

# RTP20 user's guide

Documentation part number: H-1000-5116-02-C



## RTP20 user's guide

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To aid end user recycling and disposal the materials used in the different components of the packaging are stated here:

Packaging component	Material	94/62/EC code	94/62/EC number
Outer box	Non-corrugated fibreboard	PAP	21
Outer box	Corrugated fibreboard	PAP	20
Packaging insert	Corrugated fibreboard	PAP	20

### Patents

Features of the RTP20 system and associated products, equipment and techniques are the subjects of one or more of the following patents and patent applications:

CN1695036B	EP1546644	JP4361016	US7293365
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# Product compliance

## EU declaration of conformity

Contact Renishaw plc or visit [www.renishaw.com/EU](http://www.renishaw.com/EU) for the full EU declaration.

## REACH regulation

Information required by Article 33(1) of Regulation (EC) No. 1907/2006 ("REACH") relating to products containing substances of very high concern (SVHCs) is available at:

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## China RoHS

Contact Renishaw plc or visit [www.renishaw.com/ChinaRoHS](http://www.renishaw.com/ChinaRoHS) for the full China RoHS tabulation.



## References and associated documents

The following Renishaw documents are referred to in this document or may be a source of further relevant information. They can easily be acquired from Renishaw web site [www.renishaw.com](http://www.renishaw.com).

Title	Document number
<a href="#">User's guide: TP20 system</a>	H-1000-5008

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# System description

RTP20 is an indexable head that uses the CMM's motion for repeatable repositioning. It offers low-cost 'motorised' head functionality with an integral TP20 touch-trigger probe.

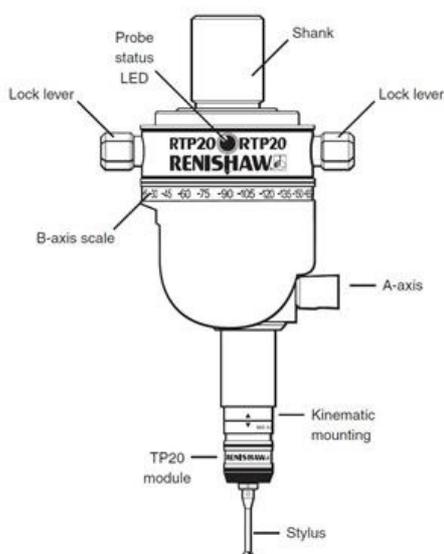
Automated indexing of the head is realised through an innovative process which uses the motion of a CMM to achieve motorised head style operation. This indexing process comprises of three operations:

- An external locking lever on the probe head is driven against a dedicated sphere mounted to a pole located on the bed of the CMM, thus unlocking the head
- The CMM motion is then used to engage a drive-cup located in the head's A-axis swivel, with the pole-mounted sphere, enabling rotation of the head in the A and B-axes by driving around the pole
- The indexing operation is completed by again using the CMM motion to drive the locking lever against the pole-mounted sphere, thus locking the head

The automated indexing of the RTP20 allows the integral TP20 probe to be moved to 168 repeatable positions in 15-degree increments using both the A and B-axes, requiring a one-time only qualification for each stylus position thus ensuring fast throughput for part inspection. Using the CMM motion to lock and orientate the head together with the MCR20 change rack, which allows repeatable interchange between qualified probe modules, provides a fully automated system.



**NOTE:** The red LED on the front of the head indicates probe status, and can be controlled by either the CMM or a Renishaw probe interface. Conventionally LED ON indicates probe seated (armed), and LED OFF indicates probe triggered. Electrical connection is via a 5 pin DIN connector.



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# RTP20

## Specification

### Measuring performance

<b>Positional repeatability (2<math>\sigma</math>)</b>	2 $\mu$ m (0.00008 in)
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(At stylus tip with TP20 standard force module and 10 mm (0.39 in) stylus length)

<b>Positional repeatability (2<math>\sigma</math>)</b>	3 $\mu$ m (0.00012 in)
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(At stylus tip with EM2 94.5 mm (3.72 in) extended module and stylus 10 mm (0.39 in) long).

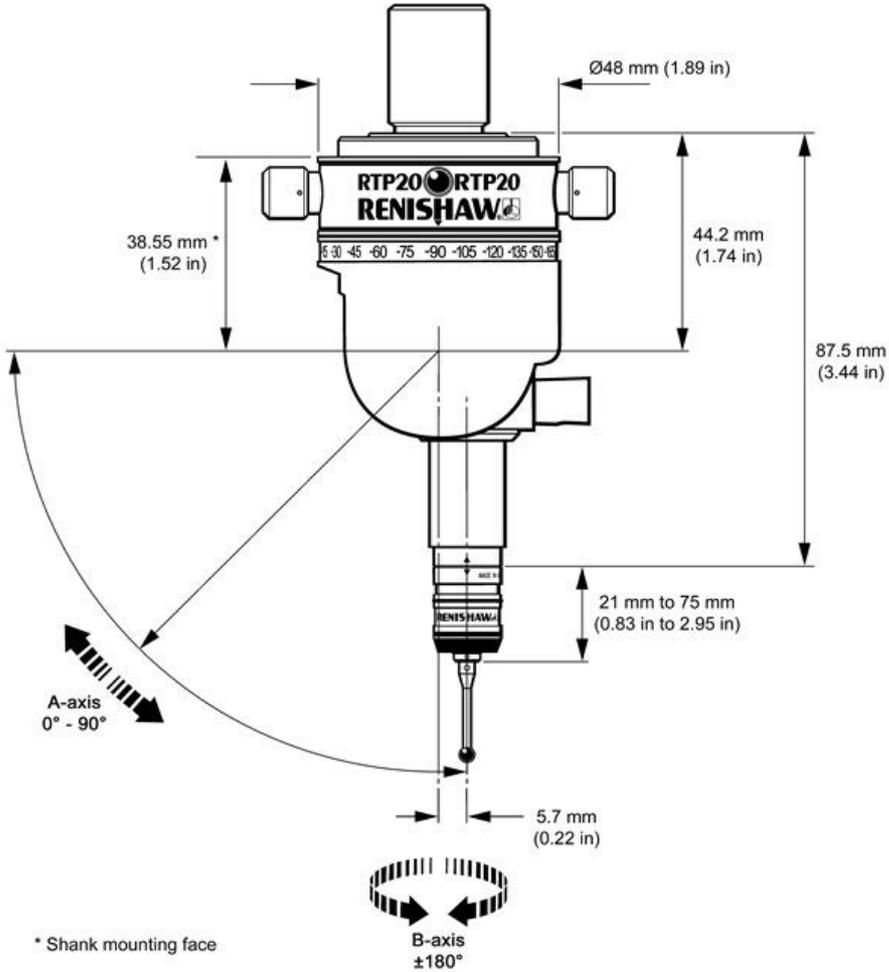
### Technical data

<b>Range of articulation A-axis</b>	0° to 90° in 15° increments
<b>Range of articulation B-axis</b>	±180° in 15° increments
<b>Dual axis lock</b>	Via lock lever
<b>Head mounting</b>	MS range of shanks
<b>Cable connection</b>	5-pin DIN socket
<b>Cable length</b>	50 m with (24 awg) conductors
<b>Probe status indication</b>	1 LED
<b>Maximum load module</b>	EM2 - 94.5 mm (3.72 in) extended
<b>Operating temperature range</b>	+10 °C to +40 °C (+50° to +104 °F)
<b>Storage temperature range</b>	-10 °C to +70 °C (+14° to +158 °F)
<b>Probe module mounting</b>	TP20 kinematic
<b>Weight - without shank</b>	208 g

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## Dimensions



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# Installation

## Mounting the shank on the probe head

 **NOTE:** The RTP20 shanks are factory fitted and are selected by part number when ordering (see 'Parts list').

- Hold the shank in the recess on the top face of the RTP20
- Rotate the shank until the four screw holes are aligned
- Fix the shank in place using only M3 × 5 mm screws (supplied)
- Progressively tighten with the 2.5 mm A/F hexagonal key (supplied)

## Mounting the RTP20 to the CMM

The head is normally attached to the CMM quill using a shank to suit it.

For optimum shielding against EM phenomena, it is recommended that the shank is grounded to the same electrical point as the control system.

Custom designed mountings are available, subject to approval from Renishaw's Custom Products Department. Please contact your supplier or Renishaw for further information.

The head mounting must be rigid, as any movement during operation will introduce system measurement errors. If the head is replaced or repositioned in the quill, all head positions in current use must be requalified before making further measurements.

 **NOTE:** Remove plastic cap from kinematic mount prior to attaching a TP20 module. Keep in a safe place for future protection.

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# Operation

**WARNING:** Safety glasses should be worn and the CMM speed be reduced during initial operation of RTP20.

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.

**CAUTION:** RTP20 is designed for automated operation under direct control of the CMM software. To avoid possible collision during use, RTP20 must not be unlocked, re-orientated or locked by hand during normal operation.

## Preparing RTP20 for use

To prepare RTP20 for use, the pivot pole must be correctly fitted to the CMM table to ensure unobstructed operation of the probe head. The pole consists of three sections; a fixing stud, middle stem and upper pole section which has the pivot sphere at its tip. The pole sections must be fitted using the torque tool (supplied) to ensure the pole does not become loose during operation. Various fixing studs are available for different CMM table fixture holes, these are; M6 x 1, M8 x 1.25, M10 x 1.5, 5/16" x UNC and 3/8" x UNC.



**CAUTION:** RTP20 must be locked in the A, 0 and B, 0 position before initially defining the pivot pole sphere.

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Prior to initial use, RTP20 is locked in the A, 0 and B, 0 position to enable the OEM supplied software to define the pivot pole sphere location at eight default positions for RTP20. This is done by calibrating four angles in the A-axis and four angles in the B-axis. Whilst a small degree of misalignment can be accommodated by head/cup geometry, this should be minimised where possible and the first moves should be carried out slowly to confirm clearances.

### Using RTP20

To change the orientation of RTP20:

1. Use the OEM supplied RTP20 software 'macro' to send the head to a safety 'stand-off' position that offers a clear path to the pivot pole sphere.
2. From this 'stand-off' position, send RTP20 to the sphere using the CMM axes to locate and rotate the appropriate left or righthand locking lever of the head to unlock it. The head is then repositioned to engage the RTP20 cup on the pivot pole sphere to index it to the required angle. Once the required angle is reached, the cup is disengaged from the pole sphere and the head is moved to locate and rotate the appropriate locking lever to the re-locked condition.
3. RTP20 is then returned to a safety 'stand-off' position clear of the pivot pole.
4. Commence gauging, ensuring that the correct qualification data is recalled for each head position.

To define RTP20 probe head positions:

- Use the OEM supplied RTP20 software 'macro' to change the orientation of the probe to the next desired position and qualify the stylus tip(s)
- Qualify the stylus tip(s) according to the CMM supplier's instructions
- Repeat the qualification process for all other desired orientations and stylus tips

Periodic re-qualification should be performed under the following circumstances:

- CMM supplier's recommendations, particularly in respect of temperature changes
- At the start of the working day or shift
- After an accidental collision
- After changing any measuring system component (except a prequalified TP20 module)
- If the initial state is unknown or uncertain

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# TP20 probe modules

This section covers the use and care of the TP20 probe modules for the RTP20.

## Introduction

The Renishaw TP20 probe modules incorporate a kinematic coupling, which ensures highly repeatable stylus tip positioning.

The range of modules comprises 5-way versions with length or trigger force options and a 6-way version.

Probe modules fit directly onto the RTP20 kinematic mount. It is possible to change TP20 modules with different stylus configurations without re-qualification.

## Specification

<b>Product compatibility</b>	The TP20 is suitable for use with all Renishaw probe interfaces and probe heads which service the TP2 and TP6 touch-trigger probes.
<b>Diameter</b>	13.2 mm
<b>Length:</b>	
<b>LF / SF / MF / EF</b>	38 mm
<b>EM1 STD</b>	88 mm
<b>EM2 STD</b>	113 mm
<b>6-way</b>	42 mm
<b>Probe module mounting</b>	TP20 kinematic
<b>Stylus mount</b>	Thread M2 × 0.4
<b>Sense directions:</b>	
<b>LF / SF / MF / EF / EM1 STD / EM2 STD</b>	5-way (±X, ±Y, +Z)
<b>6-way</b>	6-way (±X, ±Y, ±Z)
<b>Probe module pull-off force</b>	10 N (1 kgf), 36 ozf maximum
<b>Sealing</b>	IP30
<b>Probe module life</b>	25,000 changes

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### Probe module type and stylus length

Parameter	LF	SF	MF	EF	6-way	EM1 STD	EM2 STD
Stylus length	10 mm	10 mm	25 mm	50 mm	10 mm	10 mm	10 mm
Trigger force (nominal at stylus tip) XY	0.055 N (5.5 gf)	0.08 N (8 gf)	0.1 N (10 gf)	0.1 N (10 gf)	0.14 N (14 gf)	0.08 N (8 gf)	0.08 N (8 gf)
Trigger force (nominal at stylus tip) Z	0.65 N (65 gf)	0.75 N (75 gf)	1.9 N (190 gf)	3.2 N (320 gf)	1.6 N (160 gf)	0.75 N (75 gf)	0.75 N (75 gf)
Overtravel force (max. at stylus tip) XY	0.09 N (9 gf)	0.2 N - 0.3 N (20 gf - 30 gf)	0.2 N - 0.4 N (20 gf - 40 gf)	0.2 N - 0.5 N (20 gf - 50 gf)	0.25 N (25 gf)	0.2 N - 0.3 N (20 gf - 30 gf)	0.2 N - 0.3 N (20 gf - 30 gf)
Overtravel force (max. at stylus tip) +Z	1.1 N (115 gf)	3.5 N (350 gf)	7 N (700 gf)	10 N (1 kgf)	2.5 N (250 gf)	3.5 N (350 gf)	3.5 N (350 gf)
Overtravel force (max. at stylus tip) -Z	-	-	-	-	9 N (900 gf)	-	-
Overtravel displacement XY*	±14°	±14°	±14°	±14°	±14°	±14°	±14°
Overtravel displacement +Z	3.1 mm	4 mm	3.7 mm	2.4 mm	4.5 mm	4 mm	4 mm
Overtravel displacement - Z	-	-	-	-	1.5 mm	-	-

\* The probe module may detach if this value is exceeded



**NOTE:** The use of cranked styli with RTP20 is not recommended.

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### Probe module changing repeatability

Probe module changing method	Repeatability
Automatic changing	1 µm
Manual changing	2 µm

### 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	LF	SF	MF	EF	6-way	EM1 STD	EM2 STD
Unidirectional repeatability* (2σ)	0.35 µm	0.35 µm	0.50 µm	0.65 µm	0.8 µm	0.35 µm	0.35 m
2D (XY) form measurement deviation*	±0.6 µm	±0.8 µm	±1 µm	±2 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

### The probe module

Each probe module houses the touch-trigger mechanism that carries the stylus assembly. The module provides overtravel in the X, Y and Z axes. The M2 stylus mounting is compatible with Renishaw's comprehensive range of M2 styli.

Electrical contact pins automatically complete the probe circuit.

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### TP20 module selector

Seven versions of the TP20 probe module can be used with the RTP20, they can be identified by the end cap colour.

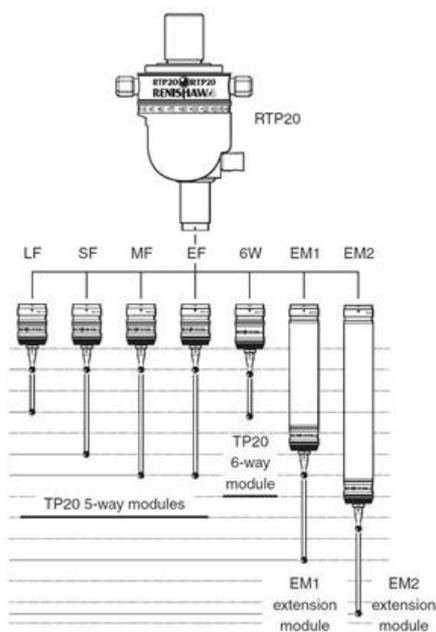
1. Low force (LF) probe module (green cap)
2. Standard force (SF) probe module (black cap)
3. Medium force (MF) probe module (grey cap)
4. Extended force (EF) probe module (brown cap)
5. 6-way (6W) probe module (blue cap)
6. Extension module 1 standard force (EM1 STD) (black cap)
7. Extension module 2 standard force (EM2 STD) (black cap)

Medium and extended force modules are used to overcome the effects of false triggers, caused either by stylus length and mass, or vibration caused by machine acceleration forces.

The low force module permits the measurement of delicate objects.

The EM1 and EM2 extended modules allow access to otherwise inaccessible workpiece features. Both operate using standard force and offer better measuring performance than using long styli with SF, MF, LF or EF modules.

The TP20 6-way senses in the +Z and -Z directions, allowing undercuts to be checked.



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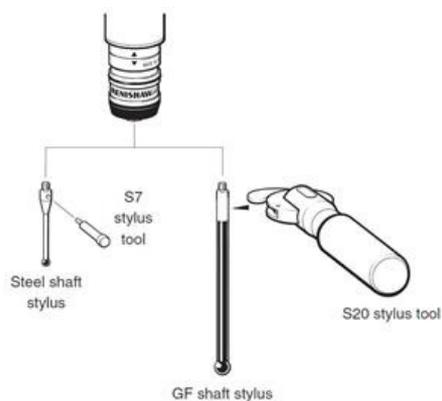
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Module	Minimum stylus length	Maximum stylus length	Overall reach
Low force (LF)	10 mm (0.39 in)	30 mm (1.18 in)	94 mm (3.70 in)
Standard force (SF)	10 mm (0.39 in)	50 mm (1.97 in)	114 mm (4.49 in)
Medium force (MF)	10 mm (0.39 in)	60 mm (2.36 in)	124 mm (4.88 in)
Extended force (EF)	10 mm (0.39 in)	60 mm (2.36 in)	124 mm (4.88 in)
6-way	10 mm (0.39 in)	30 mm (1.18 in)	98 mm (3.86 in)
EM1	10 mm (0.39 in)	50 mm (1.97 in)	143 mm (5.63 in)
EM2	10 mm (0.39 in)	50 mm (1.97 in)	168 mm (6.61 in)

## TP20 installation

### Assembling the probe module and stylus

1. Select the probe module with the correct trigger force rating for the application (see 'TP20 module selector' section).
2. Fit the stylus to the probe module, first hand tightening then using the S7 stylus tool (supplied) for final tightness. Renishaw GF styli require an S20 spanner. The recommended tightening torque is 0.05 Nm to 0.15 Nm (0.04 lb ft to 0.11 lb ft). Torque must not exceed 0.3 Nm (0.22 lb ft).

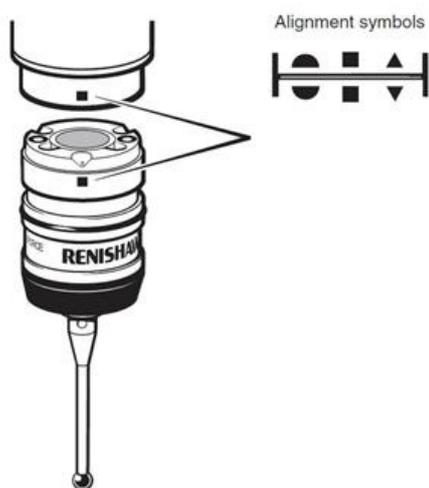


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### Fitting the probe module with stylus on the RTP20

1. Examine all mating faces for cleanliness. Where necessary, clean the surfaces with the Renishaw CK200 kit (supplied).
2. The TP20 module and kinematic mount are marked with three unique alignment marks. When offering the TP20 up to the probe head, ensure that similar marks are aligned with each other. Allow the TP20 body to engage under magnetic force.



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# The MCR20 module change rack

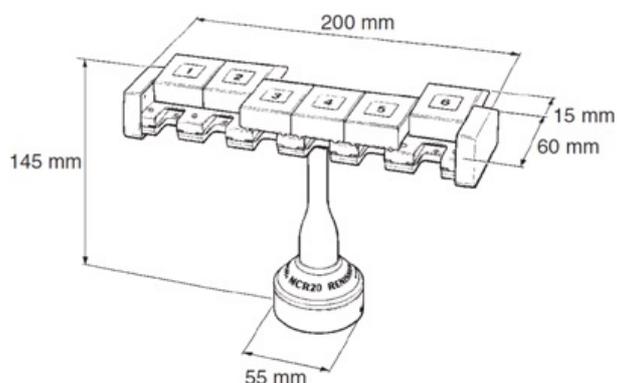
## The MCR20 probe module changing rack kit

**i** **NOTE:** Renishaw supplies eight types of MCR20 probe module changing rack kit, each kit providing a different combination of probe modules. See 'The MCR20 module change rack' for the range of kits offered.

The MCR20 probe module changing rack kit 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.



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 normally it should not 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:

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MCR20 probe kit number	LF	SF	MF	EF	Part number
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

## Mounting the MCR20 onto the CMM

To mount the MCR20 probe module change rack onto your CMM, carry out the following procedure:

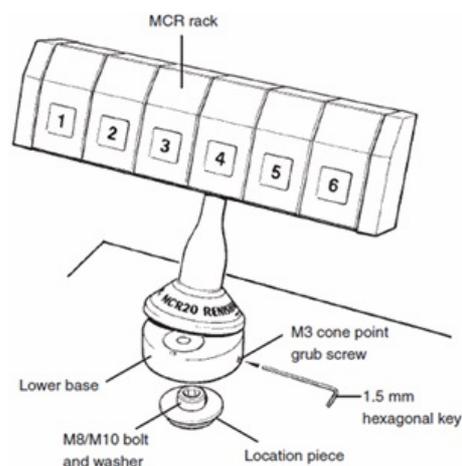


**CAUTION:** For optimum crash protection, it is recommended that the MCR20 is mounted as close as possible to the extreme edge of the CMM operating envelope.

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.



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 grub screw (0.5 Nm to 1 Nm) to lock the MCR20 in position.

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**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.

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

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# Fault finding

## RTP20

 **CAUTION:** RTP20 is designed for automated operation under direct control of the CMM software. To avoid possible collision during use, RTP20 must not be unlocked, re-orientated or locked by hand during normal operation.

### Poor measuring performance

Possible causes	Remedy
Loose mounting	Ensure shank mounting screws are tight and mounting to CMM is secure.
Problem with TP20 probe module	Diagnosis of the probe unit should be carried out with axes correctly locked and without head adjustment between probe points.
Problem with swivelling / indexing unit	Diagnosis of the indexing unit should only be carried out following satisfactory probe performance.

### No probe signal and / or no probe status LED

Possible causes	Remedy
Cable faulty / not connected	Check continuity of cabling from head to interface / machine control.
Probe interface faulty / not connected	Ensure correct connection of interface / machine control.

### Poor repeatability (RTP20 only)

Possible causes	Remedy
Axes lock procedure incorrect	Using automated cycle ensure lock lever is fully rotated to lock position.
Axes unlock procedure incorrect	Using automated cycle ensure lock lever is fully rotated into unlock position during indexing.
Forces imparted onto head during lock-up	Using automated cycle unlock and re-lock.
Attempted lockup in incorrect unqualified position	Using automated cycle unlock, reposition correctly and re-lock.

### Axes 'rattling' during indexing (RTP20 only)

Possible causes	Remedy
Incorrect unlock procedure	Using automated cycle ensure lock lever is fully rotated to unlock position.
Incorrect indexing procedure	Using automated cycle index each axis separately.

 **NOTE:** The RTP20 is not user serviceable and should be returned to Renishaw if suspected faulty.

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### TP20

#### Poor measuring performance

Possible causes	Remedy
Stylus configuration too long or not rigid	Use shorter stiffer stylus configuration.
Poor stylus assembly	Ensure stylus joints are kept to a minimum and the joints are clean and secure.
Contamination / damage to stylus ball	Inspect for damage, clean thoroughly with solvent.
Trigger force too high.	Use lower force module.

#### Unwanted triggering during probe or CMM movement

Possible causes	Remedy
Trigger force too low / stylus configuration too heavy	Use higher force module / reduce mass of stylus configuration.

#### Probe fails to rearm after trigger

Possible causes	Remedy
Trigger force too low / stylus configuration too heavy	Use higher force module / reduce mass of stylus configuration.
Probe reseal failure	Re-trigger probe. If problem persists please return to Renishaw for service.

#### Loss of measuring accuracy

Possible causes	Remedy
Mounting not secure	Check that the RTP20 is correctly mounted on the shank and that the screws are secure. Check clamping mechanism in the CMM quill is secure for RTP20.
RTP20 not fully locked	Ensure that the thumbwheel / lock lever is turned fully clockwise.
Force imparted to probe module after locking	Re-qualify the probe.
RTP20 worn or damaged	Use only with the specified probe and extension combinations.
Faulty probe module	Check by substitution or return to Renishaw or your supplier.

# Maintenance

Renishaw probes are intended for use in a protected metrology environment and therefore accumulation of dust or contamination should not occur.

In common with all precision measuring equipment, regular inspection and cleaning is recommended to ensure continued high performance.

Maintenance of the head is limited to wiping the outer surfaces and axes scale labels with a clean dry cloth or proprietary cleaning material.

Maintenance of the TP20 probe is restricted to the periodic cleaning of the kinematic couplings on the probe head and the probe module. To aid cleaning of these couplings, the RTP20 is supplied with a Renishaw CK200 cleaning kit. Do not use any other cleaning method.

When operating the TP20 probe in environments subjected to air-borne contamination, the user should determine the frequency of cleaning required.

## RTP20 user's guide

www.renishaw.com

# Parts list

## TP20 probe modules

The RTP20 can be ordered with either LOW, STD, MED, or EXT force modules (see 'TP20 module selector' section for details). If additional modules are required please refer to the table below for part numbers:

Description	Part number
<b>TP20 modules</b>	
LOW	A-1371-0392
STD	A-1371-0270
MED	A-1371-0271
EXT	A-1371-0272
EM1	A-1371-0430
EM2	A-1371-0431
TP20 6-way	A-1371-0419
<b>Probe tools</b>	
S7 stylus tool kit (supplied)	A-5000-7835
S20 stylus tool (not supplied)	A-5003-2300
CK200 cleaning kit (supplied)	A-1085-0016

## Head and shank combinations

Description	Part number
RTP20 pole adaptor - M8	A-5400-0121
RTP20 pole adaptor - M6	A-5400-0122
RTP20 pole adaptor - 5/16	A-5400-0123
RTP20 pole adaptor - 3/8	A-5400-0124
RTP20 pole adaptor - M10	A-5400-0125
RTP20 pole	A-5400-0126
RTP20 cup replacement kit	A-5400-0300
RTP20 kits	Please contact your local Renishaw subsidiary

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