Installation and user guide

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HPRA and TSI 2 / TSI 2-C removable arm and interface

Original instructions – translations of these original instructions are available on request.

www.renishaw.com/hpra

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

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Before you begin

Trade marks

Google Play and the Google Play logo are trademarks of Google LLC.

Apple and the Apple logo are trademarks of Apple Inc., registered in the U.S. and other countries. App Store is a service mark of Apple Inc., registered in the U.S. and other countries.

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 system

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

Patents

None applicable.

Intended use

The HPRA system is a tool setting solution predominantly intended for use on CNC turning machines for high-precision measurement of cutting tools.

Safety

Information to the user

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

Remove power before performing any maintenance operations.

The expected method of providing an emergency stop for Renishaw products is to remove power.

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

The high-precision removable arm (HPRA) 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 TSI 2 or TSI 2-C disconnected.

CAUTION: HPRA and TSI 2 / TSI 2-C are intended for exclusive use as part of the HPRA system. Any attempts to integrate with other arms or interfaces could result in unexpected behaviour and/or product damage.

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:

- the dc supply to this equipment must be derived from a source which is compliant with current local electrical safety requirements and is approved to IEC 60950-1, UL BS EN IEC 62368-1, UL BS EN IEC 61010-1 or suitable equivalent;
- 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.

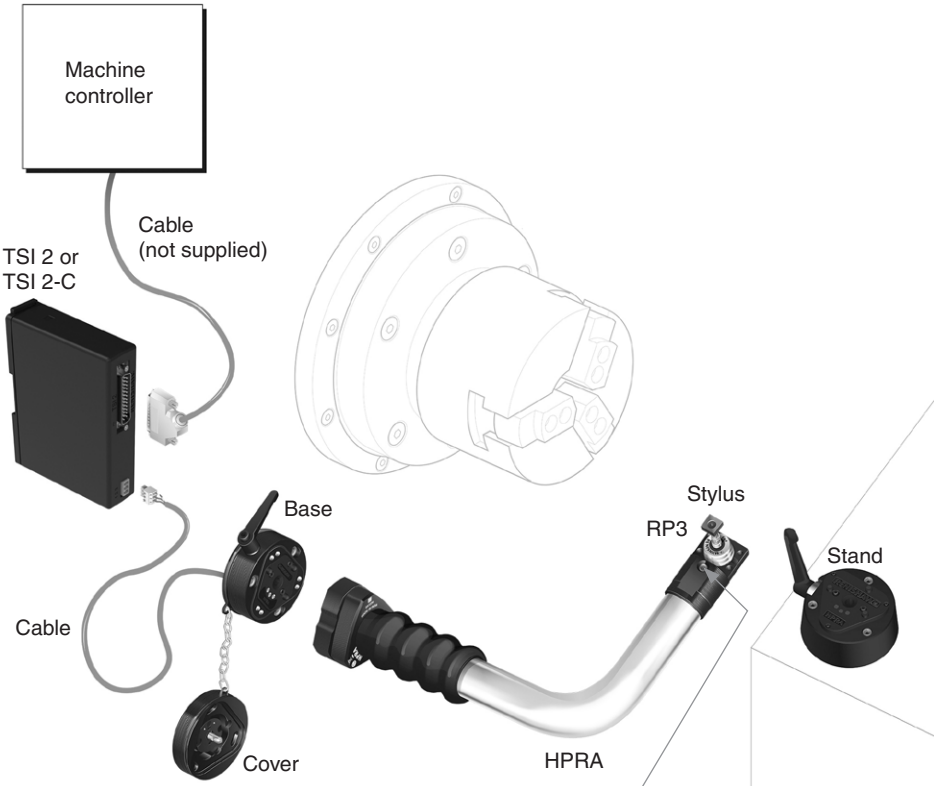
Equipment operation

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

Glossary of terms

Abbreviation	Definition
HPRA	High-precision removable arm
CNC	Computer numerical control
TSI	Tool setting interface
ARO	Arm ready output
MRO	Machine ready output
INH	Inhibit input
SEL	Select input
NO	Normally open
NC	Normally closed
SCR	Screen
O/C	Open circuit
OCT	Open collector transistor
SSR	Solid-state relay
COM	Common
PELV	Protective extra-low voltage
LED	Light-emitting diode
EMI	Electro-magnetic interference

System kit



Probe status LED	
Green	Arm ready for use and probe seated
Red	Triggered

NOTE: For part numbers, refer to the parts list on **page 51**.

The HPRA system is a mechanism for manually presenting a probe into the working envelope of a machine tool, in order for tool setting to be carried out. Once complete, the arm is detached and stored in a safe location outside of the machine environment.

HPRA specification

Variant		Standard rear exit	Standard side exit
Principal application		Tool measuring on 2-axis and 3-axis CNC lathes.	
Transmission type		Hard-wired transmission	
Weight		≈ 3 kg (106 oz)	
Probe		RP3 [1]	
Compatible interfaces		TSI 2 or TSI 2-C	
Cable (base to interface)	Type	Ø4 mm (0.16 in), 2-core screened cable, each core is 0.34 mm^2	
	Length	3 m (9.8 ft), 5.5 m (18 ft), 10 m (32.8 ft), 12 m (39.4 ft)	3 m (9.8 ft)
Sense directions		±X, ±Y, +Z (probe axes; refer to page 16, “HPRA dimensions”, for definition)	
Typical positional repeatability (probe axes) [2 3]		5 µm (197 µin) 2σ X/Y (arms for machines with 6 in to 15 in chucks) 8 µm (315 µin) 2σ X/Y (arms for machines with 18 in to 24 in chucks)	
Stylus trigger force (probe axes) [4 5] XY low force XY high force +Z direction		 1.5 N, 153 gf (5.4 ozf) 3.5 N, 357 gf (12.59 ozf) 12 N, 1224 gf (43.16 ozf)	
Mounting		M6 bolts (× 3)	
Environment	IP rating	IPX6 and IPX8, BS EN 60529:1992+A2:2013 (for base with cover attached)	
	Storage temperature	–25 °C to +70 °C (–13 °F to +158 °F)	
	Operating temperature	+5 °C to +55 °C (+41 °F to +131 °F)	

1 Where the RP3 is to be used in the probe’s Z axis (typically the CNC lathe Y axis), a five-faced stylus is available to order from the Renishaw Online store at **www.renishaw.com/shop**.

2 Test conditions: Stylus length: 22 mm (0.87 in)
Stylus velocity: 36 mm/min (1.42 in/min)

3 Repeatability performance is not specified in the probe Z axis. Refer to **page 16**, “HPRA dimensions”, to identify this axis.

4 Trigger force, which is critical in some applications, is the force exerted on the stylus by the tool 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.

5 These are the factory settings; manual adjustment is not possible.

TSI 2 / TSI 2-C specification

Variant		TSI 2	TSI 2-C
Principal application		Input and output interfacing between the HPRA arm and the host CNC controller	
Weight		≈ 0.2 kg (7 oz)	
Mounting		DIN rail preferred; alternatively M4 screw (× 2)	
I/O connector type		25-way D-sub	
Inputs		Opto isolated probe inhibit command, 15 Vdc to 30 Vdc	
Outputs		OCT active high for ARO, MRO and X+, X–, Z+, Z–	Voltage-free SSRs for probe status, arm ready and arm stowed
Four-wire I/O probe option (for example, Fanuc automatic length measurement input XAE, ZAE)		Four internally pulled down active high inputs, four OCT active high outputs	N/A
Power supply requirement	Voltage	24 Vdc	
	Current	500 mA	
Environment	IP rating	IP20, BS EN 60529:1992+A2:2013	
	Storage temperature	–25 °C to +70 °C (–13 °F to +158 °F)	
	Operating temperature	+5 °C to +55 °C (+41 °F to +131 °F)	

HPRA installation

WARNINGS:

Safety footwear and eye protection should be worn while installing the HPRA.

Remove all power before commencing installation.

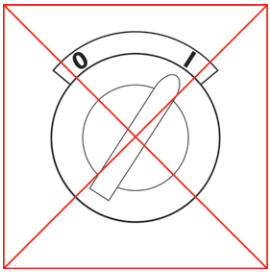
Care should be taken to avoid any finger traps.

CAUTIONS:

Do not add any attachments to the arm. If any attachment is deemed essential, contact Renishaw.

For best performance of the HPRA, the following installation guidelines are recommended:

- The HPRA is ideally mounted on a solid fixed part of the machine tool, such as a casting. If mounting brackets or plates are used, these must be designed to maximise stiffness with minimal joints. If mounted onto a moving part of the machine tool, repeatability may be adversely affected.
- The HPRA base (with the cover attached) is sealed to IPX6 and IPX8, designed for the harsh environments inside a machine tool. However, high-pressure jets and reflected jets can exceed this specification and must not spray directly onto the HPRA base. If it is not possible to position the HPRA base away from these jets, the base should be protected with suitable guarding. Guarding is not supplied by Renishaw.
- Like all metrology systems, repeatability can be adversely affected by thermal effects on the machine tool. Renishaw recommends that thermal compensation routines are incorporated into the measurement software cycles to counteract these effects.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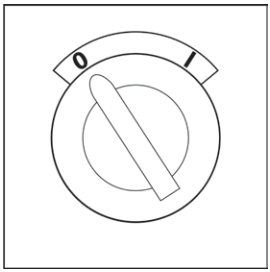
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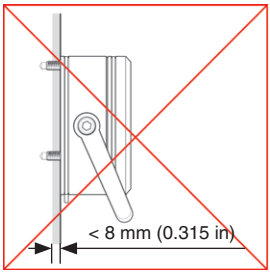
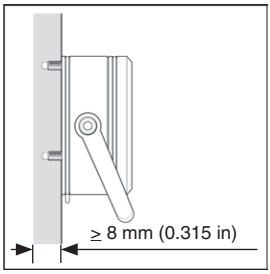
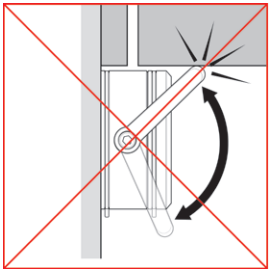
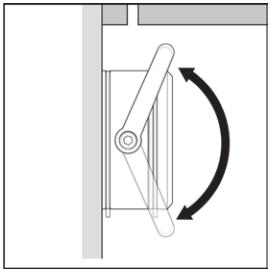
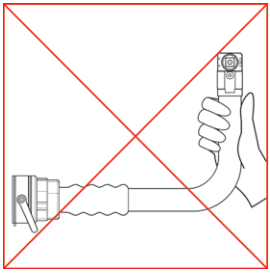
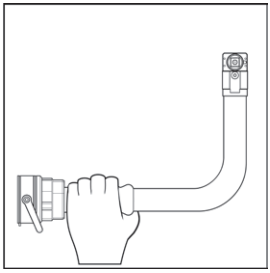

< 8 mm (0.315 in)


≥ 8 mm (0.315 in)

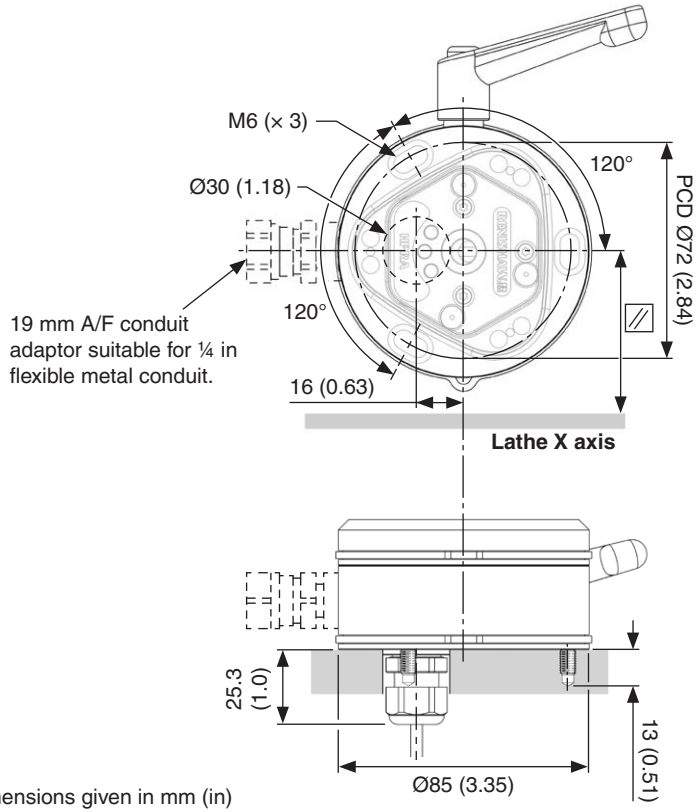






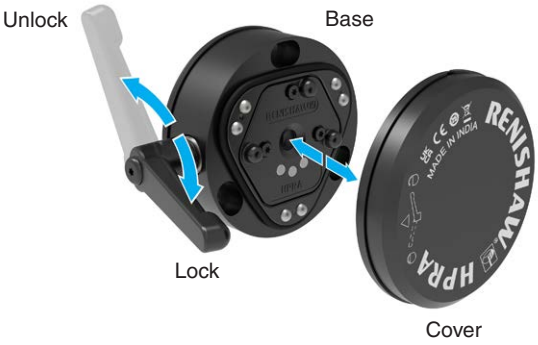


HPRA mounting details



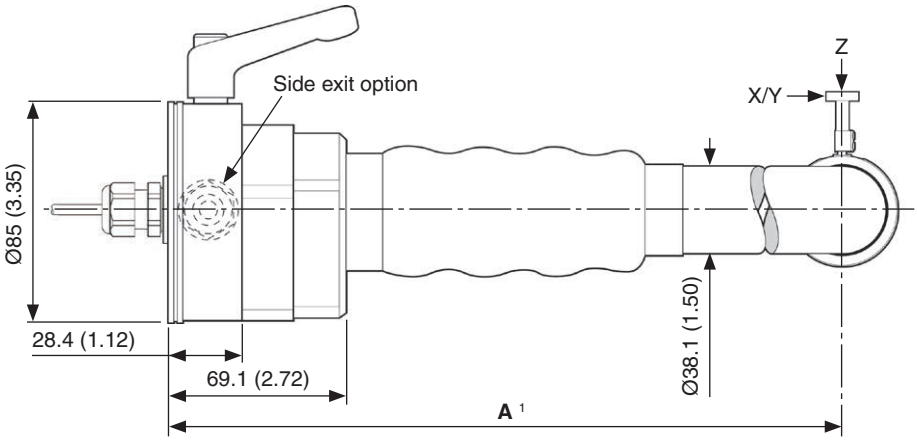
Dimensions given in mm (in)

HPRA cover removal



HPRA dimensions

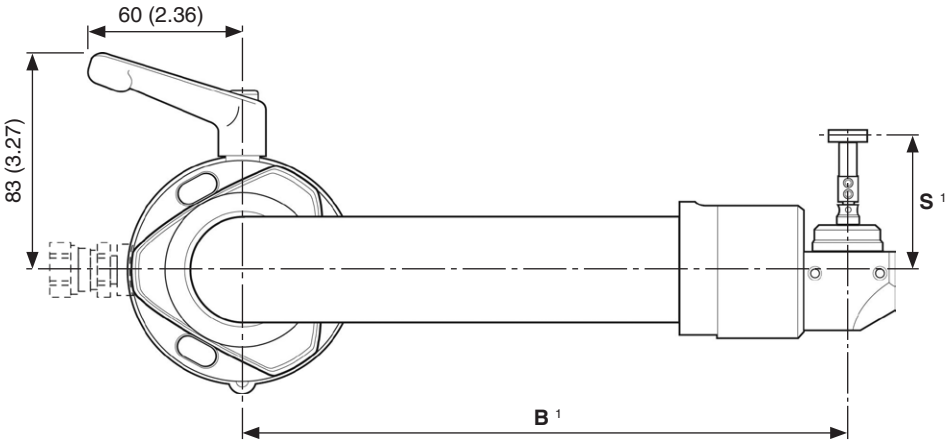
Side view



Dimensions given in mm (in)

1 A range of standard sizes are available, with either a rear or side exit connection. See the table on **page 17** for further information.

Front view



Dimensions given in mm (in)

1 A range of standard sizes are available, with either a rear or side exit connection. See the table on **page 17** for further information.

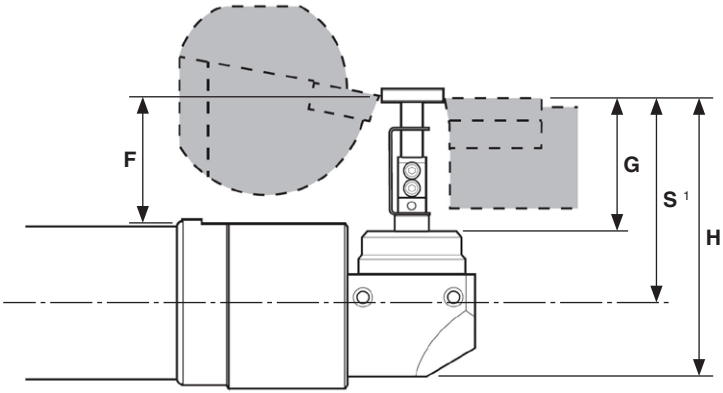
Standard arms dimension table

Chuck size	Tooling size	Arm size		S [1]
		A	B	
6 in	16 mm 20 mm 25 mm 32 mm	250 (9.84)	211 (8.31)	35.7 (1.40) 41 (1.61) 51 (2.01) 56 (2.20)
8 in	16 mm 20 mm 25 mm 32 mm	280 (11.02)	241 (9.49)	35.7 (1.40) 41 (1.61) 51 (2.01) 56 (2.20)
10 in	16 mm 20 mm 25 mm 32 mm 40 mm	325 (12.80)	290 (11.42)	35.7 (1.40) 41 (1.61) 51 (2.01) 56 (2.20) 61 (2.40)
12 in	16 mm 20 mm 25 mm 32 mm 40 mm 50 mm	355 (13.98)	290 (11.42)	35.7 (1.40) 41 (1.61) 51 (2.01) 56 (2.20) 61 (2.40) 71 (2.80)
15 in	20 mm 25 mm 32 mm 40 mm 50 mm	455 (17.91)	335 (13.19)	41 (1.61) 51 (2.01) 56 (2.20) 61 (2.40) 71 (2.80)
18 in	25 mm 32 mm 40 mm 50 mm	510 (20.08)	375 (14.76)	51 (2.01) 56 (2.20) 61 (2.40) 71 (2.80)
24 in	25 mm 32 mm 40 mm 50 mm	580 (22.83)	450 (17.72)	51 (2.01) 56 (2.20) 61 (2.40) 71 (2.80)

Dimensions given in mm (in)

[1] Stylus height, S, is adjustable. See “Stylus coarse adjustment” on **page 22**.

Stylus dimensions by tool size



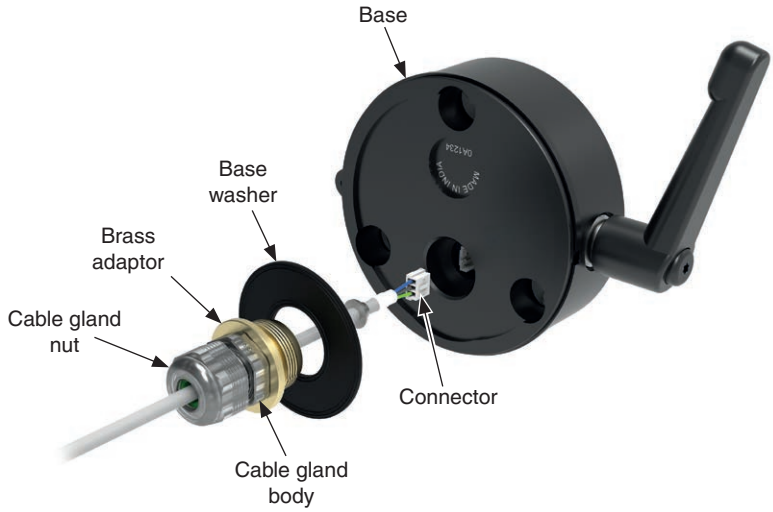
1 Stylus height, S, is adjustable. See “Stylus coarse adjustment” on **page 22**.

Tooling size	Stylus length (see “Parts list” on page 51)	F	G	H	S
16 mm	14.2 (0.56)	14.2 (0.56)	19.1 (0.75)	56.9 (2.24)	35.7 (1.40)
20 mm	19.5 (0.77)	19.5 (0.77)	24.4 (0.96)	62.2 (2.45)	41 (1.61)
25 mm	29.5 (1.16)	29.5 (1.16)	34.4 (1.35)	72.2 (2.84)	51 (2.01)
32 mm	34.5 (1.36)	34.5 (1.36)	39.4 (1.55)	77.2 (3.04)	56 (2.20)
40 mm	39.5 (1.56)	39.5 (1.56)	44.4 (1.75)	82.2 (3.24)	61 (2.40)
50 mm	49.5 (1.95)	49.5 (1.95)	54.4 (2.14)	92.2 (3.63)	71 (2.80)

Dimensions given in mm (in)

Mounting the base

Step 1 – attaching the cable to the base (rear exit only)

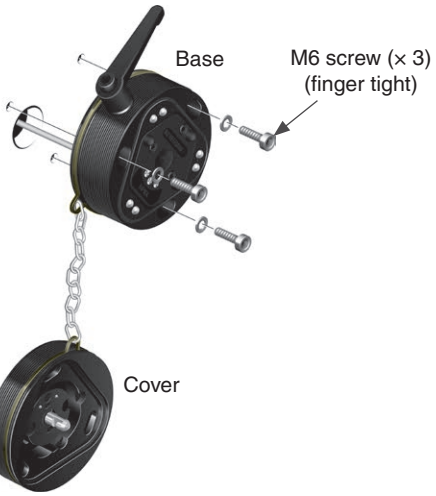


1. Ensure cable gland nut is loose.
2. Feed connector through base washer and fit to PCB in base.
3. Screw cable gland body with brass adaptor into the base, ensuring that the base washer is positioned up against the flange on the brass adaptor. Tighten cable gland body to 4 Nm (2.95 lbf.ft).
4. Tighten cable gland nut to 3.5 Nm (2.58 lbf.ft).

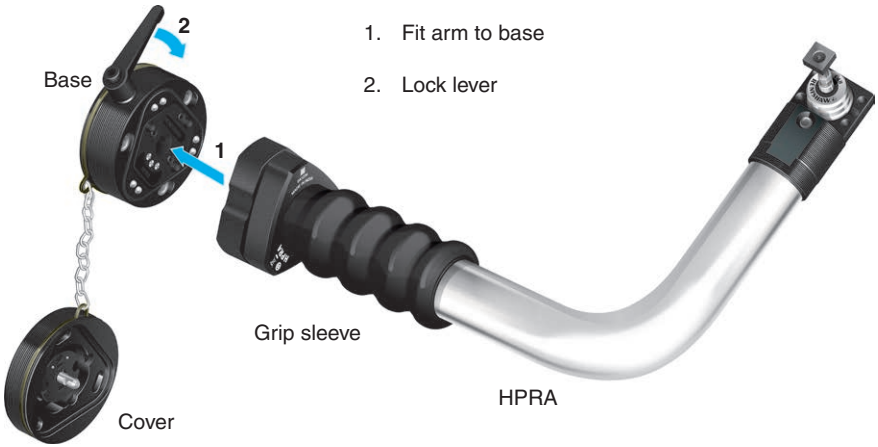
CAUTION: Ensure cable does not twist or rotate while tightening the cable gland nut.

Step 2 – mounting the base to the machine

NOTE: Refer to page 15, “HPRA mounting details”, for mounting hole pattern



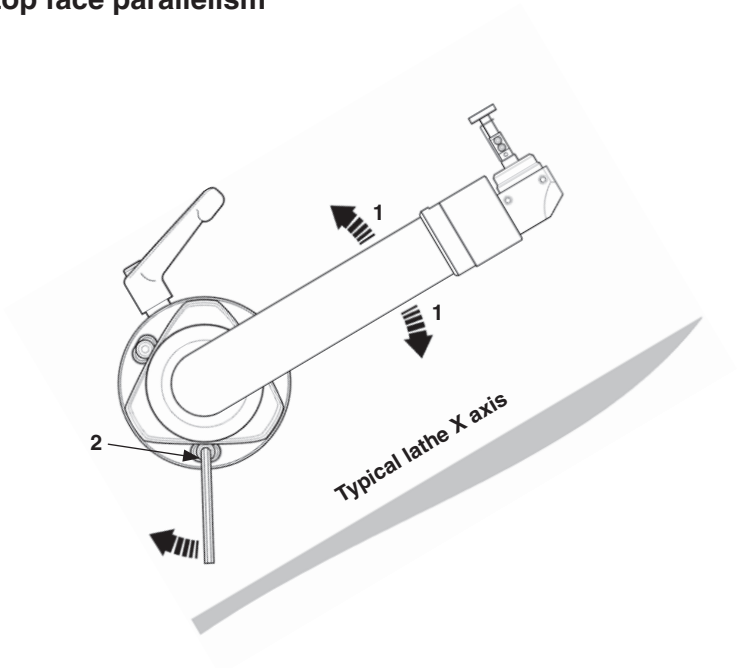
Step 3 – mounting the HPRA to the base



1. Fit arm to base
2. Lock lever

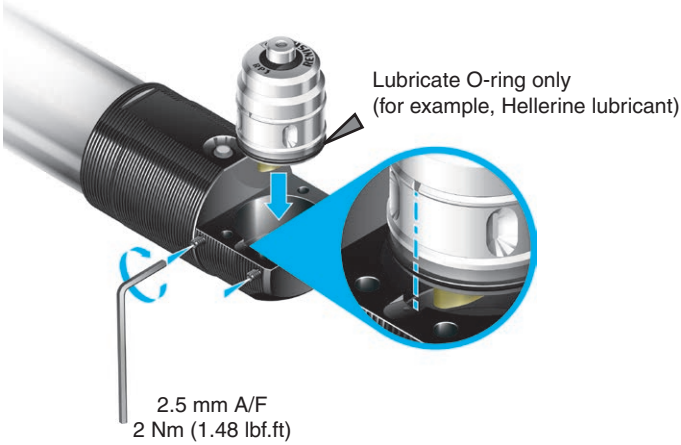
CAUTION: Only handle the HPRA by the grip sleeve.

Step 4 – top face parallelism



1. Rotate arm (with base) to set stylus alignment.
2. Tighten the three mounting screws to 10 Nm (7.38 lbf.ft).
3. Check that stylus alignment has not moved after tightening.

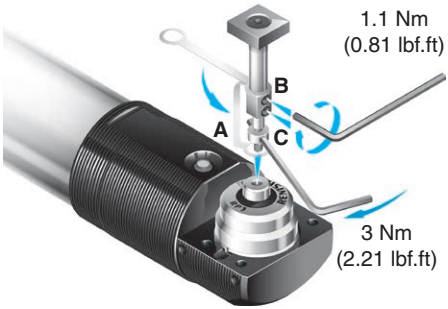
Fitting the probe to the arm



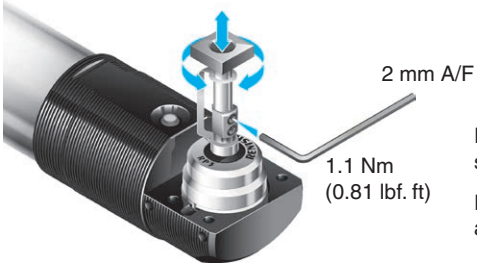
1. Loosen grub screws (× 2)
2. Insert probe
3. Tighten grub screws (× 2)

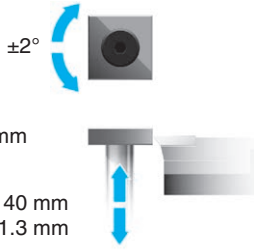
Stylus fitting

1. Fit the free end of the captive link over the threaded end of the break stem (**A**).
2. Fit the break stem inside the stylus and secure it by tightening the M3 grub screw(s) (**B**).
3. Using a 2 mm hexagonal key fitted through the hole in the break stem (**C**), fit the stylus to the probe.



Stylus coarse adjustment



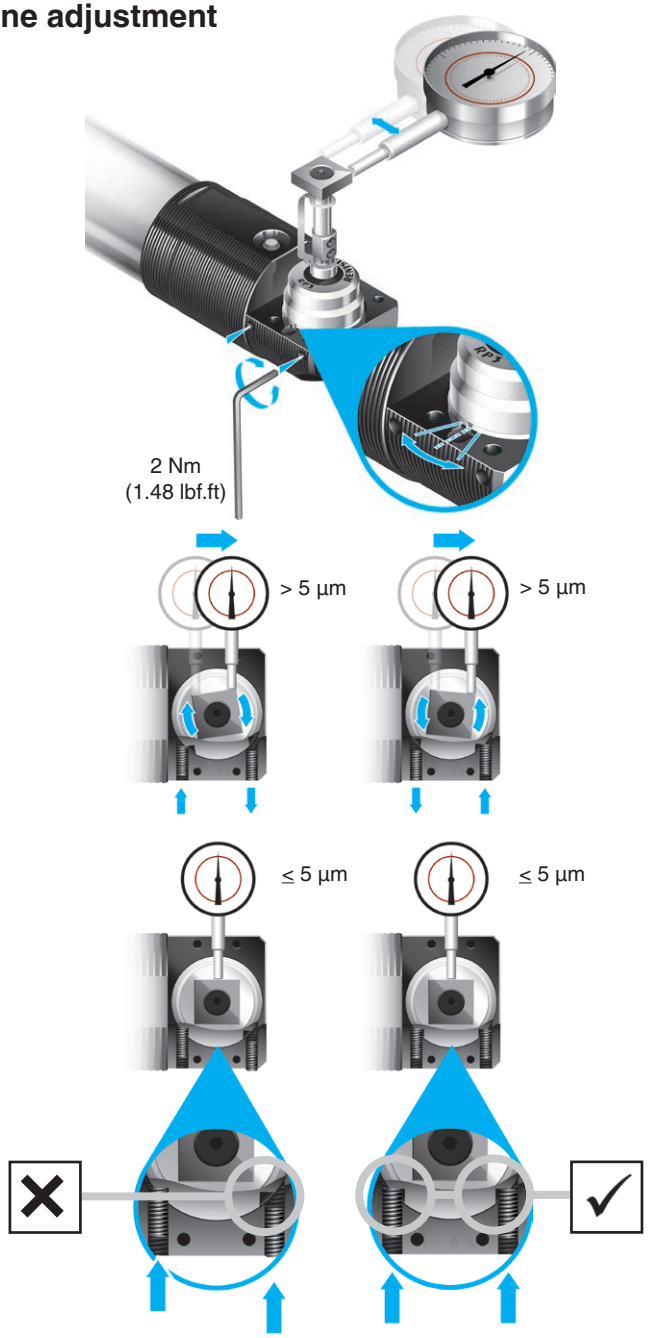


For 16 mm and 20 mm stylus ±0.8 mm

For 25 mm, 32 mm, 40 mm and 50 mm stylus ±1.3 mm

Set approximately parallel with machine tool axes.

Stylus fine adjustment



TSI 2 / TSI 2-C installation

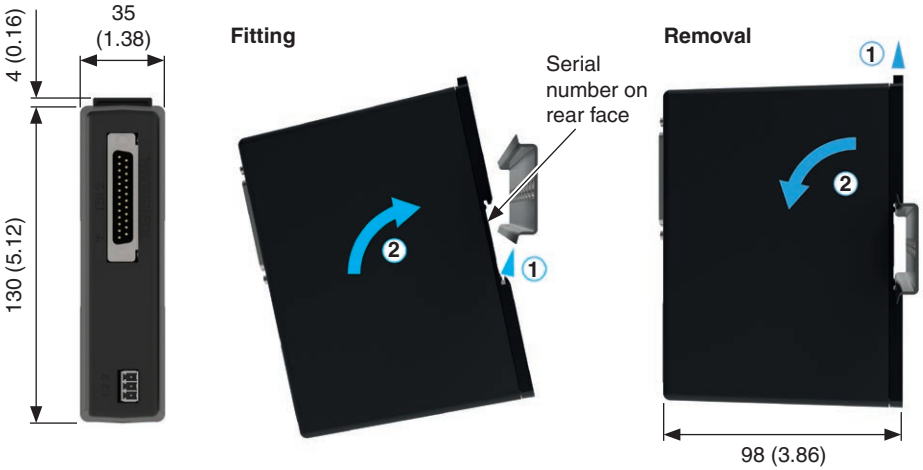
WARNINGS:

Safety footwear and eye protection should be worn while installing the TSI 2 or TSI 2-C.

Remove all power before commencing installation.

Standard mounting and dimensions

The TSI 2 or TSI 2-C interface unit should be installed in the CNC controller cabinet. Where possible, site the unit away from potential sources of interference such as transformers and motor controllers.

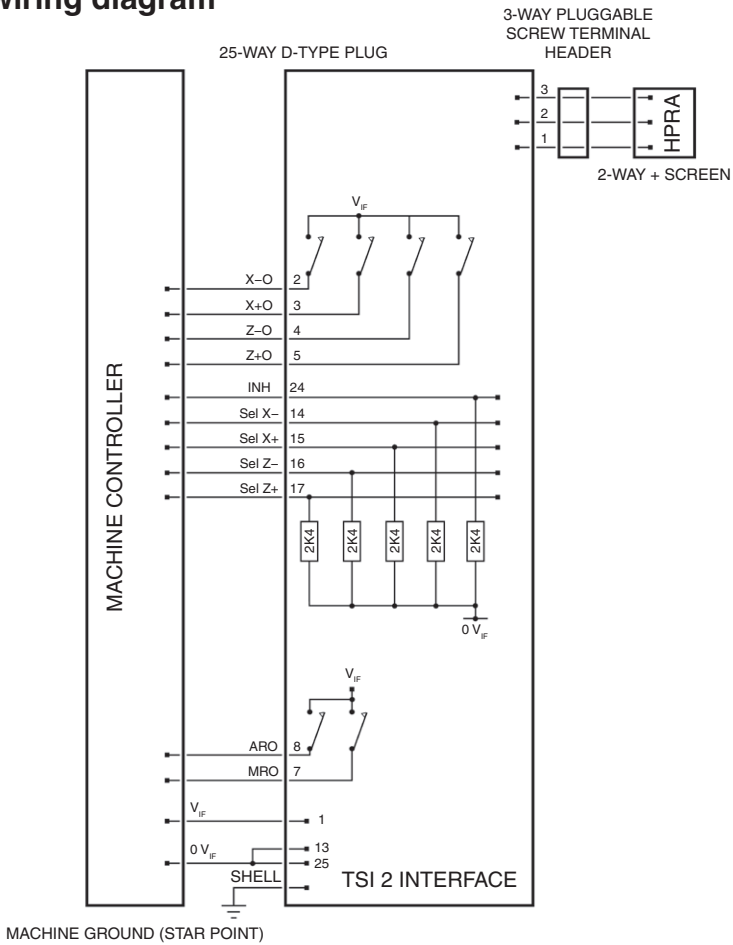


Dimensions given in mm (in)

Alternative mounting

TSI 2 installation and operation

TSI 2 wiring diagram



V_{IF} = 24 Vdc PELV 0.75 to 1.25 × rated voltage.
This supplies the power to the system electronics which include the probe circuit.
I_{MAX} = 100 mA, not including output load currents (all outputs o/c).
Circuit protection: power supply protected against overcurrent and reverse connection.

NOTES:

Cable screen must be terminated at the machine star point via the most direct route from the free end of the cable.

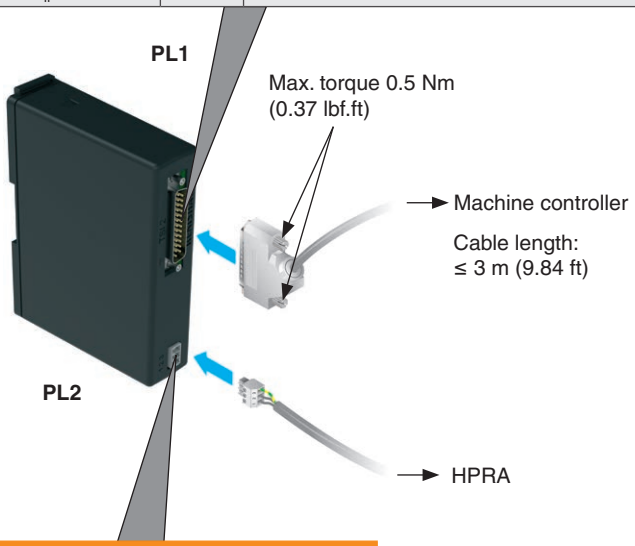
Mount interface and route cables away from known sources of EMI.

TSI 2 interface connections

Pin	Function	Pin	Function
1	Interface 24 Vdc supply (V_{IF}) [2]	14	Select X– input (Sel X–)
2	X– output (X–O)	15	Select X+ input (Sel X+)
3	X+ output (X+O)	16	Select Z– input (Sel Z–)
4	Z– output (Z–O)	17	Select Z+ input (Sel Z+)
5	Z+ output (Z+O)	24	Probe inhibit (INH)
6	ARO	25	Interface 0 Vdc (0 V_{IF})
7	MRO	Shell [1]	SCR
13	Interface 0 Vdc (0 V_{IF})	-	-

[1] Shell to be connected to the machine star point

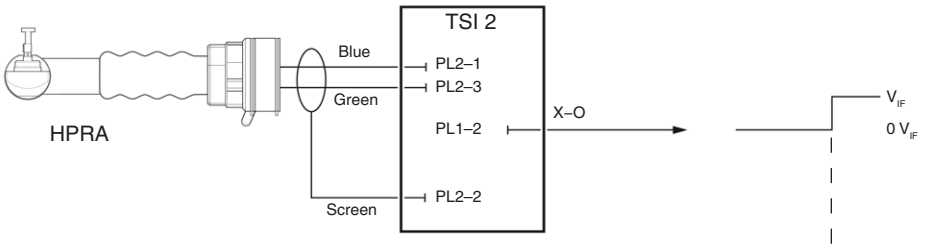
[2] 24 Vdc PELV
0.75 to 1.25 × rated voltage
I_{MAX} = 100 mA (not including output load currents).



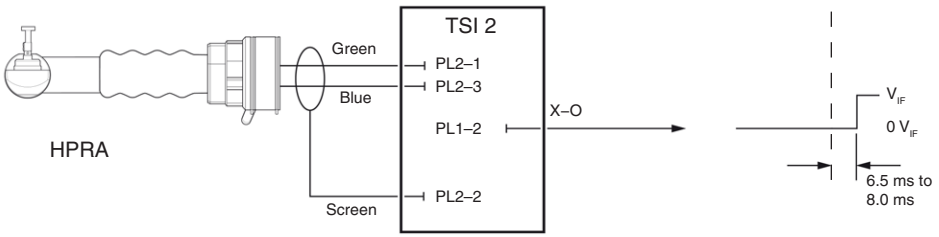
	Rear exit version or side exit version		
Pin	Function	Standard	Trigger delay
1	Probe +	Blue	Green
2	SCR	Grey/Black	Grey/Black
3	Probe –	Green	Blue

TSI 2 probe trigger delay

Configuration for DELAY OFF
Blue/Green (rear or side exit version)

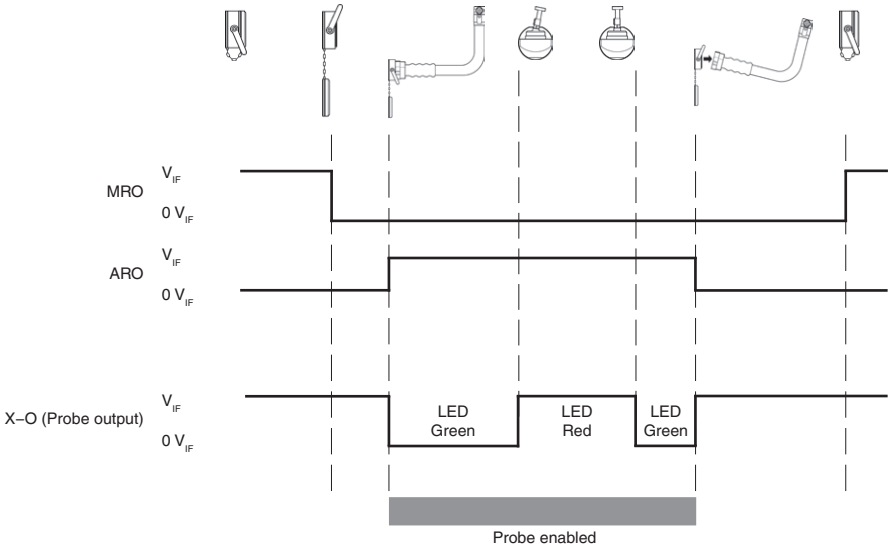


Configuration for DELAY ON
Blue/Green (rear or side exit version)



NOTE: Probe trigger delay is only compatible with on-centre length measurement; it should not be used for setting the ROTATING DIAMETER.

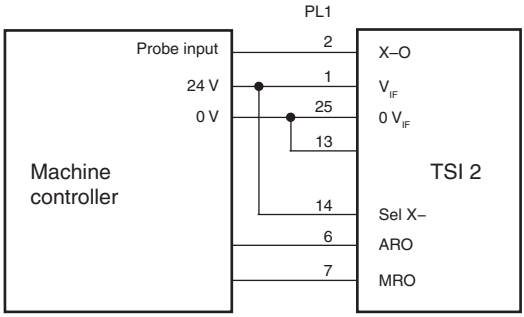
TSI 2 standard wiring for probe output



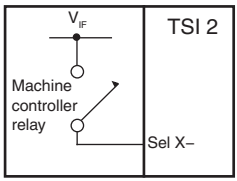
NOTES:

These wiring diagrams assume the standard one-wire Renishaw probe output can be used.

Where the four-wire option is required (for example, Fanuc automatic length management input XAE, ZAE), the user must provide **four** inputs from the controller to indicate which axis is moving in order to obtain a probe trigger (Sel X–, Sel X+, Sel Z–, Sel Z+). This signal will instruct the TSI 2 to send the probe trigger output out through one of four possible channels (X–, X+, Z–, Z+).



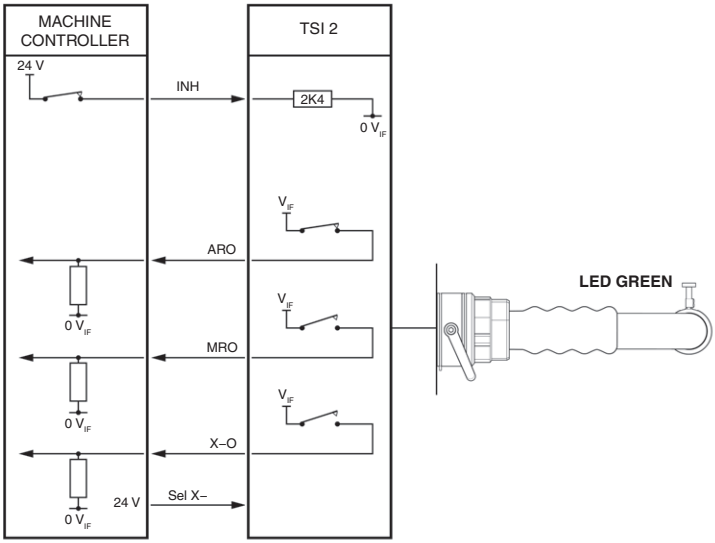
TSI 2 probe select inputs

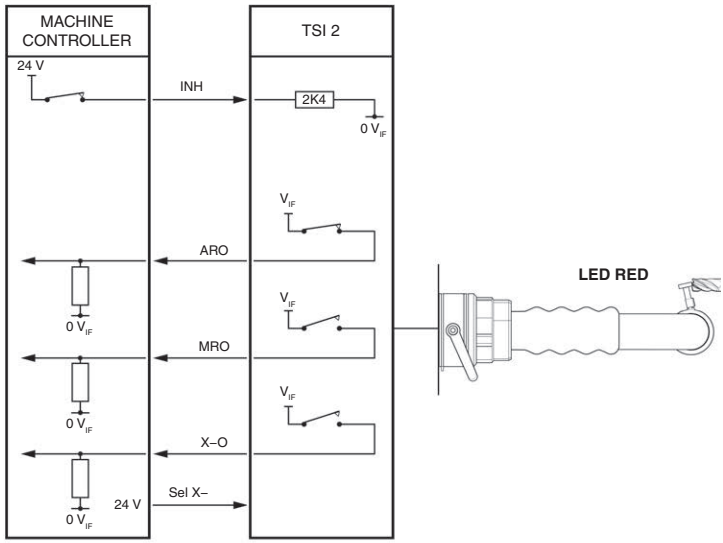


NOTE: The example above shows Sel X–; it also applies to Sel X+, Sel Z– and Sel Z+.

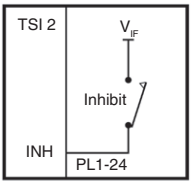
TSI 2 probe inhibit

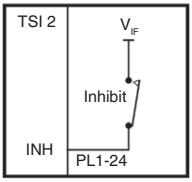
Shown as “active high”.

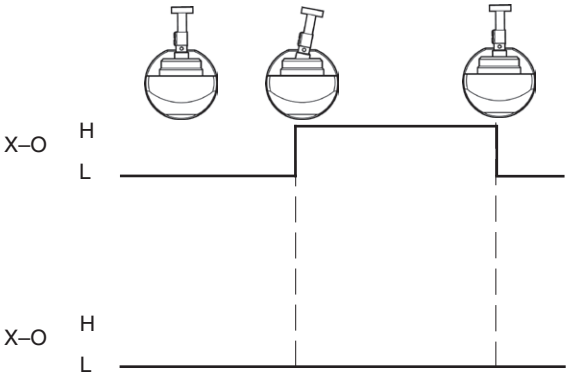




TSI 2 inhibit inputs







NOTE: The probe status LED will still function when inhibit is active.

TSI 2 system inputs and outputs

Input specification

INH
Sel X–
Sel X+
Sel Z–
Sel Z+

} Internally pulled down (2K4) ACTIVE HIGH inputs

Output specification

ARO and MRO are current limited.

X–O, X+O, Z–O, Z+O are protected by the supply fuse in the TSI 2.

Probe signal outputs

(PL1-2) X–O
(PL1-3) X+O
(PL1-4) Z–O
(PL1-5) Z+O

} OCT ACTIVE HIGH outputs (one probe signal output only)

V_{IF} – 3.8 V @ max. source 120 mA
V_{IF} – 2.4 V @ 20 mA

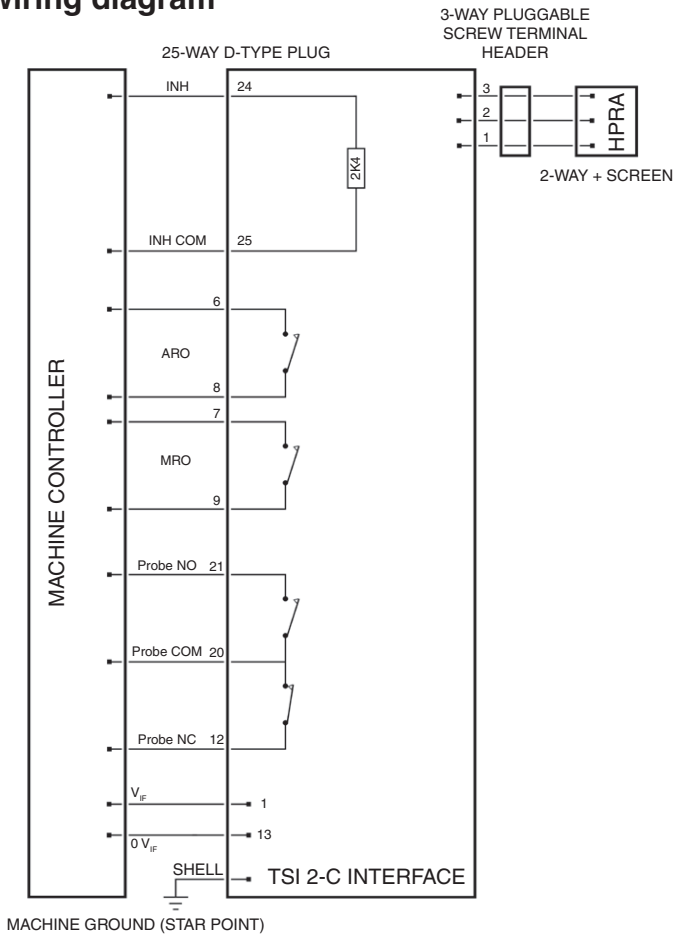
Arm ready (ARO) / Machine ready (MRO) outputs

ARO (PL1-6) MRO (PL1-7)

OCT ACTIVE HIGH outputs V_{IF} – 2.4 V @ 20 mA

TSI 2-C installation and operation

TSI 2-C wiring diagram



V_{IF} = 24 Vdc PELV 0.75 to 1.25 × rated voltage.
This supplies the power to the system electronics which include the probe circuit.
I_{MAX} = 100 mA, not including output load currents (all outputs o/c).
Circuit protection: power supply protected against overcurrent and reverse connection.

NOTES:

Cable screen must be terminated at the machine star point via the most direct route from the free end of the cable.

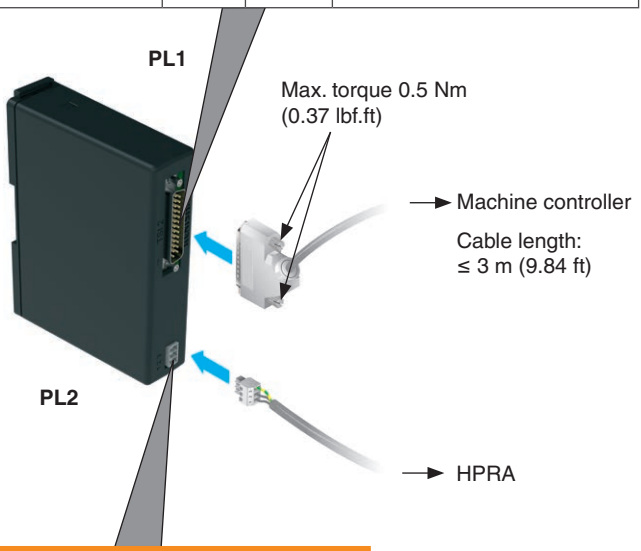
Mount interface and route cables away from known sources of EMI.

TSI 2-C interface connections

Pin	Function		Pin	Function	
1		Interface 24 Vdc supply (V_{IF}) [2]	12		Probe status (NC)
6		ARO (NO)	20		Probe COM
8			21		Probe status (NO)
7		MRO (NO)	24		Probe inhibit (INH) (15 Vdc to 30 Vdc)
9			25		
13		Interface 0 Vdc supply (0 V_{IF})	Shell [1]		SCR

[1] Shell to be connected to the machine star point

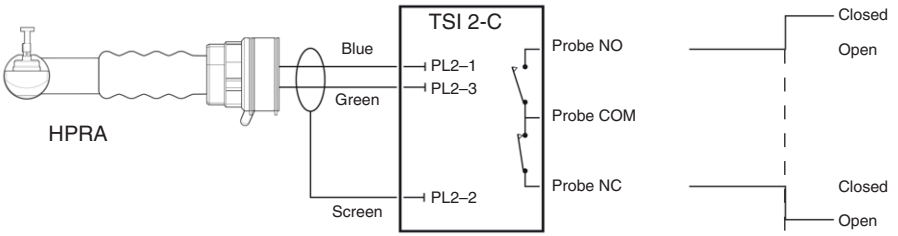
[2] 24 Vdc PELV
0.75 to 1.25 × rated voltage
I_{MAX} = 100 mA (not including output load currents).



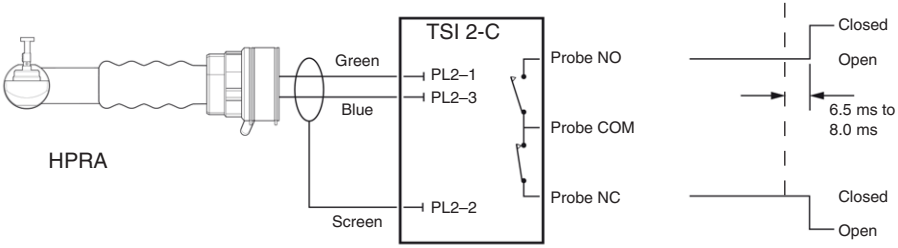
		Rear exit version or side exit version	
Pin	Function	Standard	Trigger delay
1	Probe +	Blue	Green
2	SCR	Grey/Black	Grey/Black
3	Probe –	Green	Blue

TSI 2-C probe trigger delay

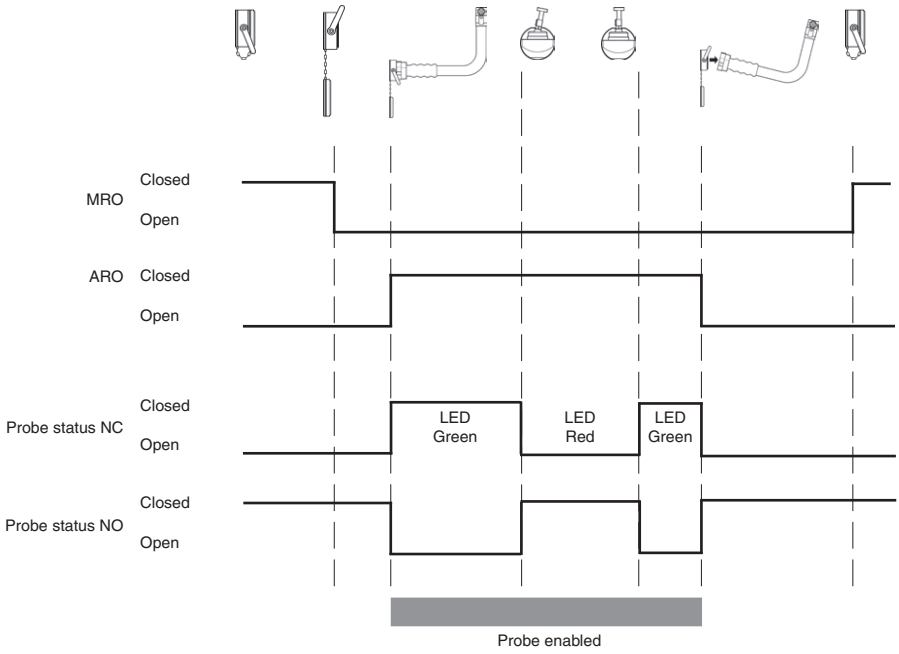
Configuration for DELAY OFF
Blue/Green (rear or side exit version)

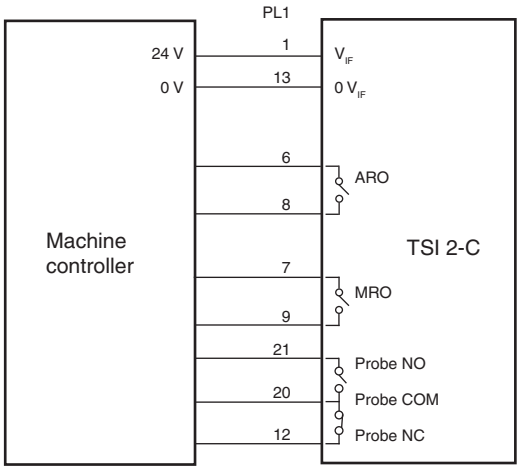


Configuration for DELAY ON
Blue/Green (rear or side exit version)



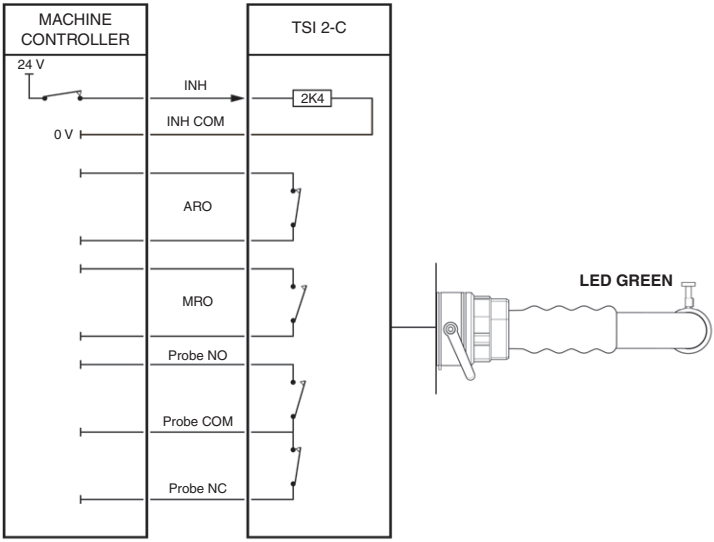
TSI 2-C standard wiring for probe output

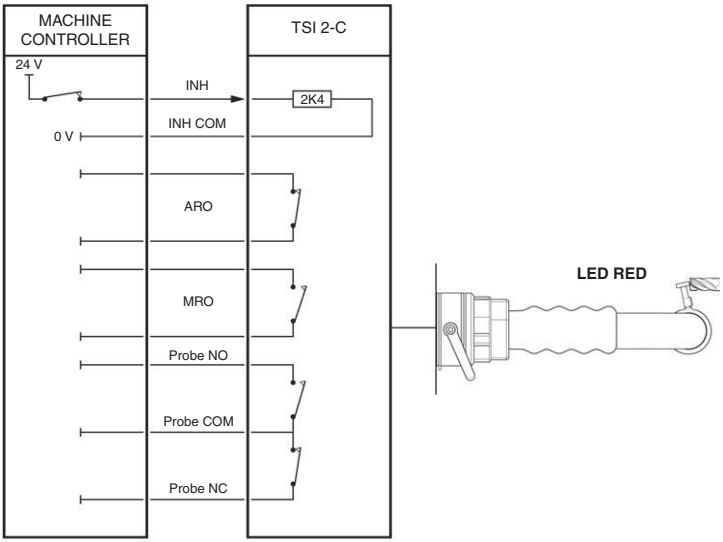




TSI 2-C probe inhibit

Shown as “active high”.



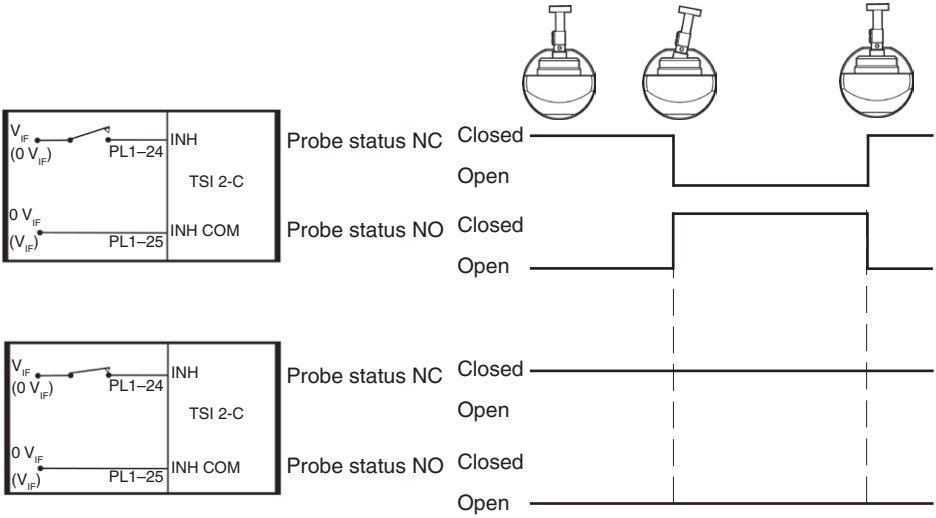


TSI 2-C inhibit inputs

Shown as “active high” (with “active low” shown in brackets).

NOTE: The inhibit input is not polarity sensitive.

Apply a voltage of 18 Vdc to 30 Vdc across PL1-24 and PL1-25 to activate. The inhibit input presents a load of 12.5 mA max. Probe inhibit disables the probe outputs.



NOTE: The probe status LED will still function when inhibit is active.

TSI 2-C system inputs and outputs

Input specification

INH	}	Opto isolated. 12.5 mA max. @ 30 V.
INH COM	}	30 V max. Activation voltage: 15 Vdc to 30Vdc.

Output specification

ARO and MRO are voltage-free SSR contacts.
ARO: NO, MRO: NO.
40 mA max., 30 V max., 10 V min.
Current limited.

Probe signal outputs

Probe status outputs are voltage-free SSR contacts.
Probe status: NO, Probe status: NC.
40 mA max., 30 V max., 10 V min.
Current limited.

For more information, see “Interface connections” on **page 34**.

Tool setting definitions

Probe datuming

Determines the relationship between the machine spindle and the stylus location, as well as the effective size of the tool setting stylus.

Your Renishaw tool setting probe can be datumed by measuring a ‘datum tool’ of known size and position.

Tool setting

Establishes the size and position of your cutting tools before you use them to machine a component. This enables you to produce parts that are ‘right first time’.

With a Renishaw tool setting probe, you can determine the size and position of your cutting tools quickly and easily.

Why datum the probe?

A Renishaw touch-trigger probe allows you to use your machine tool to determine the size and position of your tools. When the stylus contacts the surface of your tool, the positions of the machine axes are recorded at that moment.

To determine the location of the surface of the tool, the software must know the size and position of the stylus.

Various probe datuming techniques allow you to determine the relationship between the stylus and the machine spindle.

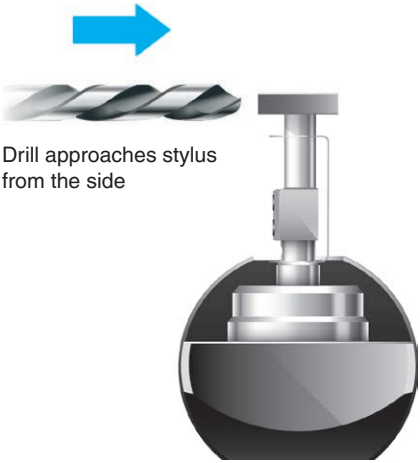
Whilst the spindle/stylus relationship will not change under normal conditions, there are certain circumstances under which you should redatum the tool setting probe:

- Before using the probe for the first time on a machine.
- Whenever a new stylus is fitted.
- If you have made any adjustment to the probe alignment.
- If you suspect that the stylus has become distorted.

Setting tools

Static tool length setting

Suitable for tools whose cutting edges are located on the spindle centre line, for example, drills. Static length setting involves moving the tip of a tool to contact the stylus.



Drill approaches stylus from the side

Rotating tool length setting (for driven tools)

Suitable for tools whose cutting edges are located around the circumference, for example, slot drills. As with static length setting, rotating length setting involves moving the tip of a tool to contact the stylus but doing so while rotating, and doing so in the opposite direction to that which is used for cutting.

Rotating length setting ensures that the true high or low point of the tool is detected.

Rotating diameter setting (for driven tools)

Suitable for tools that are used to interpolate features, for example, slot drills, and which must be set for diameter. It involves moving the side of a tool to contact the stylus tip and, as with rotating length setting, the tool must be rotating in the opposite direction to that which is used for cutting (to protect the stylus).

NOTE: Do not use “Probe trigger delay” if setting the diameter of rotating tools.

Slot drill approaches stylus from both sides whilst spinning in reverse direction

Maintenance and fault-finding

The following section describes the maintenance actions that can be carried out on the HPRA.
A fault-finding section for assisting the user in diagnosing faults begins on **page 49**.

WARNING: It is recommended that eye protection and protective gloves be worn while inspecting and cleaning the HPRA.

HP Arms app

The HP Arms app makes configuring and supporting the range of Renishaw high-precision tool setting arms simple.

Intended for suitably-trained installation and maintenance engineers, the app provides a convenient, single point of reference for typical configuration, maintenance and troubleshooting tasks.

The app is easy to use with detailed animations, images, help text and step-by-step instructions and can be downloaded by searching for 'HP Arms' on the following stores:

Download on the App Store

GET IT ON Google Play

HPRA calibration

The exact procedure adopted is specific to each machine, controller system and software package. However, certain rules are common.

Before setting tools, it is necessary to calibrate the stylus position to establish its trigger points in relation to a datum on the machine. This can be achieved by using a tool of known reference.

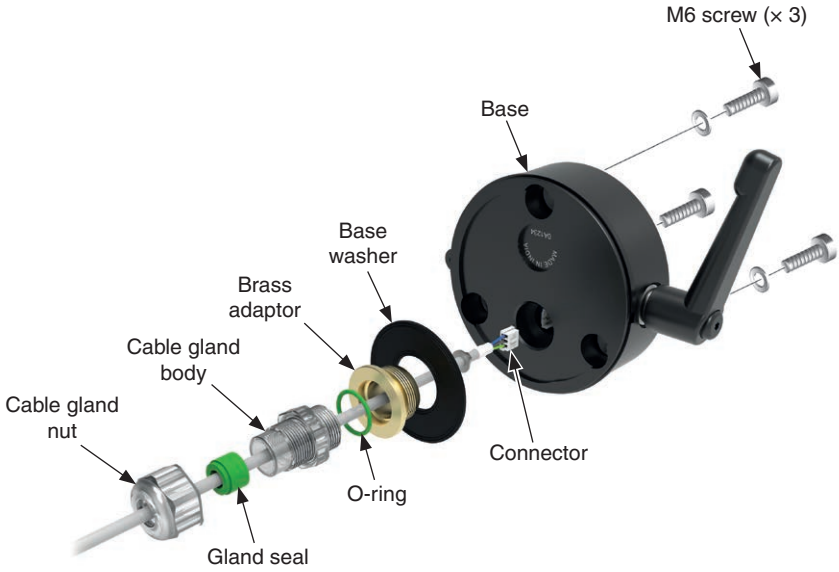
The HPRA must be recalibrated periodically (at least every 6 months), and in special circumstances, for example, if the arm has been subjected to a crash or if the stylus has been replaced.

The recommended frequency of normal recalibration is dependent on how frequently the arm is used. This may vary greatly depending on the application of the tool setting arm; for example, a typical jobbing shop may want to set tools twice per day and have eight tools to set. This would therefore result in two arm operations per day. A large volume manufacturer, however, may only wish to check for broken tools, but with a typical cycle time of 5 minutes and 24-hour working days, would operate the arm 288 times per day.

Use the table below to determine how frequently you should recalibrate your HPRA.

Recommended frequency of arm recalibration	
Arms operations per day	**Recalibrate every ...**
< 50	6 months
< 100	3 months
> 100	1 month

Base removal (rear exit base only)



CAUTIONS:

Base washer, O-ring and gland seal must be fitted to ensure sealing integrity.

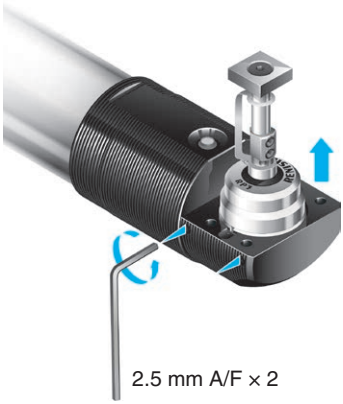
Base removal must be performed in the following sequence to avoid cable/connector damage.

1. Remove the three M6 screws.
2. Remove the base.
3. Ensuring that the cable gland body does not rotate, unscrew and remove the cable gland nut.
4. Unscrew and remove the cable gland body.
5. If required, the brass adaptor and base washer can now be removed before the connector is carefully disconnected from the PCB.

RP3 probe removal

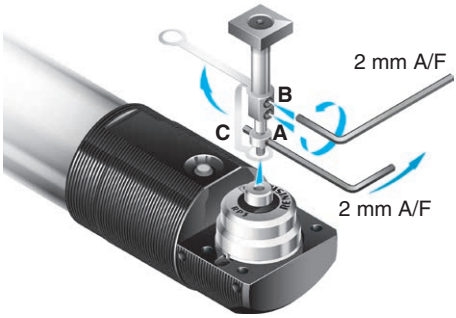
CAUTION: Ensure the area around the probe is dry and free of swarf and coolant before removing the probe.

1. Remove the M5 grub screws prior to cleaning to allow any coolant to escape.
2. Clean the probe and the area around the probe using clean dry air (Dust Remover clean air spray).
3. Remove the probe.



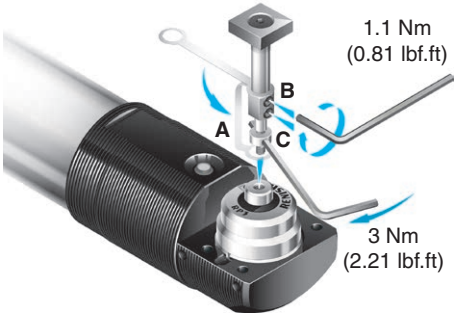
Stylus and break stem removal

1. Using a 2 mm hexagonal key fitted through the hole in the break stem (**A**), unscrew the stylus from the probe.
2. Using a 2 mm hexagonal key, unscrew the M3 grub screw(s) (**B**) that hold the break stem to the stylus.
3. Free the end of the captive link from the threaded end of the break stem (**C**) and remove the break stem.



Break stem and stylus fitting

1. Fit the free end of the captive link over the threaded end of the break stem (**A**).
2. Fit the break stem inside the stylus and secure it by tightening the M3 grub screw(s) (**B**).
3. Using a 2 mm hexagonal key fitted through the hole in the break stem (**C**), fit the stylus to the probe.



RP3 probe care

The probe mechanism is protected from coolant and debris by a diaphragm. This provides adequate protection under normal working conditions.

Periodically clean the probe and check the diaphragm for signs of damage.

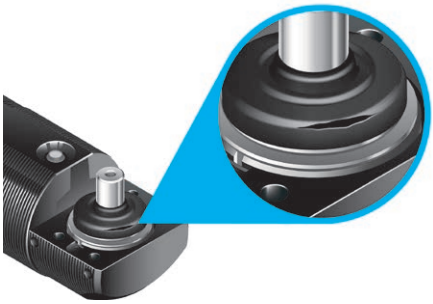
CAUTION: Do not remove the diaphragm. If the diaphragm is damaged, return the probe to your supplier for repair.

Cleaning and diaphragm inspection

1. Leaving the probe in the arm, use a screwdriver to release and remove the front cover.

2. Clean the probe mechanism with low-pressure clean coolant.

   CAUTION: Do not use high-pressure water jets to clean the probe mechanism.



3. Inspect the diaphragm for damage. If it is damaged, return the probe to your supplier.

   CAUTION: Do not remove the diaphragm, as this will invalidate your warranty.

Fitting the cover

4. Fit the front cover by pressing it back into place with your hand, while supporting the probe holder.

Base inspection and cleaning

Renishaw recommends regular inspection and cleaning of the base, arm and cover.

CAUTION: Do not use polish or solvent when cleaning the base or arm contacts.

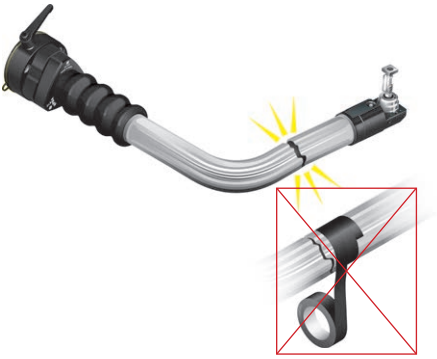
1. Wipe clean base and arm contact points.
2. Grease tungsten carbide balls.
3. Wipe clean mating faces and seal.

CAUTION: Ensure the cover is wiped clean and is dry before refitting.

HPRA inspection

Periodically inspect the arm for signs of damage.

CAUTION: Contact your supplier if damaged. Do not attempt to fix it yourself.

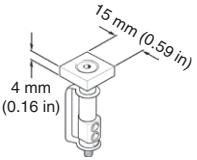
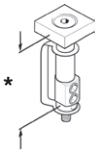
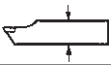
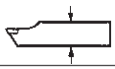
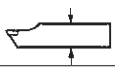


Fault-finding

Symptom	Cause	Action
Poor system repeatability.	Mounting screws not fully tightened.	Tighten screws to specified torque.
	Loose probe.	Verify tightness of probe in arm assembly.
	Loose stylus.	Ensure tip of stylus is tight. Ensure M4 grub screw in stylus stem is tight. Ensure break stem is fully tightened into RP3 probe.
	Swarf on tool tip.	Remove swarf.
	Calibration and updating of offsets is not occurring.	Review software.
	Calibration and probing speeds are not the same.	Review software.
	Probing is being performed within the machine's acceleration/deceleration zones.	Review software.
	Arm not mounted as recommended (for example, on sheet metal guards).	Mount on solid base.
	Probing feedrate is too high for the machine controller.	Perform repeatability trials at various feedrates.
	Temperature variation is causing excessive movement of the machine and the HPRA.	Minimise machine and HPRA temperature changes. Increase the frequency of calibration.
	Machine has poor repeatability due to loose encoders, backlash, tight slideways and/or accidental damage.	Perform health check on machine.

Symptom	Cause	Action
Poor system repeatability (continued).	Excess machine vibration.	Eliminate vibration. Change wiring to enable probe trigger delay circuit.
No probe output (probe status LED not lit).	Damaged or dirty probe contacts.	Check condition of probe contacts. If contacts are dirty, clean using compressed air and a clean lint-free cloth.
	Damaged or dirty arm base contacts.	Check condition of arm base contacts. If contacts are dirty, clean using compressed air and a clean lint-free cloth.
	Probe not connected.	Check wiring to machine. Check that the probe is properly located in the holder.
	Probe has failed.	Remove probe and check probe for continuity across probe contacts (resistance should be less than 1 KΩ).

Parts list

Recommended for:	 Stylus assembly	 * Stylus length	Break stem
 16 mm	A-2197-0157	14.2 mm (0.56 in)	M-2197-0156
20 mm	A-2197-0158	19.5 mm (0.77 in)	M-2197-0156
25 mm	A-2197-0159	29.5 mm (1.16 in)	M-2197-0150
 32 mm	A-2197-0160	34.5 mm (1.36 in)	M-2197-0150
 40 mm	A-2197-0161	39.5 mm (1.55 in)	M-2197-0150
50 mm	A-2197-0162	49.5 mm (1.95 in)	M-2197-0150

Item	Part number	Description
Tools	A-2176-0636	Standard HP arm tool kit.
	A-2176-0639	Micro HP arm tool kit.
Base fixing	A-2176-0028	HPRA base fixing kit.
Front cover	A-2197-0006	RP3 probe front cover kit.
TSI 2-C	A-2176-1152	TSI 2-C interface unit with DIN rail mounting.
TSI 2	A-2176-0010	TSI 2 interface unit with DIN rail mounting.
RP3 probe	A-2197-0004	RP3 probe assembly.
Rear exit base	A-2176-0443	HPRA rear exit base assembly (3 m cable).
Side exit base	A-2176-0450	HPRA side exit base assembly (3 m cable).
Stand	A-2176-0019	HPRA stand base assembly.
Cables	A-2176-0020	HPRA base cable assembly 3 m
	A-2176-0120	HPRA base cable assembly 5.5 m
	A-2176-0906	HPRA base cable assembly 10 m
	A-2176-1511	HPRA base cable assembly 12 m

Item	Part number	Description
Publications. These can be downloaded from our website at **www.renishaw.com**.		
RP3	H-2000-5187	User guide: RP3 probe.
HPRA and TSI 2 / TSI 2-C	H-2000-2029	Data sheet: HPRA and TSI 2 / TSI 2-C removable arm and interface.
HPPA and TSI 2 / TSI 2-C	H-2000-2032	Data sheet: HPPA and TSI 2 / TSI 2-C pulldown arm and interface.
HPPA and TSI 2 / TSI 2-C	H-2000-5186	Installation and user guide: HPPA and TSI 2 / TSI 2-C pulldown arm and interface.
Styli	H-1000-3200	Technical specifications guide: Styli and accessories – or visit our Online store at **www.renishaw.com/shop**.
Probe software	H-2000-2298	Data sheet: Probe software for machine tools – programs and features.

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