

## TP20 user's guide

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# TP20 user's guide

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### Probing forces and overtravel limits

| Probe module type and stylus length | XY (trigger force (nominal at stylus tip)) | Z (trigger force (nominal at stylus tip)) | XY (overtravel force (max. at stylus tip)) | +Z (overtravel force (max. at stylus tip)) | XY** (overtravel displacement) | +Z (overtravel displacement) |
|-------------------------------------|--|---|--|--|--------------------------------|------------------------------|
| 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 N - 0.3 N (20 gf - 30 gf)              | 3.5 N (350 gf)                             | ± 14°                          | 4 mm                         |
| MF 25 mm                            | 0.1 N (10 gf)                              | 1.9 N (190 gf)                            | 0.2 N - 0.4 N (20 gf - 40 gf)              | 7 N (700 gf)                               | ± 14°                          | 3.7 mm                       |
| EF 50 mm                            | 0.1 N (10 gf)                              | 3.2 N (320 gf)                            | 0.2 N - 0.5 N (20 gf - 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)                             | ± 14°                          | 3.6 mm                       |
| EM1 STD 10 mm                       | 0.08 N (8 gf)                              | 0.75 N (75 gf)                            | 0.2 N - 0.3 N (20 gf - 30 gf)              | 3.5 N (350 gf)                             | ± 14°                          | 4 mm                         |
| EM2 STD 10 mm                       | 0.08 N (8 gf)                              | 0.75 N (75 gf)                            | 0.2 N - 0.3 N (20 gf - 30 gf)              | 3.5 N (350 gf)                             | ± 14°                          | 4 mm                         |

\* 6-way:

| -Z (overtravel force (max. at stylus tip)) | -Z** (overtravel displacement) |
|--|--------------------------------|
| 1.6 N (160 gf)                             | 1.5 mm                         |



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

### Probe module changing repeatability

| Probe module changing method | Repeatability |
|------------------------------|---------------|
| Automatic changing           | ±0.5 µm       |
| Manual changing              | ±1 µm         |

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## Technical specifications

### TP20

|  |   |
|--|---|
| Product compatibility                                    | The TP20 is suitable for use with all Renishaw probe interfaces and probe heads which service the TP1, TP2 and TP6 touch-trigger probes.<br>The TP20 is compatible with the PEL, PK, PAA and PEM series of probe extensions / adaptors. |
| Diameter   | 13.2 mm   |
| Length - LF / SF / MF / EF                               | 38 mm   |
| Length - EM1 STD   | 88 mm   |
| Length - EM2 STD   | 113 mm  |
| Length - 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 ( $\pm X$ , $\pm Y$ , $\pm Z$ )   |
| Sense directions - 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 modules life                                       | 25,000 changes  |

### MCR20

|                      |  |
|----------------------|--|
| 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<br>55 mm travel at port height                       |
| Z axis overtravel    | Hinged docking port assembly<br>90° travel in –Z axis                          |
| Inhibit range        | 100 mm from port centre  |

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### TCR20

|                           |   |
|---------------------------|---|
| Width                     | 200 mm (7.87 in)                                |
| Depth                     | 57 mm (2.24 in)                                 |
| Base diameter             | 50 mm (1.97 in)                                 |
| Height to top of rack     | 186 mm (7.32 in)                                |
| Height to bottom of ports | 159 mm (6.26 in)                                |
| Port entry velocity       | Maximum 800 mm/s (31.5 in/sec)                  |
| Mounting orientation      | Ports in a horizontal position only             |
| Tip correct artefact      | Centre of rack assembly                         |
| Overtravel                | Not required - protection provided by PH20 head |
| Inhibit range             | Not required - provided by UCC controller       |

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# Applications guide

## 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.

### 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.

### Standard force probe module

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

### 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.

### 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.

### 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.

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### 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](http://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

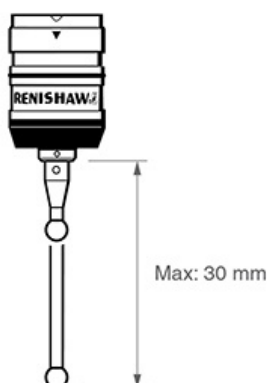
### Recommended stylus limits

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

#### 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



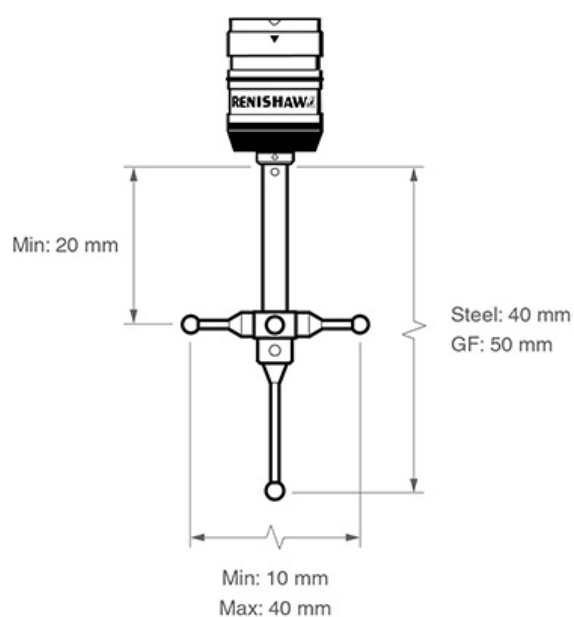
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### Standard force probe module

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



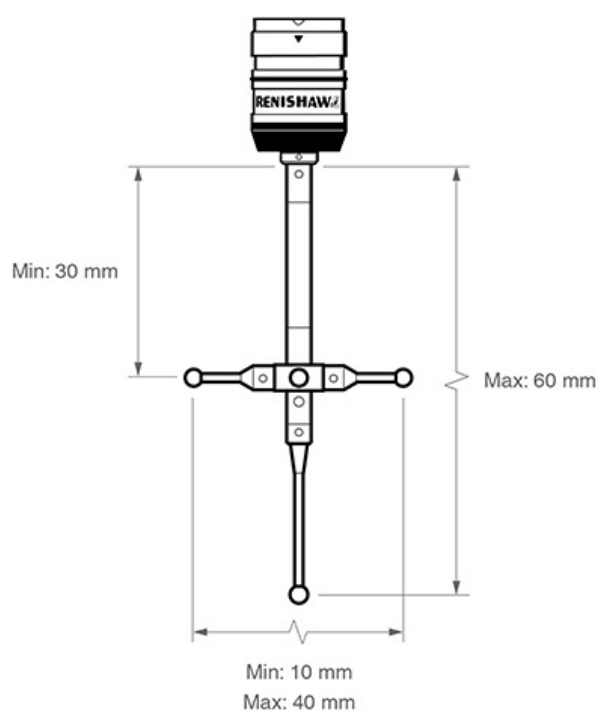
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### Medium force and extended force probe modules

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





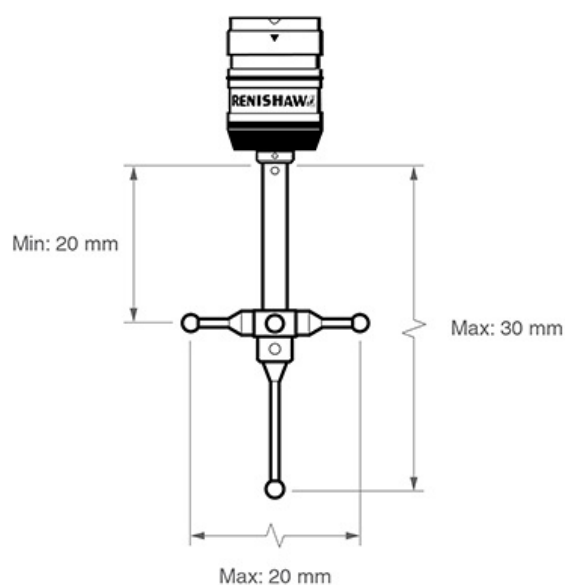
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### 6-way probe module

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



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### Comparative stylus lengths

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

