Installation and user's guide
H-1000-5131-01-A

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TP20 probe for FARO arm

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CE

Care of equipment

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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

Contents

1 Introduction

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.

The TP20 comprises a two-piece design – a probe body and detachable probe module(s).

Figure 1 - The TP20 probe

2 Product description

2.1 The FARO 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 medium force TP20 probe module (see page 8 for available combinations)
- Ø 6 mm (0.24 in) x 10 mm (0.39 in) stylus
- Ø 2 mm (0.08 in) x 10 mm (0.39 in) stylus
- 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.

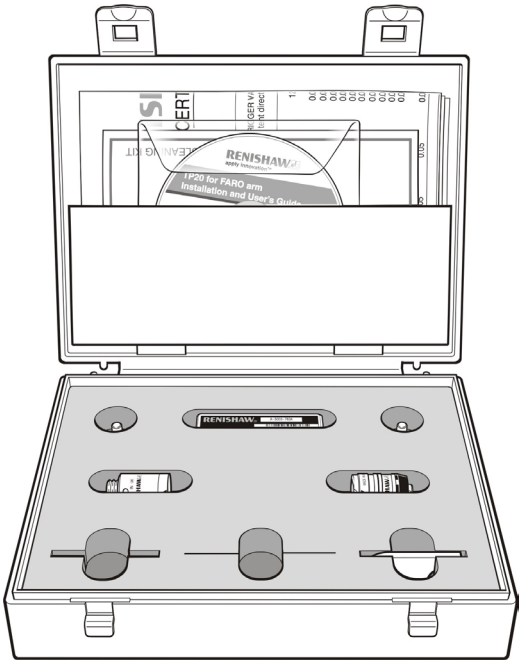

Figure 2 - The TP20 probe for FARO arm kit

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 acceleration and vibration, can cause the probe to false trigger (these are referred to as 'spurious triggers').

To allow the TP20 to be used where acceleration forces 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) (supplied)
- 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 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

3 Product installation

3.1 Fitting the TP20 probe onto a FARO arm

To fit the TP20 probe carry out the following procedure (see figure 3):

1. By hand, screw the threaded end of the probe body into the TP20 adaptor and finger tighten to secure.
2. Fit the S1 'C' wrench (supplied) onto the probe body as shown in Figure 3.
3. Using the S1 'C' wrench, fully finger 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 3):

1. Screw the threaded end of your chosen stylus into the M2 stylus mount of the probe module and finger tighten to secure.
2. Using the type S7 stylus tools provided, or type S20 wrench if fitting a stylus from the Renishaw GF range, fully finger 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).

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

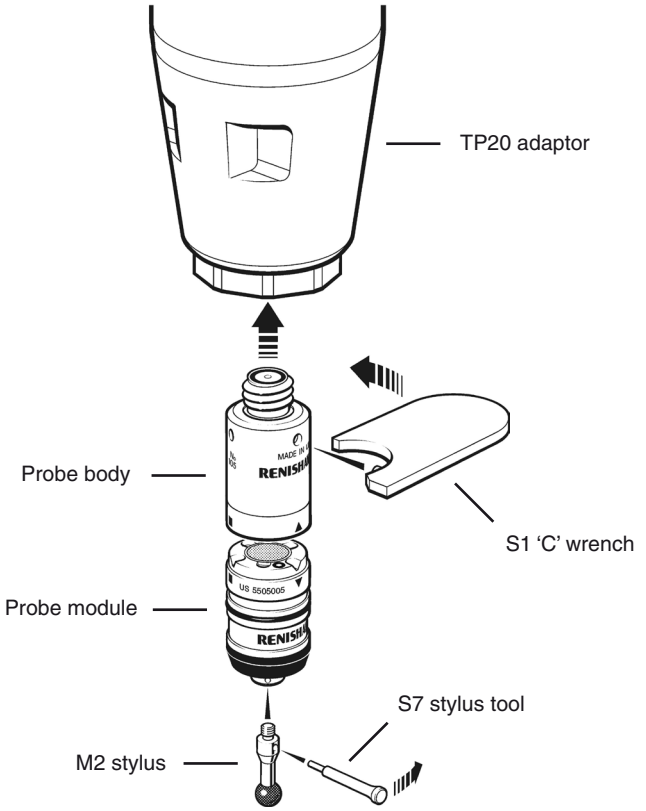

Figure 3 - Fitting the TP20 probe onto the FARO adaptor

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 4):

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.

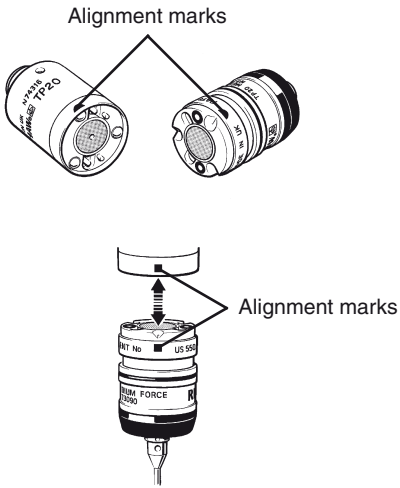

Figure 4 - Fitting the probe module and stylus onto the probe body

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

4.1 Measuring performance

NOTE: The following data is derived from high accuracy test rig measurements and may not represent the performance achievable on an arm. Please consult your 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* (2σ)	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

4.1.1 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.

4.1.2 Probe module changing repeatability

Probe module changing	Repeatability
Manual changing	2.0 µm

4.1.3 Technical specification

Dimensions		
Diameter	13.2 mm (0.52 in)	
Length	LF/SF/MF/EF	38 mm (1.5 in)
	EM1 STD	88 mm (3.46 in)
	EM2 STD	113 mm (4.45 in)
	6-way	42 mm (1.65 in)
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 (±X, ±Y, +Z)
	6-way	6-way (±X, ±Y, ±Z)
Probe module pull-off force	10 N (1 kgf) maximum	
Sealing	IP30	
Probe module life	25,000 changes	

5 Applications guide

5.1 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 movement and 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) (supplied)
- Extended force probe module (brown cap)
- 6-way probe module (blue cap)
- EM1 STD probe module (black cap)
- EM2 STD probe module (black cap)

5.1.1 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.

5.1.2 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.

5.1.3 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.

5.1.4 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 acceleration preclude the use of either the standard or medium force probe modules.

5.1.5 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.

5.2 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.

5.2.1 Recommended stylus limits

Owing to the modular construction of the TP20 probe, it is recommended that the limits shown in figures 5 to 9 are applied when selecting styli to be used.

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 (2.36 in) long.
- Star and cranked styli up to 20 mm (0.79) offset.

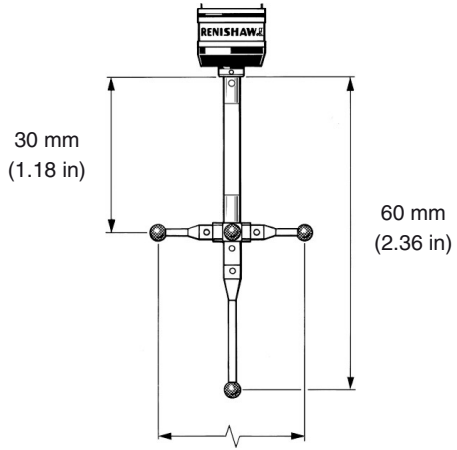

Figure 5 - Recommended stylus limits for medium and extended force probe modules

The low force probe module

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

- Steel and carbide styli up to 30 mm (1.18 in) long
- No star or cranked styli

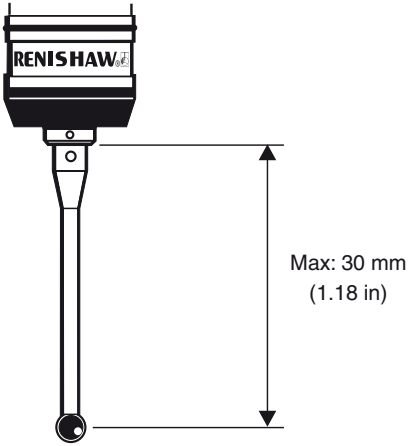

Figure 6 - Recommended stylus limits for low force probe module

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 (1.57 in) long.
- Renishaw graphite fibre (GF) type styli up to 50 mm (1.97 in) long.
- Star and cranked styli up to 20 mm (0.79 in) offset.

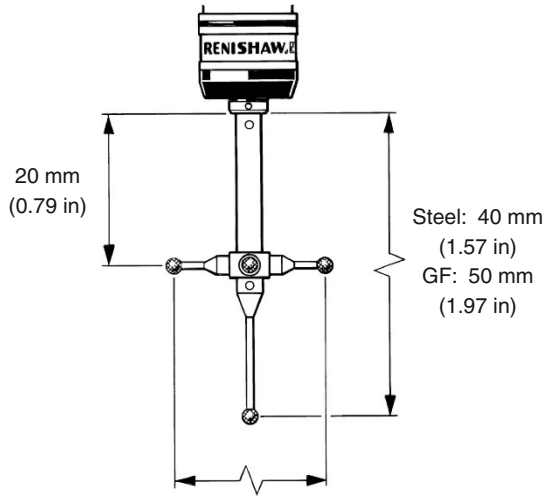

Figure 7 - Recommended stylus limits for standard force probe modules

The 6-way probe module

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

- Any stylus type up to 30 mm (1.18 in) long
- Star and cranked styli up to 10 mm offset

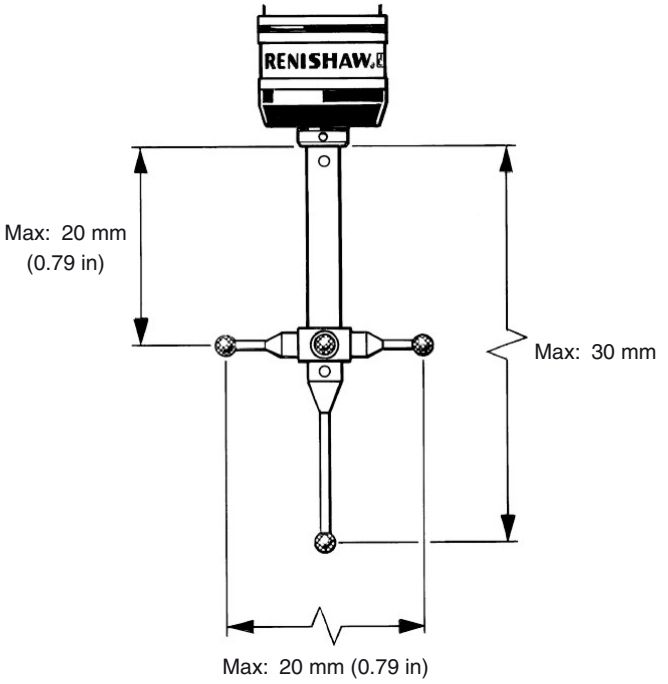

Figure 8 - Recommended stylus limits for 6-way probe module

Comparative stylus lengths

A comparison of the minimum and maximum stylus lengths for use with each probe module is shown in figure 9.

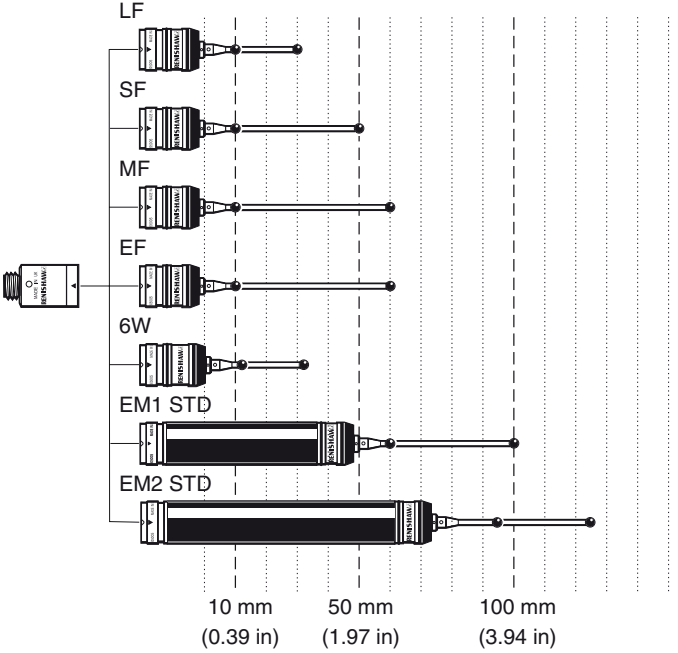

Figure 9 - Comparative stylus lengths

6 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 their transport boxes, to prevent contamination.

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