RENISHAW
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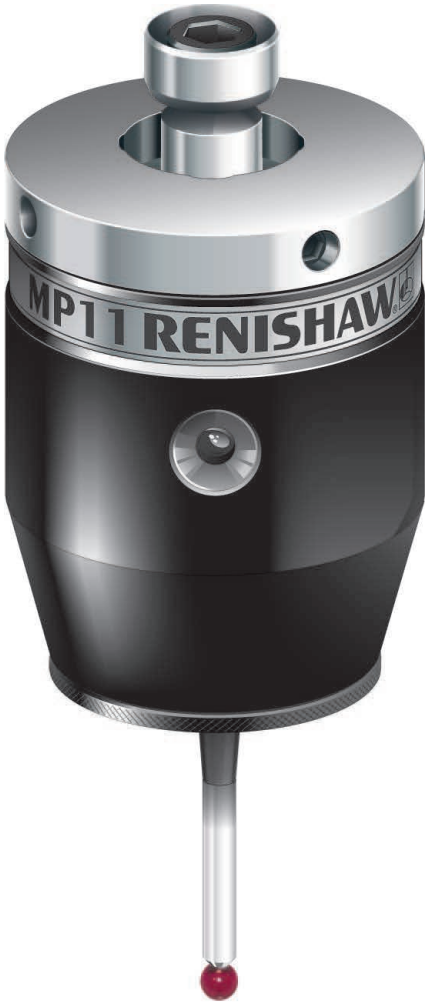
MP11 probe



Compliance information for this product is available by scanning the QR code or visiting **www.renishaw.com/mtpdoc**

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Contents

Before you begin

Warranty

Unless you and Renishaw have agreed and signed a separate written agreement, the equipment and/or software are sold subject to the Renishaw Standard Terms and Conditions supplied with such equipment and/or software, or available on request from your local Renishaw office.

Renishaw warrants its equipment and software for a limited period (as set out in the Standard Terms and Conditions), provided that they are installed and used exactly as defined in associated Renishaw documentation. You should consult these Standard Terms and Conditions to find out the full details of your warranty.

Equipment and/or software purchased by you from a third-party supplier is subject to separate terms and conditions supplied with such equipment and/or software. You should contact your third-party supplier for details.

CNC machines

CNC machine tools must always be operated by fully-trained personnel in accordance with the manufacturer's instructions.

Care of the probe

Keep system components clean and treat the probe as a precision tool.

Patents

None applicable.

Intended use

MP11 is a cabled spindle probe for workpiece inspection and job set-up on CNC milling machines with a manual tool change.

Safety

Information to the user

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

The MP11 must be installed by a competent person, observing relevant safety precautions. Before starting work, ensure that the machine tool is in a safe condition with the power switched OFF.

Refer to the machine supplier's operating instructions.

Information to the machine supplier / installer

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 literature, and to ensure that adequate guards and safety interlocks are provided.

If the probe system fails, the output signal may falsely indicate a probe seated condition. Do not rely on probe signals to halt the movement of the machine.

Information to the equipment installer

All Renishaw equipment is designed to comply with the relevant UK, EU and FCC regulatory requirements. It is the responsibility of the equipment installer to ensure that the following guidelines are adhered to, in order for the product to function in accordance with these regulations:

- any interface MUST be installed in a position away from any potential sources of electrical noise (for example, power transformers, servo drives);
- all 0 V/ground connections should be connected to the machine "star point" (the "star point" is a single point return for all equipment ground and screen cables). This is very important and failure to adhere to this can cause a potential difference between grounds;
- all screens must be connected as outlined in the user instructions;
- cables must not be routed alongside high current sources (for example, motor power supply cables), or be near high-speed data lines;
- cable lengths should always be kept to a minimum.

Equipment operation

If this equipment is used in a manner not specified by the manufacturer, the protection provided by the equipment may be impaired.

MP11 basics

System operation

The probe storage area must be clean and provide complete protection against all forms of dirt, oil and coolant contamination.

The probe is in effect another tool in the system. A workpiece set-up or inspection cycle may be included at any stage in the machining cycle.

When a probing routine is required, the operator first inserts the probe in the machine spindle, and then plugs the power cable into the probe body.

NOTE: Ensure the probe LED is lit, with the stylus seated before commencing a probe routine.

Probing may now commence. A probe routine is activated by a command from the machine control.

When probing is complete the operator must first disconnect the cable from the probe socket. The free end of the cable should be parked on a remote socket. Finally return the probe to storage.

The probe must be kept clean and handled with care at all times. The probe is sealed for working in normal conditions, but extra care must be taken to avoid chips cutting the front seal and coolant contamination of the plug.

Probe moves

A probe trigger signal is generated when the probe is in the operating mode and the stylus is driven against a surface. The machine control records the probe contact position and commands machine motion to stop.

High probing speeds are desirable, however a probing velocity must be chosen which allows the machine to stop within the limits of stylus overtravel. Follow feed rate guidelines given by supplier.

To ensure a trigger signal is given, drive the probe against the workpiece to a target beyond the expected surface, but within the limits of stylus overtravel.

After the probe stylus touches the surface, reverse clear of the surface.

Probe gauging move should be made at constant speed.

Single and double touch

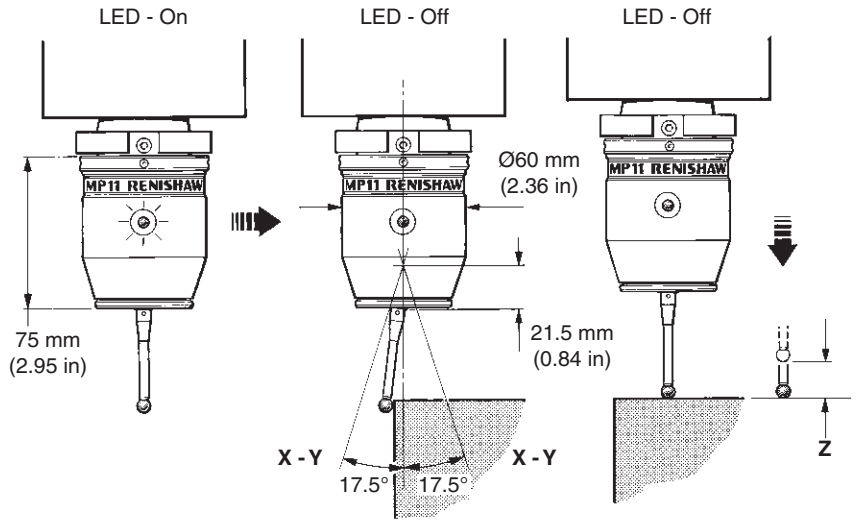
If the probe operating sequence is based on a single touch, then the probe may be returned to its start point, following a gauging move.

With some types of controllers, it is an advantage to use the two touch method. The first move finds the surface quickly. Then the probe is reversed to a position clear of the surface, before making the second touch at a slower feed rate, thereby recording the surface position at a higher resolution.

Gauging speed

Gauging speeds are not limited by the transmission system delay, which has a repeatability of less than 2 µs.

System delays are constant for each direction measurement is taken. These delays are automatically cancelled out and need not be taken into account, provided a datum move is made in the same direction and velocity as each measurement move.



Stylus overtravel limits		
Stylus length	**X - Y**	**Z**
50 mm (1.96 in)	21.5 mm (0.84 in)	8 mm (0.31 in)
100 mm (3.93 in)	36.5 mm (1.43 in)	8 mm (0.31 in)

Software requirements

Verify your software

1. Does your software have calibration routines which compensate for stylus on centre errors?
   If not you must set the probe stylus on centre mechanically.

   NOTE: When using probe styli which are not on spindle centre. Spindle orientation positioning repeatability is important to avoid probe measurement errors.

2. Does your software compensate for probe triggering characteristics in all measuring directions?

Job set-up requirements

1. Does the software automatically adjust the program co-ordinate system to the relevant set-up feature on the component?

Inspection requirements

1. **Simple to use canned cycles for standard features:**
   Bore / Boss.
   Web / Pocket.
   Single surface.
   Simple to use canned cycles for optional features:
   Angle measurement.
   Vector 3 point bore / Boss.
   Vector single surface.

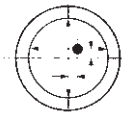
Good software will allow the following functions:

- Update work co-ordinate systems for positioning.
- Report measured sizes and update tool offsets for automatic tool offset compensations.
- Print data in the form of an inspection report to an external PC / printer.
- Set tolerances on features.

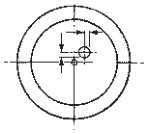
Basic software

Calibration

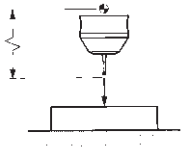
Probe XY offset calibration



Stylus ball radius calibration

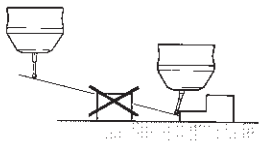


Probe length calibration



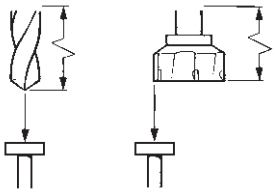
Protection

Probe collision protection



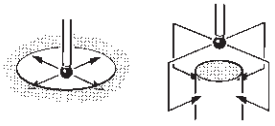
Tool setting probe

Tool length

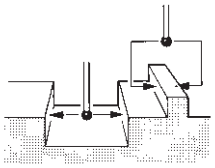


Inspection

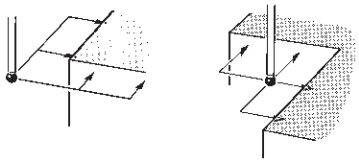
Bore and boss measure



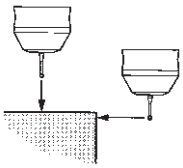
Web and pocket measure



Internal and external corner find



XYZ single surface position



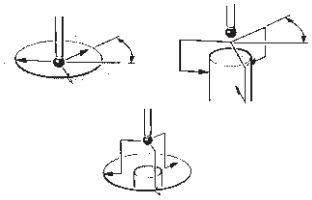
Inspection print-out

COMPONENT No. 1				
OFFSET NO.	NOMINAL DIMENSION	TOLERANCE	DEVIATION FROM NOMINAL	COMMENTS
99	1.5000	.1000	.0105	
97	200.0000	.1000	.2054	OUT OF TOL

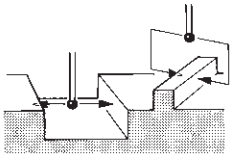
Additional software features

Inspection

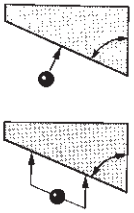
Bore and boss measure (three point)



Angled web and pocket measure

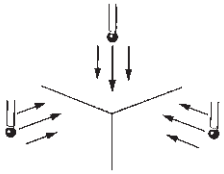


Angled surface measure

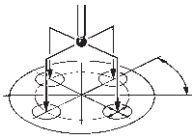


Inspection

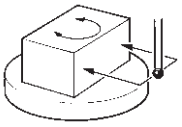
Stock allowance



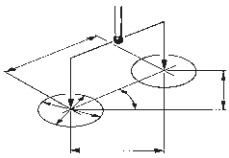
Bore boss on PCD



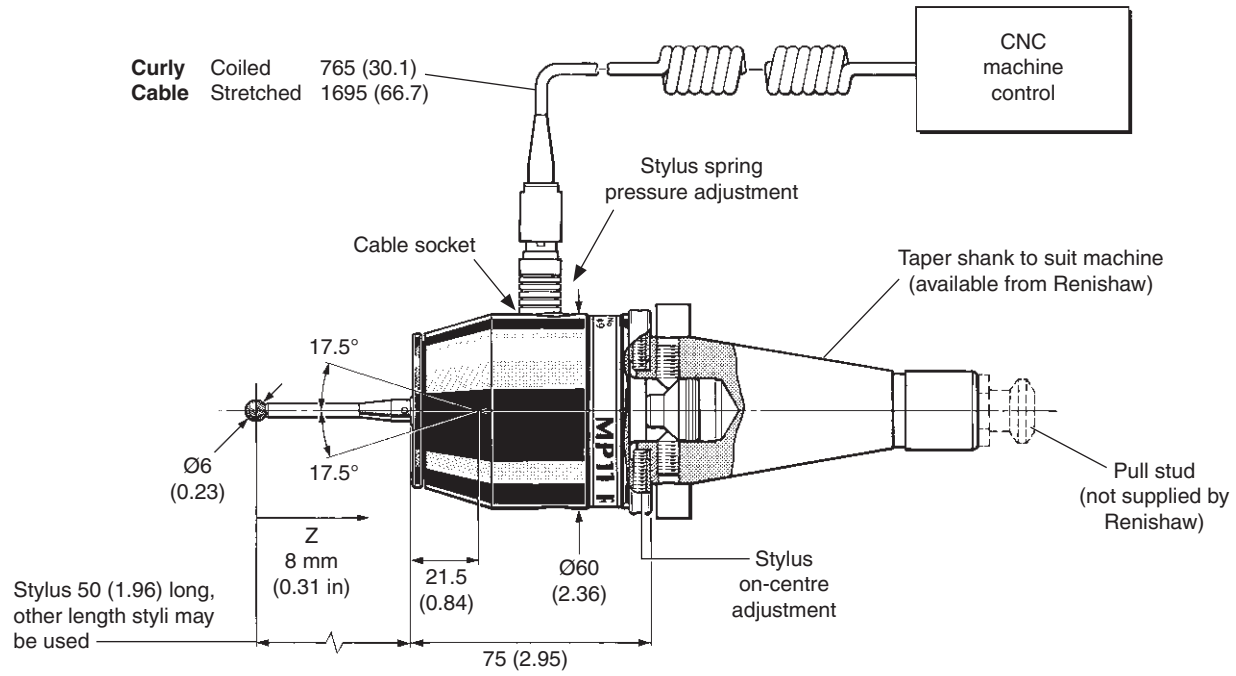
4th Axis XY measure



Feature to feature measure



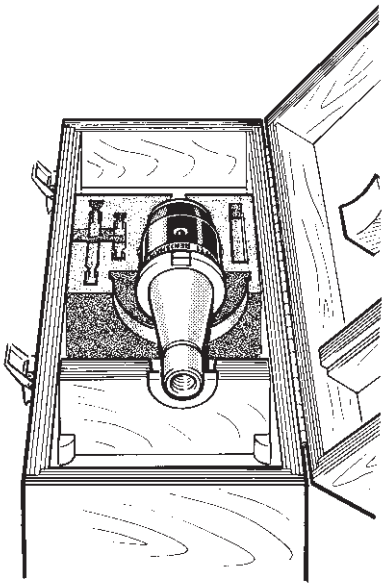
Dimensions



Dimensions mm (in)

Storage

The custom box provides, clean, protected storage, when the probe is not in use.



Specification

Principal application	Workpiece inspection and job set-up on CNC milling machines with manual tool change.	
Transmission type	Hard-wired transmission	
Compatible interfaces	N/A (integrated interface)	
Recommended styli	Ceramic, lengths 50 mm (1.97 in) to 100 mm (3.94 in)	
Weight	540 g (19.05 oz)	
Sense directions	±X, ±Y, +Z	
Unidirectional repeatability	1.00 µm (40 µin) 2σ [1]	
Stylus trigger force [2 3] XY low force XY high force +Z direction	 0.50 N, 51 gf (1.80 ozf) 1.50 N, 153 gf (5.40 ozf) 1.80 N to 7.00 N, 184 gf to 714 gf (6.47 ozf to 25.18 ozf)	
Stylus overtravel	XY plane +Z plane	±17.5° 8 mm (0.31 in)
Environment	IP rating	IP66, BS EN 60529:1992+A2:2013
	Storage temperature	–10 °C to +70 °C (+14 °F to +158 °F)
	Operating temperature	+5 °C to +50 °C (+41 °F to +122 °F)

1 Performance specification is tested at a standard test velocity of 480 mm/min (18.9 in/min) with a 50 mm stylus. Significantly higher velocity is possible depending on application requirements.

2 Trigger force, which is critical in some applications, is the force exerted on the component by the stylus when the probe triggers. The maximum force applied will occur after the trigger point (overtravel). The force value depends on related variables including measuring speed and machine deceleration.

3 These are the factory settings; manual adjustment is possible.

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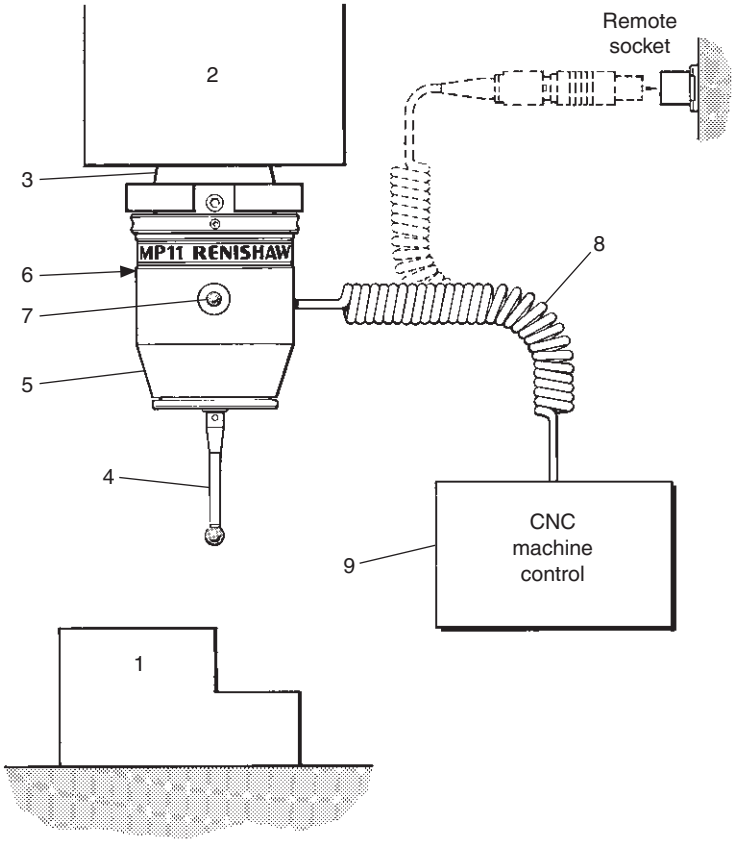
System installation

MP11 probe system



1. Workpiece.
2. Machine spindle.
3. Shank.
   Modified to accept the MP11 probe.
4. Stylus.
5. MP11 probe.
6. Interface.
   An interface contained within the probe body, processes signals between the probe and CNC machine control.
7. LED – light emitting diode.
   The LED is lit when the stylus is seated. The LED is off when the stylus is deflected (probe triggered) or power is off.
8. Cable.
   Signals are transmitted between the probe and CNC machine control via the cable.
9. CNC machine control.

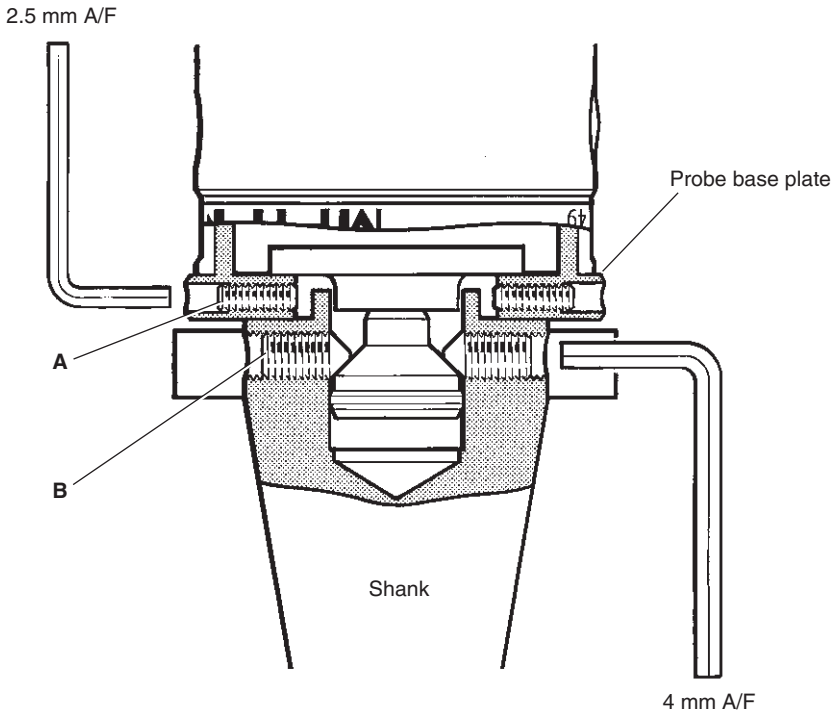
Shank attachment

Stage 1 – attachment

1. Fully slacken screws **A**. Then fit screws **B** to shank, after lightly greasing them.

2. Fit the probe to the shank as shown in the diagram and visually position the probe centrally relative to the shank. Partially tighten screws **B** 2 Nm – 3 Nm (1.5 lbf.ft – 2.2 lbf.ft).

3. Fit the probe/shank assembly into the machine spindle.



Stylus on-centre adjustment

Adjusters incorporated in the shank mounting allow the stylus tip to be set to correspond with the spindle centre line.

Stylus tip position is established using a low force, (less than 0.2 N / 0.45 lbf) dial test indicator or setting gauge.

Stage 2 – adjustment

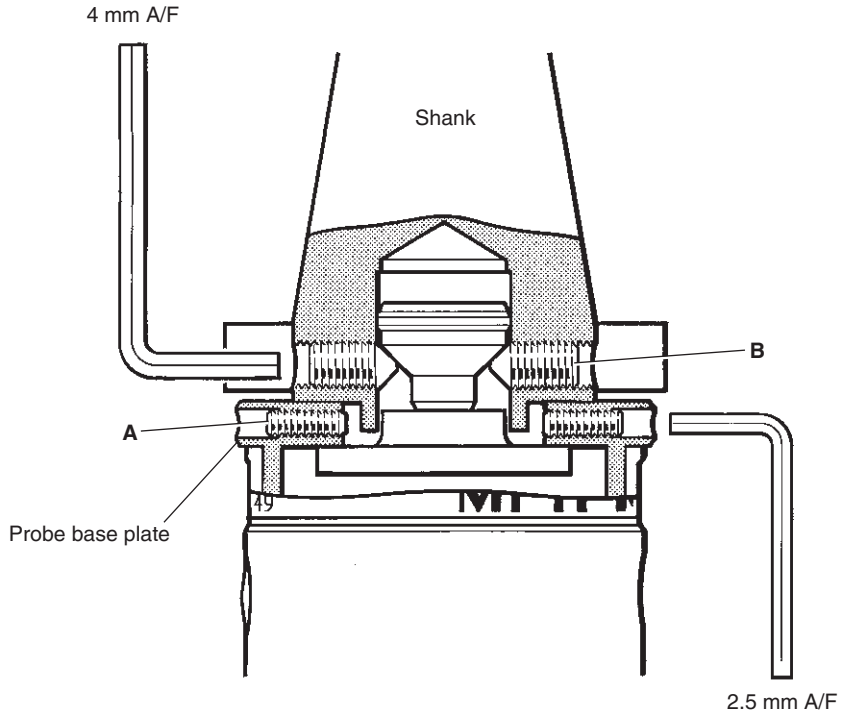
1. Adjust on-centre position using screws **A** indiviually backing them off each time **or** by tapping the probe baseplate with a soft implement.

2. When the stylus tip runout is less than 20 µm, fully tighten screws **B** 6 Nm – 8 Nm (4.4 lbf.ft – 5.9 lbf.ft) and repeat step 1 until desired runout is achieved (5 µm possible).

   If using screws **A**, use them in opposition to move the probe, at the same time progressively tightening them as the final setting is approached. Use two hexagon keys if necessary.

3. It is important that all four screws **A** are tight or tightened 1.5 Nm – 3.5 Nm (1.1 lbf.ft – 2.6 lbf.ft), once the final setting has been achieved.

NOTE: If at any time the unit is accidentlly dropped, it should be checked for on-centre position.



Stylus trigger force adjustment – gauging force

Stylus trigger force is determined by internal spring pressure, which is set by Renishaw. Only adjust spring pressure in special circumstances (for example, when the weight of the stylus is too great for standard pressures).

It is advisable to make adjustments in small increments, and test the results at each stage, until a satisfactory result is obtained.

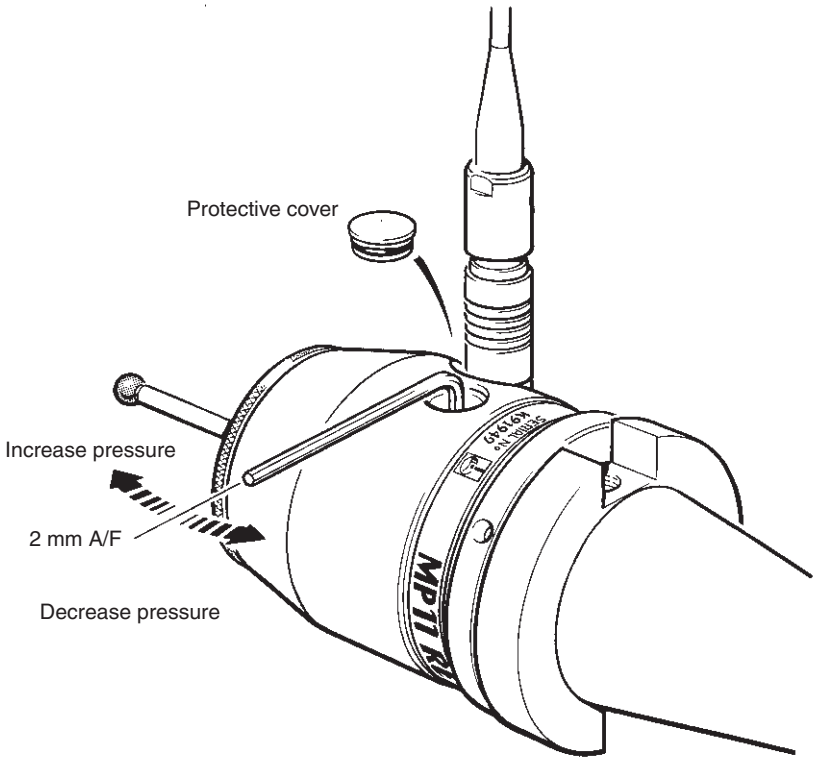
To adjust pressure, remove the protective cap, and insert the 2 mm hexagon key into the adjuster socket.

Turn the key anti-clockwise to reduce spring pressure, this will increase touch sensitivity.

Turn the key clockwise to increase spring pressure.

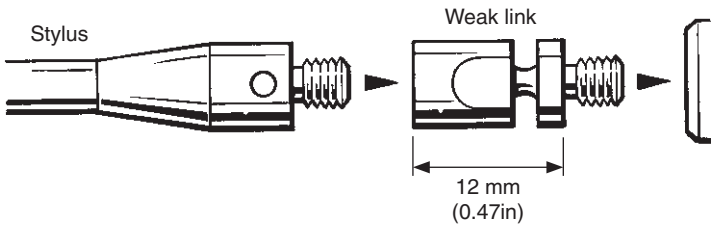
Adjustment is limited in both directions by end stops.

NOTE: Stylus trigger force adjustment and use of styli other than calibration stylus type, may cause probe repeatability to differ from the calibration certificate results.



Weak link for styli with steel shaft – optional

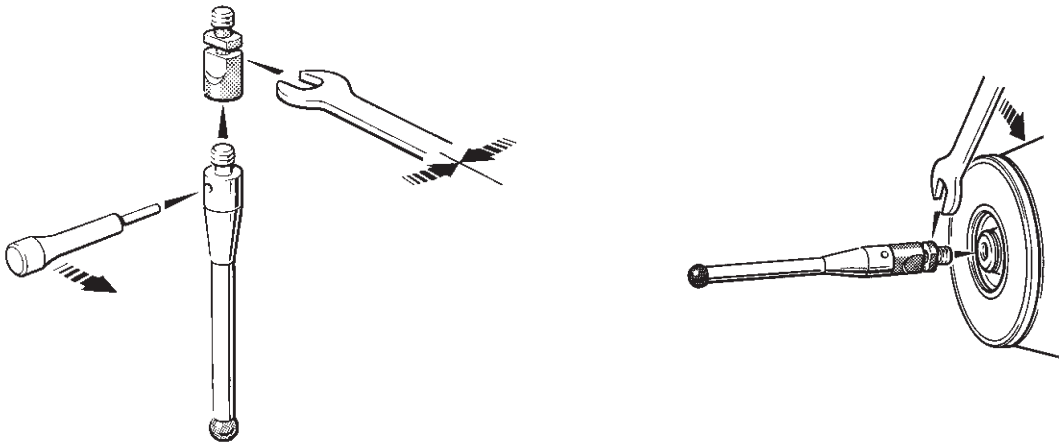
In the event of excessive stylus overtravel the weak link stem, fitted between the probe and stylus is designed to break, thereby protecting the probe from damage.



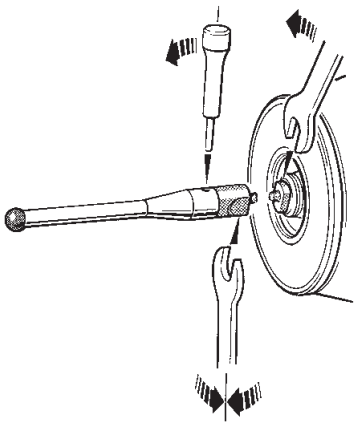
Fitting stylus with weak link onto probe

Take care to avoid stressing the weak link during assembly – see **page 4-4**.

NOTE: The weak link is not used with ceramic shaft styli.



To remove a broken stem



Probe cable

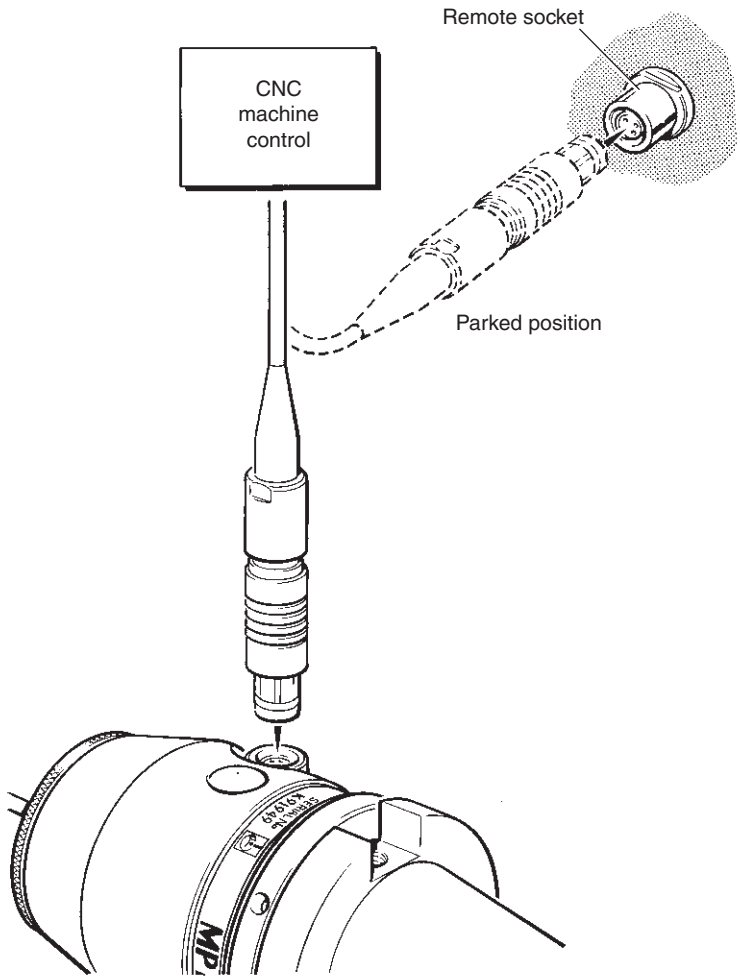
WARNING: The probe must not be spun, when it is mounted in the machine spindle. Flying cable could harm the operator.

The cable conveys probe signals to the CNC machine control, and supplies power for probe operation.

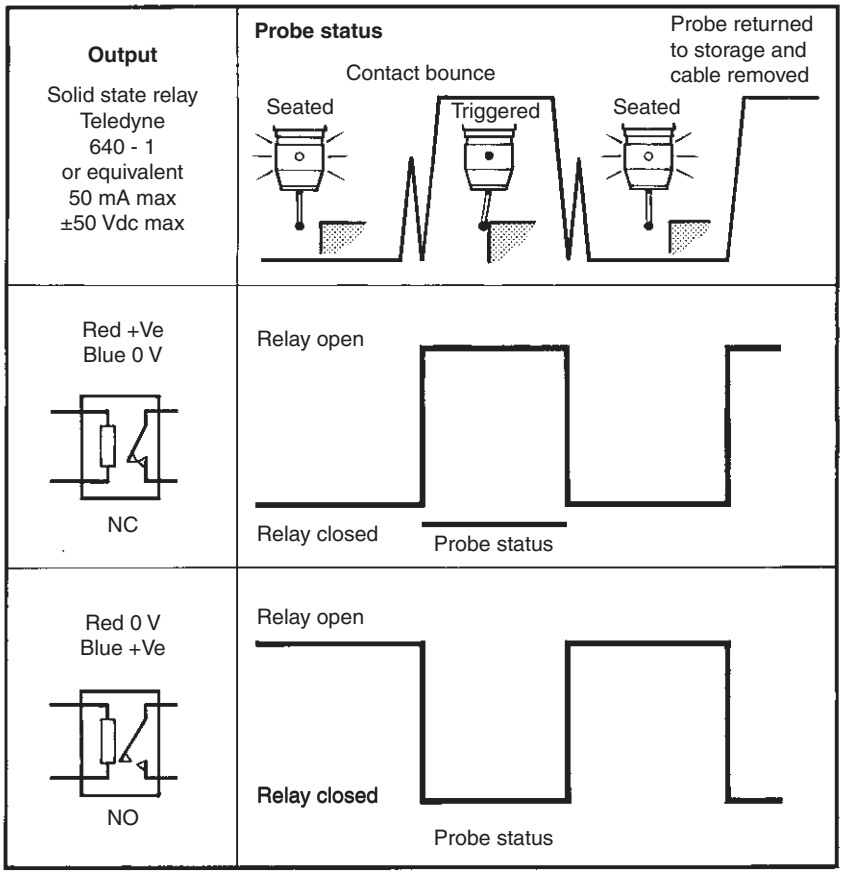
One end of the cable is permanently connected to the CNC machine control. The free end of the cable is manually plugged into the probe, when the probe is mounted in the machine spindle.

When the probe is not in use it is recommended that the free end of the cable is parked in a remote socket in a clean area within the machine.

The remote park socket could then be wired, such that when the cable plug is disconnected from the parked position the machine spindle will not rotate (i.e. it is inhibited). Protect the remote socket with a cover when the plug is removed.



Interface output waveforms



Relay output is inverted by reversing the 0 V and +Ve (red and blue) power supply wires. If remote park socket is installed, see **pages 3-8** and **3-9** for wiring details.

The output signals from the interface must be compatible with the machine control input.

Wiring diagram – relay normally open (NO) contacts

Operator safety

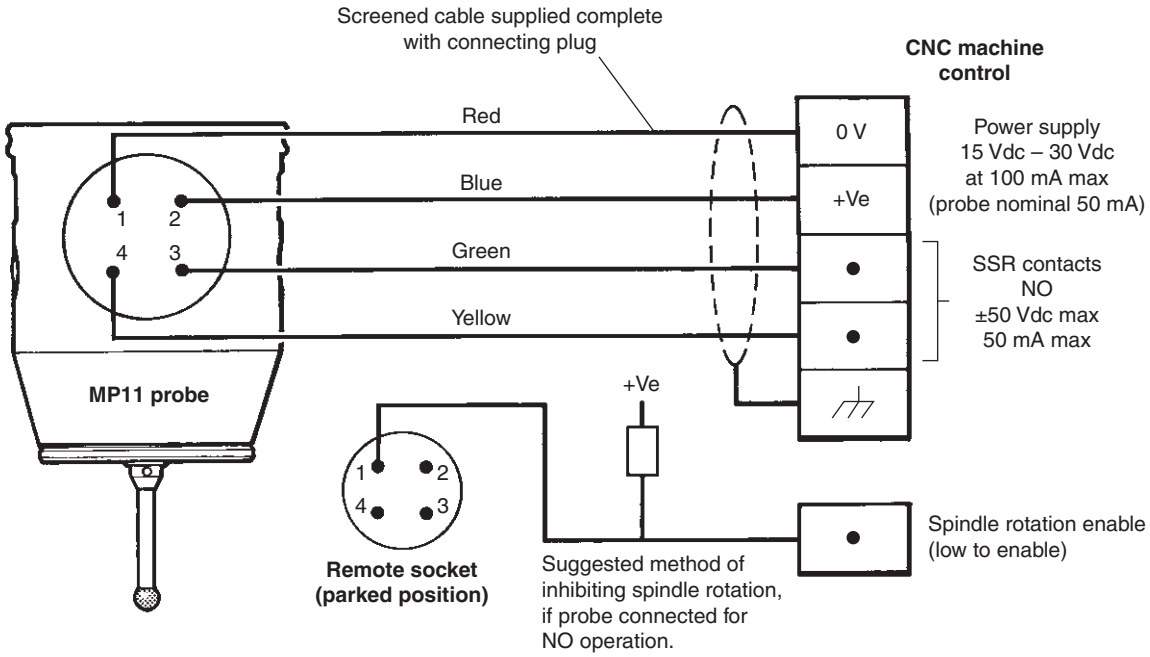
CAUTIONS:

SSR will be permanently damaged if ±50 Vdc is exceeded across socket pins 3 and 4 or the current exceeds 50 mA. (i.e. ensure SSR supply is current limited).

Probe power supply must not exceed 30 Vdc.

Route cable away from high current sources (for example, high current cables, axis drive motors, three phase transformers etc.).

It is recommended that a fail safe SPINDLE ROTATION INHIBIT is built into the system. This is one example, where the probe cable is plugged into a remote socket before spindle rotation is enabled. This prevents spindle rotation when the probe is used.



Wiring diagram – relay normally closed (NC) contacts

Operator safety

CAUTIONS:

SSR will be permanently damaged if ±50 Vdc is exceeded across socket pins 3 and 4 or the current exceeds 50 mA. (i.e. ensure SSR supply is current limited).

Probe power supply must not exceed 30 Vdc.

Route cable away from high current sources (for example, high current cables, axis drive motors, three phase transformers etc.).

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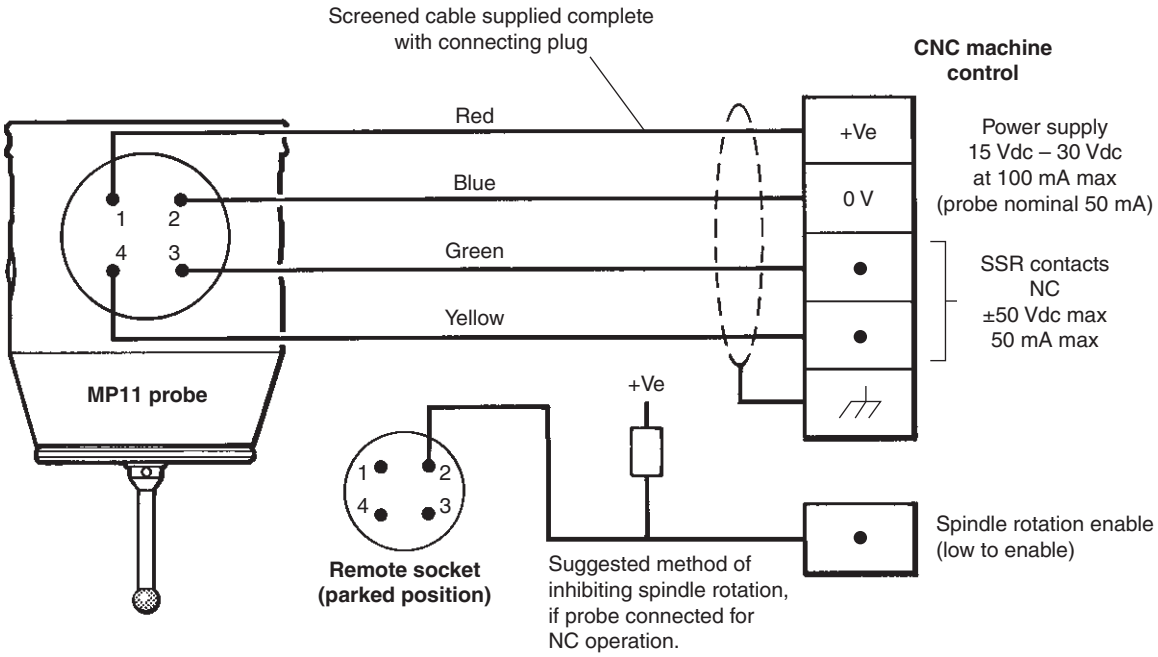

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Maintenance

CAUTIONS:

The probe is a precision tool handle with care.

Ensure the probe is firmly secured in its mounting.

Switch power off when making electrical connections.

Although Renishaw probes require little maintenance, the performance of the probe will be adversely affected if dirt, chips or liquids are allowed to enter the sealed working parts. Therefore keep all components clean and free from grease and oil.

Periodically check cables for signs of damage, corrosion or loose connections.

Probe diaphragm inspection

The probe mechanism is protected by two diaphragms, these provide adequate protection under normal working conditions.

The user should periodically check the outer diaphragm, for signs of damage and coolant leakage. If this is evident replace the outer diaphragm.

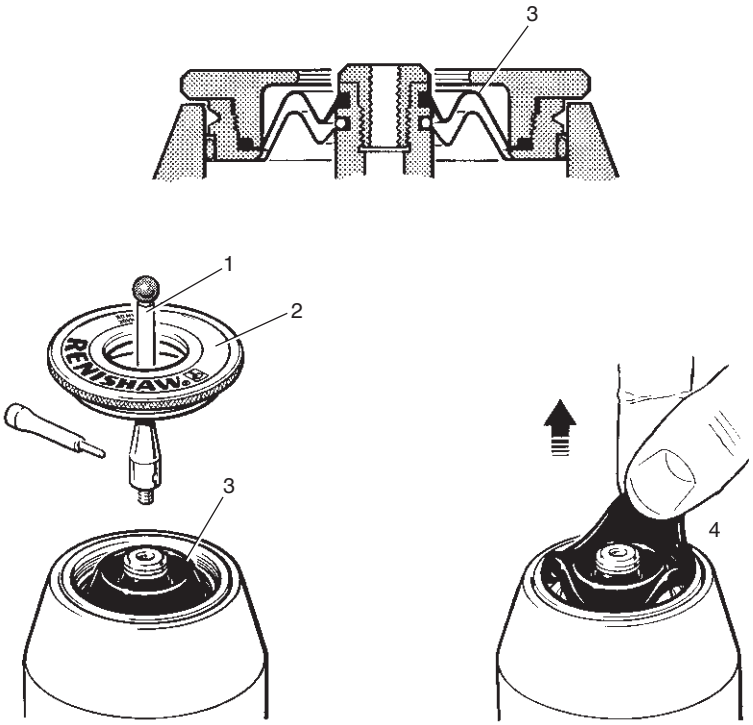
The outer diaphragm is resistant to coolant and oils. However if the outer diaphragm is damaged, the inner diaphragm could become weakened with prolonged immersion in certain coolants and oils.

The user must not remove the inner diaphragm. If damaged, return the probe to your supplier for repair.

Outer diaphragm inspection

WARNING: Never attempt to remove diaphragm with metal objects.

1. Remove the stylus.
2. Unscrew the front cover.
3. Inspect outer diaphragm for damage.
4. To remove outer diaphragm, grip near the middle and pull upwards.



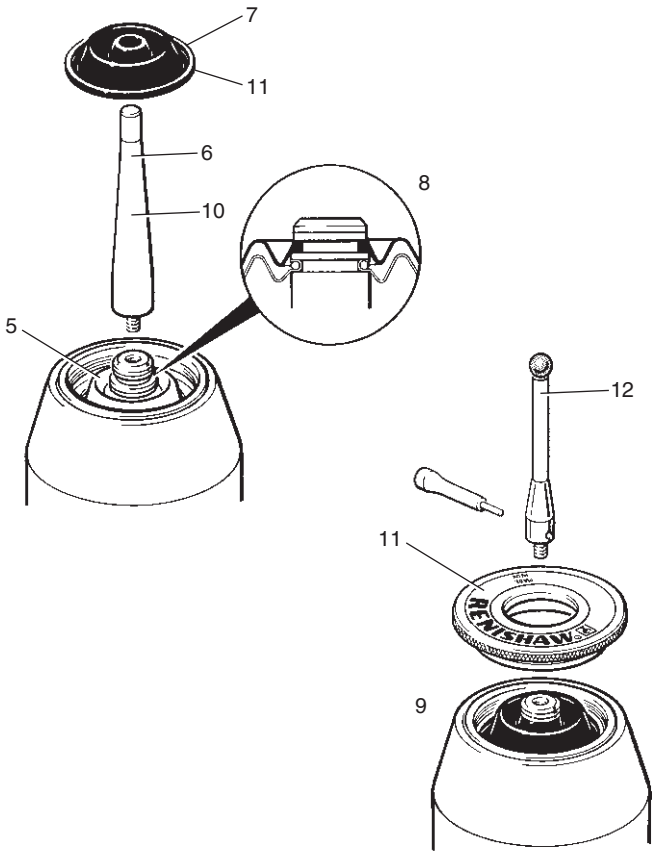
Inner diaphragm inspection

5. Inspect inner diaphragm for damage. If damaged return the probe to your supplier for repair.

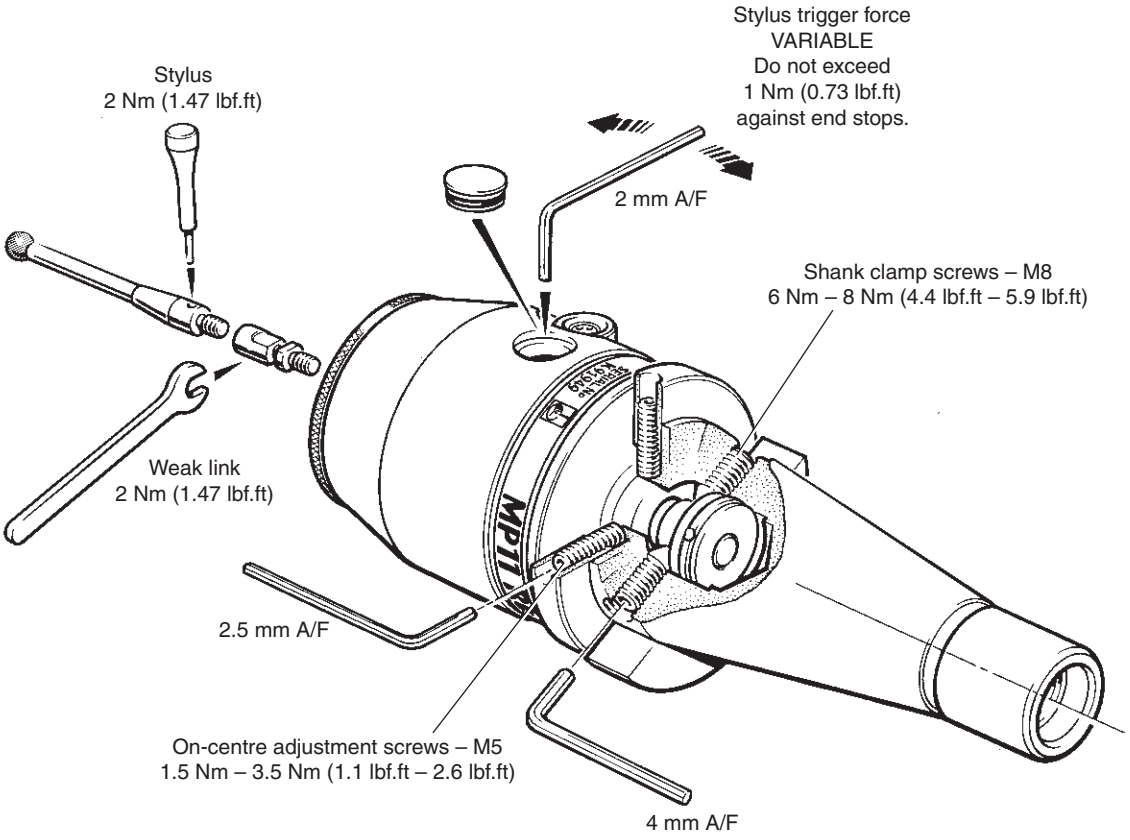
NOTE: Do not remove inner diaphragm.

Outer diaphragm replacement

6. Screw tool fully into stylus holder. Oil surface lightly.
7. Fit new diaphragm.
8. The diaphragm must locate centrally in the stylus holder groove.
9. Press diaphragm to expel trapped air.
10. Remove tool.
11. Lightly smear medium grease on front cover lower surface. Then refit cover and tighten.
12. Refit stylus.



Screw torque values



Fault-finding

Symptom	Cause	Action
Complete failure (no change in output).	LED not on.	Check power supply connections. Check probe seated. Check if plug is inserted correctly into socket. Check continuity of cable.
	LED on and operating.	Check if plug is inserted correctly into socket. Check continuity of cable.
	LED on but inoperative.	No check.
	LED failure (output correct).	No check.
Poor repeatibility.	Loose mounting.	Check all screwed connections for tightness.
	Loose stylus.	Tighten stylus.
	Poor electrical connection.	Check connectors.
	Excessive machine vibration.	Eliminate vibration or increase spring pressure.
Spurious reading.	Electrical noise.	Keep probe cable away from high power electrical cables and machines. Check cable screen continuity. Check for noise on power supply, suppress if present. Loose connections on cable.
	Mechanical noise.	Check and eliminate excess machine vibration. Increase stylus spring pressure.
Poor re-arming (the probe is armed when the stylus is seated, the electrical circuit is complete and readings can be taken).	Stylus spring pressure too low.	Increase stylus spring pressure.
	Diaphragms pierced or damaged.	Inspect outer diaphragm. If inner diaphragm damaged return to your supplier for repair.

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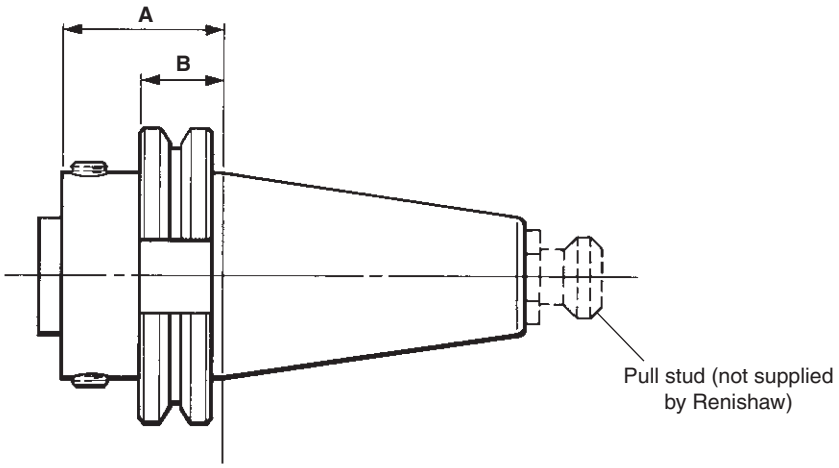
Parts list

Taper shanks for MP11



Dimensions mm (in)

Shanks available from Renishaw – please quote the part number when ordering equipment

Shank	Part number	Taper	A	B
DIN 2080	M-2045-0132	30	20.0 (0.787)	9.6 (0.378)
	M-2045-0024	40	13.6 (0.535)	11.6 (0.457)
	M-2045-0025	45	15.2 (0.598)	15.2 (0.598)
	M-2045-0026	50	15.2 (0.598)	15.2 (0.598)
DIN 69871	M-2045-0064	30	35.25 (1.388)	19.0 – 19.1 (0.748 – 0.752)
	M-2045-0065	40	35.25 (1.388)	19.0 – 19.1 (0.748 – 0.752)
	M-2045-0066	45	35.25 (1.388)	19.0 – 19.1 (0.748 – 0.752)
	M-2045-0067	50	35.25 (1.388)	19.0 – 19.1 (0.748 – 0.752)
ANSI B5.50 - 1985 (CAT)	M-2045-0137	40	35.25 (1.388)	19.0 – 19.1 (0.748 – 0.752)
	M-2045-0138	45	35.25 (1.388)	19.0 – 19.1 (0.748 – 0.752)
	M-2045-0139	50	35.25 (1.388)	19.0 – 19.1 (0.748 – 0.752)
BT	M-2045-0077	30	27.5 (1.083)	27.5 (1.083)
	M-2045-0027	40	32.0 (1.260)	32.0 (1.260)
	M-2045-0038	45	33.0 (1.299)	33.0 (1.299)
	M-2045-0073	50	38.0 (1.496)	38.0 (1.496)

Item	Part number	Description
MP11	A-2045-0003	MP11 probe complete with adjusting plate.
MP11	A-2045-0001	MP11 probe kit comprising MP11 probe + curly cable + wooden storage box + M8 × 12 cone point grub screw (× 2) + tool kit + hexagon key 2.5 mm A/F.
MP11	A-2045-0005	MP11 probe kit + stylus 50 mm long with Ø6 mm ball + DIN 2080-A 40 shank.
MP11	A-2045-0006	MP11 probe kit + stylus 50 mm long with Ø6 mm ball + DIN 2080-A 45 shank.
MP11	A-2045-0007	MP11 probe kit + stylus 50 mm long with Ø6 mm ball + DIN 2080-A 50 shank.
MP11	A-2045-0009	MP11 probe kit + stylus 50 mm long with Ø6 mm ball + DIN 69871-A 30 shank.
MP11	A-2045-0010	MP11 probe kit + stylus 50 mm long with Ø6 mm ball + DIN 69871-A 40 shank.
MP11	A-2045-0011	MP11 probe kit + stylus 50 mm long with Ø6 mm ball + DIN 69871-A 50 shank.
MP11	Refer to Renishaw	MP11 probe kit + stylus 50 mm long with Ø6 mm ball + ANSI (CAT) or BT shank.
Cable	A-2045-0051	Curly cable – Coiled 765 mm (30.1 in). Stretched 1695 mm (66.7 in).
Screw	P-SC04-0812	M8 × 12 mm cone point screw for shank (two required).
Stylus	A-5000-3709	Ceramic stylus 50 mm long with Ø6 mm ball.
Weak link	M-2085-0069	Weak link stem.
Socket	P-CN21-0304	Remote socket for spindle inhibit.
Cover	P-CN21-0602	Protective cover – remote socket.
Cover	A-2045-0008	Protective cover – stylus trigger force adjustment.
DK1	A-2051-7105	Probe outer diaphragm replacement kit.
TK1	A-2053-7531	Probe head tool kit comprising: stylus tool Ø1.98 and hexagon keys 1.5 mm A/F, 2.0 mm A/F, 2.5 mm A/F, 3.0 mm A/F and 4.0 mm A/F.
Hexagon key	P-TLO1-0250	Hexagon key 2.5 mm A/F (supplied in addition to tool kit).
Publications. These can be downloaded from our website at **www.renishaw.com**.		
Styli	H-1000-3200	Technical specifications guide: Styli and accessories – or visit our Online store at **www.renishaw.com/shop**.

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