

TP20 system



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Renishaw part no: H-1000-5008-03-B

Issued: 03 2007

TP20 system
installation and user's guide

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Patents

Aspects of the TP20 probing system and aspects of similar systems are the subject of the following patents and patent applications.

EP 548328	JP 3294269	US 5,323,540
EP 750171	JP JP 3279317	US 5,505,005
EP 501710	JP 2,510,804	US 5,327,657
EP 826136	JP 505,622/1999	US 5,404,649
EP 566719		US 5,339,535
		US 5,918,378
		US 6012230



CAUTION: One option of the TP20 probe system uses a magnetically-actuated inhibit system. It is important to apply the following limitations when using the inhibit version TP20.

Neglecting to do so may result in failure of the probe to trigger.

1. The inhibit TP20 may not be armed at a distance of up to 100 mm from the front of the MCR20 probe module change rack.
2. Do not use the inhibit TP20 to gauge magnetised parts or parts held in magnetic fixtures.
3. Do not use the Renishaw PE series extension bars with the inhibit TP20 unless they have been fully de-magnetised.

In all these instances the use of the non-inhibit TP20 probe body will ensure that the probe system operates fully.



CAUTION: The TP20 non-inhibit probe can only be used for automatic stylus changing using the MCR20 probe module change rack when the probe inhibit is controlled by the CMM.

In the case of any uncertainty, do not attempt to perform automatic stylus changing with a TP20 non-inhibit probe and an MCR20 until the CMM supplier has checked the CMM for compliance to this requirement.

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Contents

1	Introduction	9
2	Product description	11
2.1	The TP20 touch-trigger probe kit.....	11
2.1.1	The probe body	11
2.1.2	The probe modules.....	13
2.2	The MCR20 probe module changing rack kit.....	16
2.3	The MSR1 module storage rack kit.....	19
3	Product installation.....	20
3.1	Fitting the TP20 probe onto a probe head.....	20
3.2	Fitting a stylus onto the probe module	20
3.3	Fitting the probe module and stylus onto the probe body	22
3.4	Mounting the MCR20 onto the CMM.....	23
3.5	Datuming the MCR20.....	25
3.5.1	Aligning the MCR20 to the CMM axes	26
3.5.2	Establishing the docking depth (Y)	26
3.5.3	Establishing the docking height (Z)	27
3.5.4	Establishing the docking centre for port 1	28
3.5.5	Establishing the docking centre for ports 2 to 6.....	29
3.5.6	Establishing the docking target co-ordinates.....	29
3.6	Mounting the MSR1 onto the CMM.....	30
3.6.1	Mounting the MSR1 onto a CMM table	30
3.6.2	Mounting the MSR1 onto a wall.....	32
4	Product operation.....	33
4.1	Storing and changing probe modules	33
4.1.1	Calculating the safe clearance position	34

4.1.2	Storing a probe module	34
4.1.3	Picking up a stored probe module	36
4.1.4	Summary of probe module changing procedure ...	37
4.1.5	Using the MSR1 module storage rack	37
5	Technical data - TP20 probe module changing touch-trigger probe	38
5.1	Measuring performance	38
5.1.1	Probing forces and overtravel limits.....	39
5.1.2	Probe module changing repeatability	39
5.1.3	Technical specification.....	40
6	Technical data - MCR20 probe module change rack	41
6.1	Technical specification	41
7	Technical data - MSR1 module storage rack.....	42
7.1	Technical specification	42
8	Applications guide	43
8.1	Probe module selection.....	43
8.1.1	The low force probe module	44
8.1.2	The standard force probe modules.....	44
8.1.3	The medium force probe module.....	44
8.1.4	The extended force probe module.....	44
8.1.5	The 6-way probe module	44
8.2	Stylus selection	45
8.2.1	Recommended stylus limits.....	47
9	Product maintenance	52

1 Introduction

This installation and user's guide supports the following Renishaw products (see figure 1):

- The TP20 probe module changing touch-trigger probe (inhibit and non inhibit versions)
- The MCR20 probe module change rack (automatic operation)
- The MSR1 module storage rack (manual operation)

The Renishaw TP20 probe module changing touch-trigger probe is a 5-way or 6-way kinematic probe with the facility to change stylus configurations without the need for re-qualification. A direct replacement for the industry-proven Renishaw TP2, the TP20 can be easily retrofitted into existing TP2 applications to bring this additional facility to both manual and DCC co-ordinate measuring machines (CMMs).

The TP20 comprises a two-piece design – a probe body (with or without magnetic actuation device) and detachable probe module(s). TP20 probe modules can be stored in the MSR1 for manually exchanging the probe modules, or in the MCR20 where automatic changing of the probe module(s) is possible under measurement program control.

Forming part of Renishaw's comprehensive CMM touch-trigger probe range, the TP20 is fully compatible with all Renishaw M8 probe heads, including those fitted with the Renishaw autojoint incorporating Renishaw's PAA range of adaptors and extension bars. Wherever necessary, probe reach may be increased in M8 applications by use of the Renishaw PEL range of extension bars.

Further information on these products may be obtained by reading the probing systems for co-ordinate measuring machines technical specifications (Renishaw part number H 1000 5050), available from your supplier or from Renishaw's website, www.renishaw.com.

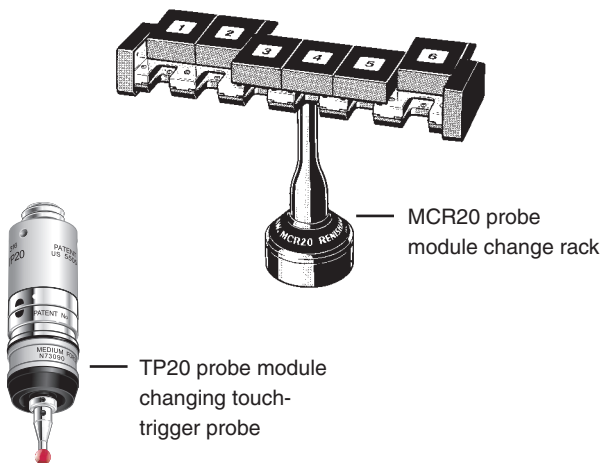


Figure 1 - The TP20 probe module changing probe system

2 Product description

2.1 The TP20 touch-trigger probe kit

The standard Renishaw TP20 touch-trigger probe kit (see figure 2) comprises the following primary components:

- One TP20 probe body
- One or two TP20 probe modules (see page 10 for available combinations)
- Probe and stylus tools

2.1.1 The probe body

The probe body incorporates a standard Renishaw M8 × 1.25 screw connector mount and is designed to house the mating half of the probe module's kinematic coupling.

The TP20 inhibit probe body

This contains the magnetic proximity switch necessary to inhibit triggering of the probe during automatic changing of the probe modules.

The TP20 non-inhibit probe body

This probe body does not include the magnetic proximity switch and so can be used for any application, including those where strong magnetic fields are present.

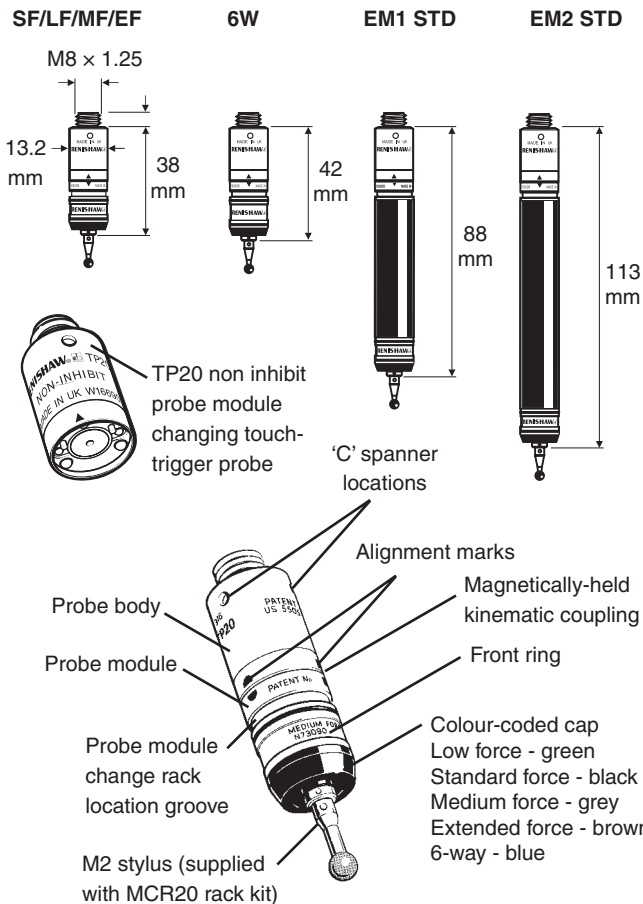


Figure 2 - The TP20 probe module changing touch-trigger probe

2.1.2 The probe modules

Each probe module, which houses the kinematic switching touch sensor mechanism, carries the stylus assembly and provides overtravel in the X, Y and +Z axes (-Z is offered when using the TP20 6-way probe module). Incorporating an M2 stylus mounting, each probe module is compatible with Renishaw's comprehensive range of M2 styli.

Designed to minimise the possibility of probe module misalignment generating a probe 'seated' signal, the probe module is held in position by a magnetically retained, highly repeatable kinematic coupling. Electrical contact pins conduct the probe sense voltage through the coupling.

Trigger force options

The standard force probe module is suitable for most applications (when used with the recommended stylus range), but sometimes the effects of stylus length and mass, combined with machine acceleration and vibration, can cause the probe to false trigger (these are referred to as 'spurious triggers').

To allow the TP20 to be used on co-ordinate measuring machines where acceleration forces or vibration would otherwise result in spurious touches, a choice of higher force probe modules is available. A low force probe module is also available for measurement of delicate materials. Refer to the applications guide later in this document for information on how to select the correct probe module for your application.

The type of probe modules supplied with your probe will be clearly marked on each probe module's front ring. The probe modules also carry a colour-coded front cap as follows:

- Low force (LF) probe module (green cap)
- Standard force (SF) probe module (black cap)
- Medium force (MF) probe module (grey cap)
- Extended force (EF) probe module (brown cap)
- 6-way (6W) probe module (blue cap)
- Extension module 1 standard force (EM1 STD) (black cap)
- Extension module 2 standard force (EM2 STD) (black cap)

The following TP20 probe kits are available from your supplier:

Part number		Probe body PLUS the following probe modules			
Inhibit probe body	Non-inhibit probe body	LF	SF	MF	EF
A-1371-0290	A-1371-0640		2		
A-1371-0291	A-1371-0641		1	1	
A-1371-0292	A-1371-0642		1		1
A-1371-0293	A-1371-0643			2	
A-1371-0294	A-1371-0644			1	1
A-1371-0295	A-1371-0645				2
A-1371-0428	A-1371-0603	1	1		
A-1371-0429	A-1371-0604	1		1	
A-1371-0370	A-1371-0656		1		
A-1371-0371	A-1371-0657			1	
A-1371-0372	A-1371-0658				1
A-1371-0390	A-1371-0602	1			

All probe kits contain:

- Probe body - inhibit or non-inhibit as selected from the table
- Number and type of probe modules as given in the table
- TP20 system installation and user's guide (H-1000-5008)
- S1 'C' spanner
- S9 double-ended 'C' spanner
- S7 stylus tools (× 2)
- CK200 cleaning material
- Test certificates

The following TP20 probe module kits are available from your supplier:

TP20 probe module kit (probe module only)	Part number
Low force probe module	A-1371-0392
Standard force probe module	A-1371-0270
Medium force probe module	A-1371-0271
Extended force probe module	A-1371-0272
6-way probe module	A-1371-0419
EM1 STD probe module	A-1371-0430
EM2 STD probe module	A-1371-0431
EM1 STD and EM2 STD probe modules	A-1371-0432

2.2 The MCR20 probe module changing rack kit

NOTE: Renishaw supplies eight types of MCR20 probe module changing rack kit, each kit providing a different combination of probe modules. See page 14 for the range of kits offered.

The MCR20 probe module changing rack kit (see figure 3) comprises the following primary components:

- One Renishaw MCR20 probe module changing rack
- One Renishaw SCR200 mounting kit
- One location piece
- One Renishaw PS2R stylus
- Two Renishaw TP20 probe modules (probe module combination supplied will depend on part number of kit)

The MCR20 probe module changing rack, which can be easily mounted onto a CMM using the Renishaw SCR200 mounting kit and location piece, is designed to securely hold stored probe modules for automatic changing, and to protect these stored probe modules from airborne contaminants that may be present within the working environment. Only seven datum points are needed to set the MCR20 rack alignment and probe module changing co-ordinates.

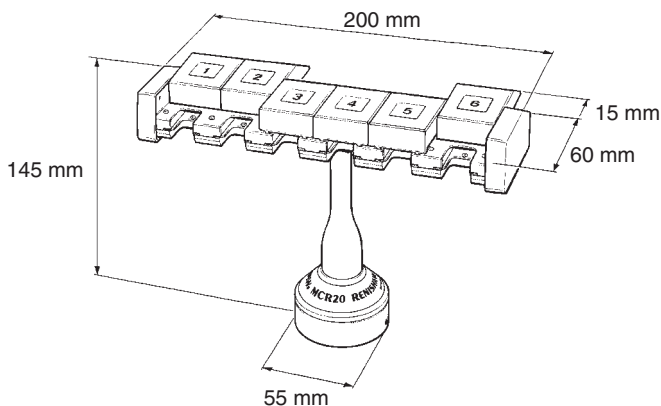


Figure 3 - The MCR20 probe module change rack

When using the rack, the inhibit version of the TP20 probe must be used. By generating a magnetic field about the front of each docking port lid, the MCR20 effectively 'closes' the probe's inhibit switch during a probe module changing cycle. Rack function is completely passive and no electrical input is required.

During automatic changing of probe modules, limited crash protection is provided by hinged overtravel mechanisms incorporated within both the base and the docking port assembly of the MCR20. Provided any collision occurs in the direction of overtravel, the hinged overtravel mechanisms can be manually reset and it should not normally be necessary to re-datum the rack.

MCR20 probe module changing rack kits are available with the following combinations of probe modules and may be ordered from your supplier:

MCR20 kit number	Probe modules in kit				Part number
	LF	SF	MF	EF	
1		2			A-1371-0261
2		1	1		A-1371-0262
3		1		1	A-1371-0263
4			2		A-1371-0264
5			1	1	A-1371-0265
6				2	A-1371-0266
7	1	1			A-1371-0267
8	1		1		A-1371-0268

2.3 The MSR1 module storage rack kit

The optional MSR1 module storage rack kit, shown in figure 4, is not supplied with any TP20 probe modules. It is available in two different mounting options (please refer to the installation section for details).

The two different versions can be ordered from your supplier under the following part numbers:

Mounting option	Part number
CMM table mounted	A-1371-0347
Wall mounted	A-1371-0330

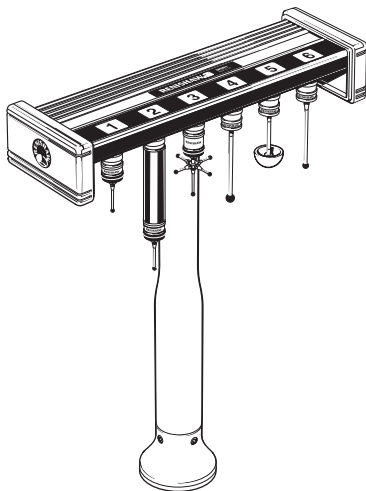


Figure 4 - The MSR1 module storage rack - CMM table mounted
(modules and styli not supplied)

3 Product installation

3.1 Fitting the TP20 probe onto a probe head

To fit the TP20 probe onto a probe head, carry out the following procedure (see figure 5):

1. By hand, screw the threaded end of the probe body into the M8 bush of the probe head and hand-tighten to secure.
2. Fit the S1 'C' spanner (supplied) onto the probe body as shown in Figure 5.
3. Using the S1 'C' spanner, fully hand-tighten the probe body into the M8 bush (0.3 Nm – 0.5 Nm).

3.2 Fitting a stylus onto the probe module

To fit a stylus onto the probe module, carry out the following procedure (see figure 5):

NOTE: For advice on both stylus and probe module selection, refer to the applications guide later in this publication.

1. Ensuring that you have selected the correct probe module for your given application (see probe module selection later in this guide), screw the threaded end of your chosen stylus into the M2 stylus mount of the probe module and hand-tighten to secure.

- Using the type S7 stylus tools provided, or type S20 spanner if fitting a stylus from the Renishaw GF range, fully hand-tighten the stylus into the stylus mount to achieve the recommended tightening torque of between 0.05 Nm and 0.15 Nm (maximum permissible torque is 0.3 Nm).

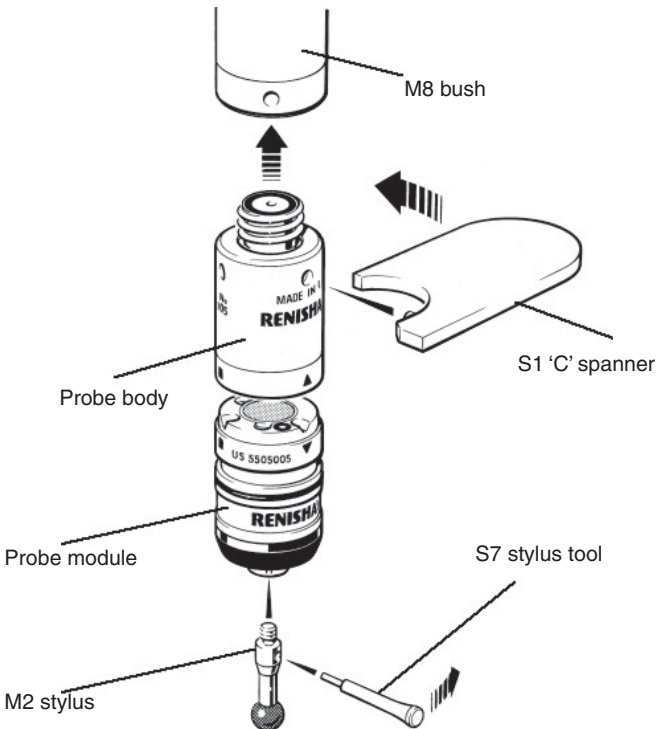


Figure 5 - Fitting the TP20 probe onto a probe head

3.3 Fitting the probe module and stylus onto the probe body

To fit the probe module and stylus onto the probe body, carry out the following procedure (see figure 6):

1. Visually examine the mating faces of both the probe module and the probe head for cleanliness; where necessary, clean the mating surfaces using the CK200 cleaning kit (supplied).
2. Offer up the probe module to the probe body and, ensuring the three alignment marks on both the probe module and probe body are correctly aligned, allow the probe module to engage the probe body under magnetic force.

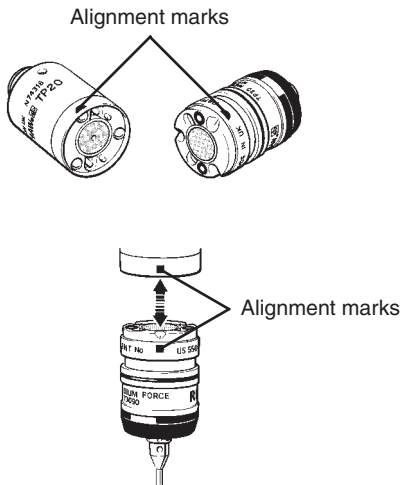


Figure 6 - Fitting the probe module and stylus onto the probe body

3.4 Mounting the MCR20 onto the CMM

To mount the MCR20 probe module change rack onto your CMM, carry out the following procedure (see figure 7):



CAUTION: For optimum crash protection, it is recommended that the MCR20 is mounted as close as possible to the extreme edge of the CMM's operating envelope.

1. Place the location piece in the desired position on the CMM table and secure in place using the M8/M10 bolt and washer supplied. Using the appropriate Allen key (supplied), fully hand-tighten the M8/M10 bolt into the threaded insert within the CMM table.
-

NOTES: Whilst the TP20 system does not require that the MCR20 is aligned with the CMM axes, ease of programming or software constraints may make alignment with the CMM axes desirable.

The MCR20 is not designed for horizontal operation with the ports in a vertical orientation.

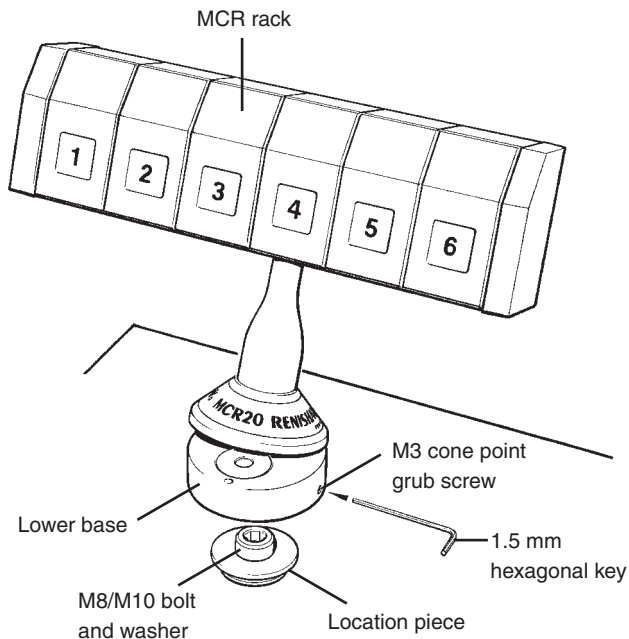


Figure 7 - Mounting the MCR20 onto a CMM

2. Mount the lower base of the MCR20 probe module change rack over the location piece and rotate the X axis of the rack until the required alignment is obtained.
3. Using the 1.5 mm hexagonal key supplied, fully hand-tighten the M3 cone point grubscrew (0.5 Nm – 1.0 Nm) to lock the MCR20 in position.

3.5 Datuming the MCR20



WARNINGS: The use of eye protection is recommended.

Pinch hazards exist between parts and between moving and static parts. Beware of unexpected movement. You should remain outside the full working envelope of probe head/extension bar/probe combinations.

It is the machine supplier's responsibility to ensure that the user is made aware of any hazards involved in operation, including those mentioned in Renishaw product documentation, and to ensure that adequate guards and safety interlocks are provided.

Under certain circumstances, the probe signal may falsely indicate a probe seated condition. Do not rely on probe signals to stop the machine.

NOTES: Renishaw recommends that datuming of the MCR20 is performed using the Renishaw PS2R stylus supplied. If a different stylus is to be used, the length (L) must be either 20 mm or 30 mm and the appropriate ball radius (R) must be used to calculate offsets.

It is strongly recommended that the EM1 STD and EM2 STD probe extension modules are not used for datuming of the MCR20, as the extended probe length may lead to increased concentricity errors within the probe system.

The following instructions assume that uncompensated probing points are taken, and therefore that the target positions for port docking are absolute machine co-ordinates.

3.5.1 Aligning the MCR20 to the CMM axes

To align the MCR20 probe module changing rack to the axes of your CMM, carry out the following procedures (see figure 8):

1. Latch all port lids in their open position by pushing each lid fully open and engaging the locking pegs into the slots in the docking plate.
2. Take points P1 and P2.
3. Using the 1.5 mm hexagonal key supplied, fully release the M3 cone point grubscrew within the base of the MCR20 (refer to figure 7 for screw location).
4. Adjust the orientation of the MCR20 until the runout between points P1 and P2 is less than 0.25 mm. Retaining the MCR20 in this position, re-tighten the M3 cone point grubscrew (0.5 Nm – 1.0 Nm) using the 1.5 mm hexagonal key supplied.

3.5.2 Establishing the docking depth (Y)

To establish the docking depth (Y) of the MCR20 ports, carry out the following procedure (see figure 8):

1. Take points P1 and P2.
2. Establish the docking depth for all ports using the following formula:

$$\{Y \text{ value of line P1/P2} + R (1 \text{ mm}) + 8.75 \text{ mm}\}$$

where R = stylus ball radius

3.5.3 Establishing the docking height (Z)

To establish the docking height (Z) of the MCR20 ports, carry out the following procedure (see figure 8):

1. Take points P3, P4 and P5. From the three points taken, construct a Z axis plane for the rack.
2. Establish the docking height for all ports using the following formula:

$$\{Z \text{ value of plane P3/P4/P5} - L (20 \text{ mm}) - R (1 \text{ mm}) - 21.25 \text{ mm}\}$$

where L = stylus length

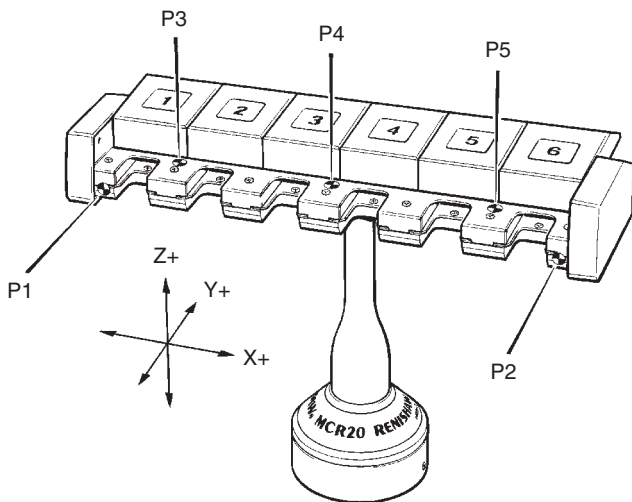


Figure 8 - Datuming the MCR20 probe module changing rack

3.5.4 Establishing the docking centre for port 1

To establish the docking centre for port 1 (X1), carry out the following procedure (see figure 9):

NOTE: The stylus shank may be used to take points P6 and P7.

1. Take points P6 and P7.
2. Establish the docking centre for port 1 (X1) using the following formula:

{centre point of P6/P7 = X1}

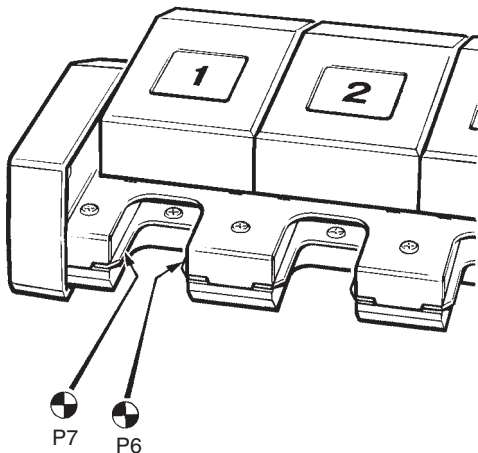


Figure 9 - Establishing the docking centres

3.5.5 Establishing the docking centre for ports 2 to 6

To establish the docking centre for ports 2 (X2) to 6 (X6), perform the following calculations:

Docking centre port 2 (X2) = X1 + 30 mm

Docking centre port 3 (X3) = X2 + 30 mm

Docking centre port 4 (X4) = X3 + 30 mm

Docking centre port 5 (X5) = X4 + 30 mm

Docking centre port 6 (X6) = X5 + 30 mm

3.5.6 Establishing the docking target co-ordinates



CAUTION: The Y values may be different for each port if the MCR20 is not aligned with the CMM axes.

To establish the docking centre co-ordinates of ports 1 (X1) to 6 (X6), perform the following calculations:

Port 1 = X1, Y, Z

Port 2 = X2, Y, Z

Port 3 = X3, Y, Z

Port 4 = X4, Y, Z

Port 5 = X5, Y, Z

Port 6 = X6, Y, Z

3.6 Mounting the MSR1 onto the CMM



CAUTION: The MSR1 rack is not crash-protected. It is recommended that the rack is mounted outside or close to the edge of the working volume of the CMM.

Two mounting options are available for the MSR1: CMM table mounted and wall mounted.

3.6.1 Mounting the MSR1 onto a CMM table

To mount the MSR1 onto your CMM table, carry out the following procedure (see figure 10):

1. Place the base over a threaded insert at the desired location on the CMM table and screw down using the M8 or M10 bolt supplied.
2. Screw the leg a few turns into the M10 nut located in the underside of the rack extrusion. Slide the rack along to the centre or other location, as required, and tighten by hand.
3. Push the lower end of the leg firmly into the base and rotate the rack to the required orientation. Tighten the grubscrews using the hexagonal key supplied.

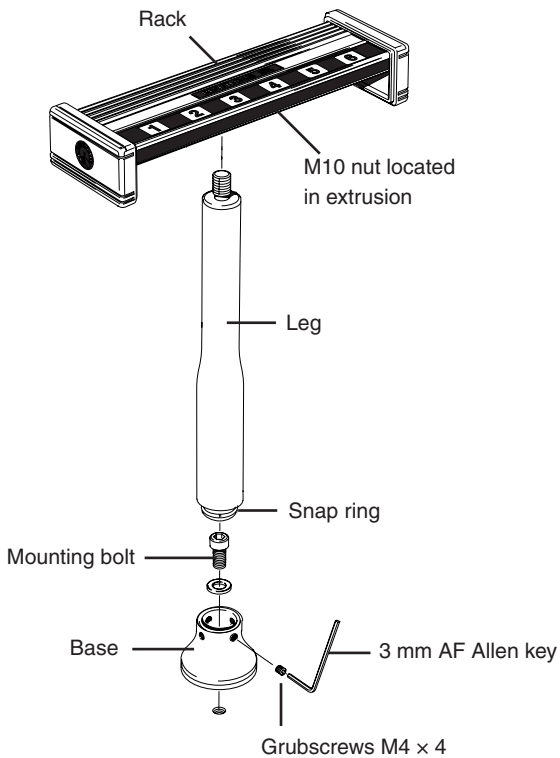


Figure 10 - Mounting the MSR1 onto a CMM table

3.6.2 Mounting the MSR1 onto a wall

To mount the MSR1 onto a wall, carry out the following procedure (see figure 11):

1. Fix the wall mounting bracket (supplied) in the desired location using the holes or other secure means.
2. Locate the rack on the bracket and secure by engaging the M10 bolt (supplied) a few turns into the M10 nut located in the underside of the rack extrusion. Slide the rack along until it is centralised or otherwise located as required and tighten the bolt.

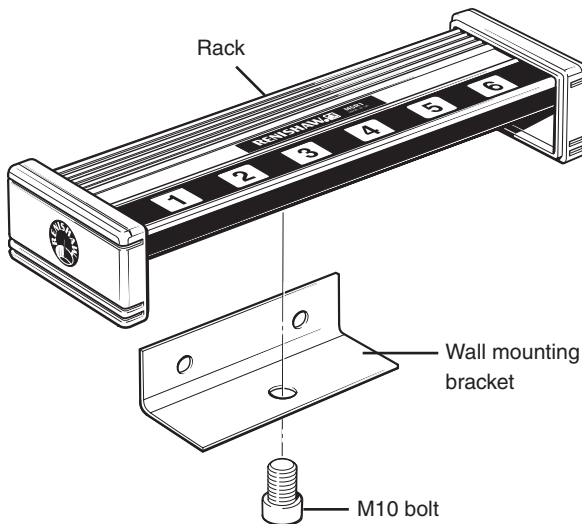


Figure 11 - Mounting the MSR1 onto a wall

4 Product operation

4.1 Storing and changing probe modules



WARNINGS: The use of eye protection is recommended.

Pinch hazards exist between parts and between moving and static parts. Beware of unexpected movement. You should remain outside the full working envelope of probe head/extension bar/probe combinations.

It is the machine supplier's responsibility to ensure that the user is made aware of any hazards involved in operation, including those mentioned in renishaw product documentation, and to ensure that adequate guards and safety interlocks are provided.

Under certain circumstances, the probe signal may falsely indicate a probe seated condition. Do not rely on probe signals to stop the machine.

NOTES: The inhibit switch in the inhibit version of the TP20 body will be automatically actuated by the magnetic field when it approaches the front of the MCR20 probe module changing rack. The minimum distance from the MCR20 probe module changing rack at which the TP20 is armed will vary with height.

When using long styli fitted to the EM1 STD or EM2 STD probe modules, do not store them in ports 3 or 4 of the MCR20 or MSR1 rack.

4.1.1 Calculating the safe clearance position

The recommended safe clearance position is located at the minimum distance from the port centre (at docking height Z) where the probe will be armed, if the probe module is attached.

The safe clearance position for any port (n) can be calculated from:

$\{X_n, Y_s, Z\}$ where $Y_s = Y - 100$ mm

4.1.2 Storing a probe module

To store a probe module, carry out the following procedure (see figure 12):

1. Move to the safe clearance position X_n, Y_s, Z for the vacant port (n).
2. Move to the docking target co-ordinate for port (n) along the Y axis at the docking height (Z).

3. Move up to the release height Z_r , where:

$\{Z_r = Z + 3$ mm}

4. Withdraw from the release co-ordinate, maintaining the release height, along the Y axis to a point clear of the port lids where the probe remains inhibited. This point is known as the 'retract point' (RP) and has the co-ordinates:

$\{RP = X_n, Y_r, Z_r\}$ where $Y_r = Y - 17.2$ mm

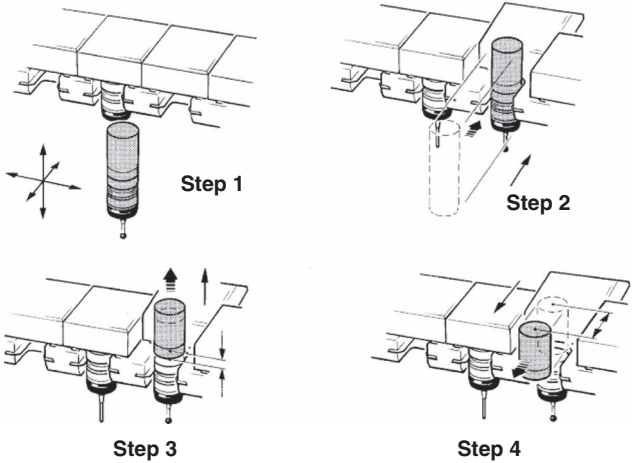


Figure 12 - Storing a probe module (typical)

4.1.3 Picking up a stored probe module

To pick up a stored probe module, carry out the following procedure (see figure 13):

1. Move along the X axis in the direction necessary to arrive at the RP co-ordinates for the next port required.
2. Move along the Y axis to the release co-ordinates above the centre of port X_n , Y, Z_r .
3. Move down to the docking co-ordinates X_n , Y, Z to attach the probe module.
4. Withdraw along the Y axis to the clearance position at co-ordinates X_n , Y_s , Z.

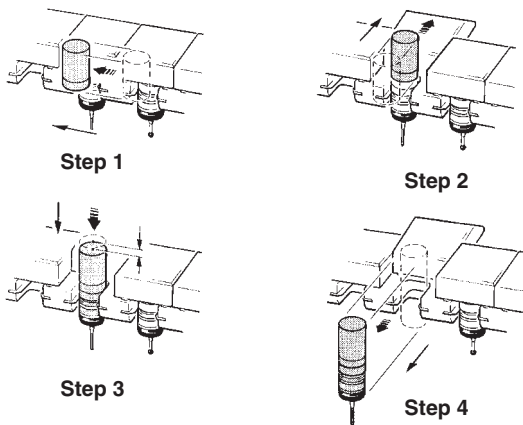


Figure 13 - Storing a probe module (typical)

4.1.4 Summary of probe module changing procedure

Operation	Co-ordinates		
	X axis	Y axis	Z axis
Safe clearance position for port (n)	Xn	Ys	Z
Move to docking position	*	Y	*
Release probe module	*	*	Zr
Move to retract point (RP)	*	Yr	*
Select next port (n)	Xn	*	*
Enter port	*	Y	*
Move to docking position	*	*	Z
Move to safe clearance position	*	Ys	*

Xn = X1 to X6 as selected by the user

Ys = Y – 100 mm

Zr = Z + 3 mm

Yr = Y – 17.2 mm

* = No change to the previous setting of the axis register

4.1.5 Using the MSR1 module storage rack

The location points for the TP20 probe modules are positioned approximately below the numbered labels on the rack. Accurate positioning is not necessary, as the magnetic force will pull them into the correct position.

The probe modules are held magnetically in the MSR1 and can be rotated if required.

5 Technical data - TP20 probe module changing touch-trigger probe

5.1 Measuring performance

NOTE: The following data is derived from high accuracy test rig measurements and may not represent the performance achievable on a CMM. Please consult your CMM supplier for overall system accuracy information.

Performance at 10 mm stylus length

Parameter	Probe module type						
	LF	SF	MF	EF	6-way	EM1 STD	EM2 STD
Unidirectional repeatability* (2 σ)	0.35 μm	0.35 μm	0.50 μm	0.65 μm	0.8 μm	0.35 μm	0.35 μm
2D (XY) form measurement deviation*	± 0.6 μm	± 0.8 μm	± 1.0 μm	± 2.0 μm	± 1.5 μm	± 0.8 μm	± 0.8 μm

* Measured at a trigger speed of 8 mm/s
Test stylus ball diameter 4 mm

5.1.1 Probing forces and overtravel limits

Probe module type and stylus length	Parameter							
	Trigger force (nominal at stylus tip)		Overtravel force (max. at stylus tip)			Overtravel displacement		
	XY	Z	XY	+Z	-Z	XY	+Z	-Z
LF 10 mm	0.055 N (5.5 gf)	0.65 N (65 gf)	0.09 N (9 gf)	1.15 N (115 gf)	-	±14°	3.1 mm	-
SF 10 mm	0.08 N (8 gf)	0.75 N (75 gf)	0.2-0.3 N (20-30 gf)	3.5 N (350 gf)	-	±14°	4.0 mm	-
MF 25 mm	0.1 N (10 gf)	1.9 N (190 gf)	0.2-0.4 N (20-40 gf)	7.0 N (700 gf)	-	±14°	3.7 mm	-
EF 50 mm	0.1 N (10 gf)	3.2 N (320 gf)	0.2-0.5 N (20-50 gf)	10 N (1kgf)	-	±14°	2.4 mm	-
6-way 10 mm	0.14 N (14 gf)	1.6 N (160 gf)	0.25 N (25 gf)	2.5 N (250 gf)	9.0 N (900 gf)	±14°	4.5 mm	1.5 mm
EM1 STD 10 mm	0.08 N (8 gf)	0.75 N (75 gf)	0.2-0.3 N (20-30 gf)	3.5 N (350 gf)	-	±14°	4.0 mm	-
EM2 STD 10 mm	0.08 N (8 gf)	0.75 N (75 gf)	0.2-0.3 N (20-30 gf)	3.5 N (350 gf)	-	±14°	4.0 mm	-

* **NOTE:** The probe module may detach if this value is exceeded.

5.1.2 Probe module changing repeatability

Probe module changing method	Repeatability
Automatic changing	1.0 µm
Manual changing	2.0 µm

5.1.3 Technical specification

Product compatibility	<p>The TP20 is suitable for use with all Renishaw probe interfaces and probe heads which service the TP1, TP2 and TP6 touch-trigger probes.</p> <p>The TP20 is compatible with the PEL, PK, PAA and PEM series of probe extensions/adaptors.</p>	
Dimensions		
Diameter	13.2 mm	
Length	LF/SF/MF/EF	38 mm
	EM1 STD	88 mm
	EM2 STD	113 mm
	6-way	42 mm
Probe mount	Thread M8 x 1.25 x 5 mm	
Stylus mount	Thread M2 x 0.4	
Sense directions	LF/SF/MF/EF/EM1 STD/EM2 STD	5-way ($\pm X$, $\pm Y$, $\pm Z$)
	6-way	6-way ($\pm X$, $\pm Y$, $\pm Z$)
Probe module pull-off force	10 N (1 kgf) maximum	
Sealing	IP30	
Cable length	50 m with (24 awg) conductors	
Probe module life	25,000 changes	

6 Technical data - MCR20 probe module change rack

6.1 Technical specification

Dimensions	
Length	200 mm
Width	60 mm
Height	145 mm
Port entry velocity	Maximum 800 mm/s
Mounting orientation	Not designed for horizontal operation with the ports in a vertical orientation
Y axis overtravel	Hinged breakout from base 55 mm travel at port height
Z axis overtravel	Hinged docking port assembly 90° travel in -Z axis
Inhibit range	100 mm from port centre

7 Technical data - MSR1 module storage rack

7.1 Technical specification

Dimensions	
Length	285 mm
Width	86 mm
Height	285 mm
Number of ports	6
Mounting	Wall mounted CMM table mounted

8 Applications guide

8.1 Probe module selection

To obtain the best possible performance from your TP20 probe, it is important to select the correct probe module for your specific application. When choosing the probe module to be used, the following considerations should be addressed:

- The mass of the stylus assembly and its centre of gravity. It is always best to use the shortest stylus possible.
- The orientation of the probe body.
- The levels of acceleration and vibration to which the TP20 probe will be subjected. These will vary with each type of CMM and movement velocity.

The following probe modules are available for use with the TP20 probe; each probe module is clearly marked on its front ring and also carries a colour-coded front cap as follows:

- Low force probe module (green cap)
- Standard force probe module (black cap)
- Medium force probe module (grey cap)
- Extended force probe module (brown cap)
- 6-way probe module (blue cap)
- EM1 STD probe module (black cap)
- EM2 STD probe module (black cap)

NOTE: It is recommended that a standard force probe module is always used, except where the application or machine acceleration or vibration would cause the TP20 to false trigger.

8.1.1 The low force probe module

The low force probe module, identified by a green cap, is suited to applications that require a low trigger force, for example rubber seals.

8.1.2 The standard force probe modules

The standard force probe modules (SF, EM1 STD and EM2 STD) are identified by black caps and are suited to the majority of applications.

8.1.3 The medium force probe module

The medium force probe module, identified by a grey cap, is provided for use where a higher trigger force than standard is required.

8.1.4 The extended force probe module

The extended force probe module is identified by a brown cap. Typically, this probe module will only be required with large stylus assemblies, and where spurious triggers caused by machine vibration and acceleration preclude the use of either the standard or medium force probe modules.

8.1.5 The 6-way probe module

The 6-way probe module is identified by a blue cap. This probe module is designed for 6-way operation where there is a requirement to measure in the $-Z$ direction, for example when measuring undercuts.

8.2 Stylus selection

NOTE: Choosing the best stylus for a given application is an important factor in achieving optimum probe performance. For further information on the full range of Renishaw styli, please refer to Renishaw's styli and accessories brochure (H 1000-3200) which can be ordered from your supplier or downloaded from Renishaw's web site, www.renishaw.com.

When selecting a stylus, it is important that the stylus length is kept to the minimum required to access all features to be measured, and that the stylus type offers the maximum possible stiffness. Factors that affect stiffness are:

- Joints in the styli: that tend to reduce rigidity and should therefore be kept to the absolute minimum.
- Stem diameters: that are governed by the ball tip diameter of the stylus.
- Stem material: that can be stainless steel, ceramic or graphite fibre (GF).

It is also important to ensure that the stylus ball diameter chosen is as large as is practical. This not only ensures that the stylus will be as stiff as possible, but also reduces the stylus's susceptibility to surface form and surface finish.

Owing to the modular construction of the TP20, when selecting and using styli the following criteria should be applied:

- Work only within the recommended stylus limits for each probe module (refer to Recommended stylus limits).
- Always use the shortest possible stylus.
- If using larger styli than those recommended for use with each probe module, always conduct trials to establish the effect on measuring performance.
- Minimise the mass of styli by using either ceramic or graphite fibre (GF) stems.

8.2.1 Recommended stylus limits

Owing to the modular construction of the TP20 probe, it is recommended that the limits shown in figures 14 to 17 are applied when selecting styli to be used.

The low force probe module

The low force probe module has the following recommended stylus limits:

- Steel and carbide styli up to 30 mm long
- No star or cranked styli

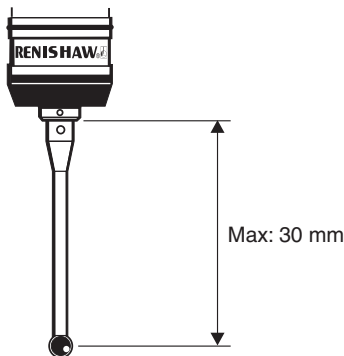


Figure 14 - Recommended stylus limits for low force probe module

The standard force probe modules

The standard force probe modules (SF, EM1 STD and EM2 STD) can be used with the following range of styli:

- Steel and carbide styli up to 40 mm long.
- Renishaw graphite fibre (GF) type styli up to 50 mm long.
- Star and cranked styli up to 20 mm offset.

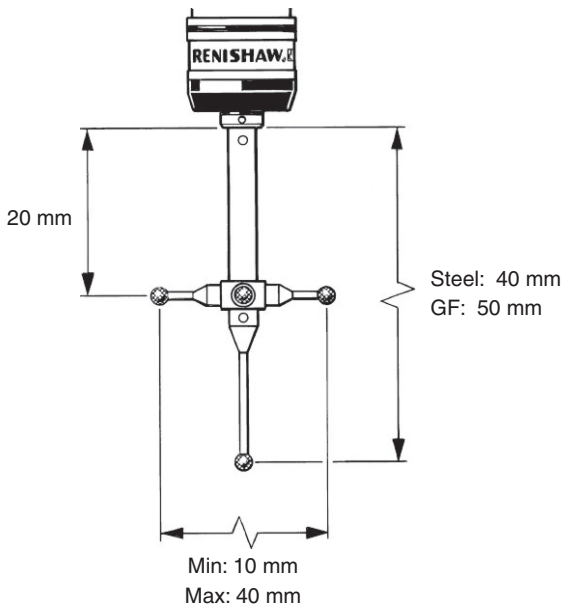


Figure 15 - Recommended stylus limits for standard force probe modules

The medium force and extended force probe modules

The medium force and extended force probe modules have the following recommended stylus limits:

- Any stylus type up to 60 mm long.
- Star and cranked styli up to 20 mm offset.

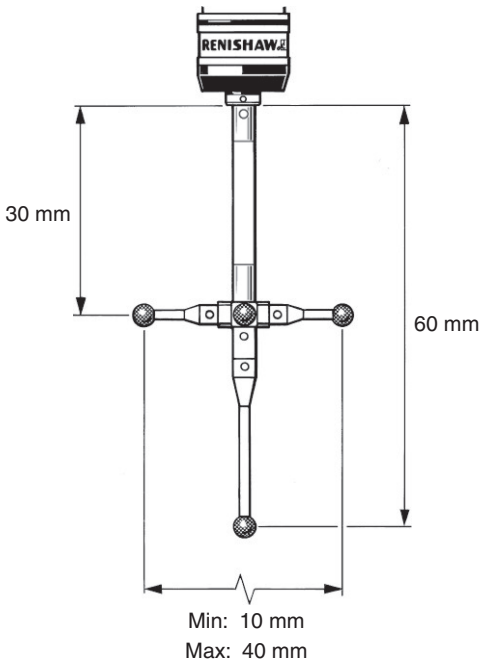


Figure 16 - Recommended stylus limits for medium and extended force probe modules

The 6-way probe module

The recommended stylus limits for the 6-way probe module are:

- Any stylus type up to 30 mm long
- Star and cranked styli up to 10 mm offset

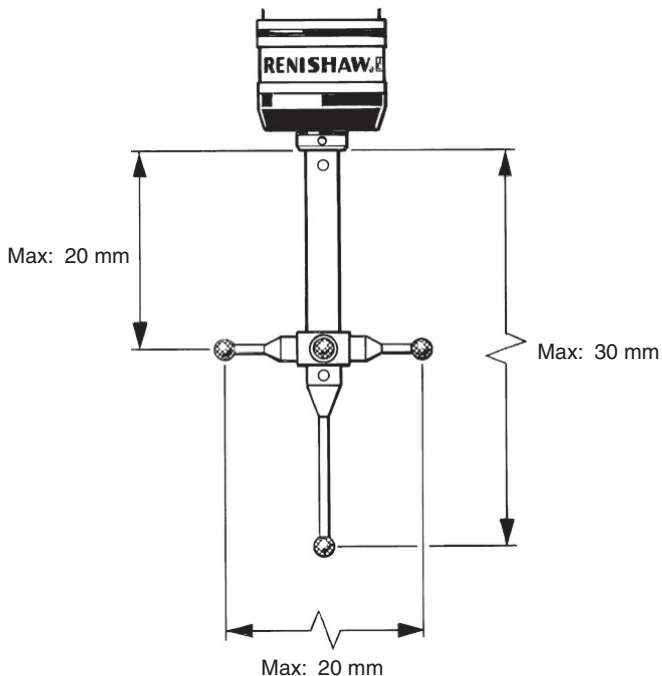


Figure 17 - Recommended stylus limits for 6-way probe module

Comparative stylus lengths

A comparison of the minimum and maximum stylus lengths for use with each probe module is shown in figure 18.

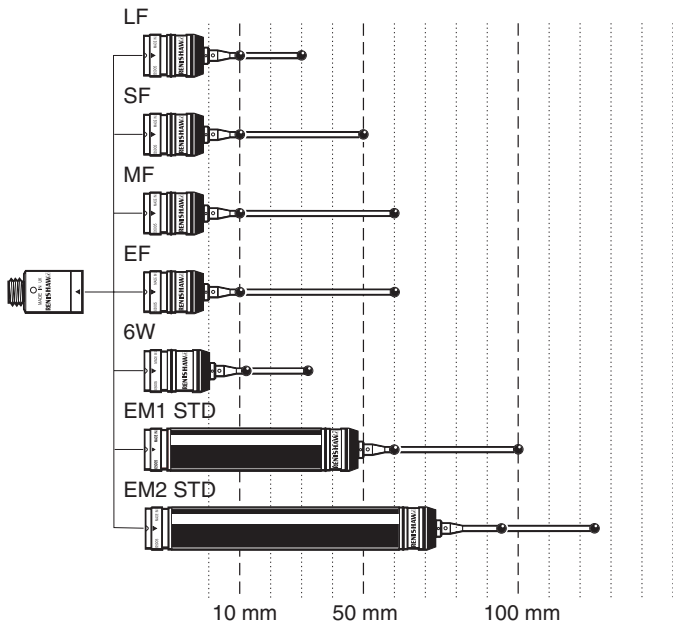


Figure 18 - Comparative stylus lengths

9 Product maintenance

NOTE: Maintenance of the TP20 probe is restricted to the periodic cleaning of the kinematic couplings of both the probe body and the probe module(s). To aid cleaning of these couplings, each TP20 probe is supplied with a Renishaw CK200 cleaning kit.

Each Renishaw CK200 cleaning kit contains a specialised material to effectively remove contamination from the precision ball/V groove seatings, electrical contacts and permanent magnets of the kinematic couplings.

NOTE: When operating the TP20 probe in environments subjected to airborne contamination, the user should determine the frequency of cleaning required to ensure the kinematic couplings remains uncontaminated.

Whilst the kinematic coupling mechanism is highly tolerant of non-metallic dust, regular inspection and cleaning with the material provided is recommended to ensure continued high performance. Instructions for use are included with the cleaning kit. If required, replacement kits can be ordered from your supplier (part number A-1085-0016).

Probe modules that are not attached to the probe body should be stored in the MCR20 or MSR1 rack, or in their transport boxes, to prevent contamination.

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