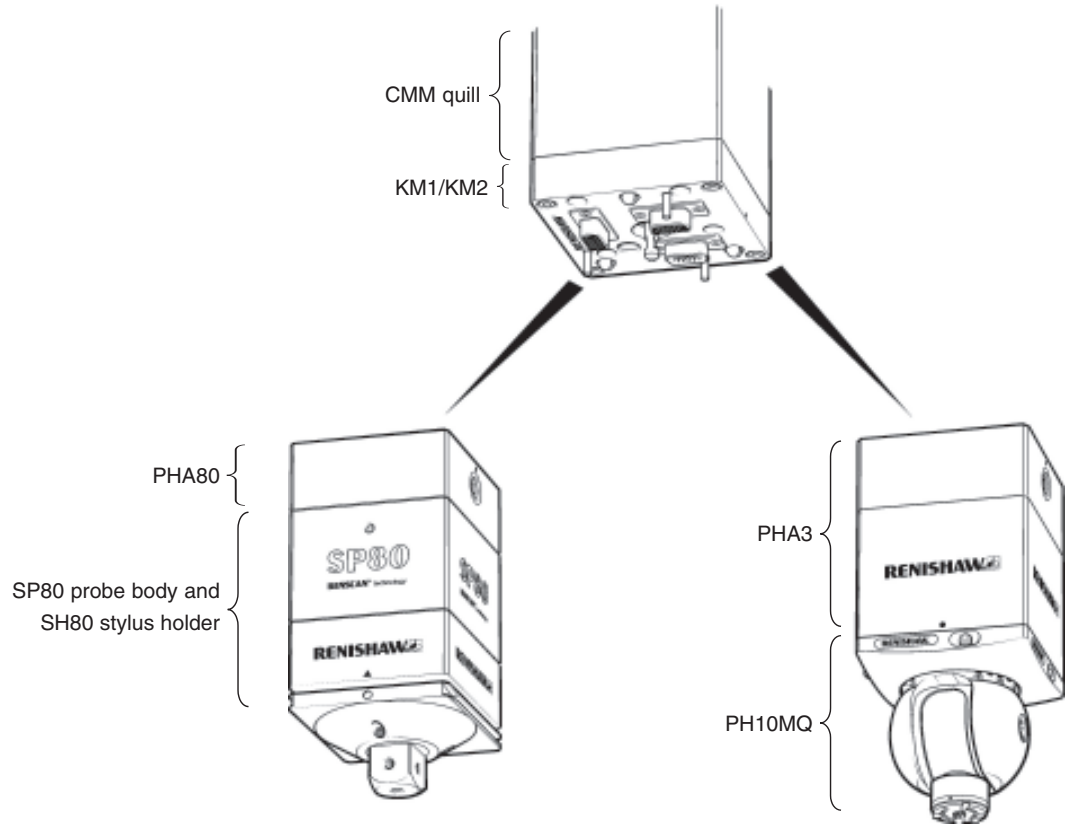
The PHA3 and PHA80 adaptor plates enable rapid interchange between PH10MQ (using PHA3) and SP80 (using PHA80) on the same CMM.

The CMM quill must first be fitted with a KM1 or KM2 (kinematic mounting plate) as appropriate, to which the PHA3/PHA80 mounts via a repeatable kinematic joint featuring quick lock/unlock by simply turning a key. The PH10MQ has to be pre-mounted on the PHA3 and similarly the SP80 to the PHA80. The general mechanical scheme is shown below.

The PHA80 is a single-piece item with the KM1/2 joint on its top face, and a direct mount to the top of the SP80 probe body on its bottom face. Therefore The KM80 is not required.

However, the PHA3 is supplied in two pieces - the PH10MQ is first mounted to the lower hollow piece making a sub-assembly, then the electrical connectors are attached before bolting this sub-assembly to the bottom face of the upper piece which has the KM1/2 joint on its top face.

It is possible to incorporate the IS1-2 interface selector unit into the system interconnection scheme.



PHA3 and PHA80 enable rapid interchange between SP80 and PH10MQ on the same CMM

Cleaning kit - CK200

CK200 (Renishaw part number A-1085-0016) is a specialised cleaning material supplied for the removal of contamination from the location faces of the magnetically retained kinematic couplings of the TP20, TP200 and SP25M probe systems.

The frequency of cleaning should be determined according to the conditions of use.

UDS universal datum sphere

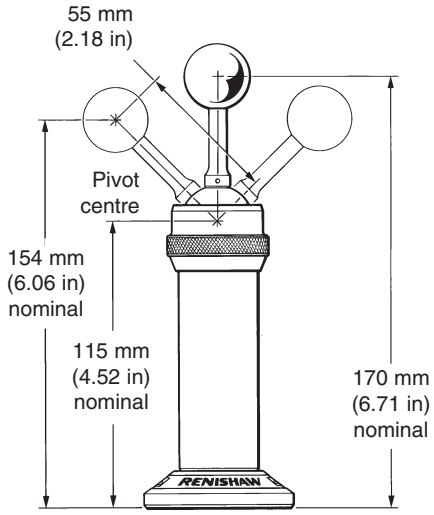
The Renishaw universal datum sphere complements the performance of manual and fully automated CMMs.

Quick and easy adjustment to set ball stem over a wide range of probe qualification angles. This enables qualification above, centrally and below the ball. The hand adjustable pivot joint enables stem rotation through 360° in the horizontal plane, and ±45° in the vertical plane.

Each datum sphere is supplied with its own certificate, giving ball diameter and roundness. All sphere measurements are performed on equipment traceable to UK (NPL) standards.

A vertical positioning feature provides positive feel when the stem arrives in the vertical position.

Vertical height from the table to centre of all ball sizes is approximately 173 mm (6.82 in). An optional pillar extension increases height to 248 mm (9.76 in).



Standard arrangement

Features

- Hard wearing tungsten carbide sphere (ball) available in five sizes: Metric Ø12, Ø19 and Ø25 mm; Imperial Ø3/4 and Ø1 in
- Sphericity to within 0.1 µm (0.000004 in)
- Diametric tolerance ±1 µm (±0.00004 in)

Universal datum sphere kit comprising:

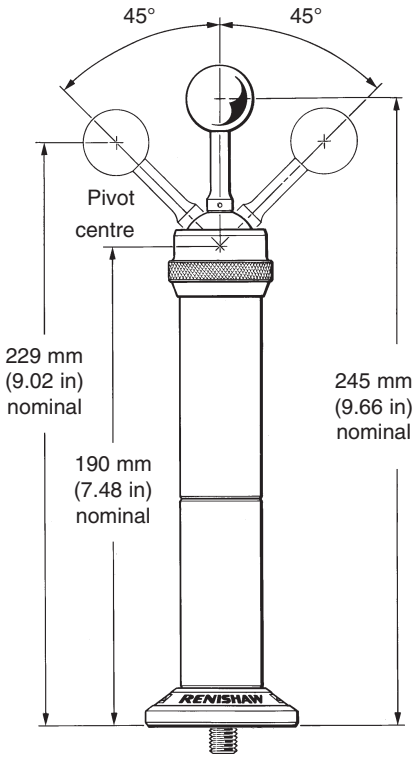
- One datum ball (selected by size): Ø12 mm, Ø19 mm, Ø25 mm, Ø3/4 in or Ø1 in.
- Pivot pillar, base, 'C' spanner
- Ball certificate and storage box
- Adaptor available for twin ball applications (optional)

Fixing stud

A fixing stud is required with each kit to attach the pillar to the table surface. Fixing stud thread sizes are:
M6 x 1, M8 x 1.25, M10 x 1.5, 5/16 in UNC, 3/8 in UNC

Optional extras

Datum ball	Ø12 mm, Ø19 mm, Ø25 mm, Ø3/4 in, Ø1 in.
Adaptor	2 way adaptor, 3 way adaptor
Pillar extension	75 mm (2.96 in) long



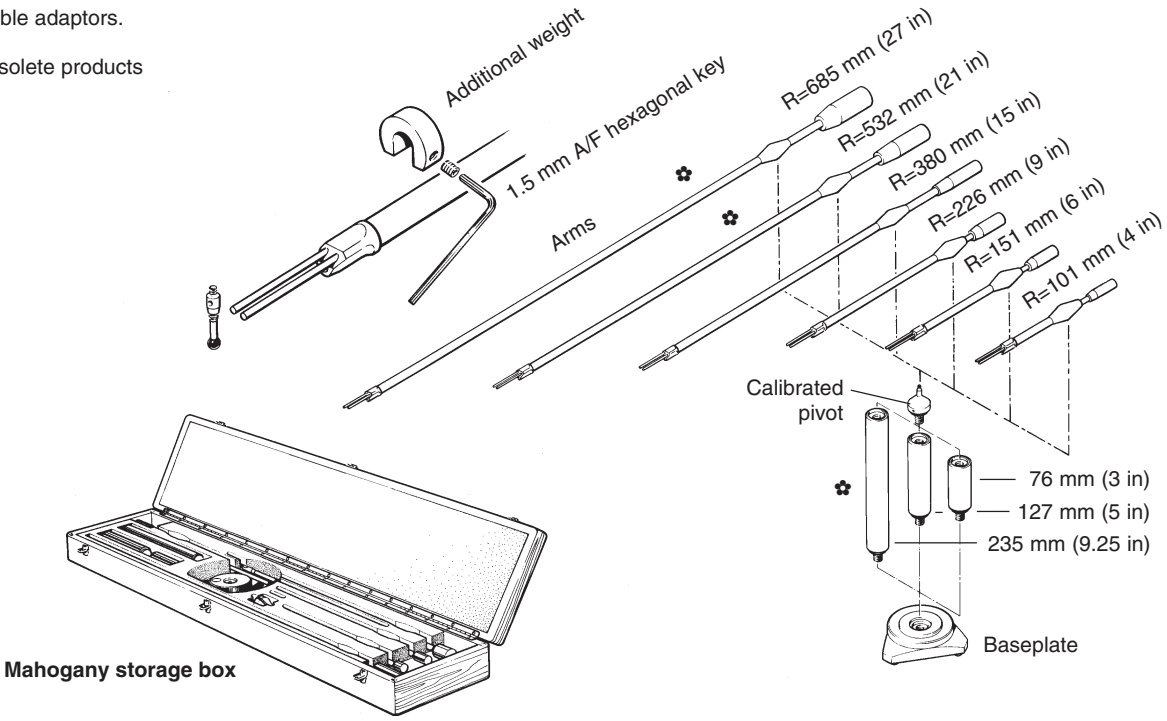
Using optional pillar extension

MCG machine checking gauge

R = Radius from calibrated pivot to stylus ball centre

Special calibrated stylus can be used with TP1, TP2, TP20, TP6, TP6A, MIP* and PH50* with suitable adaptors.

* Obsolete products



Mahogany storage box

Kit	Description
MCG1	**Small kit** machines up to 1 m^3 (35.315 ft^3)
MCG2	**Comprehensive kit** machines greater than 1 m^3 (35.315 ft^3)

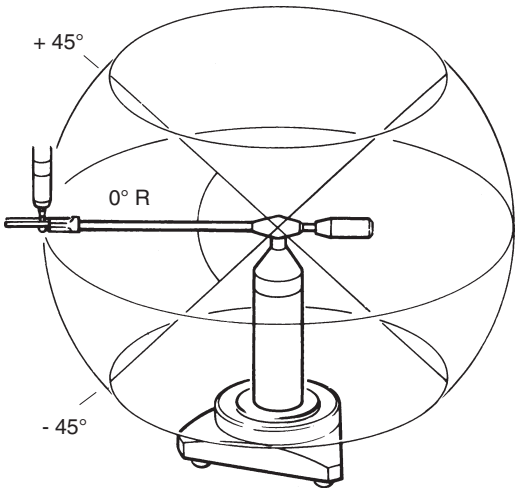
Specification

CHECKING TIME	
CNC (DCC) machine	Typically 15 minutes
Joystick machine Manual machine	Typically 45 minutes
MEASURING RANGE	
Vertically	±45° ✱
Horizontally	360°
TOTAL GAUGE ERROR	±0.5 µm (±0.00002 in)

Calibration traceable to USA National Institute of Standards and Technology (Ref #731/23897-87). The machine checking gauge also complies with British Standard BS EN ISO 10360-2.

The probe's stylus slots into the end of what is in effect a reference ballbar. The probe carries the bar with it over a circular path, and radial readings are taken at 0°, +45° and -45° elevations. The range of these readings indicates the volumetric measuring performance of the CMM. Repetition of a sequence of readings checks the system for repeatability.

Volumetric measuring performance is the maximum error between any two points in any plane, over any distance within the full measuring volume.



Notes:

✿ These items are included in the **MCG2** kit

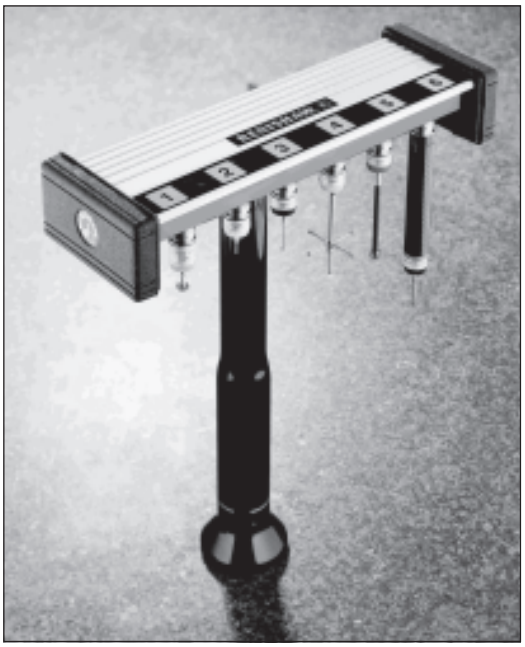
✱ Maximum negative arm angle possible is 42° when using MCG1 kit with the longest arm 320 mm (12.60 in) and both pillars supplied, 127 mm + 76 mm = 203 mm (5 in + 3 in = 8 in)

MSR1 manual storage rack

MSR1 manual storage rack for manual or DCC CMM operation

The MSR1 holds up to six pre-qualified stylus assemblies for fitting to TP20 or TP200 probe modules. It eases the operators' task where manual module changing is performed and thus aids productivity improvements.

The MSR1 can be table mounted (as shown) or wall mounted using a bracket. The rack is intended for use on either manual or DCC CMMs, to hold pre-qualified stylus assemblies fitted to TP20 or TP200 probe modules. It provides convenient storage and protects the kinematic coupling mechanism from contamination.



Specification (table mount version)

OVERALL HEIGHT	285 mm (11.2 in)
DEPTH (inc wall bracket)	86 mm (3.4 in)
WIDTH	236 mm (9.3 in)

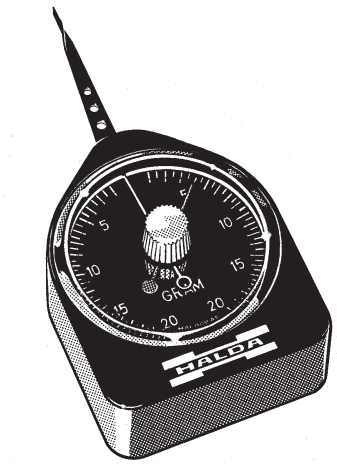
Gram gauge

Renishaw's gram gauge enables the adjustment, reset and checking of probe trigger force settings on all standard Renishaw CMM touch trigger probes. Setting the optimum trigger force using the gram gauge maximises a probe's performance.

The gram gauge can be used to set trigger force settings over a range from 4 to 35 grams.

The scale graduations are set at 1 gram intervals which is sufficient for all probe trigger force measurements on CMMs.

Due to the use of SI units, the trigger force for probes is given in Newtons. The conversion factor used is 1 gf = 0.01 N.



Specification

OVERALL LENGTH	95 mm (3.74 in)
NEEDLE LENGTH	41 mm (1.61 in)
DEPTH	27 mm (1.06 in)
WIDTH	43 mm (1.69 in)
RANGE	4 to 35 gram range with 1 gram graduations

Probe type	Stylus length	Optimum trigger force *
TP1	31 mm (1.22 in)	0.15 N (0.52 ozf)
TP2-5W	10 mm (0.39 in)	0.07 N to 0.08 N (0.24-0.28 ozf)
TP6	21 mm (0.82 in)	0.11 N to 0.13 N (0.38-0.45 ozf)
TP6A	21 mm (0.82 in)	0.11 N to 0.13 N (0.38-0.45 ozf)
MIP	21 mm (0.82 in)	0.11 N to 0.13 N (0.38-0.45 ozf)

* This is the optimum trigger force recommended by Renishaw. Higher trigger forces may be required for longer styli.

Styli

Comprehensive information on Renishaw's styli products can be found in the styli and technical specifications document (H-1000-3200).

Accuracy at the point of contact

As industry has developed its requirement for increasingly diverse and complex manufactured parts, inspection systems have had to work hard to keep up. The use of CMMs with probing systems, and in-process inspection on machine tools, are two of the solutions offered by Renishaw to help you maximise your productivity and maintain the highest possible standards of quality.

Successful gauging depends very much on the ability of the probe's stylus to access a feature and then maintain accuracy at the point of contact. Renishaw has used its expertise in probe and stylus design to develop a comprehensive range of CMM and machine tool styli to offer the greatest possible precision.

These notes explain the critical features of each stylus type, helping you to choose the right design for each inspection need.

What is a stylus?

A stylus is that part of the measuring system which makes contact with the component, causing the probe mechanism to displace, the generated signal enabling measurement to be taken. The feature to be inspected dictates the type and the size of stylus used. However, in all cases maximum rigidity of the stylus and perfect sphericity of the tip are vital.

The performance of gauging can easily be degraded if a stylus is used with poor ball roundness, poor ball location, bad thread fit or a compromised design that allows excessive bending during measurement. To ensure the integrity of the data gathered, make certain that a stylus from the comprehensive range of genuine Renishaw styli is specified and used.

Choosing a stylus

To maintain accuracy at the point of contact it is recommend that:-

- **Styli be kept short**
- **Joints minimise**
- **A large as possible styli ball is used**



Genuine Renishaw styli ball materials

Ruby

The industry standard and the optimum stylus ball material for a vast majority of measurement applications is ruby, one of the hardest known materials.

Very few applications exist where ruby is not the best ball material. However, there are two such applications where balls manufactured from other materials are recommended, and these are Silicon nitride and Zirconia.



Ruby

Silicon nitride

For heavy duty scanning applications on aluminium, a phenomenon known as ‘adhesive wear’ can occur, which involves build up of aluminium from the surface onto the ball. The preferred ball material for this application is Silicon nitride.

Silicon nitride possesses many similar properties to ruby. It is a very hard and wear resistant ceramic which can be machined into very high precision spheres. It can also be polished to an extremely smooth surface finish. Silicon nitride does not have the attraction to aluminium and so does not exhibit the adhesive wear seen with ruby in similar applications. Silicon nitride does, however, show significant abrasive wear characteristics when scanning steel surfaces so its applications are best confined to aluminium.



Silicon nitride

Zirconia

In heavy duty scanning applications on cast iron. Interaction between the two materials can result in ‘abrasive wear’ of the ruby ball’s surface. For such applications, Zirconia balls are recommended.

Zirconia is a particularly tough ceramic material with hardness and wear characteristics approaching those of ruby. Its surface properties, however, make it an ideal material for aggressive scanning applications on cast iron components.



Zirconia

Stylus types

The genuine Renishaw stylus range comprises several types:

Straight styli	Cylinder styli
Star styli	Pointer styli
Disc styli	Ceramic hollow ball styli

Accessories and tools

Stylus centres	Stylus thread adaptors
Stylus knuckles	Stylus tools
Stylus extensions	Stylus cranks

Custom design service

Renishaw's Styli and Custom Products Division offer a unique service by providing customers with a total solution should their probing needs for CMM, machine tool or scanning applications be specialised.

In many application problems, the solution lies in the choice of the stylus which influences access of the workpiece features, inspection times and probe performance. All of these aspects are considered within the design of a custom stylus, ensuring that the solution provided incorporates the ideal choice of materials and optimises probe performance for a particular application.

Renishaw's Styli and Custom Products Division has supplied over 5,000 different custom styli into probing applications worldwide, so the solution to an application problem may already exist. For advice and further details, please contact your nearest Renishaw distributor.

For more detailed information please refer to the styli and accessories technical specifications (H-1000-3200)

Always use genuine Renishaw styli or your probe performance will be compromised!

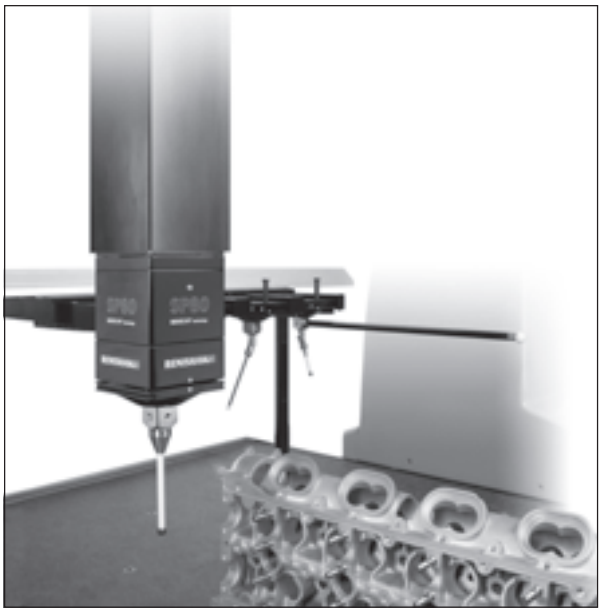




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Glossary of terms

Accuracy	For touch trigger probes, the accuracy is stated in terms of the uncertainty of measurement arising from error sources such as repeatability and pretravel variation.
Analogue probe	A proportional probe in which the displacement of the stylus is represented by a continuously variable output voltage or current proportional to the displacement.
Autojoint	Renishaw's patented highly repeatable 2-part coupling, incorporating a 13-pole connector, which allows probes or extension bars to be interchanged without requalification.
Contact probe	A probe that uses a stylus to physically touch the target gauge point on the workpiece whose co-ordinates are to be recorded.
Controller	The electronic unit that controls the motion and positioning of an actuator or motion system. Examples are the controllers for a probe head or the axes of a CMM.
Datum	The reference feature (line or plane) from which other co-ordinates are measured.
E-bar or ebar	An abbreviated name for extension bar.
Edge triggering	The ability of a non-contact probe to automatically locate the edge or boundary of contrasting features on the workpiece.
EWL	Effective working length.
Extension	Device for increasing the reach of a probe or stylus. Extensions placed between the probe and the probe head are known as 'extension bars' or ' E-bars'.
Indexing head	An articulating probe head that may be oriented and locked in a number of repeatable kinematically seated spatial positions. After the stylus tips have been qualified at each required position, the head may be moved to any of these positions without requalification.
Jog	An incremental move of an indexing head to an adjacent position.
Kinematic seating	A mechanism in which the spatial position of a movable component, when located in the seated position, is kinematically constrained by 6 contact points formed by a system of rollers (or 'V' grooves) and ball bearings.
Kinematic	A contact probe in which the kinematic seating forms an electrical circuit where the resistance varies as the stylus is displaced in its mounting, to provide the trigger signal. After displacement, the stylus ball returns to the highly repeatable position defined by the kinematic location points.
Kinematics	The science of motion, independent of force.
Lobing characteristics	Used to describe the form measurement error of kinematic switching probes resulting from the tri-lobed pretravel pattern (in the X-Y plane) that characterises this type of sensor mechanism. Refer to pretravel variation.
M8 connector	The threaded 2-pole connector used to mount a range of probes to the probe head.
Multiwire	The method of interconnection from a probe head fitted with a 13-pole autojoint connector to a probe interface.
Overtravel	The distance that the CMM takes to stop following the assertion of a probe trigger signal.
Overtravel force	The force applied by the stylus ball to the surface at a defined overtravel displacement.
PICS	Acronym for Renishaw's product interconnection system.
Pretravel	The displacement from the point where the stylus ball contacts the workpiece, to the point where a probe trigger is asserted.

Pretravel variation (PTV or XYPTV)	Also called form measurement error or lobing, this source of systematic error is predominant in kinematic switching probes where a tri-lobed pretravel pattern (in the X-Y plane) characterises this type of sensor mechanism.
Probe	The sensor that locates the features to be gauged, relative to the CMM scales.
Probe head	A device fitted to the quill of the CMM that carries the probe mounting connector. Probe heads may have fixed orientation or may articulate to provide re-orientation of the probing axis. Articulating heads may be manually operated or motorised.
Probe interface	An electronic unit that processes the output from the probe sensor and communicates with the CMM controller.
Proportional probe	A displacement measuring probe that provides an output, which may be analogue or digital, proportional to stylus displacement over a defined operating range.
Qualification	The procedure in which the measurement processor determines the radius of the stylus tip and its position relative to the scale reference marks or other datum by gauging a calibrated reference sphere or ring gauge.
Quill	The moving component of the CMM that carries the probe, also called the ram.
Repeatability	"The quantitative degree of agreement between results of successive measurements of the same quantity under identical conditions." Unidirectional repeatability is specified for touch trigger probes.
Requalification	Repetition of the qualification procedure that may be necessary after changing or moving components in the measurement path, or following a change to ambient temperature
Retrofit	The installation of new products or parts onto equipment that is in service.
Scanning probe	A proportional probe that is passed over the surface of the workpiece in a continuous movement sending data to the processor at a high rate.
Sense directions	The directions of gauging relative to the probe's coordinate system.
Servo	A motorised articulating probe head that may be oriented to virtually any desired spatial positioning head position with fine resolution. The position is held during probing by the servo control system. High precision rotary position encoders eliminate the need for requalification.
Shank	A plain or tapered shaft for mounting a probe or probe head to the quill of the CMM.
Stylus	The part of contact probes that makes physical contact with the feature to be gauged.
Stylus changing	A system based on a highly repeatable kinematically constrained coupling, to allow the fast exchange of stylus configurations without requalification.
Swept radius	On an articulating probe head, the distance from the centre of rotation of the 'A' axis to the probe or stylus mounting face.
Touch trigger probe	A discrete point taking type of contact probe.
Trigger force	The force that must be applied at the stylus tip to trigger the probe.
TTP	Touch trigger probe/probing
Unidirectional repeatability	The variation of the position of successive triggers taken in the same direction of triggering under constant conditions.

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