**RENISHAW®**

apply innovation™

# RMI - radio machine interface

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# **Contents**

# $C\epsilon$

## EC DECLARATION OF CONFORMITY

Renishaw plc declares that the product:-

Name:     RMI

Description:   Radio machine interface

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.

## 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.

## SAFETY

**Information for the user**

Beware of unexpected movement. The user should remain outside of the full working envelope of probe head/extension/probe combinations.

Handle and dispose of batteries in according to the manufacturers recommendations. Use only the recommended batteries. Do not allow the battery terminals to contact other metallic objects.

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

Refer to the machine supplier's operating instructions.

**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 machine's movement.

# 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.

### Care of the RMI
Keep system components clean and treat the RMI with care.

Do not apply metallic labels to the front of the RMI.

### Changes to equipment
Renishaw reserve the right to change specifications without obligation to change equipment previously sold.

### Weight
RMI including 15 metres (49.2 ft) of cable = 1,700 g (60 oz).

**⚠ CAUTION:** Only qualified persons should adjust switches.

### CNC machine
CNC machine tools must always be operated by competent persons in accordance with manufacturers instructions.

### Environment
**Temperature**
The RMI is specified for storage over –10 °C to 70 °C (14 °F to 158 °F) and operation over 5 °C to 50 °C  (41 °F to 122 °F) ambient temperature range.

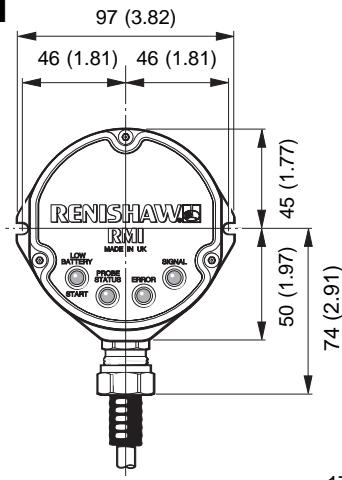### Sealing
The unit is fully sealed to IPX8.

### 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 |
| EP | 1576560 |
| JP | 3,126,797 |
| US | 5,279,042 |
| WO | 2004-057552 |

## RMI

dimensions mm (in)

97 (3.82)

46 (1.81) | 46 (1.81)

44 (1.73)

45 (1.77)

50 (1.97)

74 (2.91)

RENISHAW
RMI
MADE IN UK

LOW BATTERY | SIGNAL
PROBE STATUS | ERROR
START

17.5 (0.69)

4 holes
M5 x 13 deep
on 80 p.c.d.

45°

Slot to suit M6
bolts supplied
(two places)

When using rear exit
cable, provide a
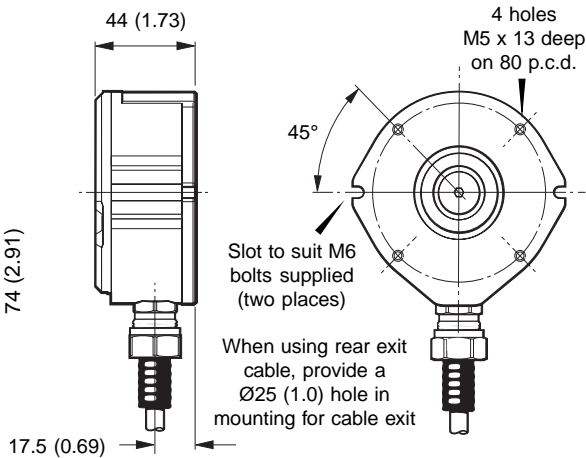Ø25 (1.0) hole in
mounting for cable exit

### RMI

The RMI is a combined radio transceiver and machine interface.

The RMI is designed to be mounted within the machine's working envelope.

### Power supply

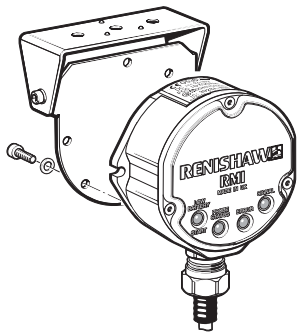The RMI can draw its supply from the CNC machine 12 V to 30 V d.c. supply and presents a peak load of up to 250 mA during turn on (typically 100 mA from 24 V).

Alternatively, power may be supplied from a Renishaw PSU3 power supply unit.
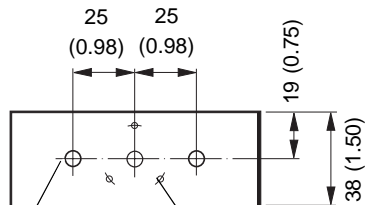
### Input voltage ripple

The input voltage ripple shall not cause the voltage to fall below 12 V, or rise above 30 V.

## **Mounting bracket** (optional)



dimensions mm (in)

25 (0.98)    25 (0.98)

19 (0.75)

38 (1.50)

3 holes Ø6.4 (0.25)    3 grip protrusions

100.5 (3.95)

2.0 (0.08)

30 (1.18)

25 (0.98)

45 (1.77)

6 holes Ø5.3 (0.20)

45 (1.77)

45°

90 (3.54)

2.0 (0.08)
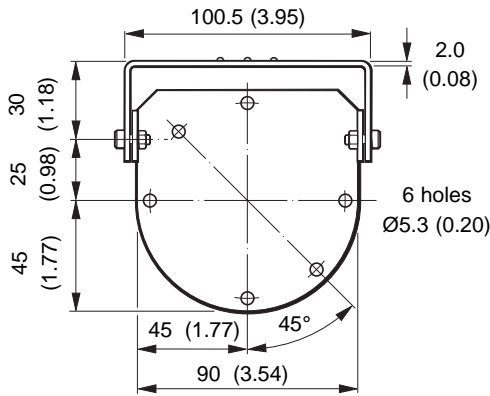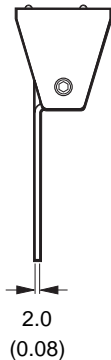
Paired holes permit RMI mounting in alternative orientation.

**NOTE:**

Install RMI with cable exiting from lower side for good coolant run off.

Mounting bracket cannot be used with an RMI in rear exit configuration.

# RMI visual diagnostics

A visual indication of system status is provided by LEDs.
Status is continuously updated and indication is provided for
START, LOW BATTERY, PROBE STATUS, ERROR, SIGNAL STRENGTH

**LED LIGHT SIGNALS**

**1. LOW BATTERY / START**

| | |
|---|---|
| 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. |
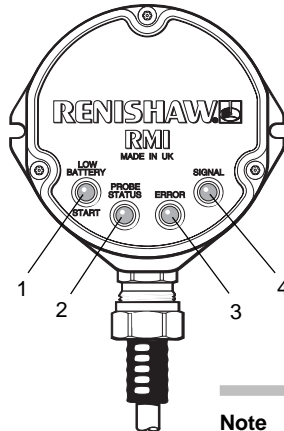


KEEP THE
FRONT COVER
CLEAN

**Note**
All LEDs flashing indicates wiring fault or output over-current

**3. ERROR**

| | |
|---|---|
| Red | Error, other outputs may be incorrect. |
| Off | No Error. |

**4. SIGNAL**

| | |
|---|---|
| Green | Excellent communications. |
| Yellow | Good communications. |
| Red | Poor communications, radio link may fail. |
| Off | No signal detected. |
| Green/off | Flashing: RMI is in 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 RMP60. 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 green signal LED (no change in outputs). After a short time (~12 secs) it will switch to its normal 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.

# RMI outputs

**There are five outputs:**

| | |
|---|---|
| **Probe status 1** | (SSR) |
| **Probe status 2a** | (5 V isolated driven skip) |
| **Probe status 2b** | (driven at power supply voltage) |
| **Error** | (SSR) |
| **Low battery** | (SSR) |

All outputs can be inverted by using switches SW1 and SW2 - see section Switches SW1, SW2 and start input.

**Probe status 1, Error, Low battery (SSR):**

| | |
|---|---|
| **'On' resistance** | = 50 ohms max. |
| **Load voltage** | = 40 V max. |
| **Load current** | = 100 mA max. |

**Probe status 2a (5 V isolated driven skip):**

| | | |
|---|---|---|
| **Load current** | = 50 mA max. | |
| **Output voltages** | | |
| Sourcing | = 4.2 V min at 10 mA. | |
| | = 2.2 V min at 50 mA. | |
| Sinking | = 0.4 V max at 10 mA. | |
| | = 1.3 V max at 50 mA. | |

**Probe status 2b (driven at power supply voltage):**

**Load current**            =   50 mA max.

**Output voltages**

Sourcing   (Voltage supply - Output voltage)

=   2.6 V max at 10 mA.

=   3.5 V max at 50 mA.

Sinking   =   2.0 V max at 10 mA.

=   2.9 V max at 50 mA.

The Low Battery, Probe Status, and Error LEDs will
start flashing red when an output overload has occurred.
All outputs will be switched off. If this occurs, turn off the
power supply and remove the source of the problem.
Turning on the power supply will reset the RMI.

# RMI outputs

**CAUTION:**

**Power supply voltage**

⚠ Do not exceed 30 V between the black wire and the screen wire (green/yellow), or the red wire and screen wire (green/yellow), or the red and black wires (power supply), as this could result in permanent damage to the RMI and/or the customer power supply.

The use of in-line fuses at the machine cabinet end is recommended to provide protection for the RMI and cable.

**Screen connection**

⚠ A good connection should be made to machine ground (star point).

**Output stage circuit**

⚠ Output stage supplies (+ve, –ve) should not be switched on and off to enable/disable them as this can cause the over current protection to switch off the output completely.

Ensure that outputs from the RMI do not exceed specified current ratings.

# RMI output waveforms

(outputs can be inverted by switches - see section 'Switches SW1, SW2 and Start Input')
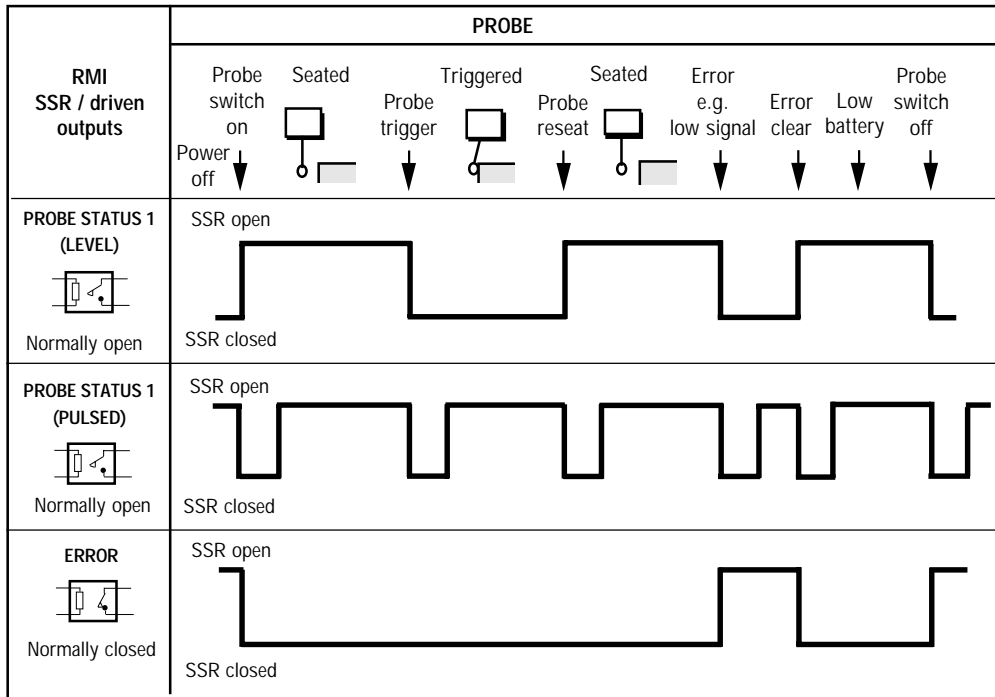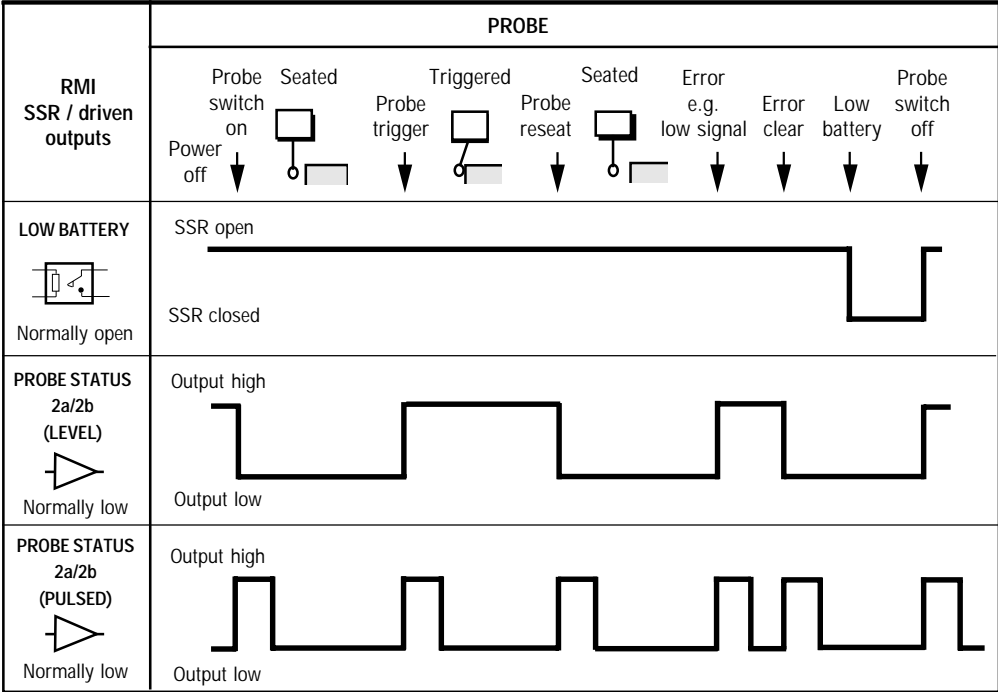
**SIGNAL DELAYS**

1. **Transmission delay**  Probe trigger to output change of state = 1.3 ms
2. **Start delay**       Time from initiation of start signal to valid signal transmission = 1 sec max.

**Note :** Pulsed outputs are 40 ms ±1 ms duration.

# Switches SW1 and SW2
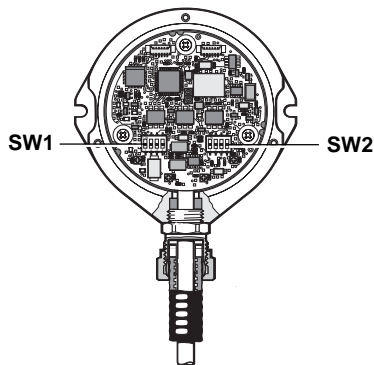


To gain access to the switches, remove the RMI cover.

**SWITCH SW1 output configuration**
Factory settings shown are for:
     A-4113-0050

   **N/O** = Normally Open
   **N/C** = Normally Closed

# Switch SW1 output configuration



**CAUTION:**
Exercise caution when using error SSR in N/O mode as a wiring fault could cause loss of error condition and therefore could result in a non-fail safe condition

## Switch SW2 output configuration

Factory settings shown are for: A-4113-0050
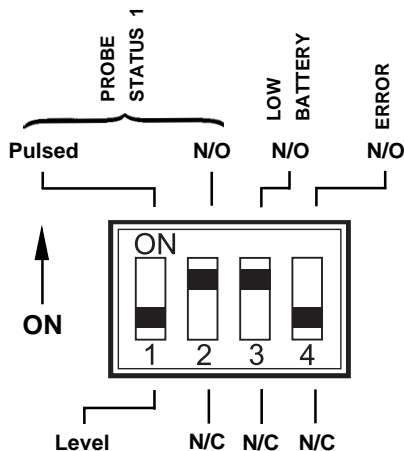
PROBE STATUS 2a/2b

MACHINE START

**Normally high**

**Pulsed**    **Level**    **Not used**

ON

**ON**

1    2    3    4

**Level**    **Normally low**    **Pulsed**    **Not used**
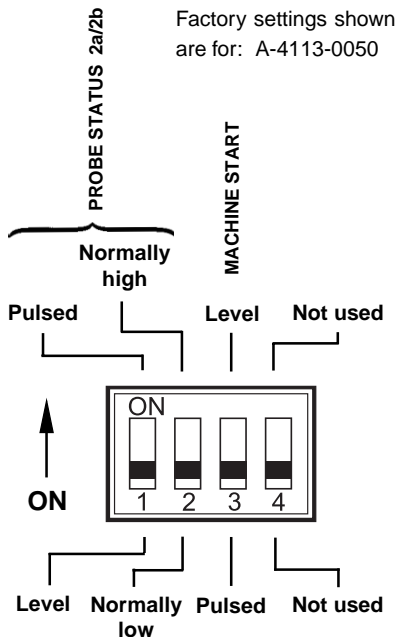
## Start input

#### Machine start

'Machine start' is configurable as a level or pulsed signal.

| Level | 10 - 30 V (2.4 mA at 24 V) When input is active, probe is switched on |
| --- | --- |
| Pulsed | 12 - 30 V (10 mA at 24 V) Probe toggles from being switched on/off. The minimum pulse width is 10 ms. |

Machine start wires (white +ve and brown –ve)

## Wiring diagram (with the output groupings shown)



**Note**
Switch can be added on installation to aid with RMI power up for partnering.

| | |
|---|---|
| Turquoise | }
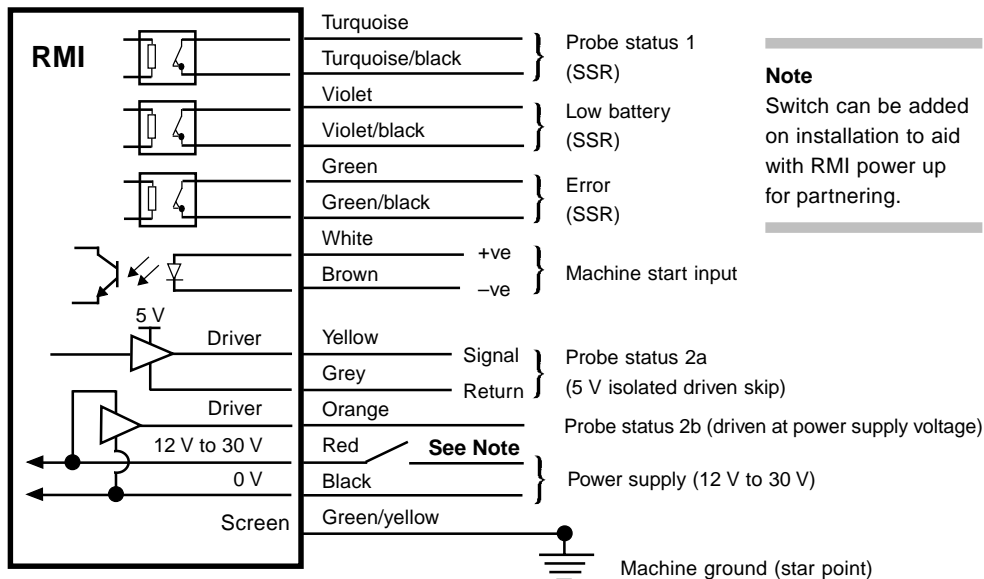| Turquoise/black | Probe status 1 (SSR) |
| Violet | }
| Violet/black | Low battery (SSR) |
| Green | }
| Green/black | Error (SSR) |
| White +ve | }
| Brown −ve | Machine start input |
| Yellow — Signal | }
| Grey — Return | Probe status 2a (5 V isolated driven skip) |
| Orange | Probe status 2b (driven at power supply voltage) |
| Red **See Note** | }
| Black | Power supply (12 V to 30 V) |
| Green/yellow | Machine ground (star point) |

**CAUTION:**
The power supply 0 V should be terminated at the machine ground (star point).
If a negative supply is used then the negative output must be fused.

# RMP60-RMI partnership

System setup is achieved using trigger logic and powering on the RMI.

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 can be made by battery insertion alone. See RMP60 user's guide for full details of reviewing probe settings.

**To partner an RMP60 and RMI**

Partnering is only required during initial system set-up. Further partnering is only required if either the RMP60 or RMI is changed.

Partnering cannot be lost by reconfiguration of probe settings or when changing batteries.

Partnering can take place anywhere within the operating envelope.

1. Use trigger logic to access RMP60 configuration mode.

2. Configure turn on method (if not configured).

3. Configure turn off method (if not configured).

4. Enter acquisition mode by deflecting stylus.

5. Remain in acquisition mode off by not releasing stylus. This allows time to get the RMI ready for partnering.

6. Power on RMI.

7. Watch the RMI signal LED; after a couple of seconds the LED will repeatedly flash on and off green. This is the start of a 10 second interval in which the RMI is in acquisition mode.

8. Release RMP60 stylus and trigger a couple of times. This causes the RMP60 to go into (and out of) acquisition mode.

9. The RMI signal LED will change to repeatedly flashing red and yellow (for the remainder of the 10 second interval) indicating a successful partnering.

10. Leave RMP60 for 20 seconds to go into standby.

11. System is ready to use.

**Note**
To check that turn on and off settings have not accidentally been changed insert batteries to review current probe settings.

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

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

It is possible for an RMP60 to be partnered with more than one RMI, but the system will not function correctly.
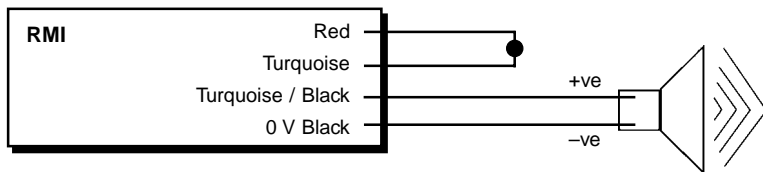
# Remote external audible output

Any output (set to pulsed) can be utilised to operate an external remote audible indicator.
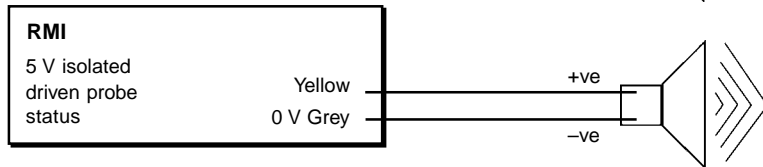
Wiring configurations are shown below.

The audible indicator must comply with the output transistor specification.

i.e. up to 50 mA.
up to 30 V.

**Option 1.**
SSR output

```
RMI                    Red
                       Turquoise
                       Turquoise / Black    +ve
                       0 V Black            −ve
```

**Option 2.**
Using 5 V output

```
RMI
5 V isolated
driven probe
status                 Yellow               +ve
                       0 V Grey             −ve
```

**Option 3.**
Using machine
voltage output

```
RMI
Driven probe status
output at supply
voltage                Orange               +ve
                       0 V Black            −ve
```
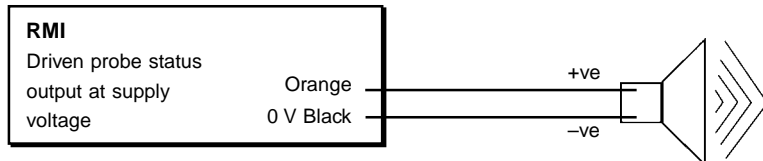
# RMI cable

## Cable termination

A ferrule should be crimped onto each cable core for more positive connection at the terminal box.

## Standard cable

The RMI standard cable is 15 m (49.2 ft) long, longer cables are available - see Parts list.

### Cable specification:
Ø7,5 mm (0.29 in), 13 core screened cable, each core 18 x 0,1 mm.

**NOTE:**
Maximum cable length:

30 m (98 ft) at 12 V

50 m (164 ft) at 24 V

# RMI cable sealing

Coolant and dirt are prevented from entering the RMI by the cable sealing gland. The cable can be protected against physical damage by fitting flexible conduit if required.

Recommended flexible conduit is Anamet™ Sealtite HFX (5/16 in) polyurethane. A conduit kit is available - see Parts list.
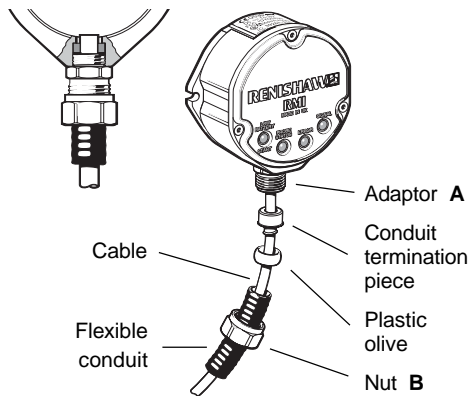
⚠ **CAUTION:**
Failure to adequately protect the cable can result in system failure due to either cable damage or coolant ingress through cores into the RMI.

Failure due to inadequate cable protection will invalidate the warranty.

When tightening or loosening nut **B** onto conduit ensure that torque is only applied between **A** and **B**.

# Fitting flexible conduit



Conduit bulkhead fittings require a clearance hole for an M16 thread

1. Slide nut **B** and plastic olive onto conduit.

2. Screw conduit termination piece into end of conduit.

3. Fit conduit to adaptor **A** and tighten nut **B**.

# RMI cover

It is not necessary to remove the RMI from the machine when adjusting the switches or installing new parts. For torque settings see Screw torque values.

## Removing the RMI cover

1. Clean RMI to ensure no debris enters unit.

2. Unscrew the three cover screws evenly (T10 torx key). Do not remove screws from cover.

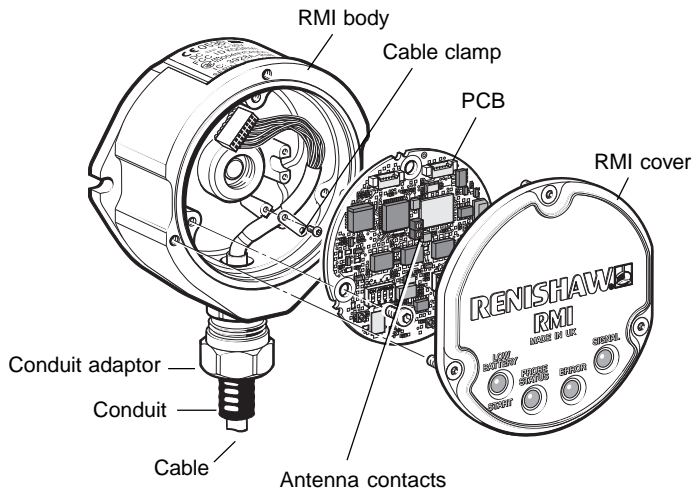3. When removing cover, do not twist or rotate by hand.

# Replacing the RMI cover

1. Before replacing the cover, check for any damage to screws or scratch marks which could prevent sealing.

2. Ensure that the 'O' ring seating on the RMI body is clean, and there are no scratch marks which could prevent complete sealing.

3. Ensure that the cover, antenna contacts and 'O' ring are clean.

4. Place cover complete with 'O' ring onto the RMI body.

   **Note :**
   The 'O' ring should be lubricated with silicone grease to prevent nicking.
   Do not get any grease on the antenna contacts.

5. Tighten each captive screw a few turns at a time, to pull the cover down evenly. Screw torque is 1,4 Nm (1.03 lbf.ft).

RMI body
Cable clamp
PCB
RMI cover
Conduit adaptor
Conduit
Cable
Antenna contacts

RENISHAW
RMI
MADE IN UK

LOW BATTERY
PROBE STATUS
ERROR
SIGNAL
START

---

⚠ **CAUTION:**
**KEEP RMI CLEAN**  No liquids or solid particles must be allowed to enter the RMI body.
**DO NOT** allow the antenna contacts to be contaminated.
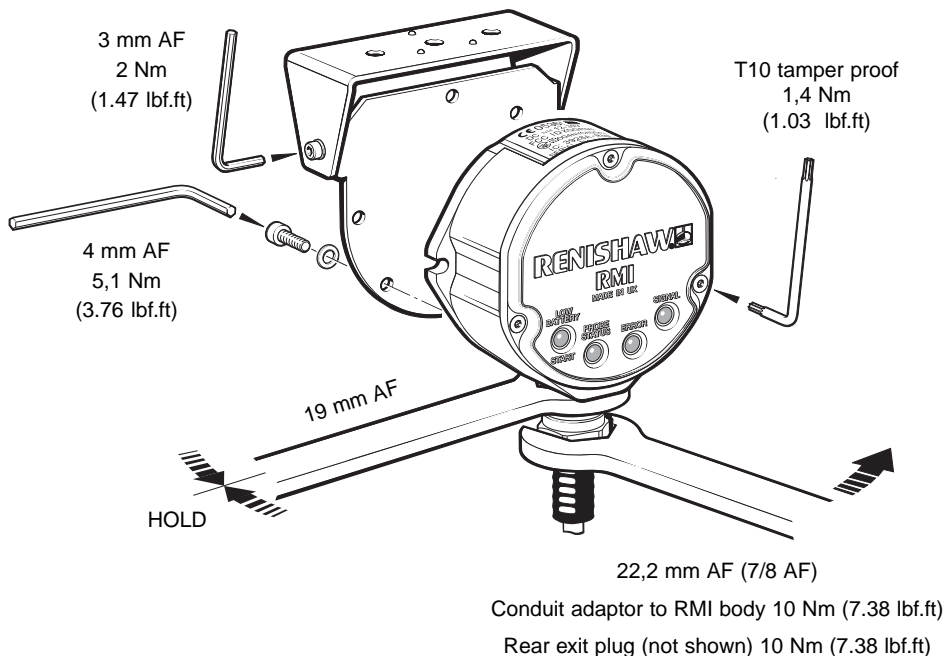
# Side exit to rear exit cable conversion

1. Remove RMI cover (page 22).

2. Remove 3 crosshead screws retaining PCB. Carefully remove PCB and disconnect cable connection to PCB.

3. Unscrew cable clamp (2 x crosshead screws).

4. Unscrew conduit gland from RMI body.

5. Unscrew rear exit plug and rubber grommet from RMI body.

6. Carefully remove cable assembly and refit through rear exit hole. Tighten conduit gland.

7. Fit rubber grommet and rear exit plug to side exit hole and tighten.

8. Fit cable assembly using cable clamp at 3 o'clock position.

9. Connect PCB to cable connector. Insert PCB and retain with 3 cross head screws.

10. Fit the RMI cover (page 22).

> ⚠️ **CAUTION**
> **Conversion from side exit cable to rear exit cable must only be undertaken by qualified personnel. Failure to do so will invalidate the warranty.**

# Screw torque values Nm (lbf.ft).



3 mm AF
2 Nm
(1.47 lbf.ft)

T10 tamper proof
1,4 Nm
(1.03 lbf.ft)

4 mm AF
5,1 Nm
(3.76 lbf.ft)

19 mm AF

HOLD

22,2 mm AF (7/8 AF)
Conduit adaptor to RMI body 10 Nm (7.38 lbf.ft)
Rear exit plug (not shown) 10 Nm (7.38 lbf.ft)

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

| Symptom | Cause | Action |
|---------|-------|--------|
| No LEDs lit on RMI | No power to RMI | Check wiring |
| RMI status LEDs do not correspond to RMP60 status LEDs | Radio link failure - RMP60 out of RMI range | Check position of RMI, see Operating envelope (RMP60 User's guide) |
| | 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 RMP60 batteries | Change RMP60 batteries |
| RMI error LED lit during probing cycle | Damaged cable | Check wiring |
| | Loss of power | Check wiring |
| | Dead RMP60 batteries | Change RMP60 batteries |

| Symptom | Cause | Action |
|---------|-------|--------|
| 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 Operating envelope (RMP60 User's guide) |
| All RMI LEDs flashing | Wiring fault | Check wiring |
| | Output over-current | Check wiring, turn power to RMI off and on again to reset |
| RMI low battery LED lit | Low RMP60 batteries | Change RMP60 batteries soon |
| Reduced range | Local radio interference | Identify and move |

**Parts list** - Please quote the part no. when ordering equipment.

| Type | Part no. | Description |
|------|----------|-------------|
| RMI | A-4113-0050 | RMI, side exit, with 15 m (49.2 ft) of cable. |
| Mtg Brkt | A-2033-0830 | Mounting bracket. |
| Conduit kit | A-4113-0306 | Conduit kit with 1 m (3.2 ft) of polyurethane conduit and bulkhead connector (16 mm hole size required). |
| Cover assy | A-4113-0305 | Cover/antenna assembly: including cover screws, torx key and O ring. |
| Cable assy | A-4113-0302 | Cable assembly 15 m (49.2 ft) long. |
| Cable assy | A-4113-0303 | Cable assembly 30 m (98.4 ft) long. |
| Cable assy | A-4113-0304 | Cable assembly 50 m (164 ft) long. |
| Tool kit | A-4113-0300 | T10 tamperproof key, 4 mm hex key, 14 x ferrules, 4 x M5 screw, 2 x M5 nut, 4 x M5 washer, O ring (Ø34,5 x 3 mm) |

The serial number of each RMI is found on the top of the housing.

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**apply innovation™**

**For worldwide contact details,
please visit our main web site at
www.renishaw.com/contact**

H-2000-5220-05