Installation and user's guide
H-2000-5018-09-A

RENISHAW
apply innovation™

TS27R – tool setting probe



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Patent notice

Features of the TS27R probe, and other similar Renishaw probes, are subject of one or more of the following patents and/or patent applications:

EP	0695926	US	5669151
EP	0967455	US	6,275,053 B1
JP	4398011		

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Tool setting probe

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Français

Manuel d'installation et d'utilisation

Palpeur de réglage d'outil TS27R

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Installations- und Benutzerhandbuch

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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 reserve 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 manufacturers 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.

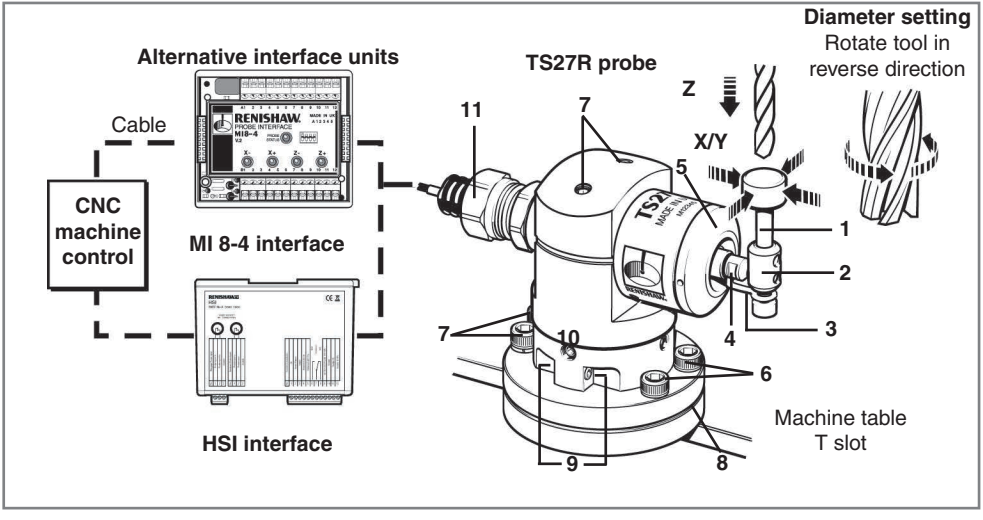
Refer to the machine supplier's operating instructions.

The 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/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 the machines movement.



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

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 control.

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:

$f = 0.16 \times$ rev/min f units mm/min (diameter set)

$f = 0.12 \times$ rev/min f units mm/min (length set)

Second touch – machine feedrate

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

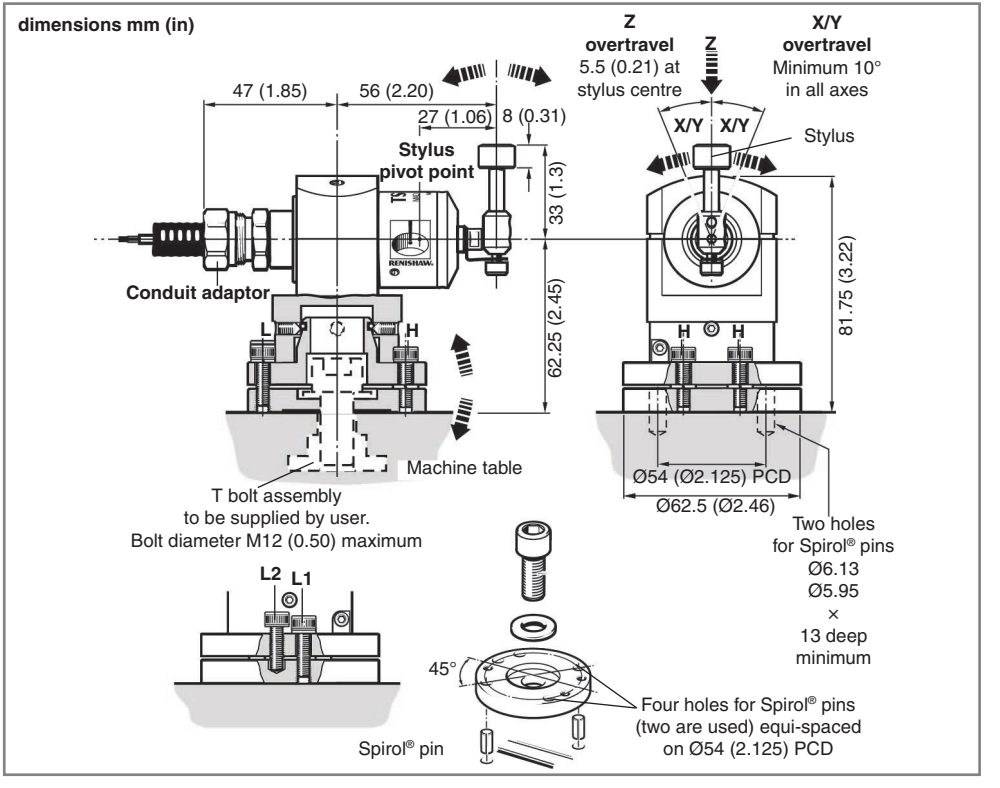
Software routines

Software routines for tool setting are available from Renishaw for various machine controllers and are described in data sheet H-2000-2289.

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 or HSI
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**	Ø4.35 mm (0.17 in), 4-core screened cable, each core 7 x 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) 2σ (see note 1)
Stylus trigger force (see notes 2 and 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 (EN/IEC 60529)
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)

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 i.e. 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.
Note 3	These are the factory settings, manual adjustment is not possible.

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


dimensions mm (in)
Z
overtravel
5.5 (0.21) at
stylus centre
Z
X/Y
overtravel
Minimum 10°
in all axes
47 (1.85)
56 (2.20)
27 (1.06)
8 (0.31)
X/Y
X/Y
Stylus
Stylus
pivot point
33 (1.3)
Conduit adaptor
L
H
62.25 (2.45)
H
H
81.75 (3.22)
Machine table
Ø54 (Ø2.125) PCD
Ø62.5 (Ø2.46)
T bolt assembly
to be supplied by user.
Bolt diameter M12 (0.50) maximum
Two holes
for Spirol® pins
Ø6.13
Ø5.95
×
13 deep
minimum
L2
L1
45°
Four holes for Spirol® pins
(two are used) equi-spaced
on Ø54 (2.125) PCD
Spirol® pin

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 AF 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 1-18).
6. Fit the stylus (see pages 1-16 and 1-17).

Spirol® pins (see page 1-10)

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

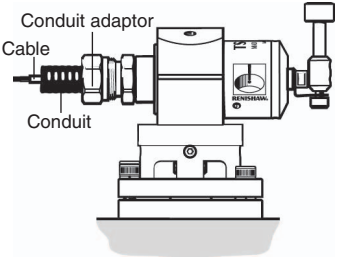
Four-core 7/0.2 polyurethane insulated and screened cable 10 m (32.8 ft) long. Cable diameter 4.4 mm (0.17 in). Probe circuit – red and blue cores (yellow and green not used).

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 MI 8-4 interface is fully described in user's guide H-2000-5008. The alternative HSI interface is fully described in user's guide H-5500-8554.

Interfaces

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

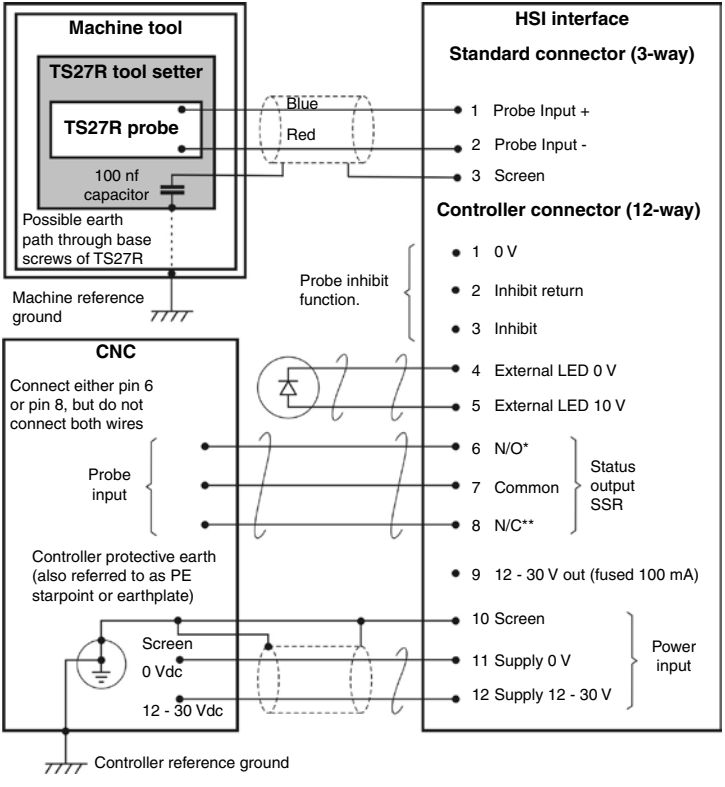
All inputs are fully configurable for ACTIVE HIGH and ACTIVE LOW operation.

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 interface is used with the standard G31 SKIP type control probe input. Probe status output is a voltage-free SSR (solid state relay) which can be connected as normally open (N/O) or normally closed (N/C).

Maximum current	50 mA peak
Maximum voltage	±50 V peak

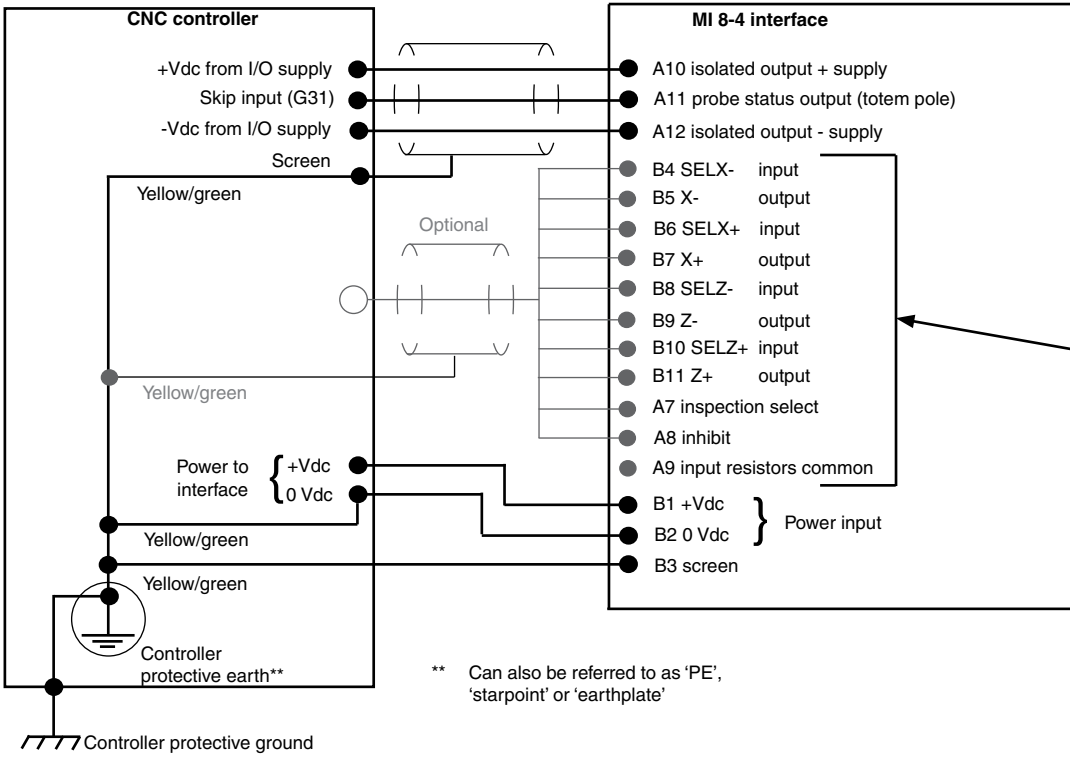
An inhibit function is included, and a facility to drive an external probe status LED.



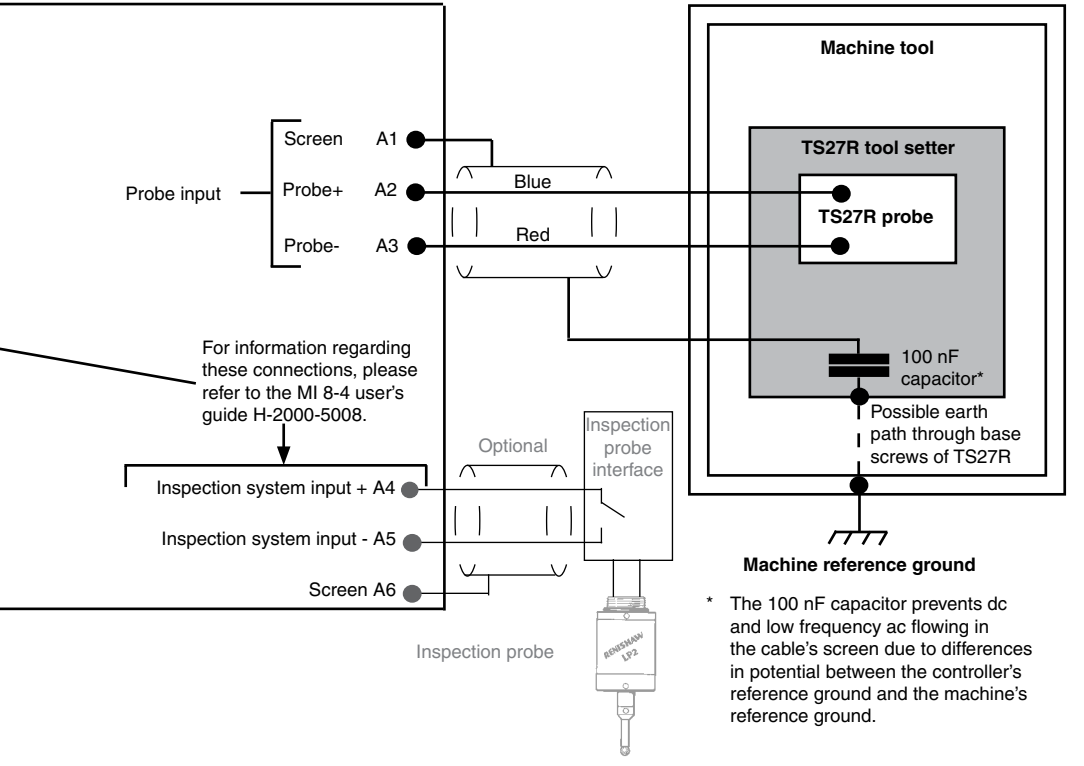
NOTE: When connecting the TS27R probe to the HSI interface, please use the connection labelled STANDARD PROBE.

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

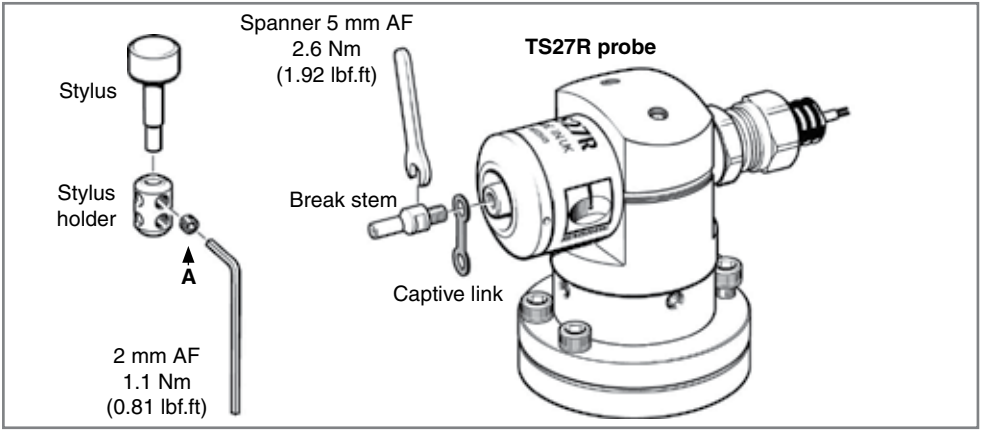
Recommended connection diagram for TS27R with MI 8-4 interface



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



* The 100 nF capacitor prevents dc and low frequency ac flowing in the cable's screen due to differences in potential between the controller's reference ground and the machine's reference ground.



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 1-17).

Fitting the stylus

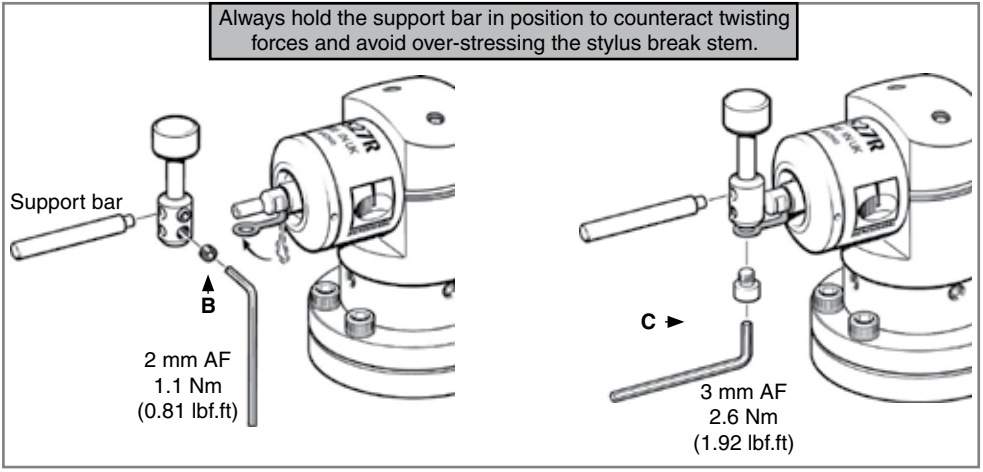
The stylus is retained in the stylus holder by tightening grubscrew **A**.

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 1-17).



Stylus and holder

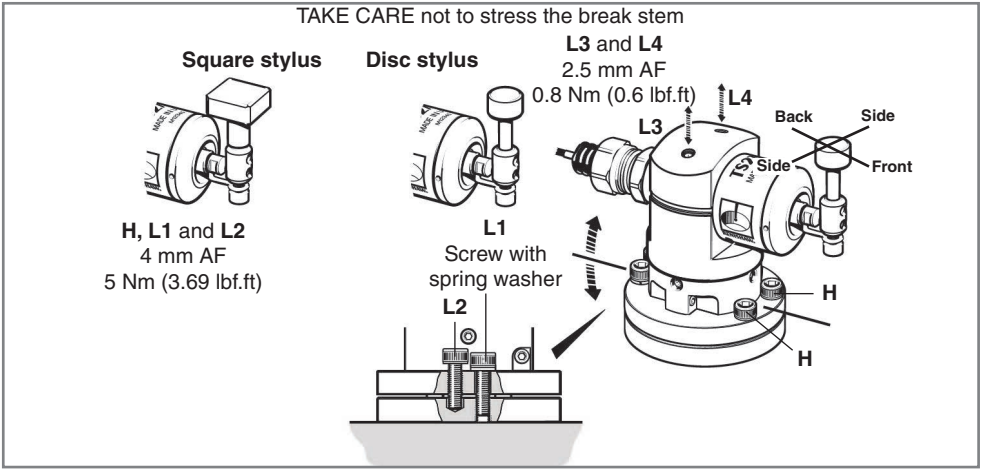
Place the stylus and holder onto the break stem and loosely fit grubscrew **B**.

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 probe were supplied with cup-pointed grubscrews and a different break stem. Only fit current components supplied with this probe or with the break stem retrofit kit.



Stylus types

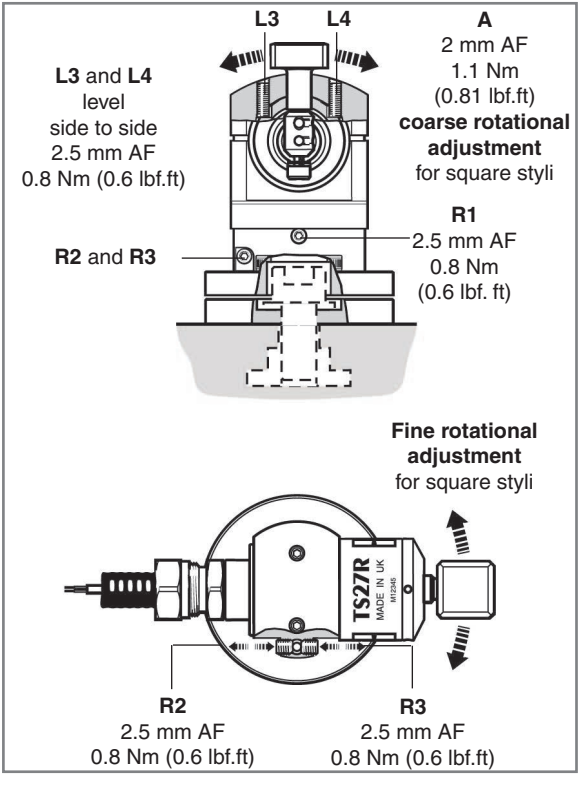
Disc stylus	Ø12.7 mm (Ø0.5 in)
Square stylus	19.05 mm × 19.05 mm (0.75 in × 0.75 in).

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**.



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 grubscrew **A (**see page 1-16), rotating the stylus in its holder, then retightening grubscrew A. (Always use the support bar – see page 1-17.)

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

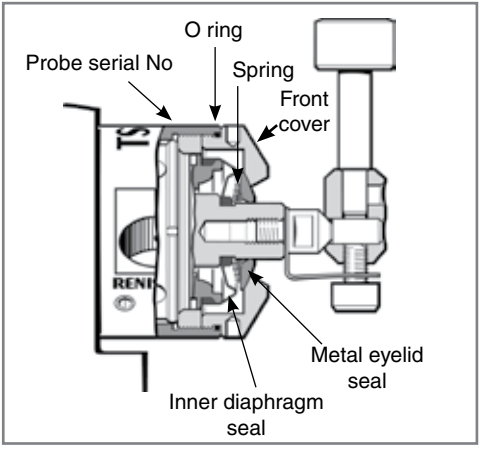
Ensure all screws are tight after adjustment.

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.

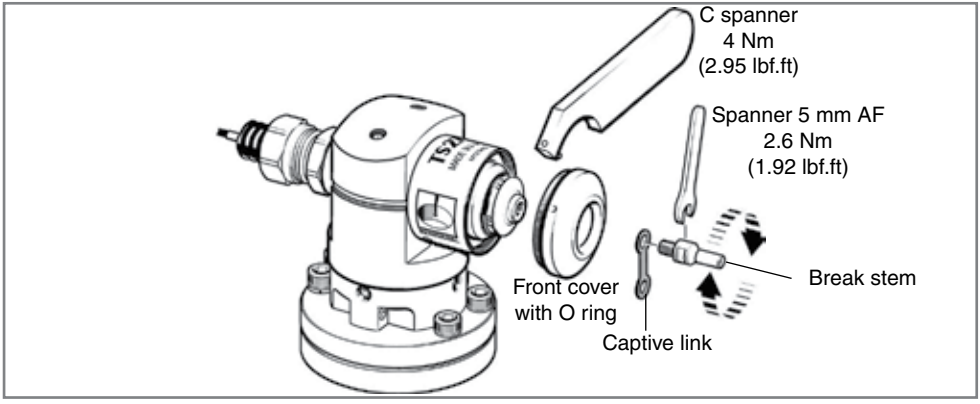
Ensure the probe is firmly secured to its mounting.

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.

1. Do not allow excessive waste material to build up around the probe.
2. Keep all electrical connections clean.
3. 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.



1. Remove the stylus and holder (see page 1-17).
2. Remove the break stem using the 5 mm AF 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. (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 pages 1-16 and 1-17).

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 kit	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 kit	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.

Type	Part Number	Description
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, quick-start guide and packaging.
Publications. These can be downloaded from our website at www.renishaw.com		
TS27R	H-2000-5018	Installation and user's guide: TS27R tool setting probe.
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	Technical specification: Styli and accessories.
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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Renishaw plc
New Mills, Wotton-under-Edge,
Gloucestershire, GL12 8JR
United Kingdom

T +44 (0)1453 524524
F +44 (0)1453 524901
E uk@renishaw.com
www.renishaw.com

RENISHAW
apply innovation™

For worldwide contact details, please visit our main website at www.renishaw.com/contact

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