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Touch-trigger probe systems - TP1, TP2, TP6, TP6A, PH1, PH6, PH6M

Document part number H-1000-5021-08-B



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Packaging component	Material	94/62/EC code	94/62/EC number
Outer box	Corrugated fibreboard	PAP	20
Outer box	Non-corrugated fibreboard	PAP	21
Outer box	Polypropylene	PP	5
Packing foam	Polyurethane	PU	7
Bag	Low density Polyethylene	LDPE	4

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EU declaration of conformity

Contact Renishaw plc or visit www.renishaw.com/EU for the full EU declaration.

EMC conformity

This equipment must be installed and used in accordance with this installation guide. This product is intended for industrial use only and should not be used in a residential area or connected to a low voltage power supply network which supplies buildings used for residential purposes.

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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Warnings

Pinch hazards exist between parts and between moving and static parts. Do not hold the probe head during movements, or during manual probe changes.

Beware of unexpected movement. The user should remain outside of the full working envelope of probe head/extension/probe combinations.

In all applications involving the use of machine tools or CMMs, eye protection is recommended.

For instructions regarding the safe cleaning of Renishaw products, refer to the Maintenance section of the relevant product documentation.

Remove power before performing any maintenance operations.

Refer to the machine supplier's operating instructions.

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 machine movement.

Introduction

Co-ordinate measuring machines (CMMs) have evolved from their origins in simple layout machines and manually operated systems, to highly accurate, automated inspection centres.

A major factor in this evolution has been the touch-trigger probe and other forms of inspection probe, together with subsequent Renishaw innovations such as the motorised probe head and automatic probe exchange system for unmanned, flexible inspection.

It all began with Rolls-Royce engines for the Anglo-French Concorde when a unique solution was required for accurate pipe measurement. The result was the first touch-trigger probe: a 3D sensor capable of rapid, accurate inspection with low trigger forces. From this unique starting point, Renishaw has established a range of precision probes and accessories for CMMs unequalled around the world.

Renishaw's success has been made possible by the close working relationship the company enjoys with CMM manufacturers and users. The market is constantly striving to extend the frontiers of inspection technology. By close liaison throughout the design, development and evaluation processes, Renishaw keeps in step with the market's needs ... and, in many cases, one step ahead.

From the Group's centre of operations in Wotton-under-Edge, Renishaw's products are exported to the world's leading industrialised nations; a fact that has been rewarded by nine Queen's Awards.

Probe system overview

In the context of this user's guide a probe system comprises a stylus mounted onto a touch-trigger probe that in turn is connected to a CMM using a manual probe head.

The intention of this guide is to cover the most common combinations of the manual probe heads and touch-trigger probes in an attempt to assist the user in making a product choice that is best for any particular application.

The guide covers the features of each of the standard kinematic touch-trigger probes and complementary manual probe heads.

Probe product overview

Renishaw's CMM touch-trigger probes detailed in this user's guide are designed to suit any CMM, but their individual characteristics are outlined below:

TP1(S)	A robust shank-mounted probe offering generous overtravel - ideally suited to manual CMMs.
TP2 - 5-way	A compact probe allowing component penetration - ideally suited to CNC / DCC machines.
TP6	Complementing the TP2 series, but carrying longer and heavier styli, this probe is suited to general-purpose applications.
TP6A	This probe has all the functions of the TP6 probe and in addition the patented Renishaw autojoint that permits fast probe exchange without the need to requalify.

Renishaw also manufacture other touch-trigger probes which are not detailed in the user's guide.

For details of these and other Renishaw products, visit the Renishaw website at www.renishaw.com.

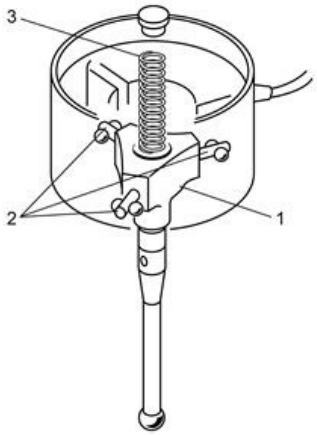
Principles of operation

The principle component of Renishaw touch-trigger probes is the kinematic location as shown below - a mechanical device that has the ability to return the stylus ball to the same repeatable position following any deflection.

The kinematic location consists of a pivotal plate [1] that is spring-loaded against three bearing points [2] by a helical compression spring [3]. These bearing points are formed by a combination of rollers and ball bearings.

Bearing points act as electrical contacts such that when the pivotal plate is deflected, the electrical circuit changes its characteristics and causes the probe interface to send a trigger to the CMM controller.

Following this trigger event, the stylus ball must be removed from contact with the surface to enable the probe to return the stylus ball to its repeatable position.



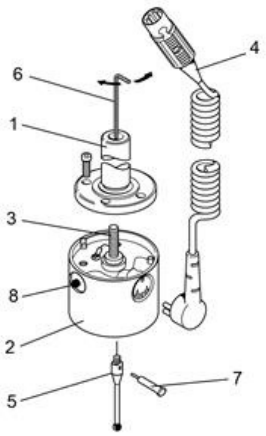
1	Pivotal plate
2	Three bearing points
3	Helical compression spring

Probe description and operation

TP1(S) touch-trigger probe

The TP1(S) touch-trigger probe (illustrated below) is a robust shank-mounted probe with a generous overtravel which is especially suited to manual CMMs. It is of a maintenance-free, sealed construction to provide a long working life.

The TP1(S) incorporates an M3 stylus mount which ensures compatibility with Renishaw's extensive M3 and M2 stylus and accessory range using the appropriate stylus adaptor where necessary.



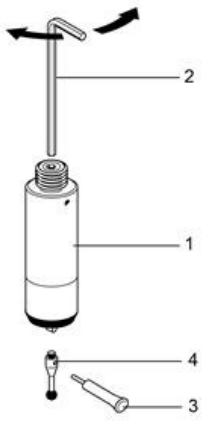
1	Shank
2	TP1(S) probe body
3	Trigger force adjustment screw
4	Probe cable (not supplied)
5	Stylus (not supplied)
6	2.5 mm AF Allen key to adjust trigger force
7	S7 stylus tightening tool
8	Probe status LED

TP2-5-way touch-trigger probe

The TP2-5-way touch-trigger probe shown below is a compact (13 mm diameter) general-purpose probe suitable for use on all types of CMM. It has an M8 mounting thread that ensures compatibility with Renishaw's comprehensive range of probe heads and extension bars.

The TP2 is of a maintenance-free construction to provide a long working life.

It incorporates an M2 stylus mount giving access to Renishaw's extensive M2 stylus range and accessories.



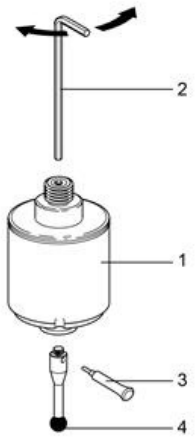
1	TP2 - 5-way probe
2	1.5 mm AF Allen key to adjust trigger force
3	S7 stylus tightening tool
4	Stylus (not supplied)

TP6 touch-trigger probe

The TP6 touch-trigger probe illustrated below combines the accuracy, flexibility and M8 mounting thread of the TP2-5-way probe with the rugged construction and generous overtravel of the TP1(S).

The larger diameter of the TP6 (25 mm) allows the probe to carry longer and heavier styli configurations than the TP2-5-way, allowing it to be used successfully on both universal DCC and manual CMMs.

It incorporates an M3 stylus mount which allows compatibility with Renishaw's extensive M3 and M2 stylus and accessory range using the appropriate stylus adaptor where necessary.

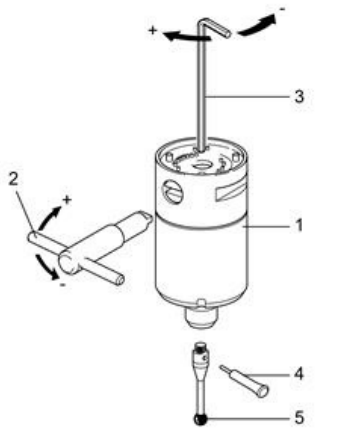


1	TP6 probe
2	1.5 mm AF Allen key to adjust trigger force
3	S7 stylus tightening tool
4	Stylus (not supplied)

TP6A touch-trigger probe

The TP6A touch-trigger probe has all the features of the TP6 with the added benefit of the Renishaw autojoint. This is a highly repeatable kinematic joint which allows rapid probe exchange without the need to requalify the probe tip. It can be operated either manually, using an S10 autojoint key, or automatically, using the autochange rack system.

This probe can be used successfully on both universal DCC and manual CMMs. It incorporates an M3 stylus mount which offers compatibility with all Renishaw's extensive M3 and M2 stylus and accessory range.



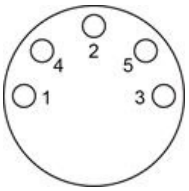
1	TP6A probe
2	S10 autojoint key
3	1.5 mm AF Allen key to adjust trigger force
4	S7 stylus tightening tool
5	Stylus (not supplied)

Installation

Electrical installation

TP1(S)

The 5-pin DIN socket on the TP1(S) probe provides the connections (shown below) to the probe interface.



Pin	Function
1	LED cathode
2	Screen
3	LED anode
4	Probe circuit
5	Probe circuit

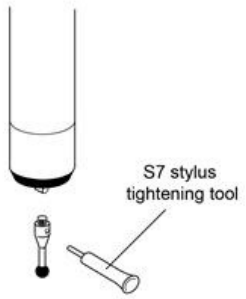
TP2 and TP6

Connections to the probe interface are made through the M8 mounting joint.

TP6A

Connections to the probe interface are made through the autojoint.

Fitting a stylus



To fit a stylus to a Renishaw touch-trigger probe, insert the correct threaded stylus or stylus adaptor into the stylus mount and tighten the stylus securely using the S7 stylus tool provided. Tightening the stylus by any means other than the stylus tool provided (e.g. spanners, drill bits, etc.) may cause internal damage to the probe mechanism.

NOTE: All stylus joints should be clean and free from dirt or debris.

Applications guide

Stylus selection

In the majority of probing applications, to maximise accuracy we recommend that you:

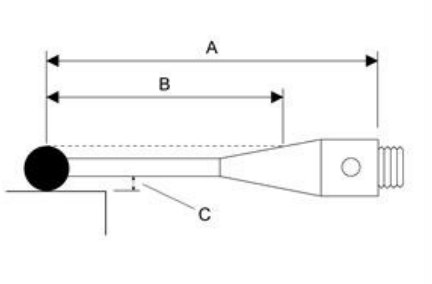
- Keep styli short and stiff

The more the stylus bends or deflects, the lower the accuracy. Probing with the minimum stylus length for your application is recommended and where possible the use of one piece styli is suggested. Probing with excessive styli / extension combinations should therefore be avoided.

- Keep the stylus ball as large as possible

This will ensure maximum ball / stem clearance whilst providing a greater yet rigid effective working length (EWL). Using larger ruby balls also reduces the effect of surface finish of the component being inspected.

EWL is the penetration that can be achieved by any ruby ball before its stem fouls against the feature. Generally, the larger the ball diameter, the greater the EWL (see figure below).



A	Overall working length
B	EWL
C	Ball / stem clearance

EWL can also be affected by assembly tolerances. For this reason, Renishaw styli are assembled to exacting standards in controlled conditions.

Trigger force

Trigger force is the amount of pressure applied by the helical compression spring onto the pivotal plate and bearing points to hold the stylus mount in place.

The trigger force is preset by Renishaw but can be altered for any of the following reasons:

- to permit the use of longer styli on the probe
- to permit the use of heavier styli on the probe
- if the preset trigger force has decreased due to probe use
- if the acceleration of the CMM is causing illegal triggers

NOTE: Changing the probe trigger force will affect the probe's measurement performance. It is important to requalify the probe configuration and check the measurement performance of the probe system after any adjustment has been made to the trigger force.

All Renishaw's touch-trigger probes have an optimum trigger force setting for general purpose applications as detailed in the table below.

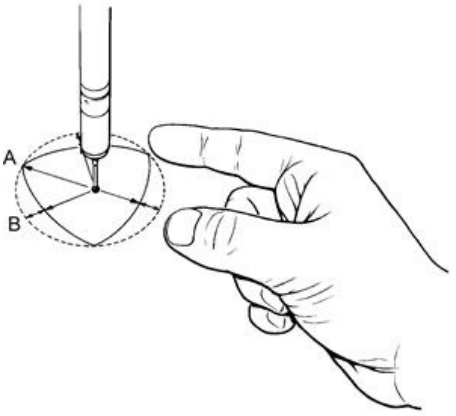
Trigger force:

CMM probes	Stylus length (typical)	Optimum trigger force (preset by Renishaw)	Trigger force range
TP1(S)	31 mm (PS1-1R)	0.15 N	0.1 N - 0.5 N
TP2-5 way	10 mm (PS12R)	0.07 N - 0.08 N	0.07 N - 0.15 N
TP6 / TP6A	21 mm (PS1-12R)	0.11 N - 0.13 N	0.11 N - 0.3 N

Checking trigger force with the Renishaw gram gauge

1. Ensure that the probe is held firmly in position (preferably on a CMM) and connected to an interface to detect a probe trigger.

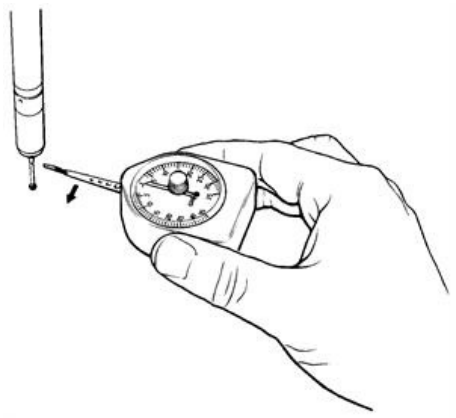
2. Establish the direction of trigger which gives the minimum resistance. The most practical way of doing this is to gently deflect the stylus with a finger, trying different directions. There are three lobes which produce three maximum and three minimum force directions. These can easily be found with a minimum of practice.



3. Set the gram gauge maximum force indicator to the zero point and place the gram gauge flat on the CMM table. Move the stylus tip to the same height above the surface as the gram gauge lever.

4. Slide the gram gauge slowly sideways so that the flat point on the end of the lever touches the probe stylus ball (ensuring that the probe is deflected in the low force direction). Very slowly continue to move the gram gauge until the probe triggers, at which point stop immediately, back off the gauge and read the maximum force indicator.

5. Repeat this procedure three or four times to ensure consistent results.



NOTE: To convert gf to Newtons the following formula is required:
Newtons = gf / 100

Trigger force adjustment - TP1(S)

The trigger force of a TP1(S) probe is preset by Renishaw at an optimal performance setting, but can be altered if necessary as follows:

1. Remove the probe from the quill of your CMM.
2. Insert a 2.5 mm AF Allen key (supplied with every probe) into the centre of the shank until you locate a grub screw.
3. Adjust this grub screw to alter the trigger force of the probe:

- Clockwise increases the trigger force
- Anticlockwise decreases the trigger force

Trigger force adjustment - TP2 and TP6

The trigger force of TP2 and TP6 probes is preset by Renishaw at an optimal performance setting, but can be altered if necessary as follows:

1. Remove the probe from the probe head on the quill of your CMM.
2. Insert a 1.5 mm AF Allen key (supplied with every probe) into the hole in the centre of the M8 thread until you locate a grub screw.
3. Adjust this grub screw to alter the trigger force of the probe:

- Clockwise increases the trigger force
- Anticlockwise decreases the trigger force

Trigger force adjustment - TP6A

The trigger force of a TP6A probe is preset by Renishaw at an optimal performance setting, but can be altered if necessary as follows:

1. Remove the probe from the probe head on the quill of your CMM.
2. Ensure that the cam of the autojoint is in the unlocked position.
3. Insert a 1.5 mm AF Allen key (supplied with every probe) through the cam towards the centre of the TP6A until you locate a grub screw.
4. Adjust this grub screw to alter the trigger force of the probe:

- Clockwise increases the trigger force
- Anticlockwise decreases the trigger force

Manual probe heads product overview

Renishaw manual probe heads detailed in this user's guide are designed to suit any CMM and this specifically covers:

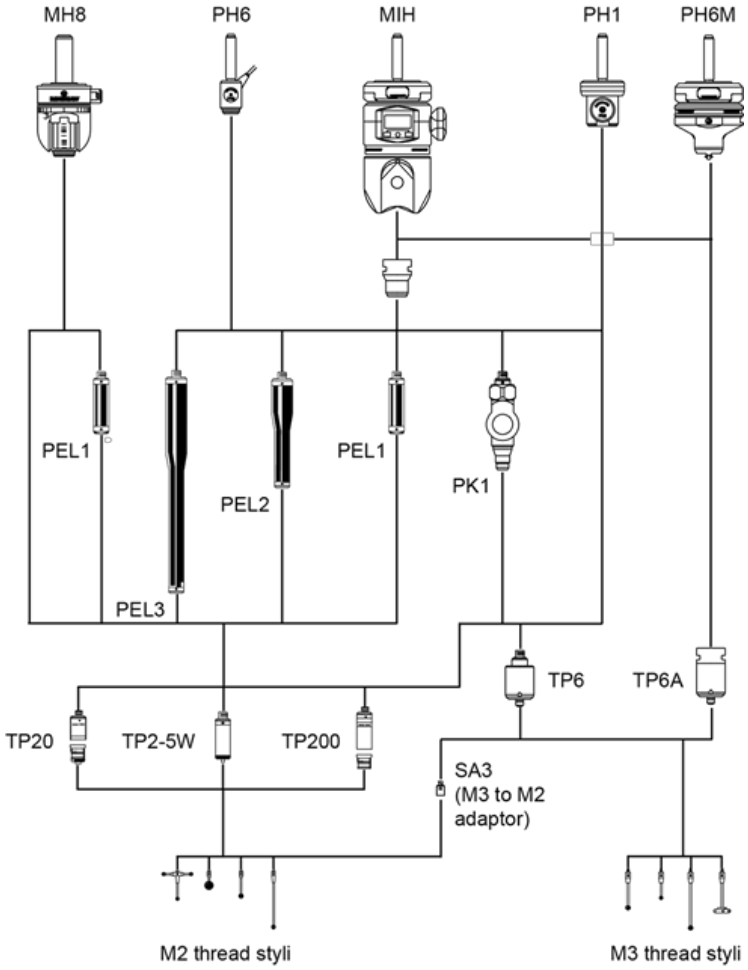
- PH1
- PH6
- PH6M

Each is designed for a specific application and purpose. The figure below explains the product interconnections and both include the MH8 and MIH for completeness.

Probe head / touch-trigger probe compatibility:

Probe head	Number of probes carried	Orientation - A-axis	Orientation - B-axis	Orientation - Repeatable	Probe joint
PH1	1	✓	✓	✗	M8 bush
PH6	1	✗	✗	✗	M8 bush
PH6M	1	✗	✗	✓	Autojoint
MIH	1	✓	✓	✓	Autojoint
MH8	1	✓	✓	✓	M8 bush

Touch-trigger probe systems - TP1, TP2, TP6, TP6A, PH1, PH6, PH6M



* This probe head can only connect one electronic probe (e.g. TP200).

Manual probe heads description and operation

Renishaw manual probe heads provide the mechanical and electrical connections required when using the majority of Renishaw touch-trigger probes on a co-ordinate measuring machine (CMM).

Installed within the quill of the CMM via the shank supplied, a manual probe head permits a CMM touch-trigger probe to be held rigidly in position. It also allows a touch-trigger probe to be connected to a Renishaw probe extension bar and probe knuckle joint for improved probe orientation and component penetration (where indicated).

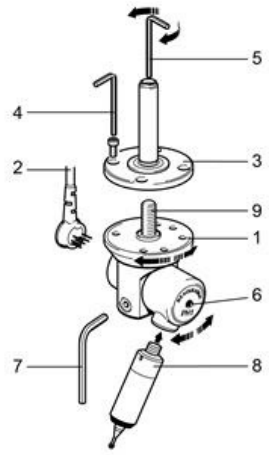
PH1 manual probe head

The PH1 is a general purpose, swivel-type probe head. Its compact design makes it ideally suited to a CMM where manual orientation of a Renishaw M8 touch-trigger probe is required.

The PH1 provides two axes of movement. The A-axis allows probe orientation in the vertical plane; the B-axis allows rotational probe orientation. Axis rotation is in relation to the shank mount.

The PH1 manual probe head incorporates the following primary components and is supplied with the following tools:

- PH1 probe head [1]
- Probe cable (to probe interface) [2]
- Shank [3]
- 2.5 mm AF Allen key [4] (for tightening the shank socket screws)
- 2 mm AF Allen key [5] (for adjusting the B-axis locking force)
- Probe status LED [6]
- 3 mm AF Allen key [7] (for adjusting the A-axis orientation)



1	PH1 probe head
2	Probe cable (not supplied)
3	Shank
4	2.5 mm AF Allen key
5	2 mm AF Allen key
6	Probe status LED
7	3 mm AF Allen key
8	TP2 5-way touch-trigger probe (not supplied)
9	B-axis force adjustment screw

The A-axis may be swivelled through ±115° and locked in position using the 3 mm AF Allen key [7] supplied. For instructions on how to move and lock the A-axis, see 'Moving and locking the A-axis'.

The B-axis is indexable, in 15° steps, through 360°. For instructions on how to move and lock the B-axis, see 'Moving and locking the B-axis'.

Connection of the PH1 to the CMM is via the probe cable [2] and an appropriate probe interface (not supplied).

The status of the probe is indicated by the probe status LED [6]. This is normally lit when the probe is ready for use and extinguishes as the probe triggers.

Technical data - PH1

Number of sockets	One
Style of probe joint	M8 bush
Probe status indication	One LED located on the A-axis swivel
Cable connection	Renishaw standard 5-pin DIN 180 socket
Overtravel break load	Adjustable from 0.02 kgf (0.44 lbf) to locked solid
A-axis indexing	±115°
B-axis indexing	15° steps through 360°
Weight (excluding shank)	125 g (0.28 lb)

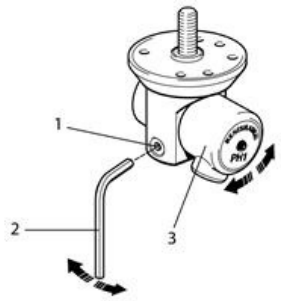
Installing and connecting the PH1

For instructions on how to install and connect the PH1, see “Installing a manual probe head”.

Moving and locking the A-axis

The A-axis may be swivelled through ±115° and locked in any position, as described below:

1. Insert the 3 mm AF Allen key [2] (supplied) into the Allen cap-head screw [1] located within the B-axis body.
2. Rotate the Allen key [2] in the counter-clockwise direction to release the holding pressure on the A-axis [3].
3. Swivel the A-axis [3] into the required position.
4. Hold the A-axis [3] in this position, and reassert the holding pressure on the A-axis by rotating the Allen key [2] in the clockwise direction.



1	Cap-head screw
2	3 mm AF Allen key
3	A-axis

Moving and locking the B-axis

The B-axis locking force of the PH1 can be adjusted so that no B-axis rotation is possible. If the PH1 will not index by hand, the locking force must be decreased.

To decrease the locking force, see 'Locking the B-axis'.

Moving the B-axis

The B-axis of the PH1 can be indexed in 15° increments throughout the 360° axis of rotation. Do this as described below:

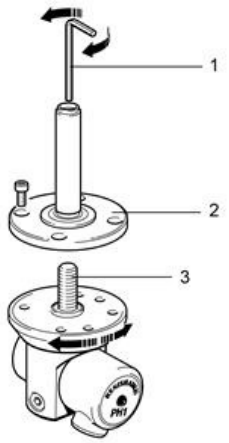
1. Hold the A-axis of the PH1.
2. Rotate the B-axis of the probe to the required step.
3. Release the A-axis.

Locking the B-axis

Adjust the holding force of the B-axis as described below:

1. With the PH1 removed from the quill of the CMM, insert the 2.5 mm AF Allen key [1] into the centre of the shank [2] until it locates the head of the B-axis force adjustment screw [3].
2. Adjust the B-axis force adjustment screw [3] as follows:

- Rotate clockwise to increase the holding force
- Rotate counter-clockwise to decrease the holding force



1	2.5 mm AF Allen key
2	Shank
3	B-axis force adjustment screw

PH6 manual probe head

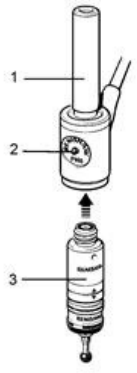
The PH6 is a compact, vertically mounted probe head that is ideally suited to a manual CMM where a single probe is required. It can be used with TP2, TP6, and TP20 touch-trigger probes.

The PH6 incorporates the following primary components:

- PH6 probe head / shank assembly with integral cable [1]
- Probe status LED [2]

The status of the probe is indicated by the probe status LED [2] that is located within the body of the probe head. During normal operation, the LED indicates the probe status as follows:

- LED illuminated: Probe is seated and is ready for use
- LED extinguished: Probe has triggered / no probe is fitted



1	PH6 probe head, shank and integral cable
2	Probe status LED
3	Touch-trigger probe (not supplied)

Technical data - PH6

Number of sockets	One
Style of probe joint	M8 bush
Probe status indication	One LED
Cable connection	Dedicated integral cable
Weight (excluding shank)	48g (0.11 lb)

Installing and connecting the PH6

For instructions on how to install and connect the PH6, see 'Installing a manual probe head'.

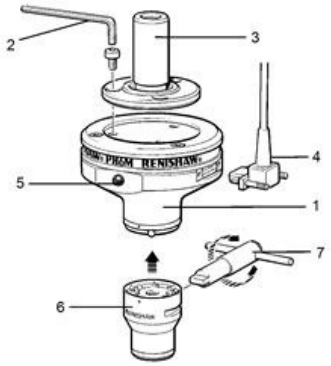
The PH6 is fitted with an integral cable, connector, and shank. These cannot be changed.

PH6M manual probe head

The PH6M is a fixed probe head that incorporates the Renishaw autojoint [6]. It has the ability to convey complex probe signals via its 15-way micro 'D' connector, thus permitting the use of the Renishaw TP7 high accuracy touch-trigger probe and OPT6M optical touch-trigger probe.

The PH6M incorporates the following primary components and is supplied with the following tools:

- PH6M probe head [1]
- 2.5 mm AF Allen key [2] (for tightening shank socket screws)
- Shank [3]
- Probe status LED [5]
- Autojoint adaptor [6]
- S10 joint key [7]



1	PH6M probe head
2	2.5 mm AF allen key
3	Shank
4	Multiwired probe cable (not supplied)
5	Probe status LED
6	Autojoint adapter (not supplied)
7	S10 joint key

The probe head can be used with all Renishaw standard CMM touch-trigger probes and accessories. It can also be used with the PAA adaptor and M8 extension bars.

Locking and unlocking the autojoint is performed either manually using the S10 joint key [7] supplied, or automatically using the Renishaw autochange system. This allows probes to be changed without the need to requalify.

The status of the probe is indicated by the probe status LED [5]. This is normally lit when the probe is ready for use and extinguishes as the probe triggers.

Technical data - PH6M

Number of sockets	One
Style of probe joint	Multiwired autojoint
Probe status indication	One LED
Cable connection	15-way micro D' connector
Autojoint repeatability (2σ)	1 µm (0.00004 in) using a TP6A touch-trigger probe and 21 mm stylus
Weight	160 g (0.36 lb)

Installing and connecting the PH6M

For instructions on how to install and connect the PH6M, see 'Installing a manual probe head'.

The PH6M is fitted with an integral 15-pin micro 'D' socket. If required, this socket can be adapted by using a suitable cable to which a 5-pin DIN socket has been fitted.

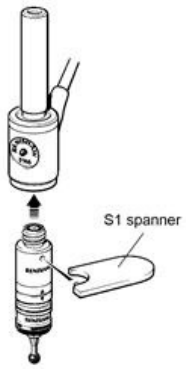
Installing a manual probe head

Fitting an M8-threaded CMM touch-trigger probe to a manual probe head

Fit an M8-threaded non-autojointed CMM touch-trigger probe to a manual probe head as described below:

1. By hand, screw the threaded end of the touch-trigger probe into the M8 bush of the manual probe head and hand-tighten to secure.
2. Fit the S1 'C' spanner (supplied) to the touch-trigger probe as shown below.
3. Use the spanner to tighten the touch-trigger probe into the M8 bush.

The S1 'C' spanner is designed to break before any damage can occur to either the probe or the probe head due to over-tightening the probe.
Do not use any other tool to tighten the probe in the probe head as this could result in damage to both the probe and the probe head.



Fitting an autojointed CMM touch-trigger probe to a manual probe head

The repeatability of the Renishaw autojoint ensures that a probe need only be qualified once. The qualification data can then be recalled whenever the probe is re-attached.

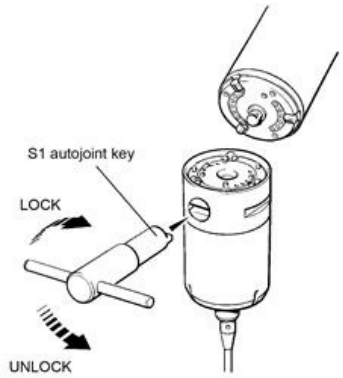
Fit an autojointed CMM touch-trigger probe or PAA series adaptor to a manual probe head as described below:

1. Check that the locking cam on the autojointed probe is in the unlocked position (the slot is horizontal).

2. Offer up the autojointed probe to the PH6M, ensuring that the alignment marks on both the probe and the probe head are correctly aligned.

NOTE: If the TP6A touch-trigger probe is to be used in conjunction with the Renishaw autochange system, the TP6A should be locked to the probe head by rotating the cam fully clockwise and then reversing it by 5°.

3. Insert the S10 joint key into the cam of the autojointed probe and rotate clockwise (120°) to lock the probe to the probe head.

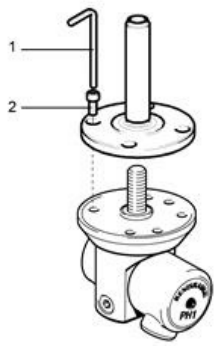


Attaching a shank to a manual probe head (except PH6)

Renishaw products may incorporate either three or four tapped holes to facilitate fitting a shank. Renishaw shanks are supplied with five holes to allow either three-hole or four-hole products to be fitted to them.

Attach a Renishaw shank to a Renishaw manual probe head as described below:

1. Locate the shank on to the top of the probe head.
2. Align the holes within the shank with those within the probe head.
3. Insert an M3 × 6 mm Allen cap screw into each of the three or four tapped holes and hand tighten using the 2.5 mm Allen key supplied.

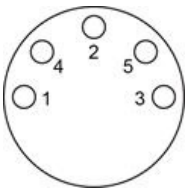


1	2.5 mm AF Allen key
2	M3 × 6 mm Allen cap screw

The pin configuration and outputs are detailed below.

The PH6 has an integral cable and connector. This will conform to the CMM manufacturer's specification. If the connector on the attached cable has a 5-pin DIN connection then, subject to external verification, the cable pin outputs will be as specified below.

The PH6M is fitted with an integral 15-pin micro 'D' socket. If required, this socket can be adapted by using a suitable cable to which a 5-pin DIN socket has been fitted.



Pin	Function	Wire colour
1	LED cathode	Red
2	Screen	Screen
3	LED anode	Yellow
4	Probe circuit	Blue
5	Probe circuit	Green

Connecting a manual probe head electrically to a CMM

All Renishaw manual probe heads (except the PH6 and PH6M) have an integral 5-pin DIN female connector. This connector is compatible with the Renishaw moulded 5-pin plug that is fitted to all Renishaw manual probe head cables.

Maintenance - cleaning

Renishaw manual heads and touch-trigger probes are sealed, maintenance-free products. They may be wiped with a clean, dry, lint-free cloth. The units are not sealed against water.

Accessories

Please contact your Renishaw representative for further information on any of the accessories described in this section or for details of Renishaw's extensive range of innovative products for CMMs, machine tools, digitising, accuracy checking, calibration, scale systems and spectral analysis.

Styli

Renishaw manufacture an extensive range of precision styli and stylus accessories.

The Renishaw stylus range can be used with any probe covered in this guide and offers a variety of ball sizes in industrial ruby from 0.3 mm (0.012 in) to 8 mm (0.31 in) diameter. These are available with steel, tungsten carbide, ceramic and Renishaw graphite fibre (GF) stems to cover a wide range of applications.

Specialist application styli including discs, cylinders, pointers, stars and large ceramic balls - up to 30 mm (1.18 in) diameter - are available.

Renishaw also offer a custom design service if your requirements are not met by our standard range. Please contact your Renishaw representative for details.

For further information on the Renishaw stylus range, please refer to the ‘Styli and accessories technical specifications' (Renishaw part number H-1000-3200).

Troubleshooting

If you experience problems which you are unable to identify or solve satisfactorily, please contact your Renishaw representative for further advice or contact the Technical Support Department at any Renishaw office for free assistance by telephone (see address list on rear cover).

Poor measurement performance:

Possible cause	Solution
Probe or probe extension bar not installed correctly.	Remove probe and / or probe extension bar and re-fit using the S1 spanner.
Stylus configuration too long or not rigid.	Use shorter / stiffer stylus configuration.
Poor stylus assembly.	Ensure that the number of stylus joints is kept to a minimum and all joints are clean and secure.
Contaminated / damaged stylus ball.	Inspect for damage, clean thoroughly with solvent.
Trigger force too high.	Decrease trigger force to the minimum necessary to ensure reliable triggering.
Too few points taken for probe qualification / measurement.	Take a larger number of points on the qualification / feature measurement.

Unwanted triggers during CMM movement:

Possible cause	Solution
Trigger force set too low.	Increase trigger force to the minimum necessary to ensure reliable triggering.
Stylus configuration too heavy.	Reduce mass of stylus configuration. Reduce stylus length to minimum possible. Use a lightweight material for stylus configuration (GF or ceramic).

No probe signal:

Possible cause	Solution
Probe not installed correctly.	Remove probe and re-fit using the S1 spanner.
Probe extension bar failure.	Check connections and integrity of probe extension bar. Contact your CMM supplier or Renishaw representative for further assistance.
Probe failure.	Contact your CMM supplier or Renishaw representative for further assistance.

Probe fails to re-arm after trigger:

Possible cause	Solution
Trigger force set too low.	Increase trigger force to the minimum necessary to ensure reliable triggering.
Stylus configuration too heavy.	Reduce mass of stylus configuration. Reduce stylus length to minimum possible. Use a lightweight material for stylus configuration (GF or ceramic).
Probe reseat failure.	Retrigger probe. Many DCC CMMs will attempt to do this automatically (refer to your CMM supplier for details). If this problem persists, please return the probe to your Renishaw representative for service.

Technical product specifications

	TP1(S)	TP2-5 way	TP6 / TP6A
Sense directions	X, Y, +Z	X, Y, +Z	X, Y, +Z
Uni-directional repeatability (max 2σ at stylus tip)	0.5 µm (0.00002 in)	0.35 µm (0.000014 in)	0.35 µm (0.000014 in)
Pre-travel variation over 360° (XY plane)	±2 µm (±0.00008 in)	±0.8 µm (±0.000032 in)	±0.6 µm (±0.000024 in)
Trigger force range (adjustable)	10 g - 50 g (0.35 oz - 1.76 oz)	7 g - 15 g (0.25 oz - 0.53 oz)	11 g - 30 g (0.39 oz - 1.06 oz)
Trigger force (set by Renishaw)	15 g (0.53 oz)	7 g - 8 g (0.25 oz - 0.28 oz)	11 g - 13 g (0.39 oz - 0.46 oz)
Stylus overtravel: XY axis	±19.5°	±14°	±22°
Stylus overtravel: +Z axis	8.5 mm (0.33 in) @ 10 g (0.35 oz) trigger force	4 mm (0.16 in) @ 7 g (0.25 oz) trigger force	5.5 mm (0.22 in) @ 11 g (0.39 oz) trigger force
Stylus overtravel: -Z axis	n/a	n/a	n/a
Test conditions: Trigger force	15 g (0.53 oz)	7 g - 8 g (0.25 oz - 0.28 oz)	11 g - 13 g (0.39 oz - 0.46 oz)
Test conditions: Trigger speed	8 mm (0.32 in) / sec	8 mm (0.32 in) / sec	8 mm (0.32 in) / sec
Test conditions: Stylus used	PS1-1R	PS12R	PS1-12R
Test conditions: Stylus length	31 mm (1.22 in)	10 mm (0.39 in)	21 mm (0.83 in)

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