Installation and user's guide
H-2000-5219-01-A

RENISHAW
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RMP60 - radio probe

Disclaimer

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Renishaw Part no: H-2000-5219-01-A

Issued: 08.2003

CE

EC DECLARATION OF CONFORMITY

Renishaw plc declare that the product: -

Name: RMP60

Description: Radio machine probe

has been manufactured in conformity with the following standard: -

BS EN 61326:1998/ 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 directive (as amended): -

89/336/EEC - Electromagnetic compatibility

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

Installation and user's guide

Warranty

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

Changes to equipment

Renishaw reserves the right to change specifications without notice.

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.

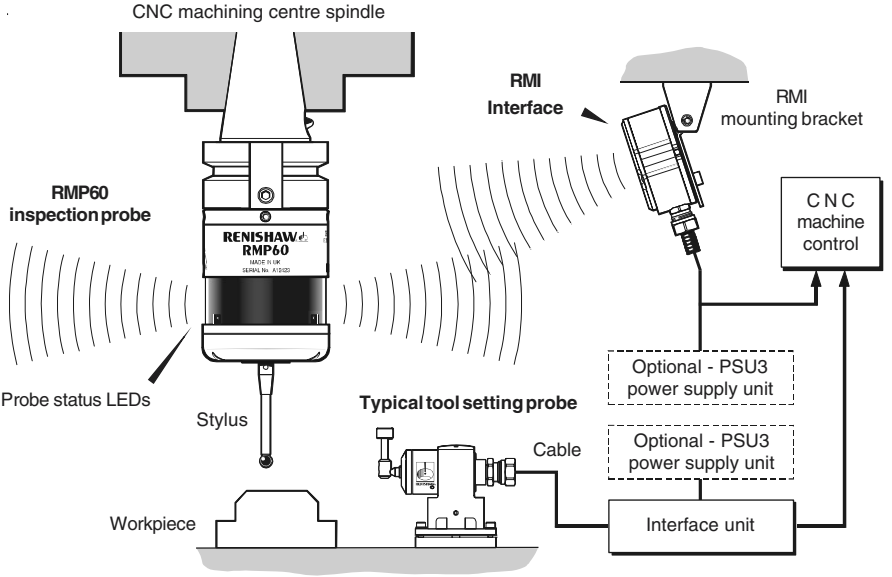
Patent notice

Features of products shown in this guide, and of related products, are the subject of the following patents and/or patent applications:

EP 0652413
US 4599524
US 5,279,042
JP 3,126,797
WO 02/063235
WO 03/021182

Contents

Typical probe system with radio transmission



A workpiece set-up and inspection probe is in effect another tool in the system.
A probing cycle may be included at any stage of the machining process.

Probe data signals are transmitted via radio link to the RMI and on to the machine control. The RMI converts probe signals into an acceptable form for the machine control.

System performance

Operating envelope

Surfaces within the machine may increase the signal transmission range.

Coolant and swarf residue accumulating on the RMP60 and RMI may have a detrimental effect on transmission performance. Wipe clean as often as is necessary to maintain unrestricted transmission.

When operating, do not touch with your hand, either the RMI cover or the probe glass window, as this will change the performance.

Operation in extremes of temperature will result in some reduction in range.

RMI position

To assist finding the optimum position of the RMI during system installation, a signal strength indication LED is available on the RMI interface.

RMI signal strength is displayed on an RMI multi-coloured LED.

Environment

RMP60 RMI PSU3	Temperature
Storage	-10 °C to 70 °C (14 °F to 158 °F)
Normal operating	5 °C to 50 °C (41 F° to 122 °F)

Probe repeatability

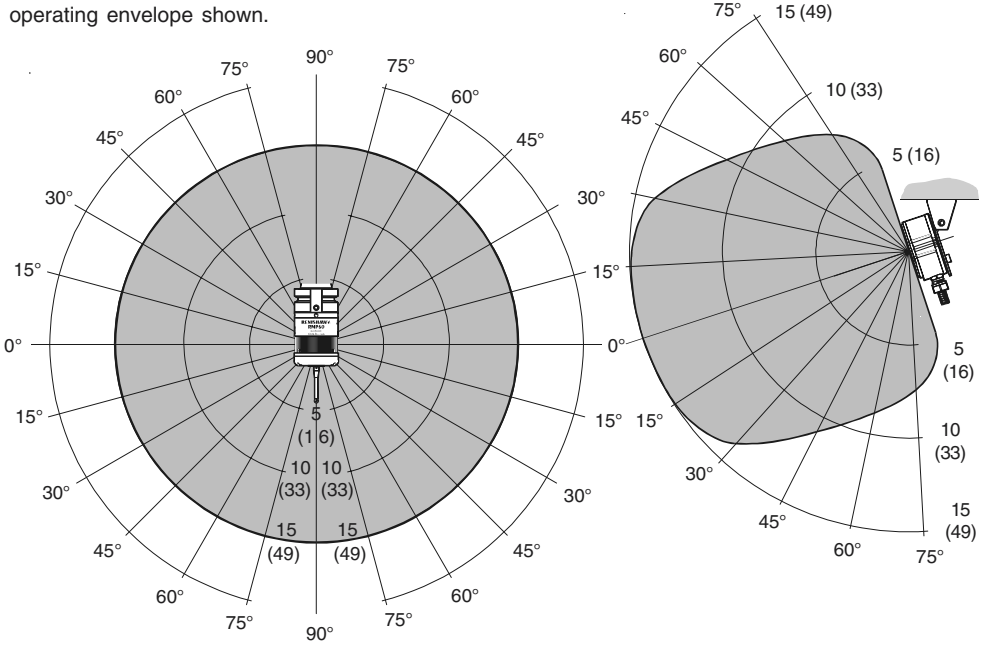
Maximum 2 Sigma (2σ) Value

Repeatability of 1,0 µm (40 µ in) is valid for test velocity of 480 mm/min (1.57 ft/min) at stylus tip, using stylus 50 mm (1.97 in) long.

Operating envelope

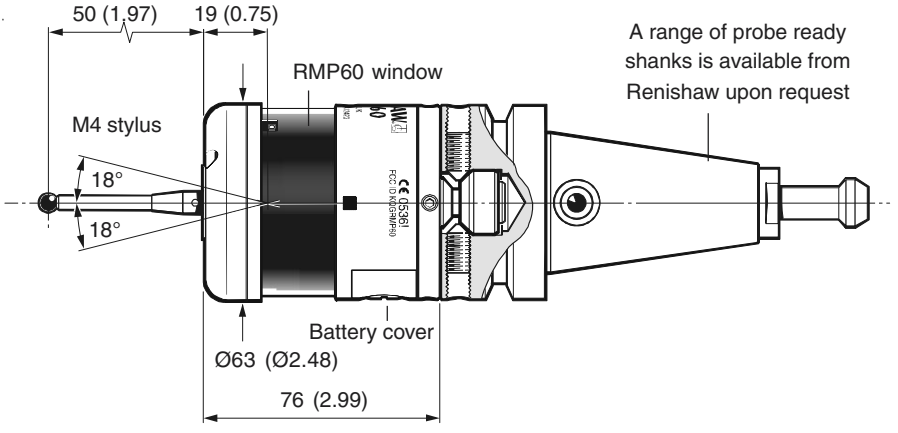
RMP60 probe + RMI

RMP60 and RMI must be within each others operating envelope shown.



RMP60 features

Dimensions mm (in)



STYLUS OVERTRAVEL LIMITS		
Stylus length	**±X / ±Y**	**Z**
50 (1.96)	21 (0.82)	11 (0.43)
100 (3.93)	37 (1.45)	11 (0.43)

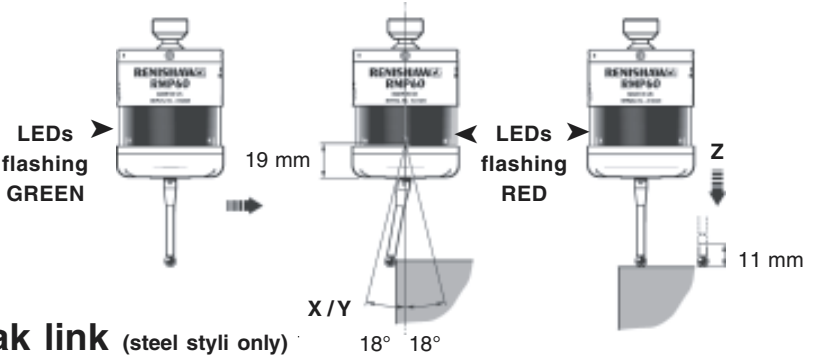
RMP60 specification

Stylus trigger force
X/Y trigger forces vary, depending on trigger direction. There are 3 high force and 3 low force directions

X/Y direction (50 mm stylus)	Typical lowest force 0.75 N / 75 gf (2.64 ozf)
	Typical highest force 1,4 N / 140 gf (4.92 ozf)
Z direction	4.90 N / 490 gf (17.28 ozf)
RMP60 IP rating	IPX8
RMP60 weight (without shank)	Without batteries 855 g (30.16 oz)
	With batteries 901 g (31.79 oz)
Max spin speed	1000 rev/min

PROBE STATUS LED		
LED colour	**Probe status**	**Graphic hint**
Unlit	Stand-by mode	
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	

Probe status LED



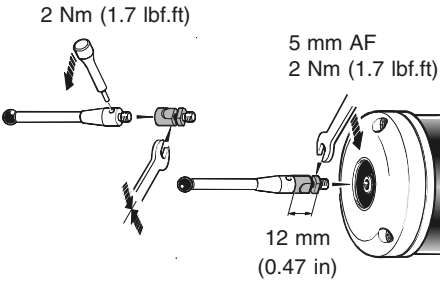
Weak link (steel styli only)

Fitting stylus with weak link onto RMP60

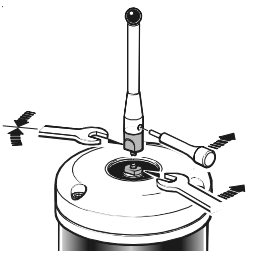
In the event of excessive stylus overtravel the weak link is designed to break, thereby protecting the probe from damage.

Take care to avoid stressing the weak link during assembly.

Fitting a weak link



Removing a broken weak link



Modes of operation

The RMP60 probe can be in one of three modes:

1. **Stand-by mode** - The RMP60 is waiting for a switch-on signal .
2. **Operating mode** - Activated by one of the switch on methods described on this page. In this mode and the RMP60 is now ready for use.
3. **Configuration mode** - The trigger-logic configuration method allows a number of RMP60 set-up options to be configured by triggering the RMP60, including the switch-off options described on page 25.

RMP60 switch-on

RMP60 power on/off

Switch-on options are configurable
- see page 13.
Three switching methods can be used.

1. **Radio start**

   Radio switch-on is commanded by M code.

2. **Spin start**

   Spin at 650 rev/min for 1 sec minimum (maximum 6 sec)

3. **Shank switch**

Note:
RMP60 will be turned on after 1 sec in all modes.

RMP60 switch-off

Switch-off options are programmable

Three switching methods can be used.

1. **Radio stop**

   Radio switch off is commanded by a M code.

   (Only applies when radio turn on is selected).

A timer automatically switches the probe off after 90 min from last trigger if not turned off by M-code.

2. **Timer off** (time out)

   (Only applies when radio on/spin on mode is selected).
   The RMP60 will time out (12, 33 or 134 sec) after the last probe trigger or reseat.

3. **Spin stop**

   (Only applies when spin on mode is selected).

   A timer switch automatically swiches the probe off after 90 min from last trigger off, if not spun off.

4. **Shank switch**
   (Only applies when shank on mode is selected).

Note:
After being turned on, the RMP60 must be on for a minimum of 1 sec (7 sec for spin off) before being turned off.

Reviewing current probe settings

START

Batteries removed from probe

Insert batteries: note the LED sequence, which follows the form below

START UP SEQUENCE

Settings review

LED TEST SEQUENCE

The probe LEDs will always begin with a colour test

SWITCH ON METHOD setting		
RADIO ON	SHANK ON	SPIN ON
		

Note This menu will be omitted if shank turn on has been selected

SWITCH OFF METHOD setting			
RADIO or SPIN	Short timeout 12 sec	Medium timeout 33 sec	Long timeout 134 sec
			

START UP SEQUENCE COMPLETE

The battery status will be displayed and after 10 s the probe will return to stand-by mode

BATTERY GOOD	BATTERY LOW
	

Configuration using trigger logic

START

Remove batteries from probe.
Hold stylus deflected and insert batteries.
Release the stylus only after 15 seconds.
The **current probe settings** review sequence, detailed on page 12 will always be displayed first.

CONFIGURATION MODE
after 15 seconds

SWITCH ON METHOD menu
Deflect the stylus (>0.5 sec) to cycle between options

RADIO ON	SPIN ON	SHANK ON
●● ▬	●● ▬	●● ▬

Once the desired switch on option is selected deflect the stylus for at least 4 sec to move onto next menu

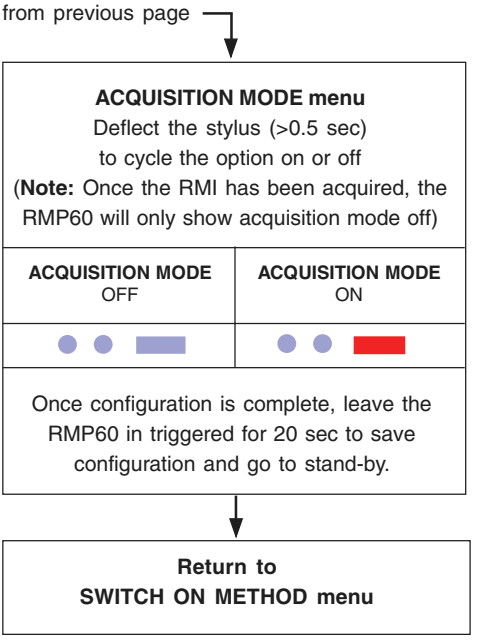
Note This menu will be omitted if shank turn on has been selected

SWITCH OFF METHOD menu
Deflect the stylus (>0.5 sec) to cycle between options

RADIO or SPIN	Short timeout 12 sec	Medium timeout 33 sec	Long timeout 134 sec
●● ▬	●● ▬	●● ▬	●● ▬

Once the desired switch off option is selected deflect the stylus for at least 4 sec to move onto next menu

continued on next page



It is recommended that settings are reviewed after programming. See 'Reviewing current probe settings'.

Always keep a record of probe settings following any programming. These will be needed should the probe be replaced.

Settings record table

Switch on method	Radio	
	Shank	
	Spin	
Switch off method	Radio/spin	
	Short time out 12 sec	
	Medium time out 33 sec	
	Long time out 134 sec	

System setup/establishing RMP60-RMI partnership.

Setup is done by using the RMP60 trigger logic and powering on the RMI at a particular time during the process.

Trigger logic is a method that allows user configuration of the options available in the RMP60. Trigger logic uses a sequence of RMP60 triggering and battery insertion followed by further RMP60 triggering.

This leads the user through a series of choices allowing selection of the required options.

Reviewing of choices made can be made by battery insertion alone. See pages 12 and 13 for full details of reviewing probe settings and configuration using trigger logic.

1. Use trigger logic to set RMP60 turn on/ off modes as desired.

2. Use trigger logic to access RMP60 acquisition mode (light blue flashes, 2 short 1 long).

Warning
When holding the RMP60 do NOT wrap a hand, or anything else, around the glass window.

3. Power on the RMI.

4. Wait until RMI signal led flashes green.

5. Trigger the probe (min 0.1 sec max 2 sec) RMP60 will flash 2 x turquoise short, followed by 1 red long and repeat until acquistion occurs.

6. RMI pattern will change to red & yellow flashing when it acquires the RMP.

7. Allow ~10 seconds for both RMP60 and RMI to timeout all RMP60 LEDs off and RMI signal LED off. The system is then ready for use.

continued on next page

Note.
When the RMP60 and RMI become partners the RMI records the RMP60 serial number. It is not possible for an RMI to be partners with more than one RMP60.

It is possible for an RMP60 to be partners with more than one RMI, but the system will not work correctly if more than one partner RMI is powered on at any one time.

RMP60 batteries

Replacing batteries

Only use specified batteries.

Clean and dry RMP60 with a cloth or paper towel before removing battery cover. Where the RMP60 has been exposed to coolant, it is recommended that the area around the battery cover is cleaned.

To access the RMP60 batteries, remove the battery cover by rotating the securing screw 30° anticlockwise and withdraw battery cassette.

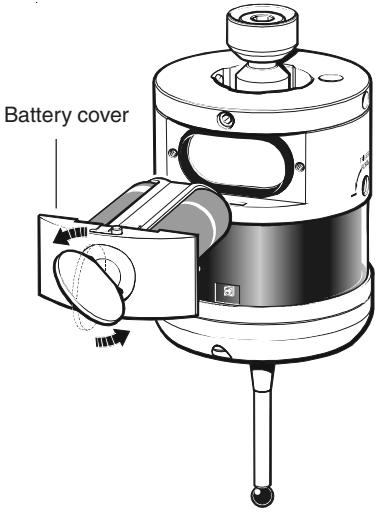
Take care to avoid damaging the cover gasket.

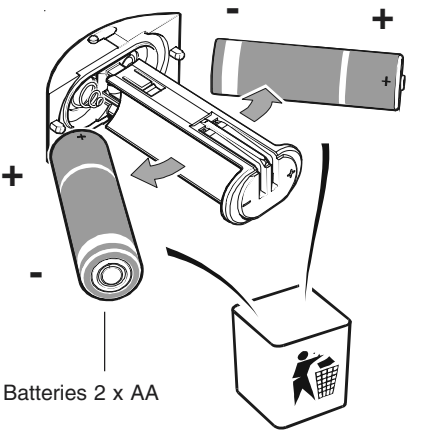
When inserting the batteries, ensure they are loaded as shown (see next page).

If one or more batteries are incorrectly loaded the probe will not respond.

Do not mix new and used batteries or battery types, as this will result in reduced life and damage to the batteries.

Always ensure that the cover gasket and mating surfaces are clean and free from damage, before reassembly.





DO NOT leave exhausted batteries in probe

DO NOT allow coolant or debris to enter the battery compartment

DO check for correct battery polarity

Please dispose of exhausted batteries in accordance with local regulations. Do not dispose of batteries in fire.

Battery life expectancy

Alkaline - Two AA type (see page 20).

Typical battery reserve life

Using the standard alkaline battery at 5 % usage, typically the probe will continue to operate for approximately 2 weeks after a low battery warning is first indicated.

Replace the batteries as soon as is practicable.

When inserting new batteries the RMP60 will flash to show current configuration (page 12).

In order to achieve stated radio stand-by life, the RMP60 must be in range of powered partner RMI.

BATTERY	SHANK/SPIN TURN ON		RADIO TURN ON		CONTINUOUS USE
Two AA type	STAND-BY LIFE (days - max)	5% USAGE 72 minutes/day (days - max)	STAND-BY LIFE (days - max)	5% USAGE 72 minutes/day (days - max)	(hours - max)
Alkaline	1,538	115	384	95	144

Low battery indicators

The low battery warning will be signalled by the alternate blue flashing of probe status LED when the end of the usable battery life is approaching. Simultaneously, the low battery LED on the RMI will be lit.

Dead battery indicators

When the battery voltage drops below the threshold where performance can be guaranteed, the RMP60 probe status LED will change to constant red.

Battery specification

The RMP60 requires two identical AA size batteries, individually rated at a voltage of between 1.2 V and 3.6 V.

The standard batteries are AA alkaline. Alternative batteries are lithium thionyl chloride (3.6 V), NiCad or NiMh.

For applications requiring maximum battery life, a high capacity lithium thionyl chloride type is essential.

Sources for lithium thionyl chloride batteries

Please use these specified part numbers only

Supplier	**Part number**
RS	596-602, 201-9438,
Radio Shack	23-037

Manufacturer	**Part number**
Saft	LS 14500
Sonnenschein	SL 760/S
Tadiran	TL-5903/S, TL-2100/S
Xeno	XL-060F

RMP60/shank mounting

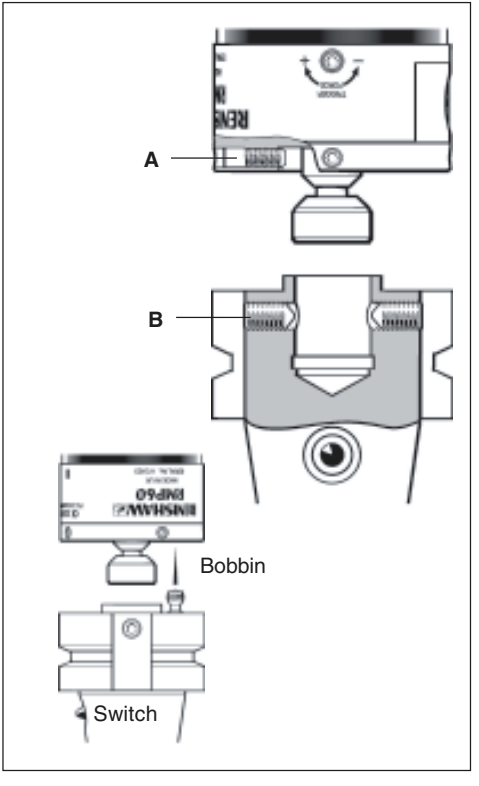
Stage 1 RMP60/shank mounting

If the RMP60 does not have a shank switch, please proceed from note 3.

1. Remove plug from rear of RMP60 using pliars.
2. Place bobbin into shank.
3. Fully slacken four screws **A**.
4. Grease two screws **B**, and fit into shank.
5. Fit RMP60 onto the shank, and visually position centrally.
6. Tighten screws **B** to 6-8 Nm (4.4- 5.9 lb.ft) (Partially tighten screws **B** to 2 - 3 Nm (1.47 - 2.2 lbf.ft), if RMP60 is to be on-centre adjusted).
7. The RMP60 assembly is ready for use.

Note :

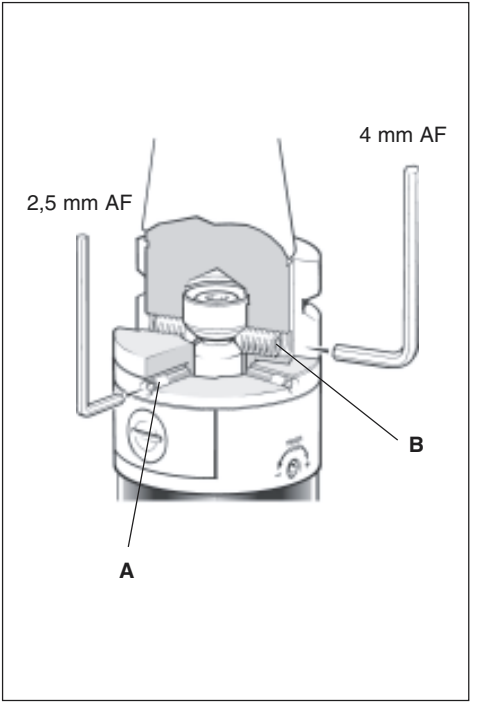
1. DURING ADJUSTMENT CARE SHOULD BE TAKEN NOT TO ROTATE THE RMP60 RELATIVE TO THE SHANK.
2. IF A RMP60/SHANK UNIT IS ACCIDENTALLY DROPPED, IT SHOULD BE CHECKED FOR ON-CENTRE POSITION.
3. DO NOT HIT OR TAP THE PROBE TO ACHIEVE ON-CENTRE ADJUSTMENT.



Stylus on-centre adjustment (if required)

Stage 2 On-centre adjustment

8. Each of the four screws **A** will move the probe relative to the shank, in the X or Y direction as pressure is applied. Tighten individually, backing off after each movement.
9. When the stylus tip run-out is less than 20 µm, fully tighten screws **B** to 6 - 8 Nm (4.4 - 5.9 lbf.ft).
10. For final centering use screws **A** to move the RMP60, progressively slackening on one side and tightening the opposite screw, as the final setting is approached, using two hexagon keys. Tip run out of 5 µm (0.0002 in) should be achievable.
11. It is important that all four screws **A** are tight or tightened to 1,5 - 3,5 Nm (1.1 - 2.6 lbf.ft) once the final setting has been achieved.

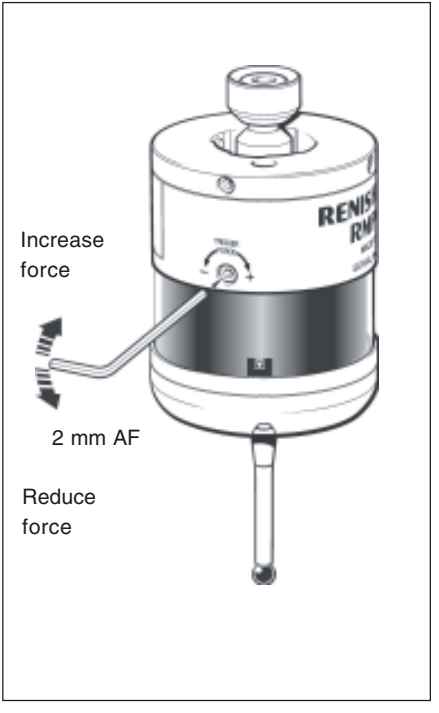


Stylus trigger force adjustment

Spring force within the probe causes the stylus to sit in one unique position, and return to this position following each stylus deflection.

Stylus trigger force is set by Renishaw. The user should only adjust trigger force in special circumstances e.g. excessive machine vibration or insufficient force to support the stylus weight.

To adjust trigger force, and turn the adjusting screw anticlockwise to reduce force (more sensitive) or clockwise to increase force (less sensitive). A stop prevents damage, which could be caused by overtightening the adjusting screw.



Probe moves

Probe trigger

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

To ensure a trigger signal, drive the probe against the workpiece to a target beyond the expected surface, but within the limits of stylus overtravel. After the probe stylus touches the surface, reverse clear of the surface.

Single and double touch probing

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

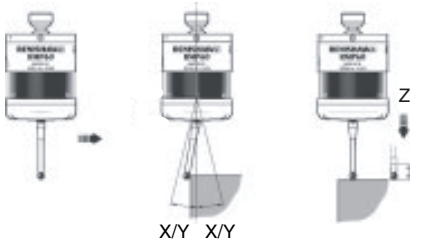
On some types of controller, it is desirable to use a two touch method, as poor accuracy and repeatability can result at higher feed rates.

With a double touch sequence the first move finds the surface quickly. Then the probe is backed off to a position clear of the surface, before making the second touch at a slower feed rate, thereby recording the surface position at a higher resolution.

Probe measuring speed

The probe system transmission delay time is small and constant. It does not normally limit the probing speed, because it is cancelled out during calibration of the probe on the machine tool.

High probing speeds are desirable, however if used, a probing velocity must be chosen which allows the machine to stop within the limits of stylus overtravel, and measuring capability of the machine.



Probing cycles are available from Renishaw

Calibrating a system

Calibration should be done in the following circumstances:

1. Before the system is used
2. When a new stylus is used.
3. To allow for machine thermal growth.
4. Poor relocation repeatability of the probe holder with machine spindle.

It is important that calibration cycles are run at the measuring cycle feed rate to cancel out system errors.

Calibration measurements should be made in every measuring direction to provide complete calibration data for the measuring cycles.

Probe interface signals

1. Error signal delay

A delay of 28 ms maximum for the RMI, will elapse between an error occurring and the output indicating error.

2. Probe signal delay

There is a nominal delay of 10 ms with a variation of ±10 µs for an interface, from the time the probe actually operates, to the RMI interface outputting a probe change of state.

Software requirements

Probing cycles and features are machine software dependant. Good software will allow the following functions :

- Simple to use cycles
- Update a tool offset
- If an out of tolerance is found, either generate an alarm stop, or set a flag for corrective action
- Update work co-ordinate systems for positioning
- Print data in the form of an inspection report to an external PC / printer
- Set tolerances on features

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

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

Inspection cycle features

Simple to use canned cycles for standard features :

Bore/boss. Web/pocket. Single surface.

Simple to use canned cycles for optional features :

Angle measurement.

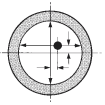
Vector 3 point bore/boss.

Vector single surface.

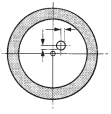
Typical probe cycles for machining centres

Simple to use canned cycles for basic features

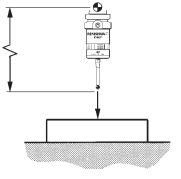
Inspection probe calibration
Probe XY offset calibration



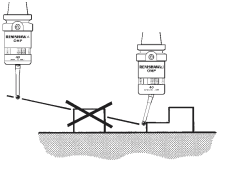
Stylus ball radius calibration



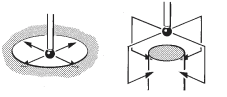
Probe length calibration



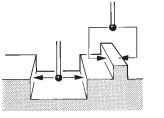
Inspection probe collision protection



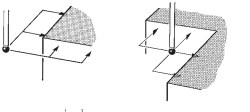
Inspection
Bore and boss measure



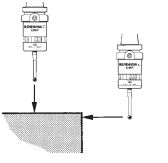
Web and pocket measure



Internal and external corner find



XYZ single surface position



Inspection print-out

COMPONENT No. 1

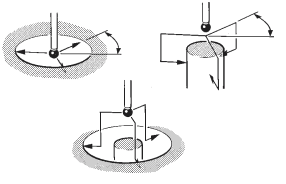
OFFSET NO.	NOMINAL DIMENSION	TOLERANCE	DEVIATION FROM NOMINAL	COMMENTS
99	1.5000	.1000	.0105	
97	200.0000	.1000	.2054	OUT OF TOL

Typical probe cycles for machining centres

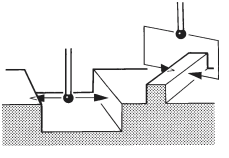
Simple to use canned cycles for additional features

Inspection

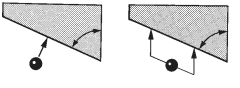
Bore and boss (three point)



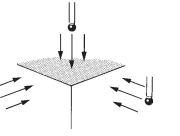
Angled web and pocket measure



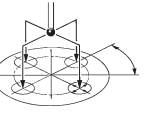
Angled surface measure



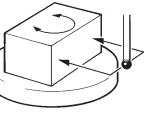
Stock allowance



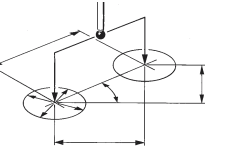
Bore and boss on PCD



4th axis measure



Feature-to-feature measure



Macro software for use with the RMP60 is available from Renishaw for the majority of major controller types, please see Parts list (page 39).

Diaphragm replacement

RMP60 DIAPHRAGMS

The probe mechanism is protected from coolant and debris by two diaphragms. These provide adequate protection under normal working conditions.

The user should periodically check the outer diaphragm, for signs of damage. If this is evident replace the outer diaphragm.

The user must not remove the inner diaphragm. If damaged, return the probe to your supplier for repair.

OUTER DIAPHRAGM INSPECTION

1. Remove the stylus.
2. Undo three M3 front cover screws and remove the front cover
3. Inspect outer diaphragm for damage.
4. To remove outer diaphragm, grip the edge and pull upwards.

INNER DIAPHRAGM INSPECTION

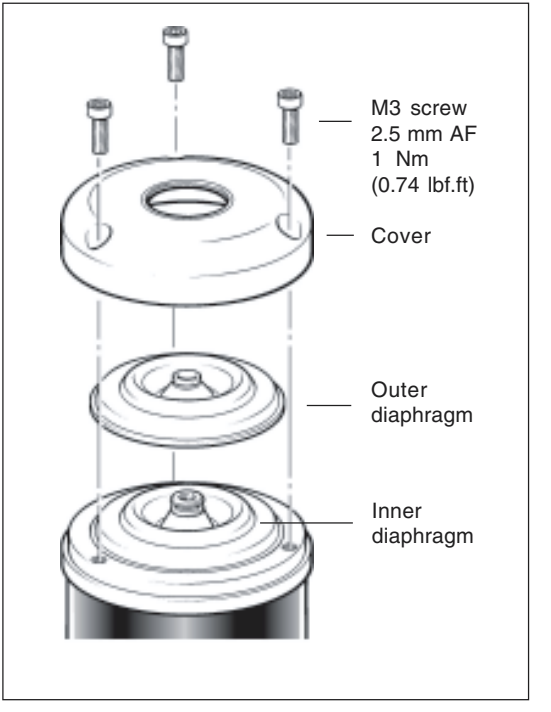
5. Inspect inner diaphragm for damage.

If damaged return the probe to your supplier.

DO NOT REMOVE INNER DIAPHRAGM AS WARRANTY WILL BE VOIDED.

OUTER DIAPHRAGM REPLACEMENT

6. Fit new diaphragm over centre.
7. Locate outer edge of diaphragm to rest on outer edge of inner diaphragm.
8. Refit front cover and M3 screws.
9. Refit stylus and re-calibrate probe.



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

Symptom	Cause	Action
RMP60 fails to switch on	Dead batteries	Change batteries
	Batteries incorrectly inserted	Check/change batteries
	Probe out of range (does not apply to spin-on or shank-on modes)	Check position of RMI, see performance envelope.
	No RMI 'start/stop' signal (only applicable in radio-on mode)	Check for green start LED Check wiring
	No power to RMI (does not apply to spin-on or shank-on modes)	Check wiring
	Incorrect spin speed (spin turn-on only)	Check spin speed.
	Malfunctioning shank switch (shank switch mode only)	Check switch operation
	Incorrect switch off method configured	Check configuration and alter as required

Symptom	Cause	Action
RMP60 fails to switch off	Incorrect switch off method configured.	Check configuration and alter as required.
	No RMI 'start/stop' signal (applicable only in radio off, mode, but not applicable in Heidenhain mode).	Check for green start LED Check wiring.
	Probe in time out and placed in tool magazine and is being triggered by movement.	Review use of time out mode. Increase spring force.
	Malfunctioning shank switch (shank switch mode only).	Check switch operation.
	Incorrect spin speed (spin turn on only).	Check spin speed.
RMP60 status LED's continuous red	Dead batteries.	Change batteries.
Poor battery life	Radio link failure – RMP out of RMI range.	Check position of RMI, see performance envelope.
	RMI power has been removed.	Check power to RMI, leave RMI powered all the time.
	Local radio interference.	Identify and move.
Probe crash	Inspection probe using tool-setting probe signals.	Review program Review installation.

Symptom	Cause	Action
Probe crash	Inspection probe using tool-setting probe signals.	Review program Review installation.
	Probe length offset missing/incorrect	Review probe software.
	Workpiece obstructing probe path.	Review program.
No LED's lit on RMI	No power to RMI	Check wiring
RMI status LED's do not correspond to RMP60 status LED's	Radio link failure – RMP60 out of RMI range.	Check position of RMI, see performance envelope.
	RMP60 has been enclosed/ shielded by metal.	Review installation
	RMP60 and RMI are not partnered.	Partner RMP60 and RMI.
RMI probe status LED continually lit red	Dead batteries.	Change batteries.
RMI error LED lit during probing cycle	Damaged cable	Check wiring.
	Loss of power	Check wiring.
	Dead batteries	Change batteries.
	Probe false trigger	Increase spring pressure. Reduce acceleration.

Symptom	Cause	Action
RMI error LED lit during probing cycle (continued)	Probe timed out	Change setting. Review turn off method
	Probe out of range	Check position of RMI, see performance envelope.
RMI error LED illuminated during intended probe cycle	Probe not switched on.	Check configuration and alter as required
	Probe out of range	Check position of RMI, see performance envelope.
All RMI LED's flashing	Wiring fault. Output over current.	Check wiring Check wiring, turn power to RMI off and on again to reset
RMI low battery led lit	Low batteries.	Change batteries soon
Reduced range	Local radio interference	Identify and move
Poor repeatability	Probing occurs within machine's acceleration/ deceleration zones.	Review probe software
	Probe feedrate too high	Check feedrate and correct, test at different speeds.
	Temperature variation	Minimise temperature . change. Calibrate more frequently. Calibrate just before use.
	Slack in machine tool	Perform health check on machine.

Symptom	Cause	Action
Poor measurement results.	Debris on part or stylus.	Clean. Recalibrate if probe was calibrated with debris on stylus.
	Repeatability of probe into spindle.	Verify by repeated toolchange and single point move.
	Loose probe to shank mounting or stylus.	Check and tighten as required, recalibrate.
	Offsets not being updated	Review software.
	Calibrated feature has moved.	Check.
	Measurement occurs as stylus leaves surface.	Review software.
	Calibration and probing speeds different.	Review software.

Appendix 1

RMI (RADIO MACHINE INTERFACE)

The RMI is fully described in User's guide H-2000-5220

A visual indication of system status is provided by light emitting diodes (LED's).
Status is continuously updated and indication is provided for
START, LOW BATTERY, PROBE STATUS, ERROR, SIGNAL STRENGTH

LED LIGHT SIGNALS

1. Low battery

Red: Battery is low.

Green: M code Start/Stop in progress.

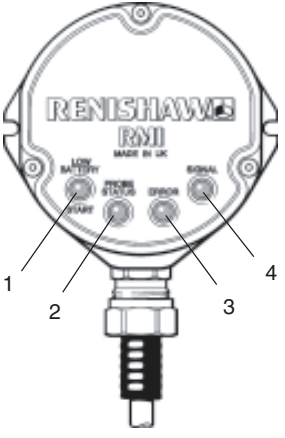
Yellow: Battery low and M code Start/stop in progress.

Off: Battery is OK (and no M code start/stop in progress).

2. Probe status

Red: Probe triggered or unknown status.

Green: Probe is seated.



KEEP THE FRONT COVER CLEAN

3. Error

Red	Error, other outputs may be incorrect.
Off:	No Error.

4. Signal

Green	Full signal strength.
Yellow	Medium signal strength.
Red:	Low signal strength, radio link may fail.
Off	No signal detected.
Green/off	Flashing: RMI is acquisition mode, and can acquire a partner RMP.
Red/yellow	Flashing: RMI has (just) acquired a new partner RMP.

Notes.

1. The probe status LED will always be illuminated when power is present, there is no power present LED/light.
2. All the indicators report the status of the partner RMP. If there is no partner in range, or the partner is off then the probe status and error LEDs will be red and the other LEDs will be off.
3. When the RMI is powered it will enter the acquire partner mode which will be indicated by the flashing. After a short time (~12 secs) it will switch to its normal (passive) mode listening for its partner.
4. The conditions shown by the low battery, probe status and error LEDs are the same as those present on the electrical signal outputs.

Parts list - Please quote the Part no. when ordering equipment.

Type	Part no.	Description
RMP60	A-4113-0001	RMP60 probe with batteries, tool kit and User's guide (set to radio on/radio off).
RMP60	A-4113-0002	RMP60 probe with batteries, tool kit and User's guide (set to radio on/time off).
RMP60	A-4113-0003	RMP60 probe with batteries, tool kit and User's guide (set to spin on/spin off).
RMP60	A-4113-0004	RMP60 probe with batteries, tool kit and User's guide (set to spin on/time off).
RMP60	A-4113-0005	RMP60 probe with batteries, tool kit and User's guide (set to shank switch).
Battery	P-BT03-0005	AA batteries - Alkaline - supplied as standard with probe (two required).
Battery	P-BT03-0008	AA batteries - Lithium thionyl chloride (two required).
Stylus	A-5000-3709	PS3-1C ceramic stylus 50 mm long with Ø6 mm ball.
Weak link	A-2085-0068	Weak link (Part no. M-2085-0069 (x 2) and 5 mm AF spanner.

Type	Part no.	Description
TK	A-4038-0208	Probe tool kit comprising: Ø1.98 mm stylus tool, 2.0 mm AF hexagon key, 2,5 mm AF hexagon key (x 2), 4 mm AF hexagon key, shank grub screws (x 2), weak link and 3 mm AF spanner.
Diaphragm kit	M-4038-0138	RMP60 outer diaphragm.
Battery cover	A-4038-0218	RMP60 battery casette assembly.
Bobbin	A-4038-0056	Bobbin for shank switch.
RMI	A-4113-0050	RMI complete with 15 m (49.2 ft) cable.
Mtg brkt	A-2033-0830	Mounting bracket with fixing screws, washers and nuts.
PSU3	A-2019-0018	PSU3 power supply unit 85-264 V input.
Styli	—	For complete listing please see Renishaw Styli guide. Part no. H-1000-3200.
Software	—	For complete list of Renishaw software for machine tools please see Data sheet. Part no. H-2000-2289.
Shanks	—	For complete listing please see Renishaw Data sheet H-2000-2011

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