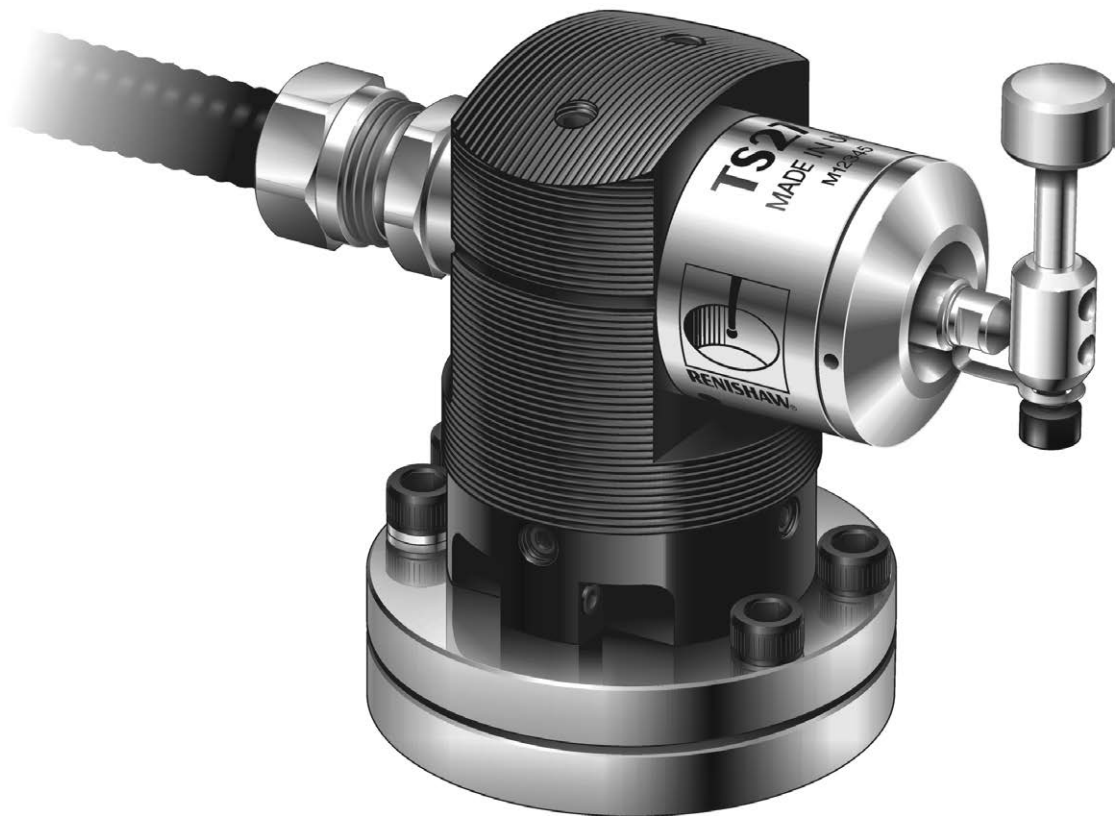


TS27R tool setting probe



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

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

TS27R is a hardwired 3D tool setter that enables automated tool length and diameter measurement on CNC machine tools. TS27R can also detect broken tools.

Safety

Information to the user

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

Refer to the machine supplier's operating instructions.

The TS27R 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-C / HSI / MI 8-4 is disconnected.

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

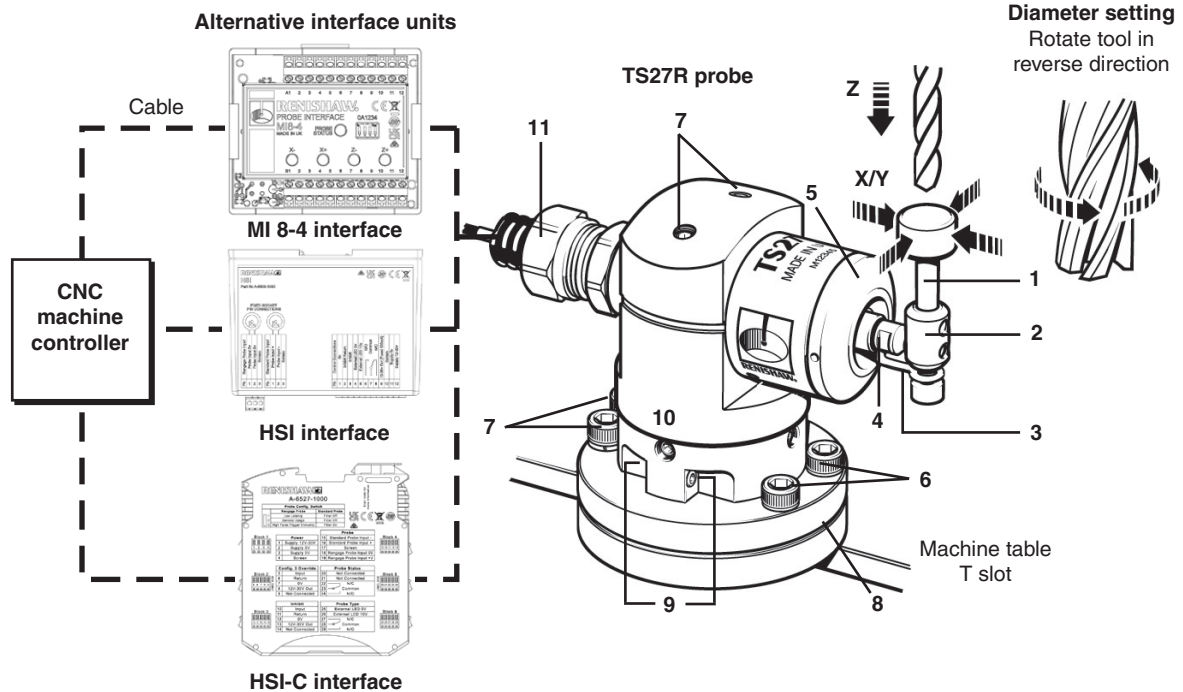
Information to the equipment installer

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, i.e. power transformers, servo drives etc.;
- 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, i.e. motor power supply cables etc., or be near high-speed data lines;
- cable lengths should always be kept to a minimum.

Product basics

TS27R probe system



- | | |
|---|--|
| 1. Stylus | 7. Stylus level alignment – adjusting screws |
| 2. Stylus holder for disc or square styli | 8. Plinth |
| 3. Captive link | 9. Square stylus axes alignment – adjusting screws |
| 4. Break stem | 10. Square stylus axes alignment – locking screws |
| 5. Front cover | 11. Conduit adaptor |
| 6. Probe base holding screws | |

Introduction

The TS27R probe is used for tool setting on CNC machining centres.

For tool length measurements and broken tool detection, the tool is driven against the probe's stylus in the Z axis. Rotating tools can be set in the X and Y axes for tool radius offsets.

Screw adjusters allow the stylus to be aligned with the machine's axes.

An interface unit processes signals between the probe and the CNC controller.

Achievable set-up tolerances

The tolerances to which tools can be set depend upon the flatness and parallelism of the stylus tip setting. A value of 5 µm (0.0002 in) front to back and side to side is easily achievable over the flat portion of the stylus tip, and 5 µm (0.0002 in) parallelism is easily achievable with the axes of a square tip stylus. This setting accuracy is sufficient for the majority of tool setting applications.

Recommended rotating tool feedrates

Cutters should be rotated in reverse to the cutting direction.

First touch – machine spindle rev/min

Rev/min for the first move against the probe stylus is calculated from a surface cutting speed of 60 m/min (197 ft/min).

Spindle speed should be maintained within the range 150 rev/min to 800 rev/min and relates to cutters of Ø24 mm to Ø127 mm (Ø0.95 in to Ø5.0 in).

The surface cutting speed is not maintained if cutters smaller than Ø24 mm (Ø0.95) or larger than Ø127 mm (Ø5.0 in) are used.

First touch – machine feedrate

The feedrate (F) is calculated as follows:

$$F = 0.16 \times \text{rev/min} \quad F \text{ units mm/min (diameter set)}$$

$$F = 0.12 \times \text{rev/min} \quad F \text{ units mm/min (length set)}$$

Second touch – machine feedrate

800 rev/min, 4 mm/min (0.16 in/min) feedrate.

Software routines

Software routines for tool setting are available from Renishaw for various machine controllers and are described in the *Probe software for machine tools – programs and features* data sheet (Renishaw part no. H-2000-2298).

TS27R Specification

Principal application		Tool measuring and broken tool detection on all sizes of vertical and horizontal machining centres and all gantry machining centres.
Transmission type		Hard-wired transmission
Receiver/interface		MI 8-4, HSI or HSI-C
Recommended styli		Disc stylus (tungsten carbide, 75 Rockwell C) or Square tip stylus (ceramic tip, 75 Rockwell C)
Weight with disc stylus		1055 g (37.21 oz)
Cable (to interface)	Specification	Ø4.4 mm (0.17 in), 4-core screened cable, each core 7 × 0.2 mm
	Length	10 m (32.8 ft)
	Electrical connection	Cable on the end of unit
Sense directions		±X, ±Y, +Z
Unidirectional repeatability		1.00 µm (40 µin) 2 σ ¹
Stylus trigger force 2 3		1.30 N to 2.40 N, 133 gf to 245 gf (4.68 ozf to 8.63 ozf) depending on sense direction
Sealing		IPX8, BS EN 60529:1992+A2:2013
Mounting		M12 (1/2 in) T bolt (not supplied) Optional Spirol® pins to allow accurate remounting
Storage temperature		-10 °C to +70 °C (+14 °F to +158 °F)
Operating temperature		+5 °C to +60 °C (+41 °F to +140 °F)

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.

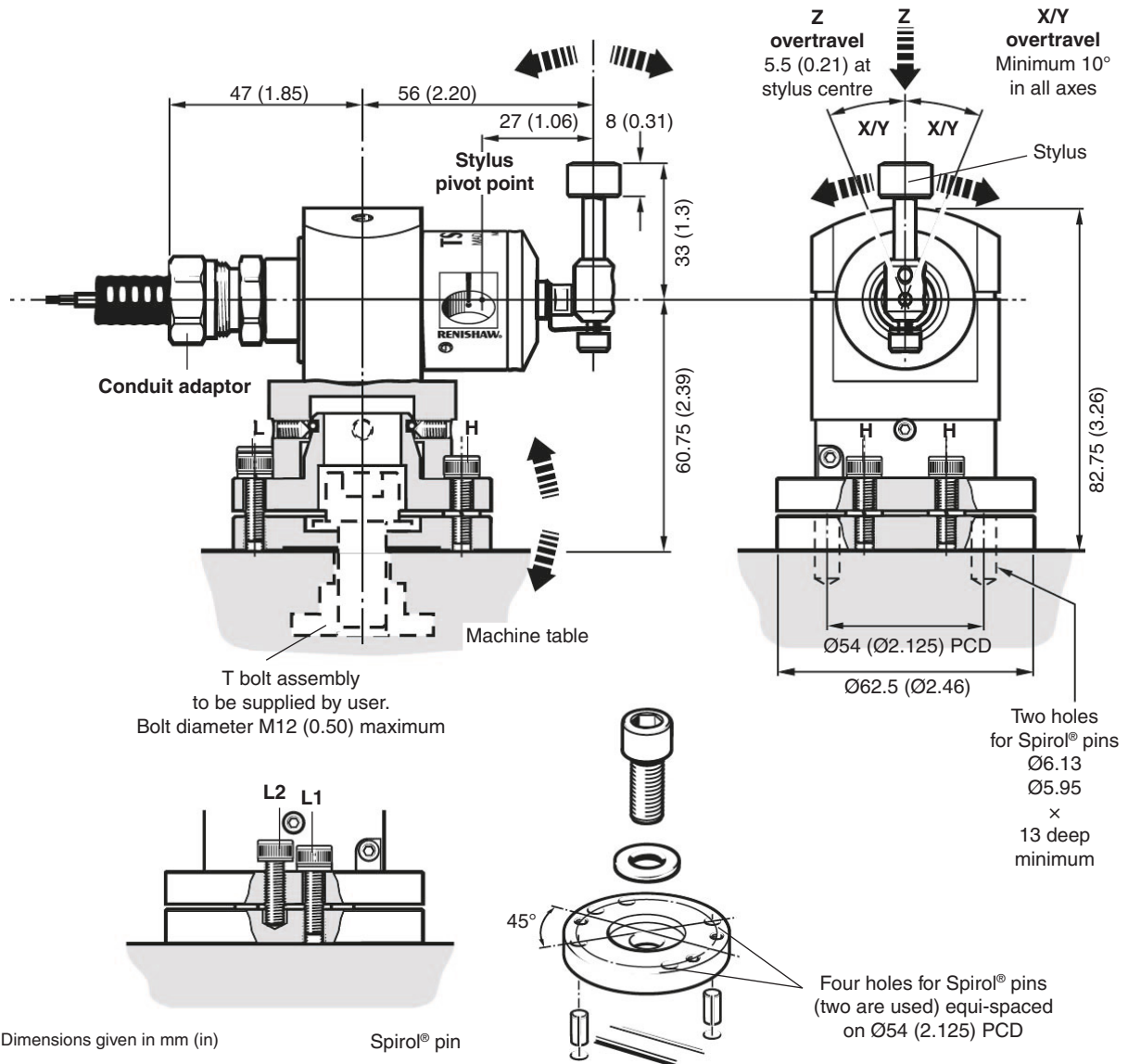
² Trigger force, which is critical in some applications, is the force exerted on the component by the stylus when the probe triggers. The maximum force applied will occur after the trigger point (overtravel). The force value depends on related variables including measuring speed and machine deceleration. Trigger force is measured with a 50 mm (1.97 in) stylus.

³ These are the factory settings; manual adjustment is not possible.

NOTE: For stylus recommendations, refer to the *Styli and accessories* technical specification (Renishaw part no. H-1000-3200).

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System installation



Mounting the probe on the machine table

1. Select a position for the probe on the machine table.
2. Detach the probe base and the plinth from the probe by removing the two screws H and the screw L1 using a 4 mm A/F hexagon key.
3. Fit the T bolt (not supplied by Renishaw).
4. Tighten the T bolt to secure the probe base to the machine table.
5. Refit the probe and plinth onto the base and fit the screws. Tighten the two screws H firmly. Keep the adjusting screws L1 and L2 loose before setting the stylus alignment. See **page 3-10**, "Stylus level setting", for further information.
6. Fit the stylus. See **page 3-8**, "Fitting the stylus and captive link", and **page 3-9**, "Break stem", for further information.

Spirol® pins

The T bolt provides adequate clamping for all normal circumstances. However two Spirol® pins (supplied in the probe kit) may be fitted on installations where there is a requirement to remove and remount the TS27R. To fit the Spirol® pins, drill two holes in the machine table to correspond with two of the probe base holes. Place the Spirol® pins in the holes and refit the probe base.

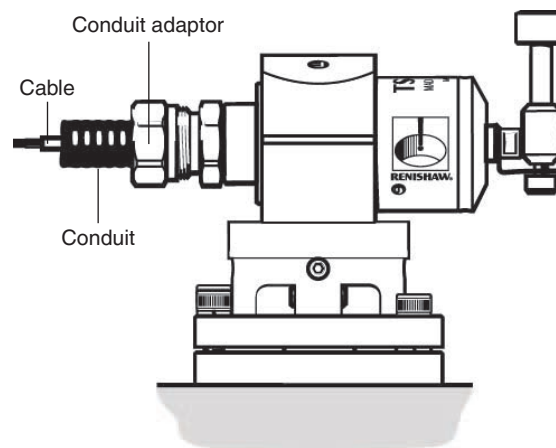
Cable

Four-core 7/0.2 polyurethane insulated and screened cable 10 m (32.8 ft) long. Cable diameter 4.4 mm (0.17 in). Probe circuit – red and blue cores (yellow and green not used).

Extension cable (15 m [49 ft] maximum extension)

Maximum permitted cable length: Probe to interface – 25 m (82 ft) long

Two-core 7/0.2 mm polyurethane insulated and screened cable. Maintain the screen through the joins.



Conduit for cable protection

Renishaw recommends that Thomas and Betts Type EF conduit, or a suitable alternative, is fitted to all installations. The TS27R conduit adaptor accepts Ø11 mm (0.43 in) flexible conduit.

NOTE: The cable screen is connected to the machine via a 100 nF capacitor inside the TS27R to prevent possible earth loops. Ensure the cable screen is connected to the appropriate input on the interface. The interface units are fully described in the following publications: *MI 8-4 interface unit installation and user's guide* (Renishaw part no. H-2000-5008), *HSI hard-wired system interface installation guide* (Renishaw part no. H-5500-8554) and *HSI-C hard-wired system interface – configurable installation guide* (Renishaw part no. H-6527-8501).

Interfaces

The MI 8-4 interface is used with the standard G31 SKIP input. The probe's status output operates between 4.75 Vdc and 30 Vdc.

All inputs are fully configurable for ACTIVE HIGH and ACTIVE LOW operation.

The interface also includes an 'inhibit' function, as well as a facility for simple selection between the tool setting probe and an inspection probe.

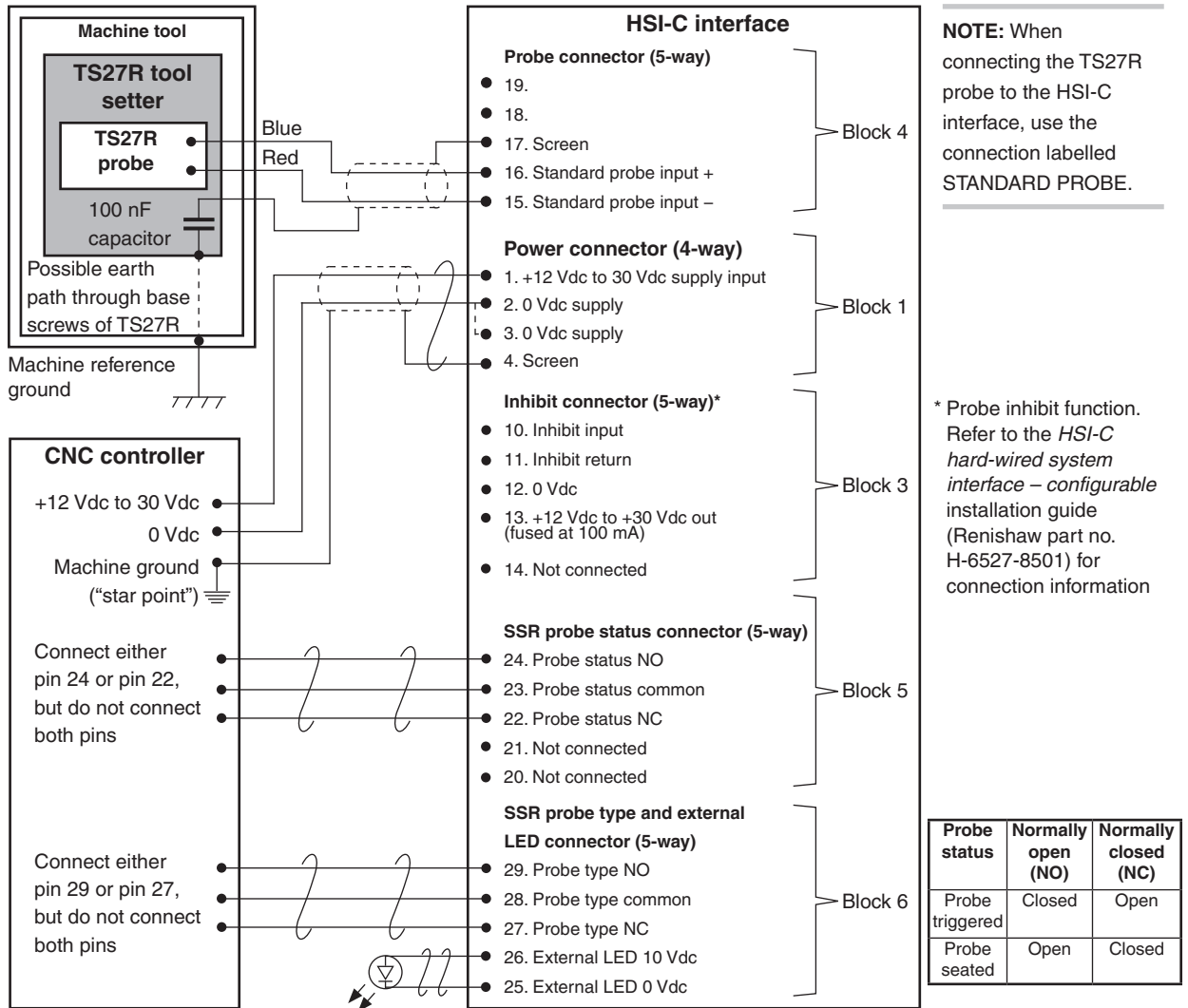
The HSI and HSI-C interfaces are used with the standard G31 SKIP input. Probe status output is a voltage-free SSR (solid-state relay) which can be connected as normally open (NO) or normally closed (NC).

Maximum current 50 mA peak

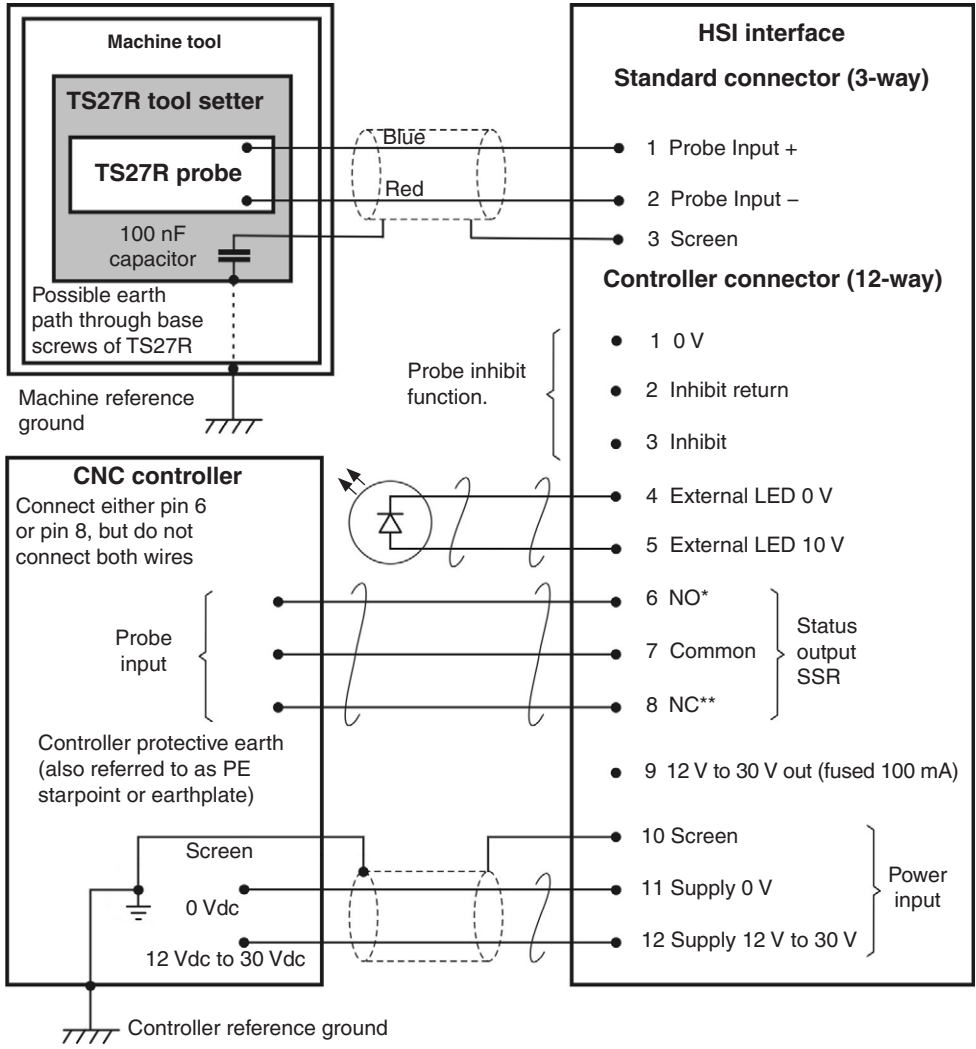
Maximum voltage ±50 V peak

An inhibit function is included, and a facility to drive an external probe status LED.

Recommended connection diagram for TS27R with HSI-C interface



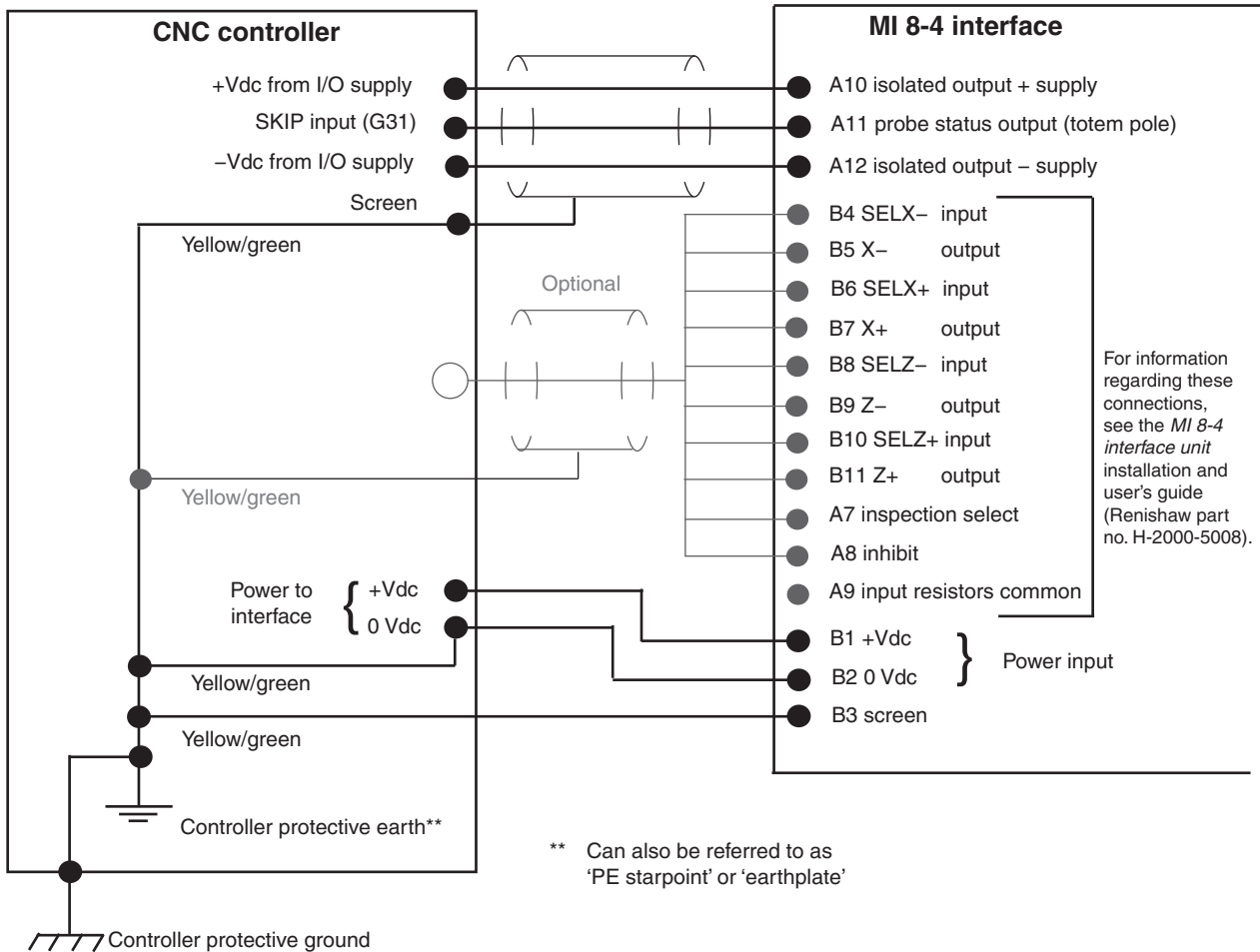
Recommended connection diagram for TS27R with HSI interface



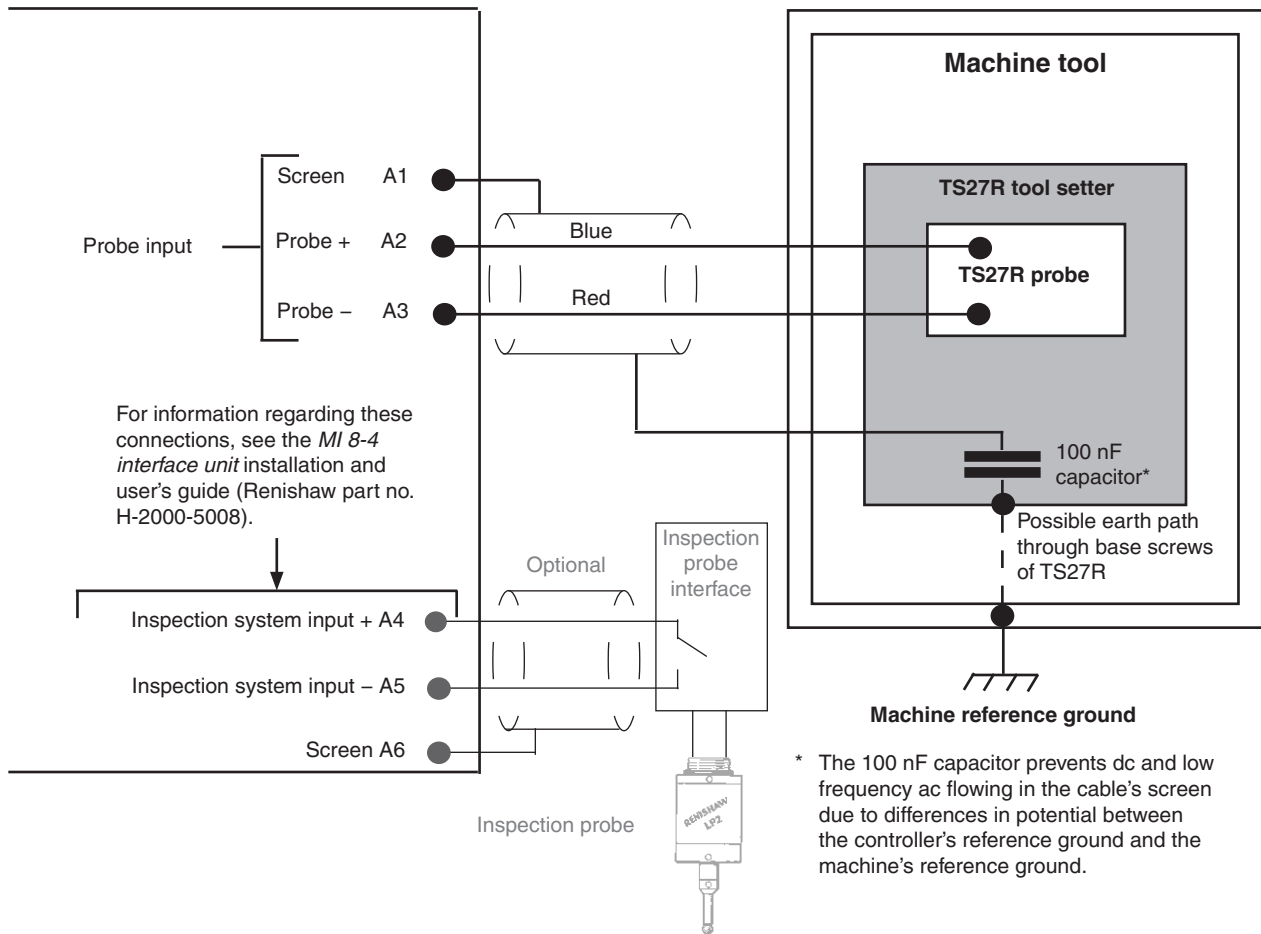
NOTE: When connecting the TS27R probe to the HSI interface, use the connection labelled STANDARD PROBE.

Probe status	*Normally open (NO)	**Normally closed (NC)
Probe triggered	Closed	Open
Probe seated	Open	Closed

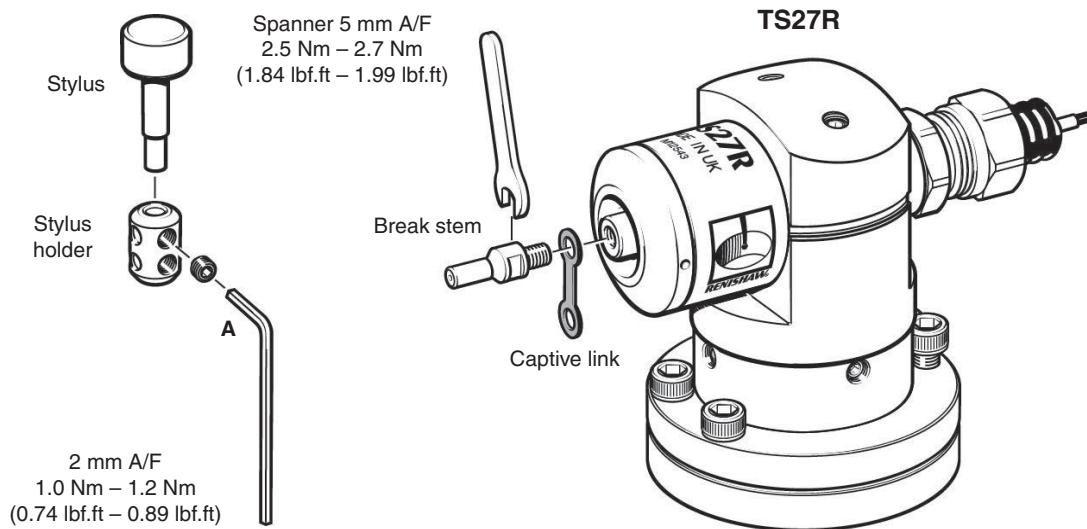
Recommended connection diagram for MI 8-4 interface with CNC controller



Recommended connection diagram for TS27R with MI 8-4 interface



Fitting the stylus and captive link



Screw torque values

Tighten all the screws to the torque values shown, remembering to use the support bar whenever adding or removing parts attached to the break stem. See **page 3-9**, “Break stem”, for further information.

Fitting the stylus

The stylus is retained in the stylus holder by tightening grubscrew **A**.

Captive link

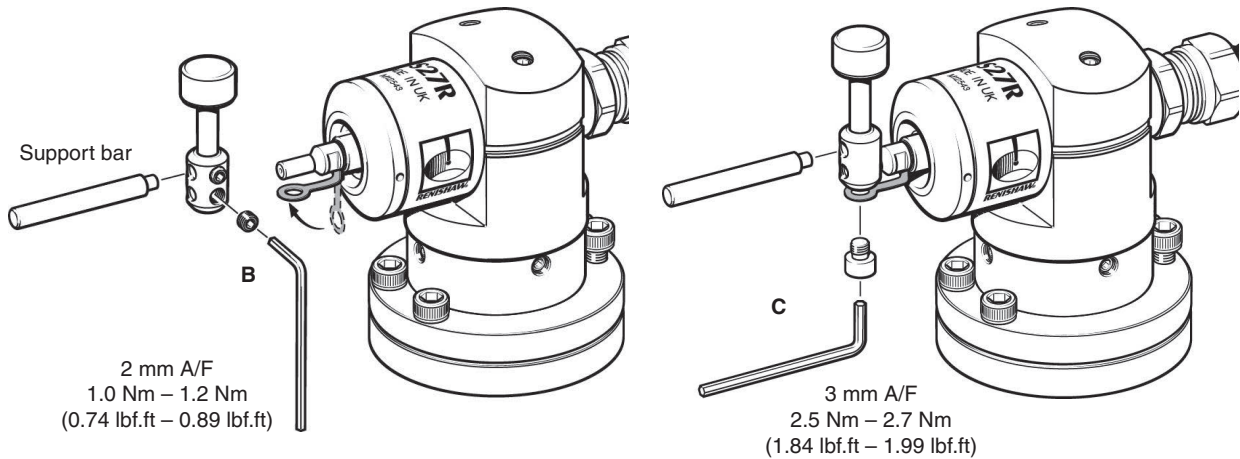
In the event of excessive stylus overtravel, the break stem breaks at its weakest point, preventing damage to the probe mechanism.

The captive link connected to the probe and stylus holds onto the stylus, otherwise the stylus could fall into the machine and become lost.

When a new captive link is fitted, it must be bent to accept screw **C**. See **page 3-9**, “Break stem”, for further information.

Break stem

CAUTION: Always hold the support bar in position to counteract twisting forces and avoid over-stressing the stylus break stem.



Stylus and holder

Place the stylus and holder onto the break stem and loosely fit grub screw **B**.

Fit screw **C** through the captive link and into the stylus holder, then tighten all the screws.

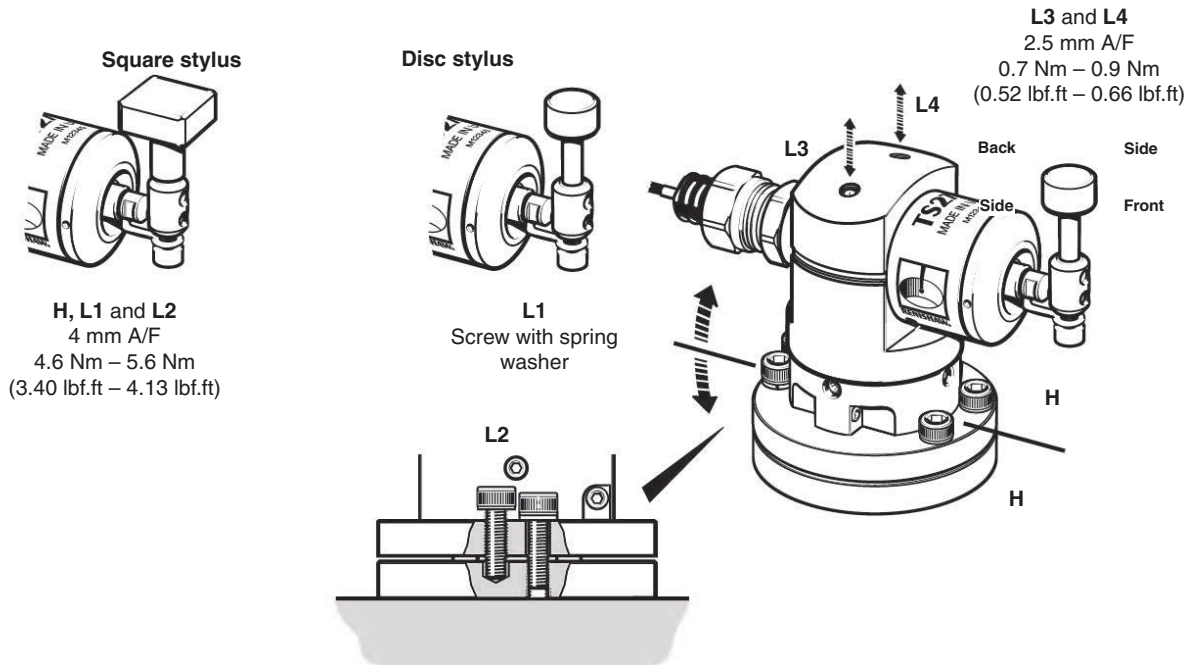
Replacing the break stem

Remove the broken parts and rebuild in the sequence shown above.

NOTE: Earlier versions of the TS27R were supplied with cup-pointed grub screws and a different break stem. Only fit current components supplied with this probe or with the break stem retrofit kit.

Stylus level setting

CAUTION: Do not stress the break stem



Stylus types

Disc stylus $\varnothing 12.7$ mm ($\varnothing 0.5$ in)

Square stylus 19.05 mm \times 19.05 mm (0.75 in \times 0.75 in).

Stylus level setting

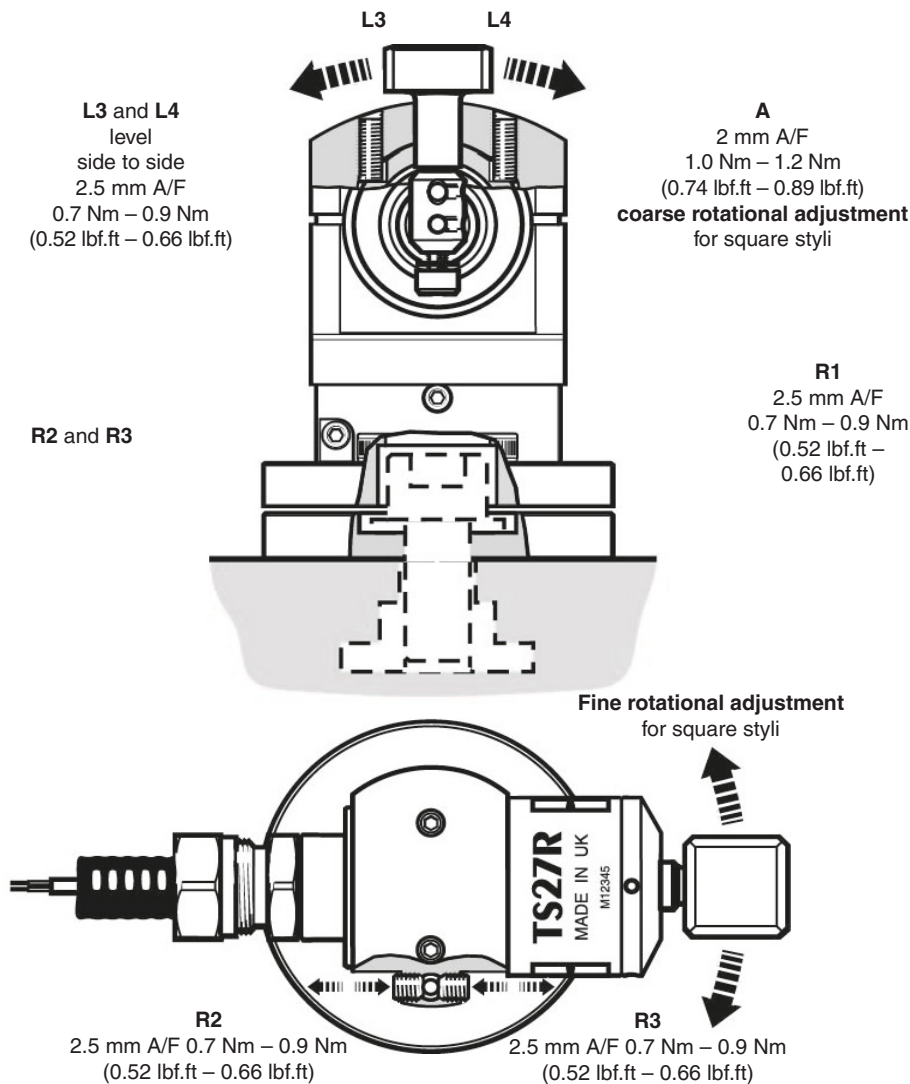
The top surface of the stylus must be set level, front to back and side to side.

The front to back stylus level is obtained by alternately adjusting screws **L1** and **L2**, which causes the probe cable end to rise or lower, changing the stylus level setting. When a level stylus surface is obtained, tighten screws **L1** and **L2**.

Side to side level is obtained by alternately adjusting grubscrews **L3** and **L4**, which causes the probe module to rotate and change the stylus level setting. When a level stylus surface is obtained, tighten screws **L3** and **L4**.

Square stylus alignment

CAUTION: Always hold the support bar in position to counteract twisting forces and avoid over-stressing the stylus break stem.



Additional setting for square styli

Stylus level setting is the same for disc and square styli. In addition, square styli side faces can be aligned with the machine's X/Y axes.

Coarse rotational adjustment is obtained by slackening the stylus holder grub screw **A** (see [page 3-8](#), "Fitting the stylus and captive link", for further information), rotating the stylus in its holder, then retightening grub screw **A**. Always use the support bar. See [page 3-9](#), "Break stem", for further information.

Fine rotational adjustment is obtained by loosening the four grub screws **R1** and alternately adjusting the two probe rotational adjuster screws **R2** and **R3** until the required tip parallelism to the axes is achieved. Retighten grub screws **R1**, **R2** and **R3**.

CAUTION: Ensure all screws are tight after adjustment.

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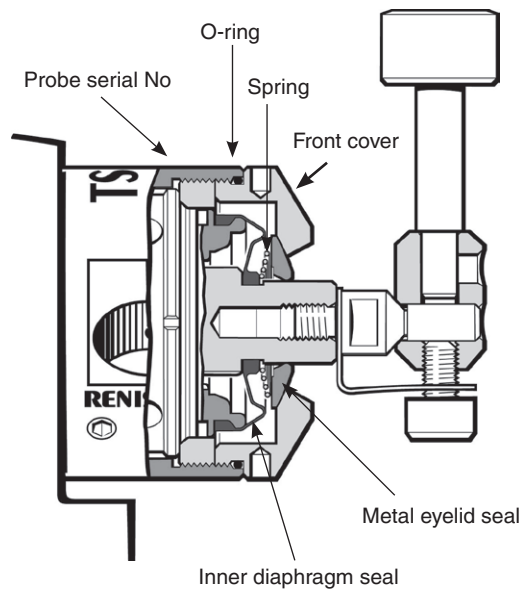
Service and maintenance

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

CAUTIONS:

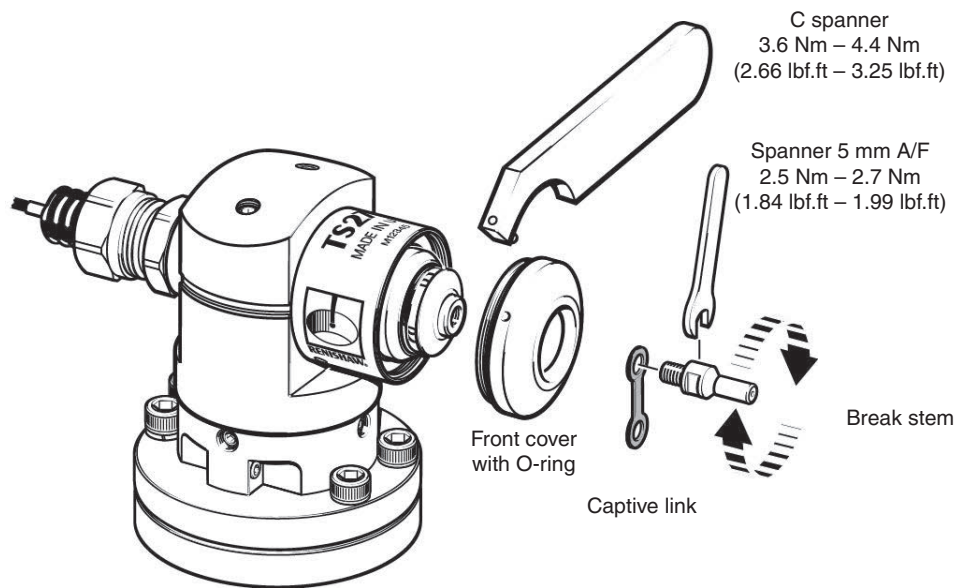
The probe is a precision tool and must be handled with care.

Ensure the probe is firmly secured to its mounting.

The probe requires minimal maintenance as it is designed to operate as a permanent fixture on CNC machining centres, where it is subject to a hot chip and coolant environment.

- Do not allow excessive waste material to build up around the probe.
- Keep all electrical connections clean.
- The probe mechanism is protected by an outer metal eyelid seal and an inner flexible diaphragm seal.
- Approximately once a month, inspect the probe inner diaphragm seal. If it is pierced or damaged, return the probe to your supplier for repair.
- The service interval may be extended or reduced depending on environment and operating conditions.

Diaphragm maintenance



1. Remove the stylus and holder. See **page 3-9**, “Break stem”, for further information.
2. Remove the break stem using the 5 mm A/F spanner.
3. Use a C spanner to remove the probe’s front cover. This will expose the metal eyelid seal and the inner diaphragm seal. Remove the metal eyelid and spring.

CAUTION: These may fall out.

4. Wash inside the probe, using clean coolant.

CAUTION: Do not use sharp metal objects to clean out debris.

5. Inspect the diaphragm seal for signs of piercing or damage. In the event of damage, return the probe to your supplier for repair, as coolant entering the probe mechanism could cause the probe to fail.
6. Refit the spring and metal eyelid (the spring’s widest diameter is against the metal eyelid).
7. Refit the remaining components. See **page 3-8**, “Fitting the stylus and captive link” and **page 3-9**, “Break stem”, for further information.

Parts list

Type	Part number	Description
TS27R (disc) with MI 8-4	A-2008-0397	TS27R holder, probe module, break stem (× 2), disc stylus Ø12.7 mm (Ø0.5 in) and MI 8-4 interface.
TS27R (square) with MI 8-4	A-2008-0396	TS27R holder, probe module, break stem (× 2), square tip stylus 19.05 mm (0.75 in) and MI 8-4 interface.
TS27R (disc) with HSI	A-2008-0359	TS27R holder, probe module, break stem (× 2), disc stylus Ø12.7 mm (Ø0.5 in) and HSI interface.
TS27R (square) with HSI	A-2008-0362	TS27R holder, probe module, break stem (× 2), square tip stylus 19.05 mm (0.75 in) and HSI interface.
TS27R (disc)	A-2008-0368	TS27R holder, probe module, break stem (× 2) and disc stylus Ø12.7 mm (Ø0.5 in).
TS27R	A-2008-0388	TS27R holder, probe module, break stem (× 2) and stylus holder (without stylus).
Break stem	A-5003-5171	Stylus protection kit comprising break stem, captive link, grubscrew flat ended (× 3), caphead screw (× 2) and tools (hexagon wrenches, spanner 5 mm AF, and support bar).
Stylus holder	A-2008-0389	Stylus holder kit comprising stylus holder and screws.
Stylus holder	M-2008-0378	Stylus holder.
Plinth	M-2008-1007	Spacer.
Disc stylus	A-2008-0382	Disc stylus Ø12.7 mm (Ø0.5 in), tungsten carbide, 75 Rockwell C.
Square stylus	A-2008-0384	Square tip stylus 19.05 mm (0.75 in), ceramic tip, 75 Rockwell C.
Grubscrew	P-SC11-0404	Grubscrew (flat end) for stylus holder M4 × 4 mm (two required).
Screw	P-SC01-X406	M4 cap head screw for stylus holder (one required).
C spanner	A-2008-0332	C spanner – used for removing the probe's front cover.
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, product card and packaging.
HSI-C interface	A-6527-1000	HSI-C probe system interface, product card and packaging.
Terminal block (HSI-C only)	P-CN47-0082	4-way terminal block (1 off required).
Terminal block (HSI-C only)	P-CN47-0083	5-way terminal block (5 off required).

Type	Part number	Description
Publications. These can be downloaded from our website at www.renishaw.com .		
MI 8-4	H-2000-5008	Installation guide: for the set up of MI 8-4.
HSI	H-5500-8554	Installation guide: for the set up of HSI.
HSI-C	H-6527-8501	Installation guide: for the set up of HSI-C.
Styli	H-1000-3200	Technical specifications: Styli and accessories – or visit our Online store at www.renishaw.com/shop .
Probe software	H-2000-2298	Data sheet: <i>Probe software for machine tools – programs and features.</i>

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