Installation and user's guide
H-2000-5021-06-A

RENISHAW
apply innovation™

LP2 probe system

English
Français
Deutsch
Italiano

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English

Installation and user's guide

LP2 – LP2H – LP2DD – LP2H DD probes
Hard-wired transmission

2

Français

Manuel d'installation et d'utilisation

Palpeurs LP2 – LP2H – LP2DD – LP2H DD
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Installations- und Benutzerhandbuch

LP2 Messtaster mit induktiver oder
Kabelübertragung

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Italiano

Manuale d'installazione e d'uso

Sonde LP2 – LP2H – LP2DD – LP2H DD
Transmissione a induttanza o cablata

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English

Installation and user's guide

LP2 – LP2H – LP2DD – LP2HDD probes

Disclaimer

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Renishaw part no: H-2000-5021-06-A

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Warranty

Equipment requiring attention under warranty must be returned to your equipment supplier.

Unless otherwise specifically agreed in writing between you and Renishaw, if you purchased the equipment from a Renishaw company, the warranty provisions contained in Renishaw's CONDITIONS OF SALE apply. You should consult these conditions in order to find out the details of your warranty but, in summary, the main exclusions from the warranty are if the equipment has been:

- neglected, mishandled or inappropriately used; or
- modified or altered in any way except with the prior written agreement of Renishaw.

If you purchased the equipment from any other supplier, you should contact them to find out what repairs are covered by their warranty.

Changes to equipment

Renishaw reserves the right to change specifications without obligation to change equipment previously sold.

CNC machine

CNC machine tools must always be operated by competent persons in accordance with the manufacturer's instructions.

Care of the probe

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

WEEE directive

The use of this symbol on Renishaw products and/or accompanying documentation indicates that the product should not be mixed with general household waste upon disposal. It is the responsibility of the end user to dispose of this product at a designated collection point for waste electrical and electronic equipment (WEEE) to enable reuse or recycling. Correct disposal of this product will help to save valuable resources and prevent potential negative effects on the environment. For more information, please contact your local waste disposal service or Renishaw distributor.

Safety

Information for the user

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

Refer to the machine supplier's operating instructions.

The LP2 system 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 and the power supply to the HSI/MI 8-4 is disconnected.

Information for the machine supplier

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 a machine's movement.

Introduction

The LP2 is a compact and versatile probe for applications on CNC lathes and machining centres. A wide range of styli and accessories is available to provide custom installations.

Principal applications

Horizontal lathes

Small enough to fit on a turret for part measuring, tool setting and broken tool detection when mounted in a suitable position.

Machining centre applications

Set-up and part measuring when spindle mounted. Tool setting and broken tool detection when table mounted.

Signal transmission systems

- Hard-wired – a range of hard-wired probe sockets is available for inspection and tool setting applications. For machining centres with manual tool change the LP2 will fit the MA2 probe holder.
- Optical or radio – for lathes and machining centres. Easy installation, particularly in retrofit applications because there is no need for the prepared passageways required for hard-wired transmission cables. LP2 can be used with OMP40M, OMP60M, RMP40M, RMP60M.

Interface Unit

A hard-wired installation with LP2 may use the HSI interface, see the *HSI interface installation guide* (Renishaw part no. H-5500-8554), or the MI 8-4 interface, see the *MI 8-4 Installation and user's guide* (Renishaw part no. H-2000-5008). The FS1i and FS2i probe sockets with integral interface may also be used, see the *FS1i and FS2i probe sockets data sheet* (Renishaw part no. H-2000-2073).

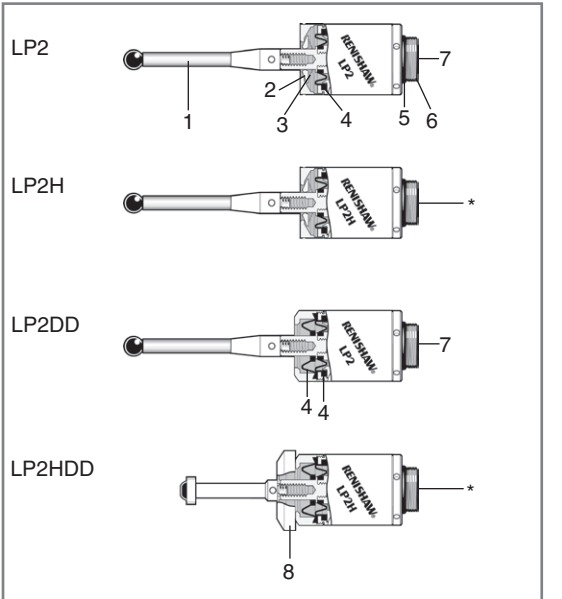
There are four versions of the LP2 probe. Each version is best suited to particular applications.

LP2 – For normal setting/inspection. The metal eyelid protects the diaphragm in a hot chip and coolant environment.

LP2H – With higher stylus pressure for long or heavy styli, or where there is excessive machine vibration.

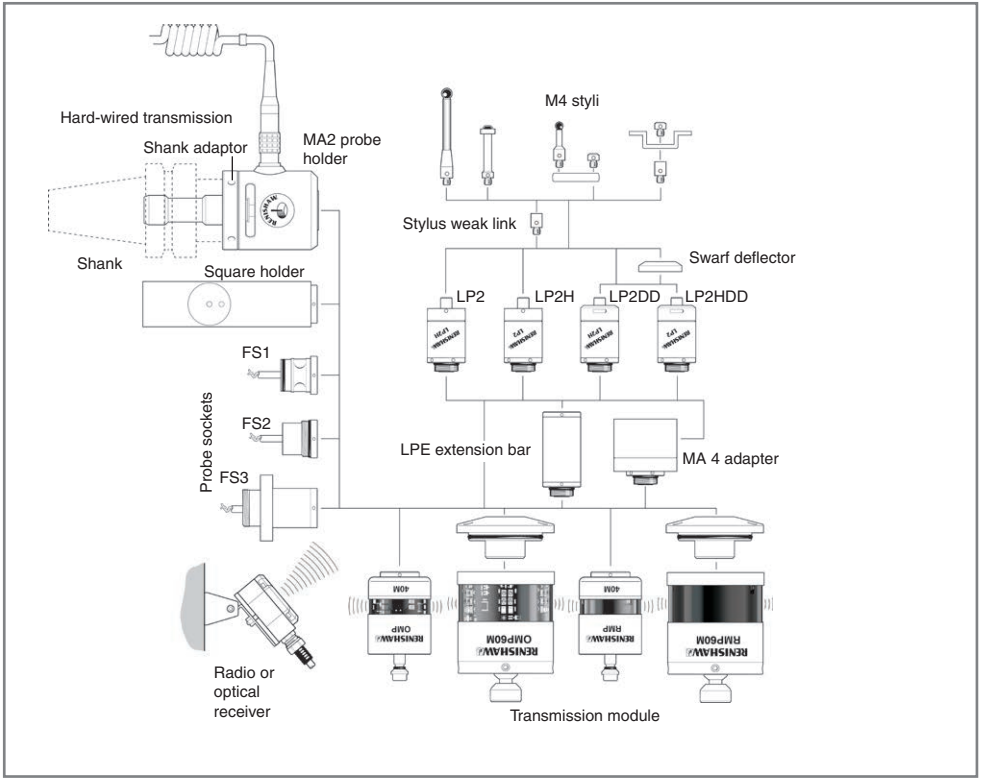
LP2DD – LP2HDD – The double diaphragm (DD) arrangement is recommended for grinding machines and other applications with particle-laden coolant. The LP2HDD is a version with a higher stylus spring pressure, similar to the LP2H.

1. Stylus – M4 thread
2. Metal eyelid
3. Spring
4. Diaphragm
5. Rear O-ring
6. M16 thread
7. Stylus spring pressure adjustment
8. Swarf deflector – essential for LP2DD and LP2HDD when continually exposed to hot chips.



Stylus spring pressure adjustment *not available* —— *

LP2DD probes are available as original equipment, or existing LP2 probes may be converted to the DD standard using a conversion kit.


Hard-wired transmission
Shank adaptor
MA2 probe holder
Shank
Square holder
FS1
FS2
FS3
Probe sockets
Radio or optical receiver
M4 styli
Stylus weak link
Swarf deflector
LP2
LP2H
LP2DD
LP2HDD
LPE extension bar
MA 4 adapter
Transmission module

Probe trigger

A probe trigger signal is generated when the probe's stylus is driven against a surface. The machine control records the contact position and instructs the machine motion to stop.

Although high probing speeds are desirable, it is essential to choose a probing velocity which allows the machine to stop within the limits of stylus overtravel and machine measuring capability. Follow feedrate guidelines given by the supplier.

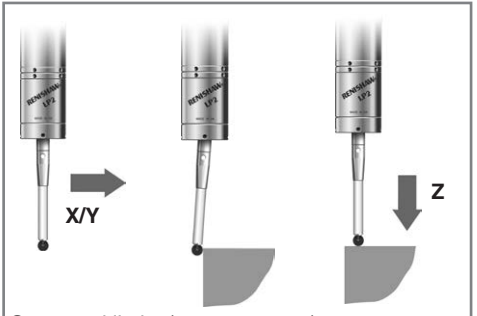
To ensure a trigger signal is generated, drive the probe against the workpiece to a target beyond the expected surface, but within the limits of stylus overtravel.

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

Single and double touch

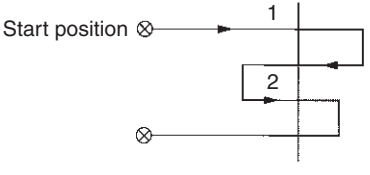
If the probe operating sequence is based on a single touch, then, following a gauging move, the probe may be returned to its start point.

With some types of controllers, it is an advantage to use a double touch method as poor repeatability can result from using higher feedrates.



Overtravel limits (see page 1-12)

With a double touch sequence, 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 feedrate, thereby recording the surface position at a higher resolution.



System delays

System delays are repeatable to less than 2 µs, and are constant in each direction in which measurement is taken.

Delays are automatically compensated for, provided a calibration move is made in the same direction and at the same velocity as each measurement move.

Calibrating a system

Calibrate the probe system at a constant measurement speed in the measurement direction, to automatically compensate for errors, in the following circumstances:

1. Before the system is used.
2. When a new stylus is used.
3. If the stylus is bent.
4. To allow for machine thermal growth.
5. Where there is poor shank relocation repeatability in the machine spindle.

Variants		LP2 / LP2DD	LP2H / LP2HDD
Principal application		Workpiece inspection and job set-up on all sizes of lathes, machining centres and CNC grinders.	
Transmission type		Hard-wired, or in conjunction with optical or radio transceiver modules	
Compatible interfaces	**Hard-wired**	HSI, MI 8-4, FS1i or FS2i	
	Optical	OMI-2 / OMI-2T / OMI-2H / OMI-2C or OSI / OMM-2	
	Radio	RMI-Q	
Recommended styli		50 mm (1.97 in) to 100 mm (3.94 in) Stylus material depends on application.	50 mm (1.97 in) to 150 mm (5.91 in) Stylus material depends on application.
Weight		65 g (2.29 oz)	
Sense directions		±X, ±Y, +Z	
Unidirectional repeatability		1.00 µm (40 µin) 2σ (see note 1)	2.00 µm (80 µin) 2σ (see note 1)
Stylus trigger force (see notes 2 and 3)			
XY low force		0.50 N, 51 gf (1.80 ozf)	2.00 N, 204 gf (7.19 ozf)
XY high force		0.90 N, 92 gf (3.24 ozf)	4.00 N, 408 gf (14.39 ozf)
+Z direction		5.85 N, 597 gf (21.04 ozf)	30.00 N, 3059 gf (107.91 ozf)

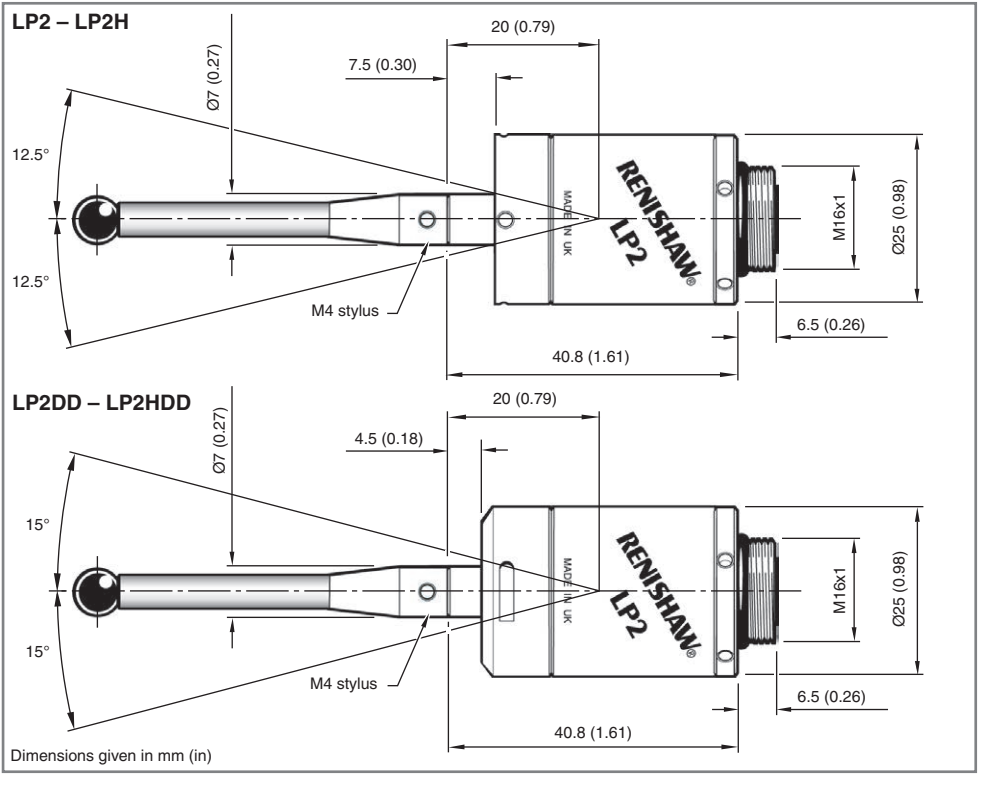
Stylus overtravel limits	LP2	LP2DD	LP2H	LP2HDD
±X / ±Y	14.87 mm (0.55 in) ±12.5°	19.06 mm (0.73 in) ±15°	14.87 mm (0.55 in) ±12.5°	19.06 mm (0.73 in) ±15°
Z	6.5 mm (0.26 in) 4.5 mm (0.18 in) when fitted with a swarf deflector		5.0 mm (0.20 in) 4.5 mm (0.18 in) when fitted with a swarf deflector	
Mounting	M16 thread, for LPE extension bars and adaptors.			
Sealing	IPX7 (EN/IEC 60529)			
Storage temperature	-10 °C to +70 °C (+14 °F to +158 °F)			
Operating temperature	0 °C to +60 °C (+32 °F to +140 °F)			

Note 1 Performance specification is tested at a standard test velocity of 480 mm/min (18.9 in/min) with a 35 mm stylus. Significantly higher velocity is possible depending on application requirements.

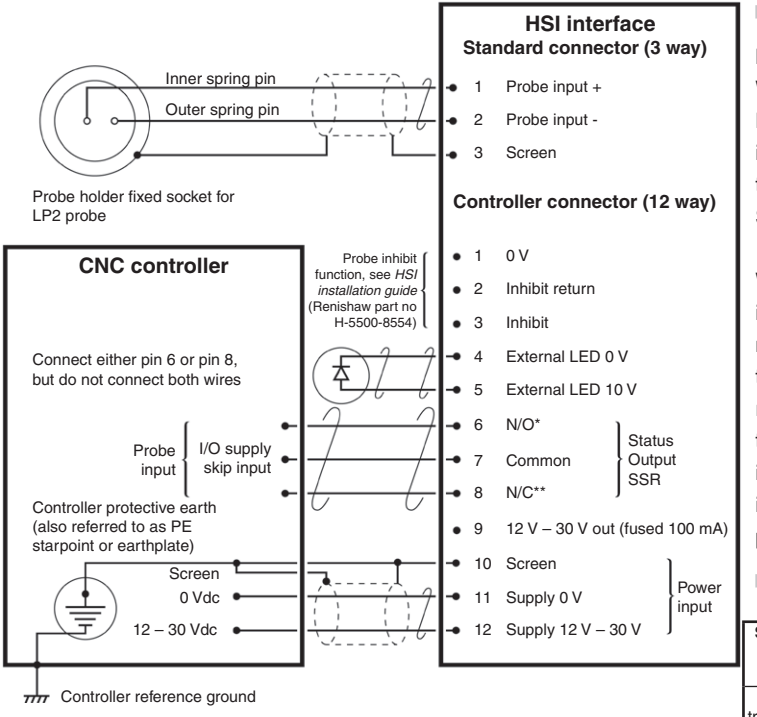
Note 2 Trigger force, which is critical in some applications, is the force exerted on the component by the stylus when the probe triggers. The maximum force applied will occur after the trigger point (overtravel). The force value depends on related variables including measuring speed and machine deceleration.

Note 3 These are the factory settings, manual adjustment of the LP2/LP2DD is possible, but the LP2H/LP2HDD is NOT adjustable.

NOTE: For stylus recommendations, please refer to the *Styli and accessories technical specification* (H-1000-3200).


LP2 – LP2H
20 (0.79)
7.5 (0.30)
Ø7 (0.27)
12.5°
12.5°
M4 stylus
MADE IN UK
RENISHAW
LP2
M16x1
Ø25 (0.98)
6.5 (0.26)
40.8 (1.61)
LP2DD – LP2HDD
20 (0.79)
4.5 (0.18)
Ø7 (0.27)
15°
15°
M4 stylus
MADE IN UK
RENISHAW
LP2
M16x1
Ø25 (0.98)
6.5 (0.26)
40.8 (1.61)
Dimensions given in mm (in)

Recommended connection diagram for LP2 with HSI interface

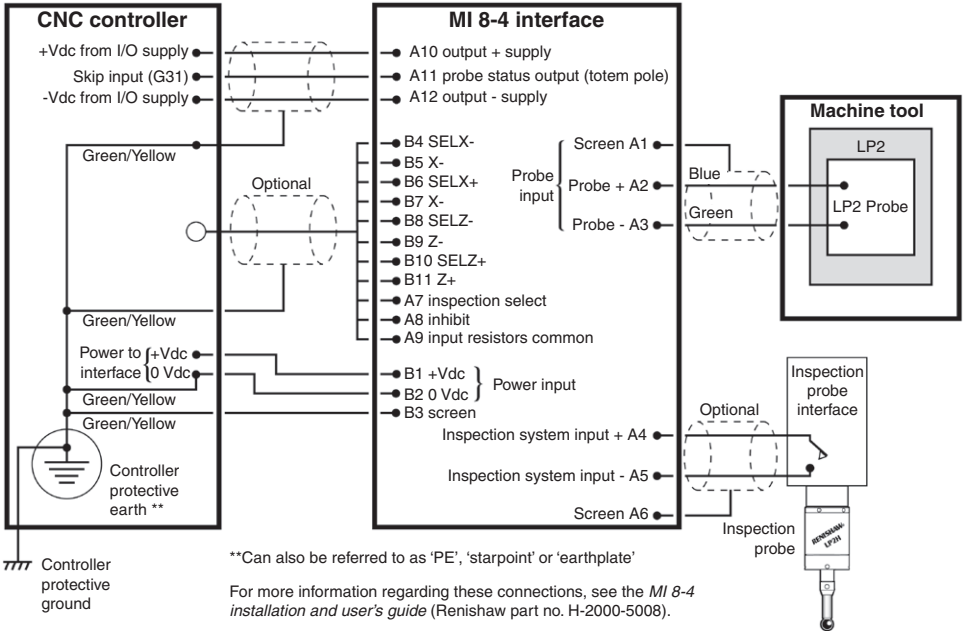


NOTES:

When connecting the LP2 probe to the HSI interface, please use the connection labelled STANDARD PROBE.

When the SSR output is connected as normally open (N/O), the LP2 probe will remain in the non-triggered (seated) state if the power supply is interrupted or if the probe is damaged.

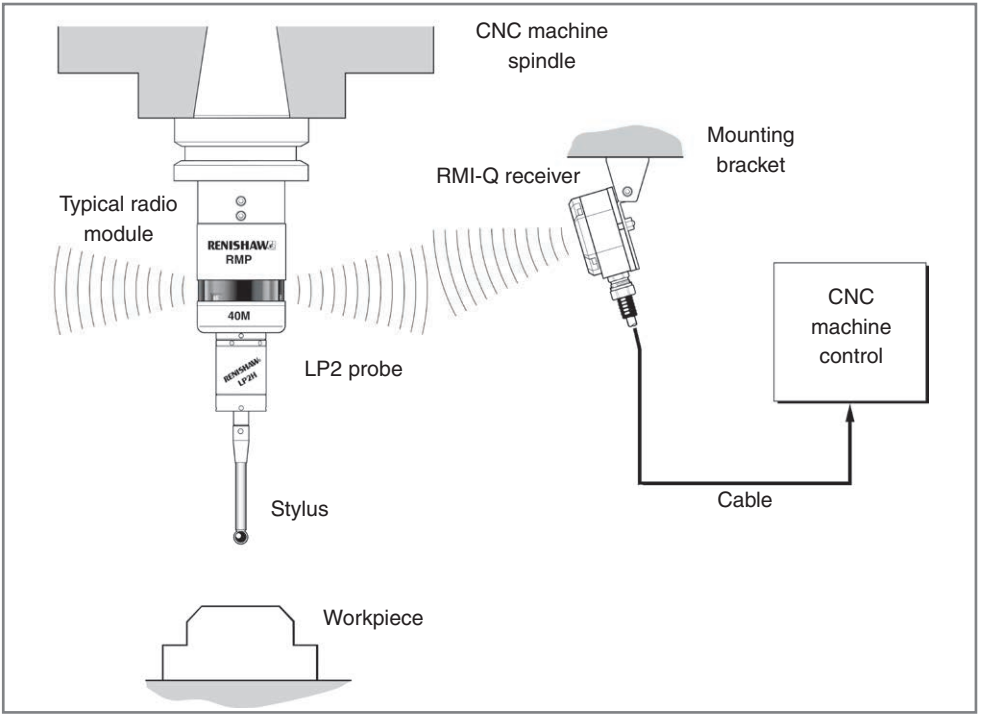
Status	*Normally open (N/O)	**Normally closed (N/C)
Probe triggered	Closed	Open
Probe seated	Open	Closed



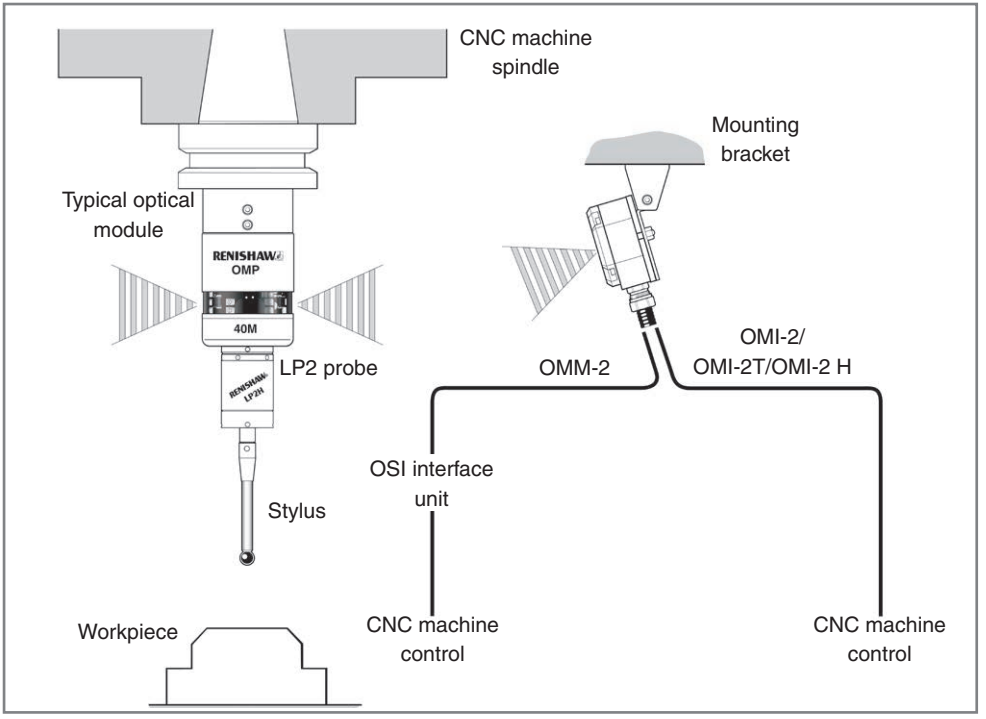
**Can also be referred to as 'PE', 'starpoint' or 'earthplate'

For more information regarding these connections, see the *MI 8-4 installation and user's guide* (Renishaw part no. H-2000-5008).

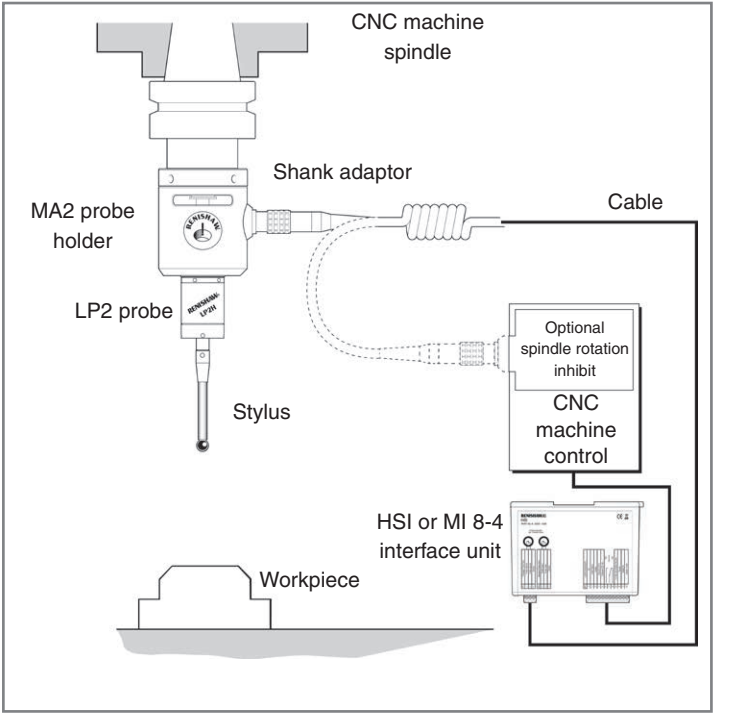
Machining centres (radio transmission)



Machining centres (optical transmission)

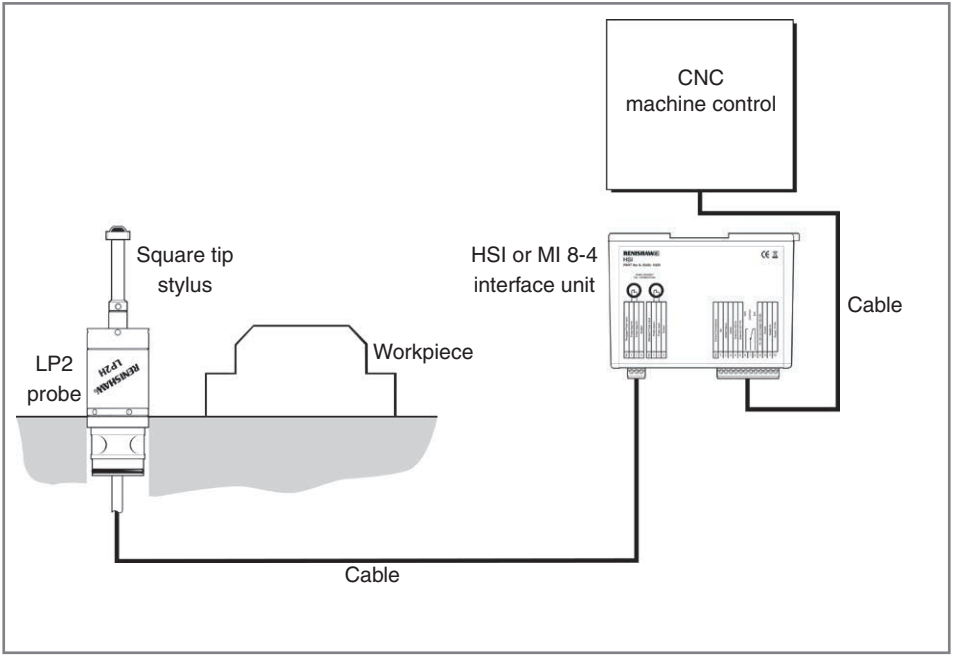


Machining centres (hard-wired transmission)

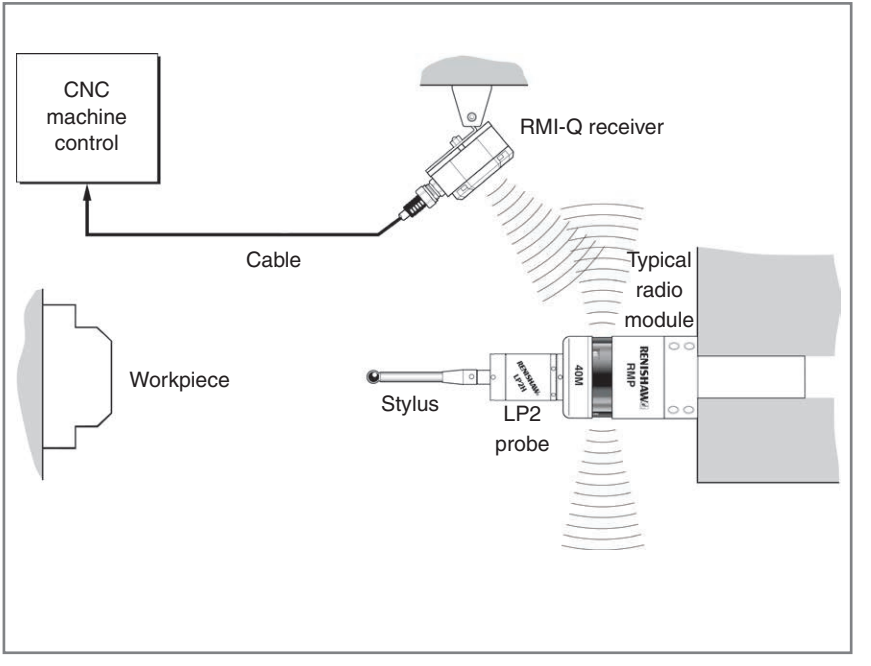


WARNING: The probe **should not be rotated (spun)** by the machine when the curly cable is connected. If this is allowed to occur, then persons may be injured by flying cable or entanglement.

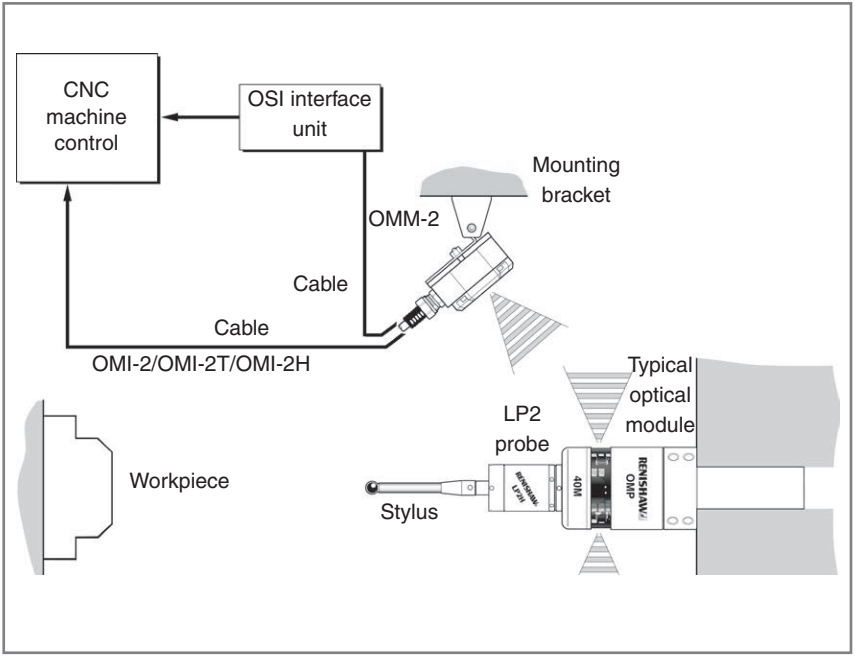
Machining centres (hard-wired transmission, tool setting)



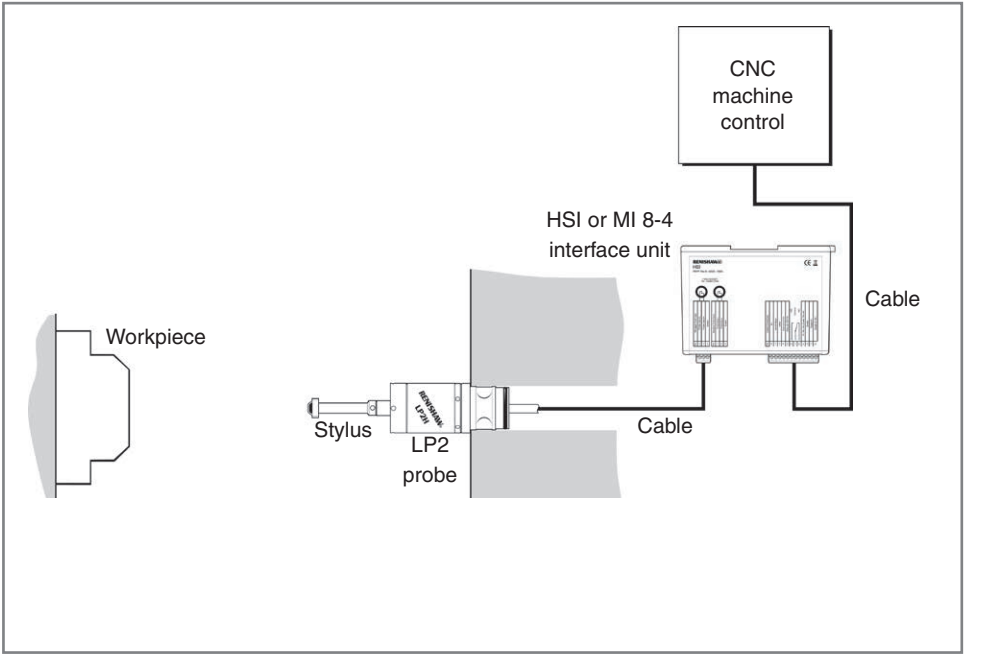
Lathes (radio transmission)



Lathes (optical transmission)



Lathes (hard-wired transmission)



LP2 and LP2DD are adjustable
LP2H and LP2HDD are not adjustable

Stylus trigger force is determined by the internal spring pressure set by Renishaw. The user should only adjust the spring pressure in special circumstances, for example, when excessive machine vibration causes faulty readings or there is insufficient pressure to support the stylus weight.

Low pressure improves probe sensitivity. To lower the pressure, turn the key anti-clockwise as far as required: it will eventually come to a stop.

To increase the pressure, turn the key clockwise. Take care, as the internal screw will eventually become disengaged. In the event of this happening, remove any pressure on the stylus and turn the key anti-clockwise to re-engage the thread. If this is unsuccessful, return the probe to your supplier for repair.

CAUTION: Stylus spring pressure adjustment, and use of styli other than a calibration stylus type, may cause probe repeatability to differ from the calibration certificate results.

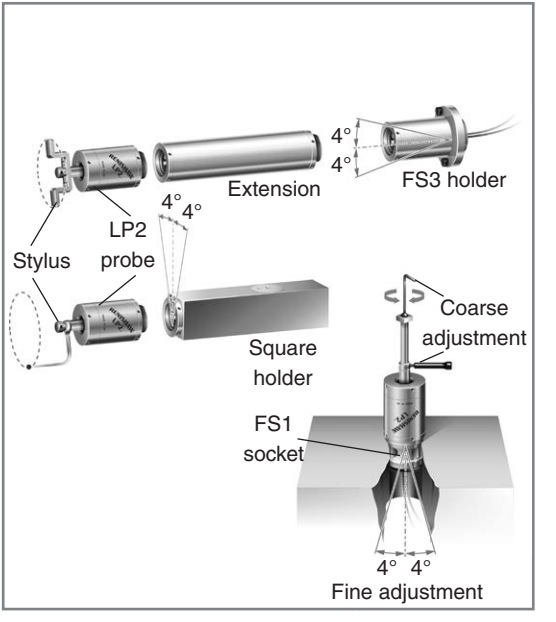
Stylus on-centre adjustment
Stylus position is established using a setting gauge or dial test indicator.

Lathes – inspection
The stylus is set to the same height as the spindle centre line to avoid errors when gauging diameters. The stylus tip position should correspond to the normal tool tip position for efficient programming.

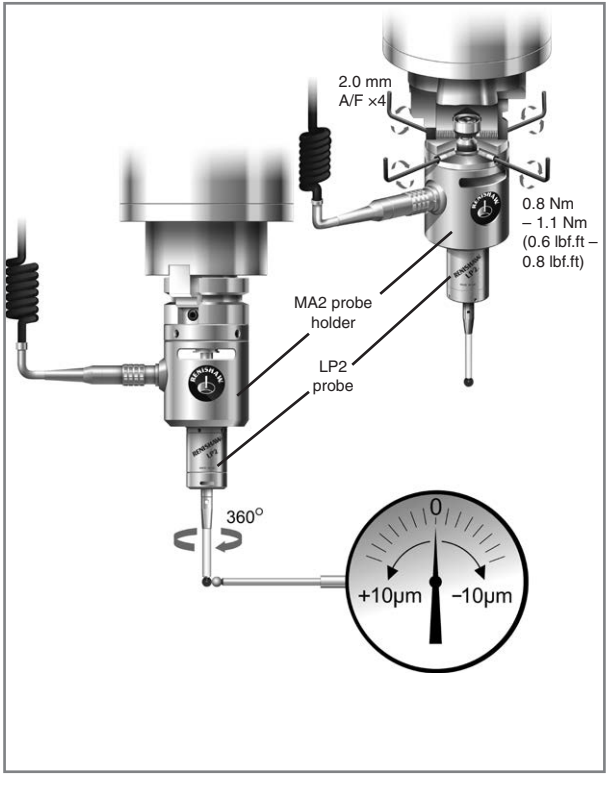
1. **MA4 90° adaptor**
   The probe is set through 360°.
2. **FS3 adjustable holder**
   The holder pivots on two Ø6 mm balls. Two opposing screws permit ±4° fine rotational adjustment.
3. **Square holder**
   Two opposing screws permit ±4° fine rotational adjustment.

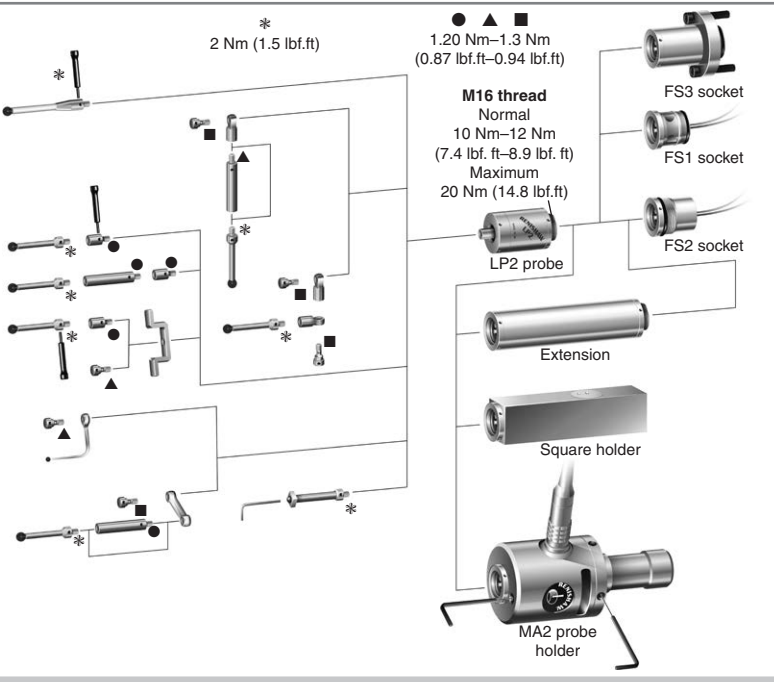
Lathes and machining centres

4. **Tool setting**
   The square tip of the stylus must align exactly with the machine's X and Y axes (machining centres) and X axis (lathes). Coarse alignment is obtained by adjusting the stylus tip. The optional FS1 socket provides ±4° fine rotational adjustment.



1. **Shank adaptor only** – fit shank adaptor onto shank and tighten the shank screws.
2. Attach the MA2 to the shank or shank adaptor. Tighten the two MA2 holding screws, then unscrew half a turn.
3. Centralise the two MA2 screws at mid-position in the MA2 slots.
4. Fit the four on-centre adjusting screws loosely.
5. Insert the probe unit into the machine spindle.
6. Position the dial test indicator (D.T.I.) against the stylus, with light pressure so as not to deflect the stylus.
7. Connect the curly cable to the MA2 and interface. Switch the power on to monitor any accidental probe trigger during adjustment.
8. Engage the machine spindle in a neutral or high gear for easy manual rotation. Check the D.T.I. during spindle rotation. Adjust the four adjusting screws one at a time. Following each adjustment, unscrew the active screw clear of the centre shaft. Repeat until the stylus is on-centre. Finally, tighten the two MA2 holding screws and four on-centre adjusting screws.





NOTE: For stylus recommendations, please refer to the *Styli and accessories technical specification* (H-1000-3200).

Software for turning and machining centres

Good software will do the following:

- Offer simple to use calibration routines
- Update a tool offset.
- Generate an alarm if a broken tool is found or set a flag for corrective action.
- 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.

NOTE: Probe cycles and features are machine software dependent. For software for probing routines is available from Renishaw.

Verify your software

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

   Note – machining centre applications:

   When using probe styli which are not on spindle centre, spindle orientation repeatability is important to avoid probe measurement errors.

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

3. Does the software automatically adjust the program co-ordinate system to the relevant set-up feature on the component, for job set-up purposes?

Service

You may undertake the maintenance routines described in this handbook.

Further dismantling and repair of Renishaw equipment is a highly specialised operation, which must be carried out at authorised Renishaw service centres.

Equipment requiring repair, overhaul or attention under warranty should be returned to your supplier.

Maintenance

The probe is a precision tool and must be handled with care.

The probe is designed to operate in a machine tool environment. Do not allow chips to build up around the probe body, and do not allow dirt or liquids to enter the sealed working parts. Keep system mating surfaces clean, and ensure that inductive transmission gaps are clear. Periodically check the probe's rear O-ring, cables and connections for signs of damage and slackness.

Cleaning the probe front seal

LP2 – LP2H

Dirt may accumulate in the cavity underneath the metal eyelid seal.

LP2DD – LP2HDD

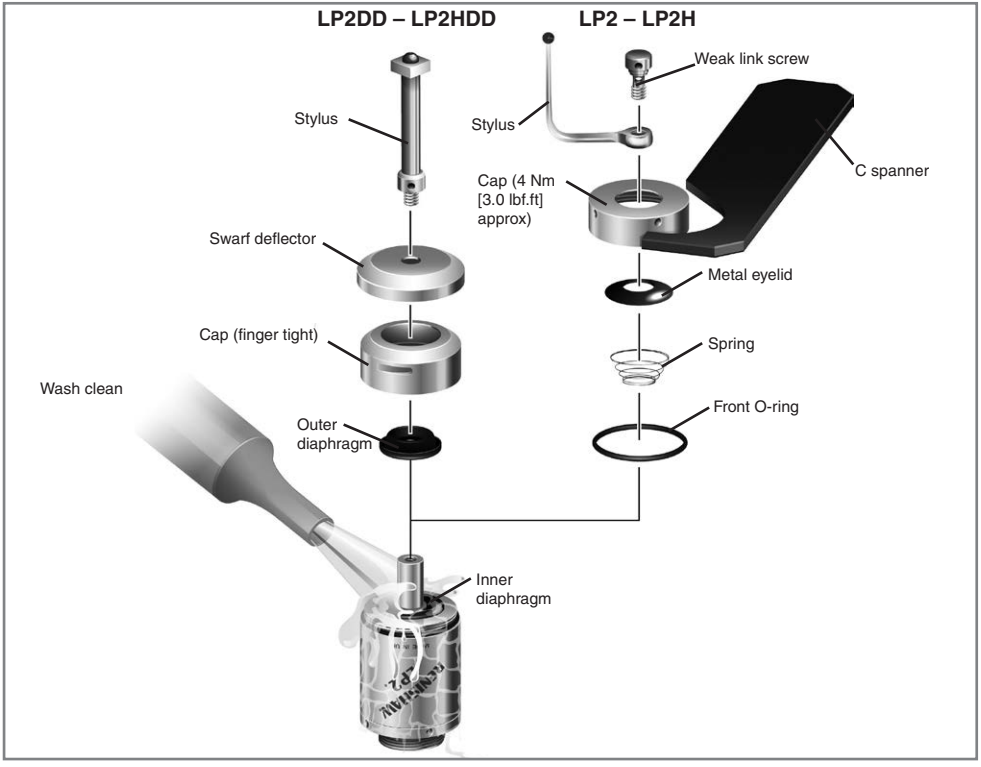
Dirt may accumulate in the cavity underneath the outer diaphragm. (Outer diaphragm replacement kits are available.)

LP2 – LP2H – LP2DD – LP2HDD

Once a month, remove the stylus front cap (the C spanner is provided for easy cap removal) then remove all the residue with a low-pressure jet of coolant. Do not use a sharp tool or a degreasing agent. The cleaning interval may be extended or reduced, depending on the rate at which dirt accumulates. If the inner diaphragm is damaged, return the probe to your supplier for repair.

Re-assembling the components

CAUTION: DO NOT use the probe with the cap removed. Check that the probe is firmly secured in its mounting.


LP2DD – LP2HDD
LP2 – LP2H
Weak link screw
Stylus
Stylus
C spanner
Cap (4 Nm [3.0 lbf.ft] approx)
Swarf deflector
Metal eyelid
Cap (finger tight)
Spring
Wash clean
Front O-ring
Outer diaphragm
Inner diaphragm

Symptom	Cause	Action
Complete failure.	Transmission modules not correctly aligned.	Align correctly.
	Transmission modules damaged.	Return to supplier for repair. For information on transmission, refer to the relevant installation guide.
	Swarf blocking inductive transmission air gap.	Clean out.
	Loose mounting.	Check all bolted or screwed connections for tightness.
	Interface LED does not light up.	Check fuses.
	Poor electrical connection.	Check connectors.
	Cable screen broken.	Replace cable.
	Incorrect voltage.	Check supply.
	Probe failure.	No continuity through probe circuit.
	Probe spring pressure too low.	Tighten stylus spring pressure.
	Probe mounting damaged.	Repair or replace.

Symptom	Cause	Action
Poor repeatability.	Transmission modules not correctly aligned.	Align correctly.
	Loose mounting.	Check all bolts and screwed connections for tightness.
	Loose stylus.	Tighten.
	Poor electrical connections.	Check connectors.
	Excessive machine vibration.	Tighten spring pressure.
Spurious reading.	Cable screen broken.	Replace.
	Poorly regulated supply voltage.	Regulate correctly.
	Excessive machine vibration.	Eliminate vibration or adjust stylus spring pressure.
Poor re-arming (the probe is armed when the stylus mounting is seated, the electrical circuit is complete and the interface LED is lit).	Spring pressure too low.	Adjust spring pressure.
	Inner diaphragm pierced or damaged.	Return to supplier for repair.

Type	Part number	Description
LP2	A-2063-6098	LP2 probe complete with two C spanners and TK1 tool kit.
LP2H	A-2064-0002	LP2H probe complete with two C spanners and TK1 tool kit.
MA2 holder	A-2063-7868	MA2 probe holder, complete with holding screws.
Adaptor	M-2063-7865	Shank adaptor for MA2 probe holder, complete with holding screws.
Cable	A-1016-6451	Cable assembly for MA2 probe holder.
Service kit	A-2063-7542	LP2 service kit comprises: front cover, eyelid seal, spring and O rings.
LP2DD	A-2063-8020	LP2DD probe complete with two C spanners and probe head tool kit.
LP2HDD	A-2064-0032	LP2HDD probe complete with two C spanners and probe head tool kit.
Deflector	M-2063-8003	Swarf deflector, Ø28 mm, protects probe from hot swarf.
Diaphragm kit	A-2063-8030	Outer diaphragm and O ring replacement kit.
Conversion kit	A-2063-8023	The kit converts LP2 and LP2H probes to the DD standard, comprising : front ring, outer diaphragm, O ring, two C spanners.
PS3-1C	A-5000-3709	Ceramic stylus 50 mm long with Ø6 mm ball.
PS2-41	A-5000-6403	Square tool setting stylus.
Protection	M-5000-7582	Stylus adaptor with weak link collision protection for straight steel styli.
Protection	M-5000-7587	Screw with weak link collision protection for straight steel styli.
Protection	M-5000-7588	Screw with weak link collision protection for swivel adaptor.
TK1	A-2053-7531	Probe head tool kit.

Type	Part number	Description
C spanner	A-2063-7587	C spanner.
MI 8-4 interface	A-2157-0001	MI 8-4 interface unit with dual lock pads and DIN rail mounting, installation and user's guide and packaging.
HSI interface	A-5500-1000	HSI probe system interface with DIN rail mounting and three terminal blocks, quick-start guide and packaging.
Publications. These can be downloaded from our website at www.renishaw.com.		
LP2	H-2000-5021	Installation and user's guide: LP2 probe system.
MI 8-4	H-2000-5008	Installation and user's guide: MI 8-4 interface.
HSI	H-5500-8550	Quick-start guide: for rapid set-up of the HSI interface, includes CD with installation guides.
Styli	H-1000-3200	Styli and accessories technical specifications.
Software features	H-2000-2289	Data sheet: Probe software for machine tools – illustrated features.
Software list	H-2000-2298	Data sheet: Probe software for machine tools – list of programs.

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