Installation guide
H-5401-8505-01-A

RENISHAW
apply innovation™

OTS - optical tool setter

Renishaw part no: H-5401-8505-01-A

Issued: 05.2007

RENISHAW
apply innovation™

Contents

Contents (continued)

RENISHAW
apply innovation™

Before you get started

Contents

Before you get started

Disclaimer

Considerable effort has been made to ensure that the contents of this document are free from inaccuracies and omissions. However, Renishaw makes no warranties with respect to the contents of this document and specifically disclaims any implied warranties.

Renishaw reserves the right to make changes to this document and to the product described herein without obligation to notify any person of such changes.

Trademarks

RENISHAW® and the probe emblem used in the RENISHAW logo are registered trademarks of Renishaw plc in the UK and other countries.

apply innovation and **Trigger Logic** are trademarks of Renishaw plc.

All other brand names and product names used in this document are trade names, service marks, trademarks, or registered trademarks of their respective owners.

Warranty

Equipment requiring attention under warranty must be returned to your equipment supplier. No claims will be considered where Renishaw equipment has been misused, or where repairs or adjustments have been attempted by unauthorised persons.

Changes to equipment

Renishaw reserves the right to change equipment specifications without notice.

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

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

EP 0337669
EP 0695926
EP 0974208
EP 1130557
EP 1373995
EP 1397637
EP 1425550
EP 1503524 B
EP 1701234
EP 1734426
JP 2,994,401
JP 2004-522,961
JP 2004-530,234
JP 2005-502,035
US 5,150,529
US 5,669,151
US 6,472,981 B2
US 6,839,563 B1
US 6,869,026 B2
US 6,941,671 B2
US 7145468 B2

CE

EC DECLARATION OF CONFORMITY

Renishaw plc declare that the product: -

Name	Description
OTS	Optical tool setter

has been manufactured in conformity with the following standard: -

BS EN 61326:1998/ A1:1998/A2:2001	Electrical equipment for measurement, control and laboratory use - EMC requirements.
	Immunity to annex A - industrial locations.
	Emissions to class A (non-domestic) limits.

and that it complies with the requirements of directives (as amended): -

89/336/EEC	Electromagnetic compatibility (EMC)

The above information is summarised from the full EC Declaration of Conformity. A copy is available from Renishaw on request.

FCC DECLARATION (USA)

FCC Section 15.19

This device complies with Part 15 of the FCC rules.

Operation is subject to the following two conditions:

1. This device may not cause harmful interference.
2. This device may accept any interference received, including interference that may cause undesired operation.

FCC Section 15.105

This equipment has been tested and found to comply with the limits for a Class A digital device, pursuant to Part 15 of the FCC rules. These limits are designed to provide reasonable protection against harmful interference when the equipment is operated in a commercial environment. This equipment generates, uses, and can radiate radio frequency energy and, if not installed and used in accordance with the instruction manual, may cause harmful interference to radio communications. Operation of this equipment in a residential area is likely to cause harmful interference, in which case you will be required to correct the interference at your own expense.

FCC Section 15.21

The user is cautioned that any changes or modifications not expressly approved by Renishaw plc, or authorised representative could void the user's authority to operate the equipment.

Warning labels to be placed on equipment and for information to be supplied to the user.

Safety

Information for the user

Handle and dispose of batteries in accordance with the manufacturer's recommendations. Use only the recommended batteries. Do not allow the battery terminals to contact other metallic objects.

Information for 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.

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

Information for the equipment installer

All Renishaw equipment is designed to comply with the relevant EEC 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 the 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 0V / 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's 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.

CAUTION: The OTS has a glass window. Handle with care if broken to avoid injury.

OTS basics

Contents

Introduction

The OTS is a tool setter with optical transmission suitable for use on small to large machining centres. It is designed to resist optical interference, false triggering and shock.

The OTS operates using 'Modulated' mode, and must be used with a modulated receiver.

All OTS settings are configured using the 'Trigger Logic ™' technique. This enables the user to review and subsequently change probe settings by deflecting the stylus whilst observing the LED display.

Configurable settings are:

- Start configuration
- Enhanced trigger filter setting
- Optical power

The tool is driven in the machine Z axis for tool length measurements and broken tool detection.

Rotating tools are set in the machine's X and Y axes for tool radius offsets.

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

Trigger Logic™

The user can configure probe settings quickly and easily by deflecting the stylus in a sequence until the correct colour configuration is observed on the LED display, this programmable method is known as Trigger Logic™.

Probe settings

Switch on method

The OTS will be switched on in less than 0.5 seconds by an optical signal.

After being switched on, the OTS must be on for 1 second minimum before being switched off.

Optical start configuration

The user can configure the OTS to either Probe 1 or Probe 2 identification (see Changing the probe settings 4.3).

The OTS is factory set to Probe 2 so that it can be used in a system with modulated spindle probes.

Typically the OTS is used in Probe 2.

A twin tool setter application would require that one of the OTS probes is reconfigured to Probe 1.

Switch off method

A timer automatically switches the probe off 90 minutes after the last trigger if not turned off by an M code.

Enhanced trigger filter

Probes subjected to high levels of vibration or shock loads may trigger without having been contacted. The enhanced trigger filter improves the probe's resistance to these effects.

When the filter is enabled, a constant nominal 7 ms delay is introduced to the probe output.

It may be necessary to reduce the approach speed to allow for the increased stylus overtravel during the extended time delay.

Probe settings continued

Optical power

Where the separation between the OTS and the receiver is small, the low optical power may be used. In this setting the optical transmission operating range will be reduced by approximately 30%. Battery life will also be increased.

Factory set to standard optical power.

The OTS can be in one of three modes:

Stand-by mode

The OTS is waiting for a switch on signal.

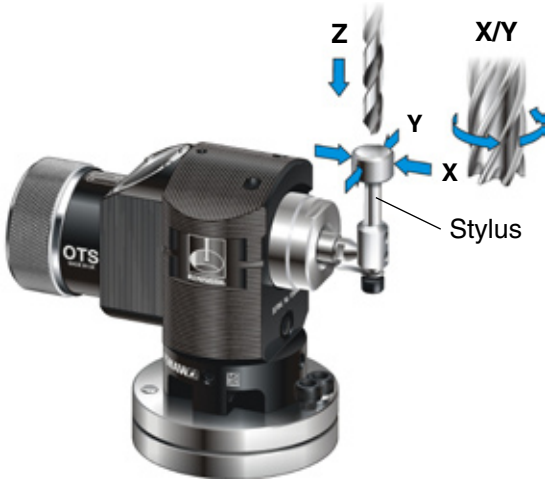
Operating mode

The OTS is ready for use.

Configuration mode

The Trigger Logic™ configuration method allows current probe settings to be reconfigured.

Operation



Rotate tool in reverse direction for diameter setting

Software routines

Software routines for tool setting are available from Renishaw for various machine controllers and are described in data sheet H-2000-2289, In addition data sheet H-2000-2298 lists available Renishaw software programs. Both data sheets can be downloaded from **www.renishaw.com/mtp**

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 feed rates

Cutters should be rotated in reverse to the cutting direction. Renishaw tool setting software calculates speeds and feeds automatically using the following information.

First touch – machine spindle rev/min

Rev/min for the first move against the probe stylus:

Diameters below 24 mm, 800 rev/min is used.

Diameters from 24 mm to 127 mm, rev/min is calculated using a surface speed of 60 m/min (197 ft/min).

Diameters above 127 mm, 150 rev/min is used.

First touch – machine feed rate

The feedrate (f) is calculated as follows:

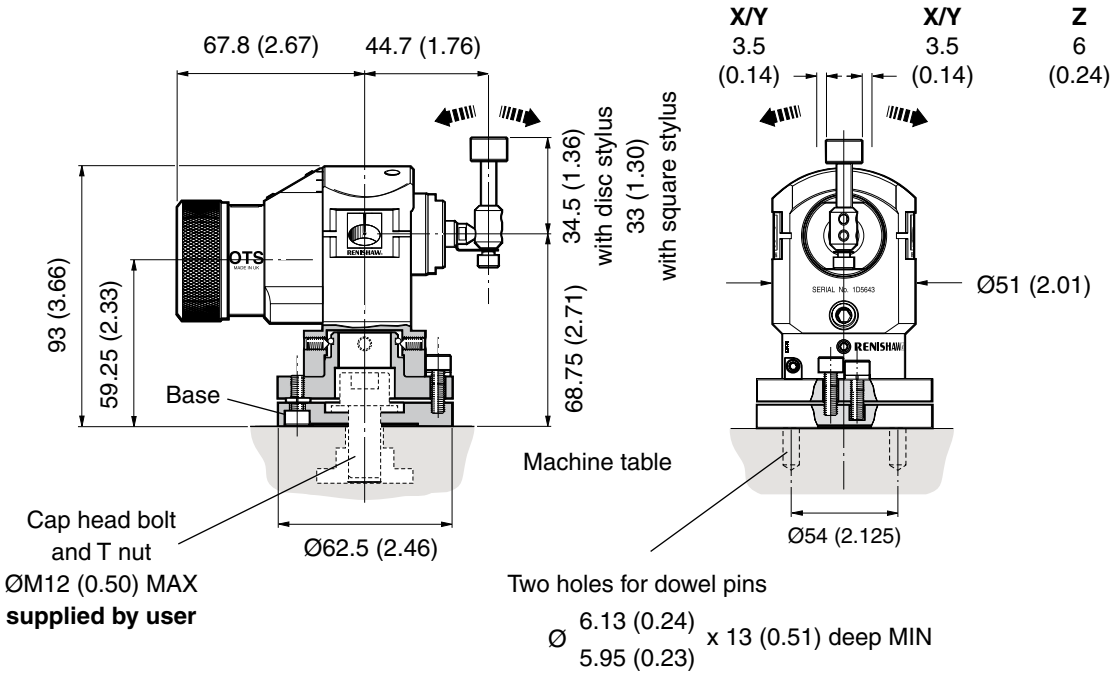
f = 0.16 × rev/min f units mm/min (diameter set)
f = 0.12 × rev/min f units mm/min (length set)

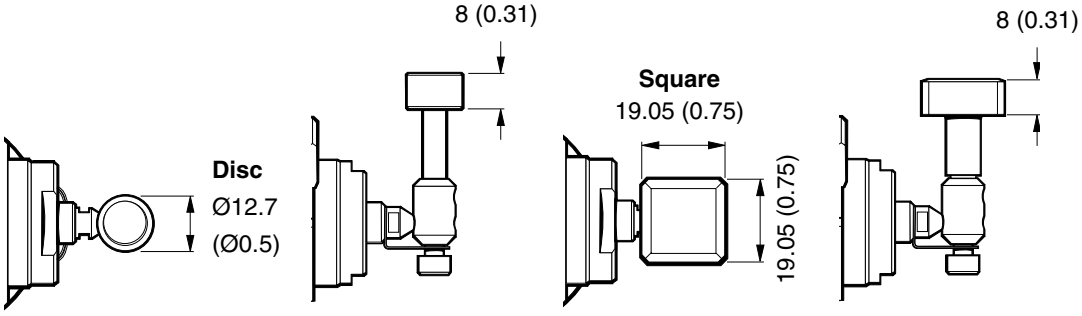
Second touch – machine feed rate

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

Probe specification

dimensions mm (in)





Disc stylus	Square stylus
Ø12.7 mm × 8 mm (Ø0.5 in × 0.31 in) Tungsten carbide 75 Rockwell C	19.05 mm x 19.05 mm (0.75 in x 0.75 in) Ceramic 75 Rockwell C

Principal application:	Machining centres		
Dimensions:	Length with square stylus	122 mm	(4.08 in)
	Width:	60 mm	(2.36 in)
	Height	103.25 mm	(4.06 in)
Weight:	with disc stylus without batteries	batteries	
	831 g (29.31 oz)	17 g (0.60 oz)	

Probe specification continued

Transmission type:	infra-red optical transmission
Turn on control:	Machine M code
Turn off control:	Machine M code
Transmission operating range:	Up to 5 m (16.4 ft)
Receiver/interface:	OMI-2T, OMI-2H or OMI-2
Sense directions:	Omni-directional ± X, ± Y, + Z
Repeatability:	1.00 µm (0.00004 in) Maximum mean 2σ value. Valid as tested with a 35 mm (1.4 in) straight stylus and a velocity of 480 mm/min at the centre of the stylus tip
Stylus trigger force: **(factory set using 50 mm (1.97 in) stylus)**	1.3 N to 2,4 N / 130 gf to 240 gf (4.5 ozf to 8.5 ozf) depending on sense direction
Stylus overtravel:	XY ± 3.5 mm (0.14 in) Z 6 mm (0.23 in)
Battery type:	1/2 AA size Lithium Thionyl Chloride (3.6 V) x 2
Battery reserve life:	Approximately 1 week after a low battery warning is first given
Low battery indication:	Blue flashing LED in conjunction with normal green probe status LED
Dead battery indication:	Constant or flashing red

Lithium thionyl chloride (LTC) battery life

Stand-by life (days - typical)		**5% usage = 72 minutes/day** (days - typical)		**Continuous use** (hours - typical)	
Standard power mode	**Low power mode**	**Standard power mode**	**Low power mode**	**Standard power mode**	**Low power mode**
180	180	100	120	300	350

System installation

Contents

Preparing the OTS for use

Fitting the stylus, break stem and captive link

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

Installing the batteries

Installing the batteries

✶ Take care not to short the battery contacts as this may be a fire hazard. Ensure the contact strips are located securely.

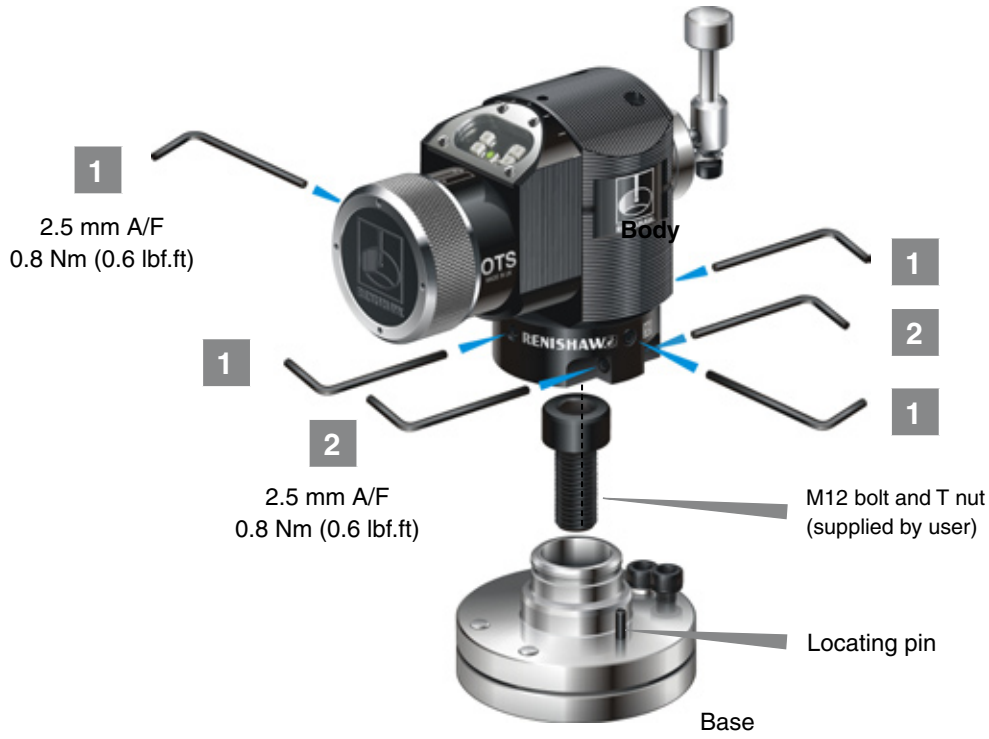
When installing batteries, do not allow coolant or debris to enter the battery compartment.

Check that the polarity is correct.

NOTE: If dead batteries are inadvertently inserted into the probe then the LEDs will remain constant red

Review current probe settings in accordance with 'Section 4 - Trigger Logic™

Mounting the probe on the machine table



Mounting the probe on the machine table

1. Select a position for the tool setter on the machine table. Position to minimise the possibility of collision and ensure the optical window faces towards the receiver.

2. Separate the base from the body by slackening four screws **1** and two screws **2** using a 2.5 mm AF hexagon key.

3. Fit the cap head bolt and T nut (not supplied by Renishaw) and tighten to secure the base to the machine table.

NOTE: A smaller washer may be fitted for a smaller bolt by disassembling the base.

4. Refit the body onto the base and tighten screws **1** and **2**. (If a square stylus is fitted and fine rotational adjustment is required, (see page 3.8 - Stylus rotational setting), before tightening screws **2**).

5. Fit the stylus (see page 3.2 - Fitting the stylus, break stem and captive link).

Dowel pins (shown on page 2.5)

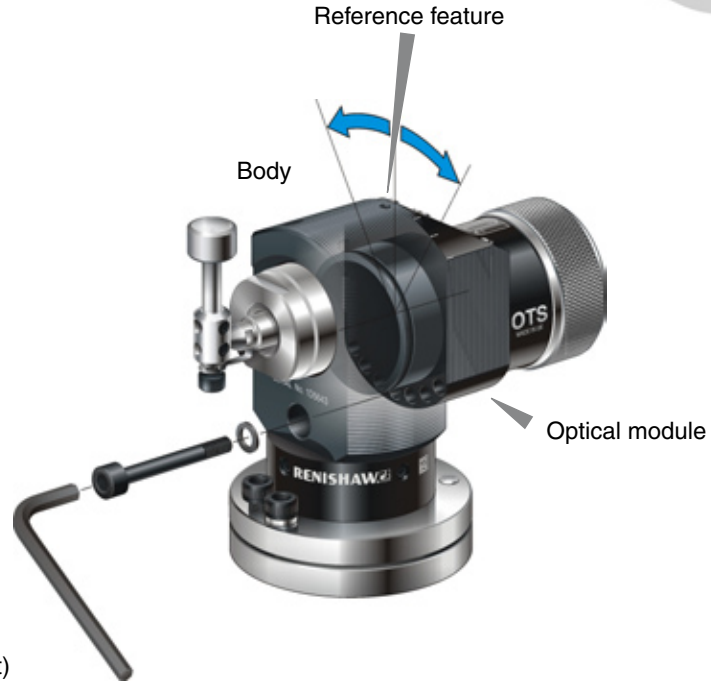
Two dowel pins (supplied in the tool kit) may be fitted on installations where there is a requirement to remove and remount the tool setter.

To fit the dowel pins, drill two holes in the machine table to correspond with the two probe base holes. Place the dowel pins in the holes and refit the probe base.

Positioning the optical module

The optical module can be set in one of seven positions at 15° increments, to allow the optical window to point towards the receiver.

1. To align the optical module, slacken and pull back the clamp screw.
2. Rotate the optical module to line up a reference mark on the optical housing with the reference feature on top of the body.
3. Re-locate the clamp screw and tighten.



Stylus level setting

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

Front to back level adjustment

Height adjusting screw
4 mm AF

Locking screw
4 mm AF
5 Nm (3.69 lbf.ft)

To raise front

Slacken locking screw **2** and adjust height adjusting screw **1** until the stylus is level. Then tighten fully locking screw **2**.

To lower front

Slacken height adjusting screw **1** and adjust locking screw **2** until the stylus is level. Then fully tighten locking screw **2**.

Side to side level adjustment

Side to side level adjustment is obtained by alternately adjusting grubscrews **3**, which causes the probe module to rotate and change the stylus level setting.

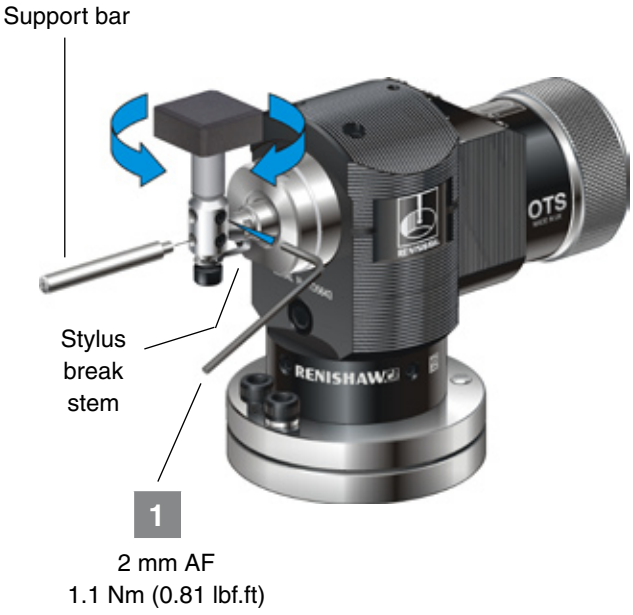
When a level stylus surface is obtained, tighten screws **3**.

Square stylus setting

Rotational adjustment allows the stylus to be aligned with the machine axes

1 Coarse rotational adjustment

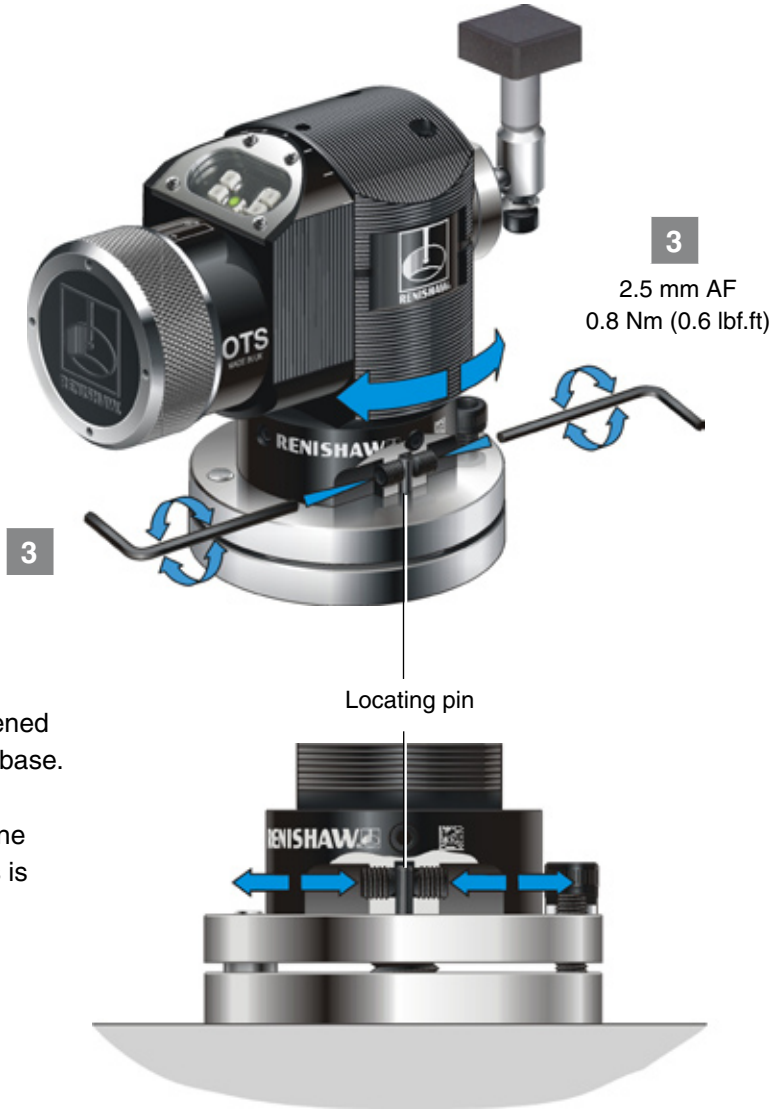
Slacken grubscrew **1** and rotate the stylus by hand to obtain alignment, then fully tighten the grubscrew



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

2 Fine rotational adjustment

Slacken the four body locking screws **2**.



Opposing grubscrews **3** are tightened against a locating pin fixed to the base. By alternatively slackening and re-tightening these grubscrews, fine rotational adjustment of the stylus is achieved.

Then tighten lightly.

Continued on next page

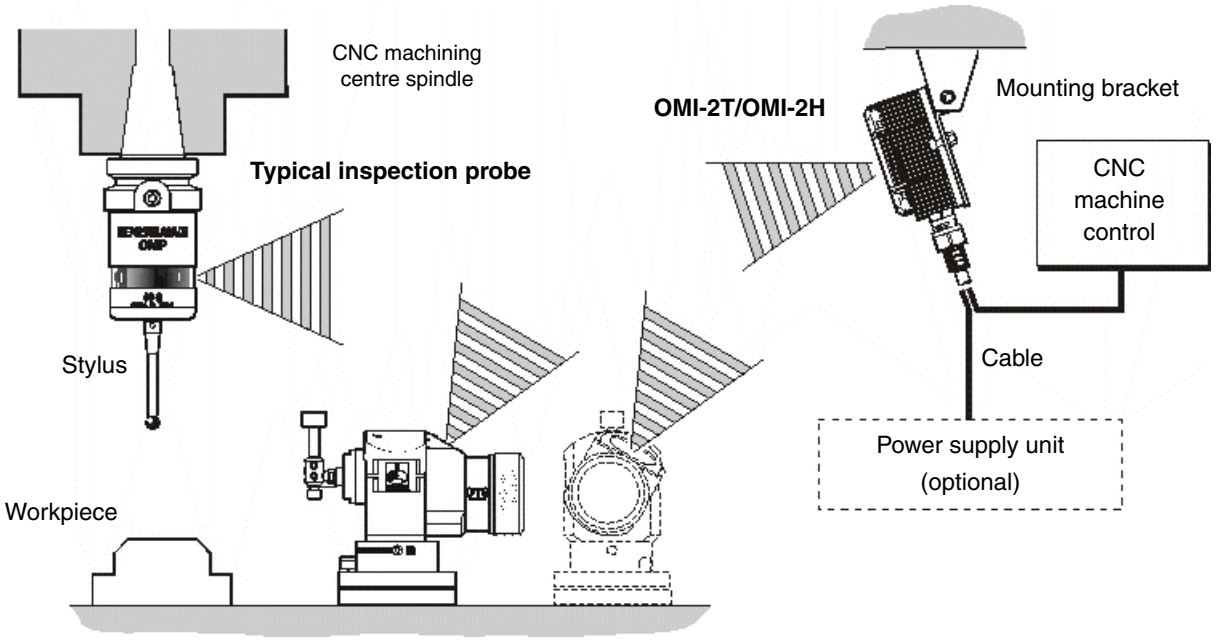
2.5 mm AF
0.8 Nm (0.6 lbf.ft)

Fully tighten body locking screws **2.**

Typical probe system with OMI-2T/OMI-2H

Spindle probe for inspection

Spindle probes must use modulated transmission



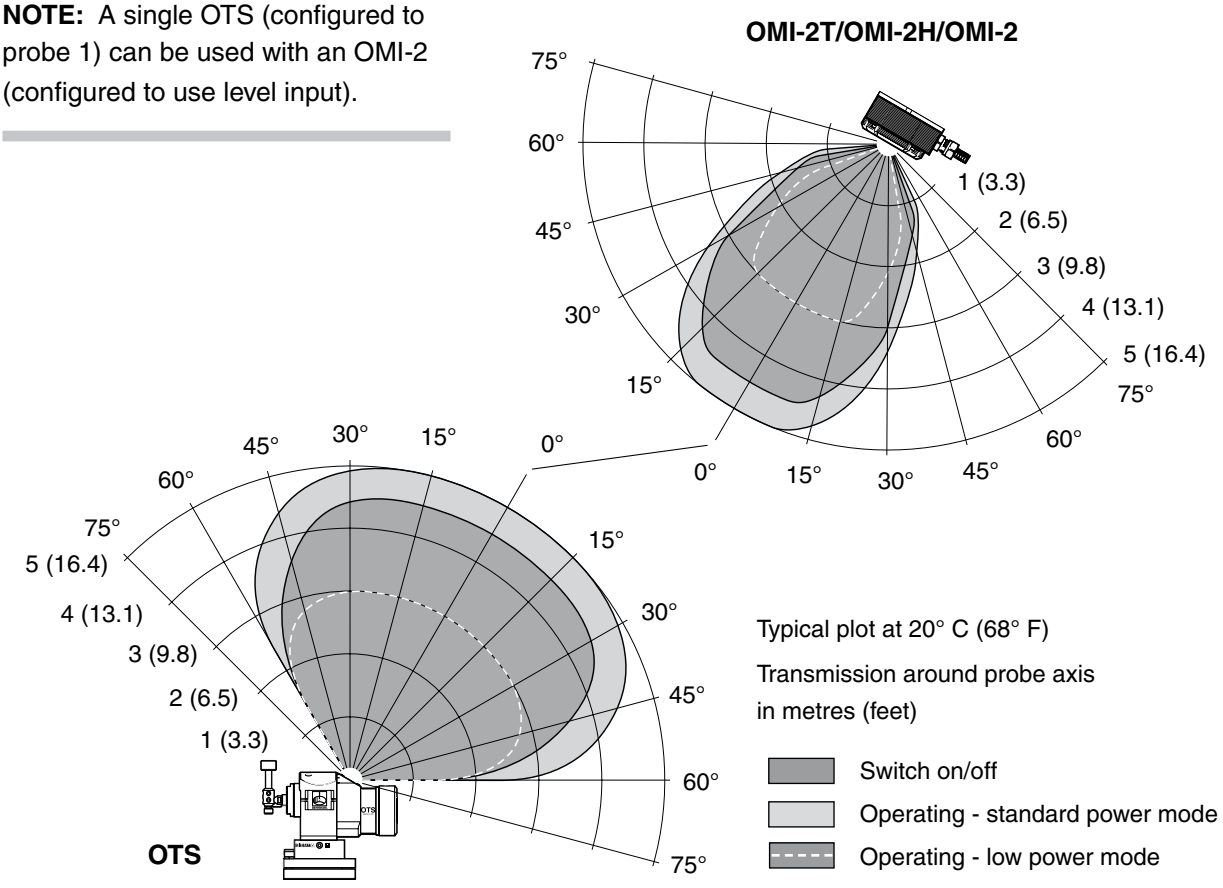
OTS tool setter

Alternative orientations

OTS performance envelope with an OMI-2T/OMI-2H/OMI-2 (modulated transmission)

The OTS probe and receiver diodes must be in the other's' field of view and within the performance envelope shown. The OTS performance envelope is based on the receiver being at 0° and vice-versa.

NOTE: A single OTS (configured to probe 1) can be used with an OMI-2 (configured to use level input).



Operating envelope

Reflective surfaces within the machine may increase the signal transmission range.

Coolant and swarf residue accumulating on the optical window will have a detrimental effect on transmission performance. Wipe clean as often as is necessary to maintain unrestricted transmission.

Some reduction in range may result when operating in temperatures of 0° C to 5° C (32° F to 41° F) and 50° C to 60° C (122° F to 140 °F).

Probe standard power or low power setting

If two machines are operating in close proximity to each other, take care to ensure that signals transmitted from a probe on one machine are not received by the receiver on the other machine, and vice versa.

When this is the case, it is recommended that the low optical power setting on probes is used, and that the low range setting is used on the receiver.

Please refer to the receiver User's Guide.

Receiver position

To assist finding the optimum position for the installation, signal condition is displayed on the OMI-2T/OMI-2H/OMI-2 receiver.

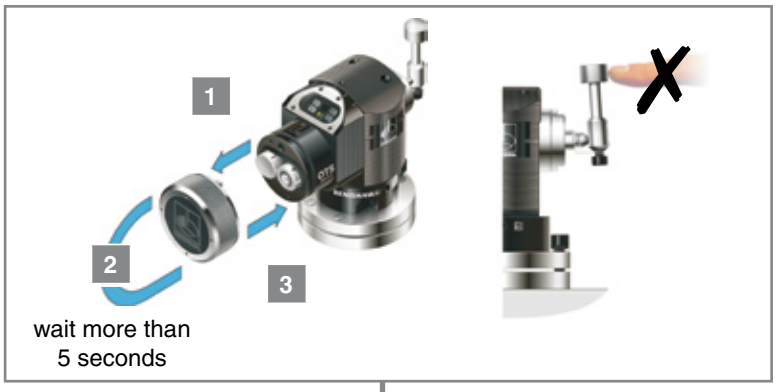
RENISHAW
apply innovation™

Trigger Logic™

Contents

Reviewing the probe settings

Key to the symbols	
●	LED short flash.
▬	LED long flash.



LED check

● ● ●

Enhanced trigger filter setting

Off	or	On
● ● ▬		● ● ▬

Probe identification

Probe 1	or	Probe 2
● ● ▬		● ● ▬

Optical power

Low	or	Standard
● ● ▬		● ● ▬

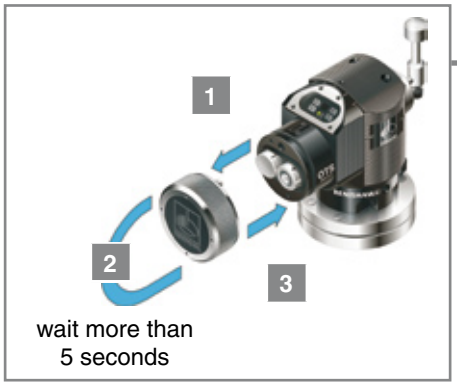
Battery status (probe seated)

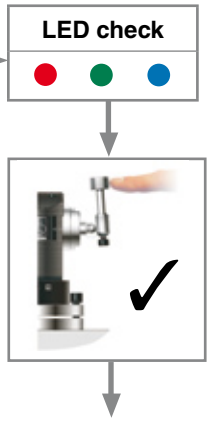
Battery good	or	Battery low
● ● ● ● ●		● ● ● ● ● ● ● ● ● ●

Probe in standby

Placing the probe in configuration mode

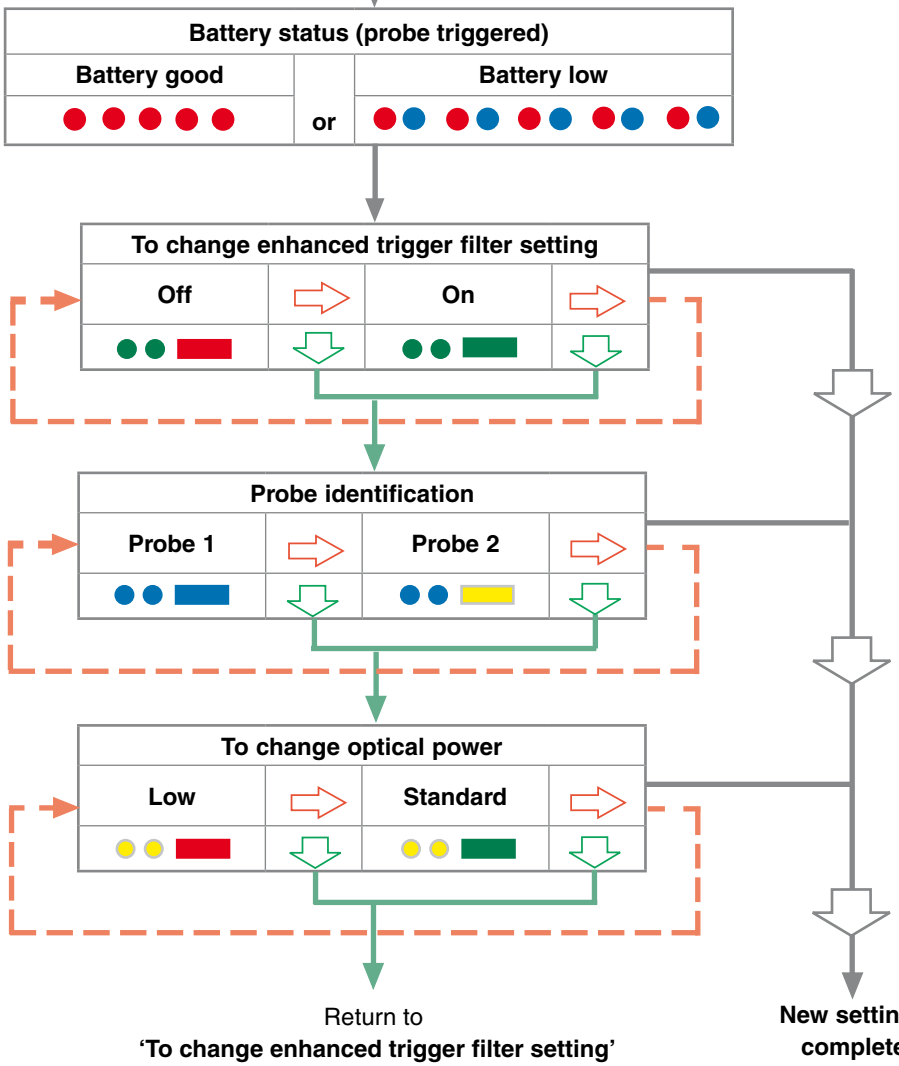
Key to the symbols	
● ▬	LED short flash. LED long flash.
⇨	Deflect the stylus. Wait less than 4 seconds before moving to next menu option.
⇩	Deflect the stylus. Wait more than 4 seconds before moving to next menu.
⇩	To exit, leave the stylus untouched for more than 20 seconds.





Deflect the stylus and hold deflected until after the battery status has been displayed at the end of the review sequence.

Changing the probe settings



Operating mode

Probe status LEDs		
LED colour	**Probe status**	**Graphic hint**
Flashing green	Probe seated in operating mode	
Flashing red	Probe triggered in operating mode	
Flashing green and blue	Probe seated in operating mode - low battery	
Flashing red and blue	Probe triggered in operating mode - low battery	
Constant red	Battery dead	
Flashing red or flashing red and green or sequence when batteries are inserted	Unsuitable battery	

NOTE:
Due to the nature of Lithium Thionyl Chloride batteries, if a 'low battery' LED sequence is ignored or overlooked, then it is possible for the following sequence of events to occur:

1. When the probe is active, the batteries discharge until battery power becomes too low for the probe to operate correctly.
2. The probe stops functioning, but then re-activates as the batteries recharge sufficiently to provide the probe with power.
3. The probe begins to run through the LED review sequence (see page 4.2).
4. Again, the batteries discharge and the probe ceases to function.
5. Again, the batteries recharge sufficiently to provide the probe with power and the sequence repeats itself.

RENISHAW
apply innovation™

Service and maintenance

Contents

Cleaning

Clean the window to maintain signal range.

CAUTION: The OTS has a glass window. Handle with care if broken to avoid injury

Service

You may undertake the maintenance routines described in these instructions.

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.

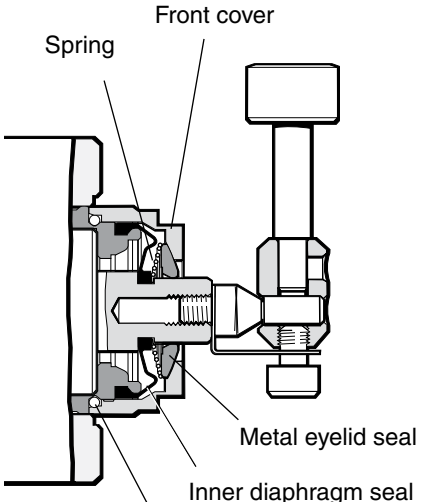
Ensure the probe is firmly secured to its mounting.

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 Coolant residue accumulating on the transmission window will have a detrimental effect on tranmission performance. Wipe clean as often as necessary to maintain unrestricted transmission

3. Keep all electrical connections clean.



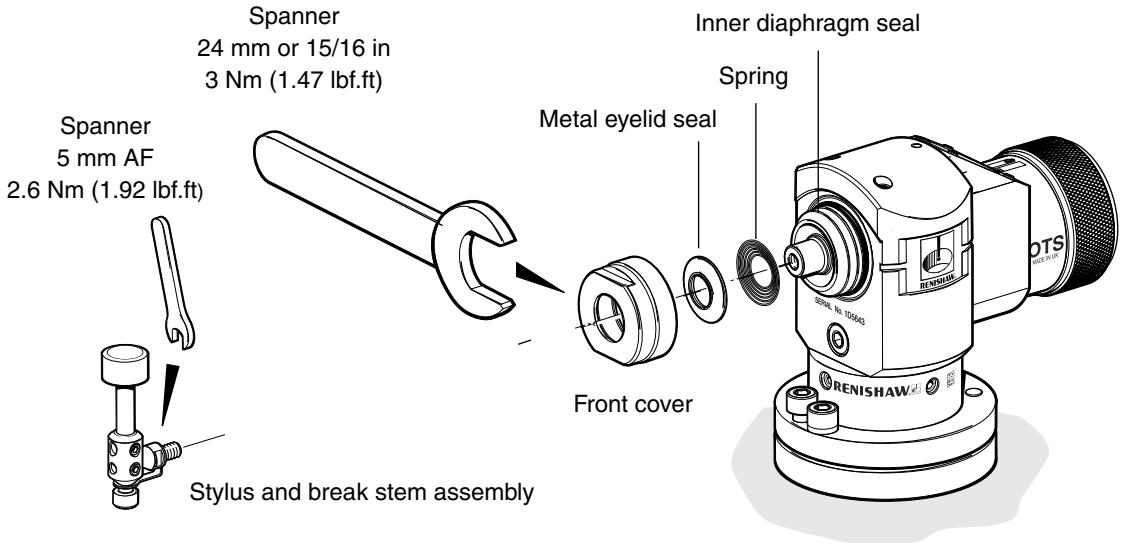
Probe module

4. 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 please contact Renishaw.

   The service interval may be extended or reduced depending on experience (see next page for inspection instructions).

Eyelid removal/replacement



1. Remove the stylus/break stem assembly using the 5 mm AF spanner.
2. Use a 24 mm or 15/16 in spanner to remove the probe's front cover. This will expose the metal eyelid seal, spring and the inner diaphragm seal. Remove the metal eyelid and spring. CAUTION – these may fall out.
3. Wash inside the probe, using clean coolant. (DO NOT use sharp metal objects to clean out debris).
4. 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.
5. Refit the spring and metal eyelid (the spring's largest diameter is against the metal eyelid).
6. Refit the remaining components.

Changing the batteries (Battery type: 1/2 AA Lithium Thionyl Chloride (3.6 V) x 2)

✔

Ecocel:	EB 1425, EB1426
Saft:	LS 14250 C, LS 14250
Sonnenschein:	SL-750
Xeno:	XL-050F

✘

Dubilier:	SB-AA02
Maxell:	ER3S
Sanyo:	CR 14250 SE
Sonnenschein:	SL-350, SL-550
Tadiran:	TL-4902 TL-5902, TL-2150, TL-5101
Varta:	CR 1/2 AA

After removing old batteries, wait more than 5 seconds before inserting new batteries.

CAUTION

Do not leave exhausted batteries in the probe.

CAUTION

Please dispose of exhausted batteries in accordance with local regulations.

Do not dispose of batteries in a fire

Installing the batteries

- Take care not to short the battery contacts as this may be a fire hazard. Ensure the contact strips are located securely.

  When changing batteries, do not allow coolant or debris to enter the battery compartment.

  When changing batteries, check that the polarity is correct.

Troubleshooting

Contents

Fault finding - If in doubt, consult your probe supplier.

Symptom	Probable cause	Remedial action
Probe fails to power up (no LED illuminated, or fails to indicate current probe settings)	Dead batteries	Change batteries.
	Wrong batteries	Change batteries
	Batteries inserted incorrectly	Check battery insertion
Probe fails to switch-on	Wrong optical start mode selected	Reconfigure transmission mode
	Dead batteries	Change batteries
	Wrong batteries	Change batteries
	Batteries inserted incorrectly	Check battery insertion.
	Optical/magnetic interference	Check for interfering lights or motors Consider removing interfering source
	Transmission beam obstructed	Check that probe and receiver windows are clean, and remove any obstruction
	Probe out of range/not aligned with receiver	Check alignment and if receiver fixing is secure
	No receiver start signal	Refer to relevant user's guide. Check connections and fuses
Probe turns on unexpectedly	Probe receiving turn-on signal from receiver on adjacent machine	Reduce turn-on range on receiver on adjacent machine
Machine stops unexpectedly during a probing cycle	Optical communication obstructed	Check interface/receiver and remove obstruction
	Interface/receiver/machine fault	Refer to interface/receiver/machine User's guide
	Dead batteries	Change batteries
	False probe trigger	Enable enhanced trigger filter
	Probe unable to find target surface	Check that part is correctly positioned and that stylus has not broken
	Adjacent probe	Reconfigure to low power mode and reduce range of receiver

Symptom	Probable cause	Remedial action
Probe crashes	Tool length offset incorrect	Review offsets
	Controller wired to respond to inspection probe instead of tool setter	Review installation wiring
Poor probe repeatability and/ or accuracy	Debris on part or stylus	Clean tool and stylus
	Loose probe mounting on machine bed or loose stylus	Check and tighten as appropriate
	Excessive machine vibration	Enable enhanced trigger filter Eliminate vibrations
	Calibration out of date and/or incorrect offsets	Review probing software
	Calibration and probing speeds not the same	Review probing software
	Measurement occurs as stylus leaves surface	Review probing software
	Measurement occurs within the machine's acceleration and deceleration zone	Review probing software and probe filter settings
	Probing speed too high	Perform simple repeatability trials at various speeds
	Temperature variation causes machine and workpiece movement	Minimise temperature changes
	Machine tool faulty	Perform health checks on machine
Probe fails to switch off	Optical/magnetic interference	Check for interfering lights or motors. Consider removing the interfering source Check position of receiver Increase receiver signal start range Ensure window is clean
	Probe out of range	Review performance envelopes

This page left intentionally blank

RENISHAW
apply innovation™

Parts list

Contents

OTS system parts and accessories

Please quote the part number when ordering equipment.

Type	Part number	Descripion
OTS	A-5401-2001	OTS probe with disc stylus, batteries, tool kit and User's guide (optical on/optical off, set to: filter off, Probe 2 start standard power)
Batteries	P-BT03-0007	1/2 AA batteries (pack of two)
Battery cap	A-5401-0301	OTS battery cap assembly.
Seal	A-4038-0301	Battery housing seal.
Break stem kit	A-5003-5171	Stylus protection kit comprising: break stem (x 1), captive link, grubscrew flat ended (x 3), cap head screw (x 2), with tools (hexagon wrenches, spanner 5 mm AF, and support bar).
Stylus holder kit	A-2008-0389	Stylus holder kit comprising stylus holder and screws.
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, 75 Rockwell C.
Mounting bracket	A-2033-0830	OMI-2T/OMI-2H/OMI-2 mounting bracket with fixing screws, washers and nuts
OMI-2T	A-5439-0049	OMI-2T complete with cable 8 m (26.25 ft) long
Quick start guide	A-5401-8500	Quick start guide for rapid set-up of the OTS probe
Publications		
Probe software for machine tools		Software features Data sheet H-2000-2289 Software list Data sheet H-2000-2298
Styli		Styli and accessories Catalogue H-1000-3200

RENISHAW
apply innovation™

Probe settings record

Contents

Probe settings record table

✔ tick

Enhanced trigger filter	OFF	
	ON	
Probe identification	Probe 1	
	Probe 2	
Optical power setting	Low power	
	Standard power	

OTS serial no .....

RENISHAW
apply innovation™

Definition of probing terms

Contents

Definition of terms commonly associated with probing

Accuracy

The closeness of agreement between the results of a measurement and the true value of the part being measured.

Repeatability

The variation in measurements obtained when multiple readings are taken with the same instrument and technique on the same part or item. In Renishaw terms, repeatability is the ability of a probe to trigger at the same point each time.

Calibration

The operation that identifies and corrects any deviation from the stated performance targets.

Probe calibration

Where a datum feature, of known size and position, is measured to establish the average pre-travel for the stylus concerned.

Datum

The reference feature from which other co-ordinates are measured.

Hysteresis

A systematic error arising from the difference in direction of a probing move resulting from the preceding reseat.

Kinematic seating

A seating mechanism in which the spatial position of a movable component is constrained in all 6 degrees of potential movement. This is achieved in a Renishaw probe by 6 contact points formed by a system of radial rollers (or 'V' grooves) and ball bearings.

Kinematic switching probe

A contact probe in which the kinematic seating forms an electrical circuit that is broken by the action of displacing the stylus, to provide the trigger signal. After displacement, the stylus ball returns to the highly repeatable position defined by the kinematic location points.

Lobing

The variation in trigger point position from a perfect spherical locus, as the direction of probing varies.

Overtravel

The distance travelled by the probe after the trigger point has been reached.

Pre-travel

The displacement from the point where the stylus ball contacts the workpiece, to the point where a probe trigger is asserted.

Pre-travel variation

The deviation of the pre-travel from its average value as it varies with trigger direction. This may be specified for 2D (X-Y) or 3D (X-Y-Z) measurements. Pre-travel itself is not a form of error, since it can easily be compensated for, by probe calibration.

Strain gauge probe

Although a strain gauge probe still uses a kinematic mechanism to retain the stylus, it does not use the resistance through the contact elements as the means to sense a trigger. Instead, a set of strain gauges are positioned on carefully designed webs within the probe structure, beyond the kinematics.

These gauges measure the contact force applied to the stylus and generate a trigger. This provides a low trigger force, low pre-travel and therefore low pre-travel variation.

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**

H-5401-8505-01