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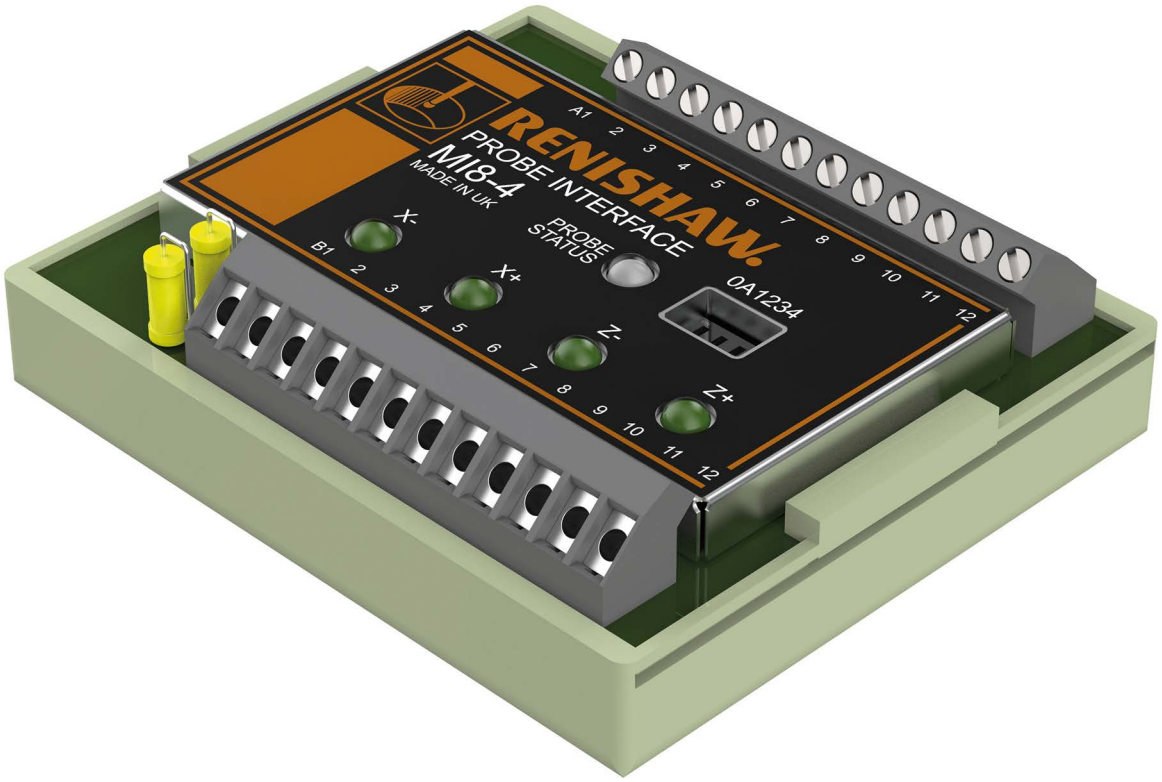
MI 8-4 interface unit



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Contents

Before you begin

Warranty

Unless you and Renishaw have agreed and signed a separate written agreement, the equipment and/or software are sold subject to the Renishaw Standard Terms and Conditions supplied with such equipment and/or software, or available on request from your local Renishaw office.

Renishaw warrants its equipment and software for a limited period (as set out in the Standard Terms and Conditions), provided that they are installed and used exactly as defined in associated Renishaw documentation. You should consult these Standard Terms and Conditions to find out the full details of your warranty.

Equipment and/or software purchased by you from a third-party supplier is subject to separate terms and conditions supplied with such equipment and/or software. You should contact your third-party supplier for details.

CNC machines

CNC machine tools must always be operated by fully-trained personnel in accordance with the manufacturer's instructions.

Care of the interface

Keep system components clean.

Patents

None applicable.

Intended use

The MI 8-4 interface processes the probe signal from a hard-wired probe and converts it into the correct format for connection to a controller's probe input.

Safety

MI 8-4

The 24 Vdc supply to this equipment must be derived from a source which is compliant with current local electrical safety requirements and is approved to IEC 60950-1, UL BS EN IEC 62368-1, UL BS EN IEC 61010-1 or suitable equivalent. It is essential for continued safety that the on-board fuse (FS1) is replaced by the correct type and rating. Approved parts are Renishaw list no. P-FS20-1A25 or Littelfuse® list no. 0251.250MAT1L.

The power supply connected to the power supply terminals of this unit (B1/B2) must have its 0 V connected to the machine star point.

Do not exceed 30 V between any terminal and the machine star point terminal (B3).

The isolated totem-pole output power supply (A10/A12) should be supplied from the controller's I/O supply and should be current-limited or fused at no more than 8 A.

Ensure the machine tool is in a safe state and power is removed from the MI 8-4 when changing fuses, making wiring connections, or changing SW1.

LP2 hard-wired inspection system

The probe should not be rotated (spun) by the machine spindle with the cable connected. If this is allowed, then serious injury could occur to persons nearby due to flying cable or entanglement.

Information to the user

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

Refer to the machine supplier's operating instructions.

The MI 8-4 interface unit must be installed by a competent person, observing relevant safety precautions. Before starting work, ensure that the machine tool is in a safe condition with the power switched OFF.

Information to the machine supplier/installer

It is the machine supplier's responsibility to ensure that the user is made aware of any hazards involved in operation, including those mentioned in Renishaw product literature, and to ensure that adequate guards and safety interlocks are provided.

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

Information to the equipment installer

All Renishaw equipment is designed to comply with the relevant UK, EU and FCC regulatory requirements. It is the responsibility of the equipment installer to ensure that the following guidelines are adhered to, in order for the product to function in accordance with these regulations:

- any interface MUST be installed in a position away from any potential sources of electrical noise (for example, power transformers, servo drives);
- all 0 V/ground connections should be connected to the machine “star point” (the “star point” is a single point return for all equipment ground and screen cables). This is very important and failure to adhere to this can cause a potential difference between grounds;
- all screens must be connected as outlined in the user instructions;
- cables must not be routed alongside high current sources (for example, motor power supply cables), or be near high-speed data lines;
- cable lengths should always be kept to a minimum.

Equipment operation

If this equipment is used in a manner not specified by the manufacturer, the protection provided by the equipment may be impaired.

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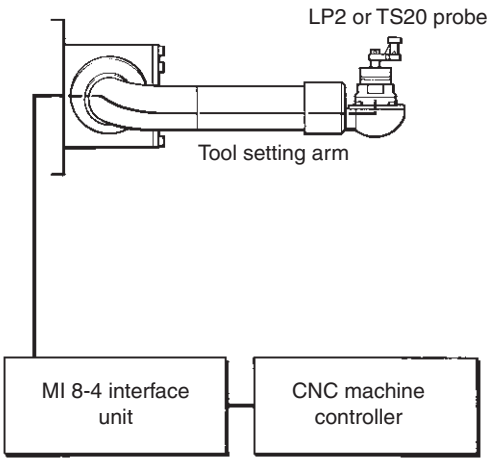
MI 8-4 basics

MI 8-4 interface

CNC machine tools using a Renishaw probe system for tool setting or workpiece set-up and inspection require an interface unit, to convert probe signals into an acceptable form for the CNC machine controller. The MI 8-4 interface unit is part of probe systems using hard-wired signal transmission.

Tool setting
Lathe

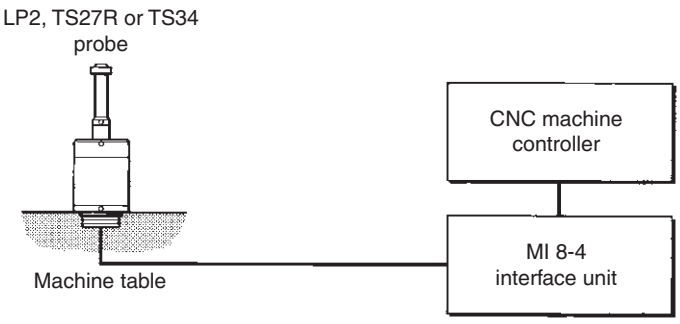
Hard-wired transmission



WARNING: The MI 8-4 interface must not be used with an in-line signal conditioning module (SCM) supplied with some Renishaw TS20 probes.

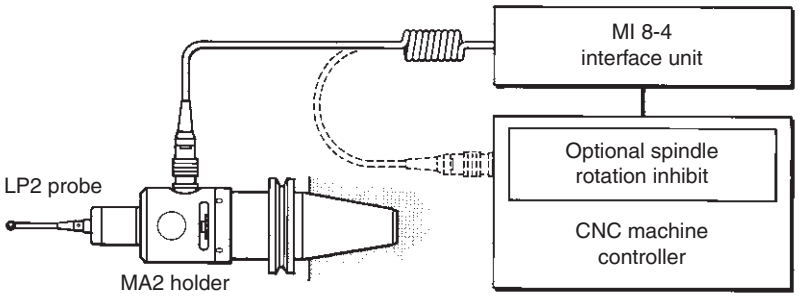
Tool setting
Machining centre

Hard-wired transmission



Workpiece set-up and inspection
Machining centre

Hard-wired transmission
Flexible cable with manual connection



MI 8-4 function

The MI 8-4 interface processes signals from Renishaw hard-wired probes and converts them into compatible outputs for transmission to the CNC machine controller. The controller stores work offsets and responds to the probe inputs.

It is designed to allow the Renishaw probe to connect directly into the standard Fanuc 'automatic length measurement' input (XAE, ZAE).

The machine tool builder must provide FOUR outputs from the controller to indicate which machine axis is moving, in order to obtain a probe trigger (SELX–, SELX+, SELZ–, SELZ+).

This signal will instruct the MI 8-4 to send the probe trigger signal out through one of four possible output channels (X–, X+, Z–, or Z+).

An example of a typical Fanuc OTC controller probe interface PMC ladder logic is shown on **pages 2-4** and **2-5**.

Probe status LED

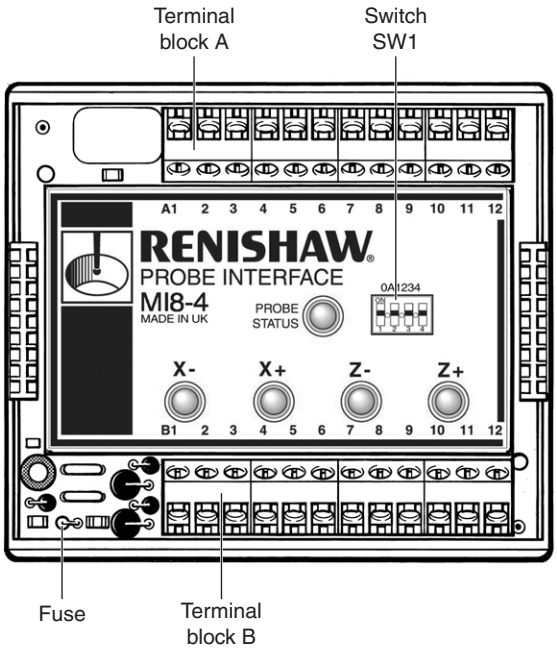
The bi-colour probe status LED is off when the MI 8-4's power is off. It is green when the probe stylus is seated (at rest), or the interface is inhibited. It is red when the probe is triggered.

When the stylus deflects on contact with a tool or workpiece, the MI 8-4 output changes state and the LED changes from green to red.

As the probe moves clear of the contact surface, the LED changes back to green, indicating that the probe stylus has reseated, and the probe is available for the next contact in the probing routine.

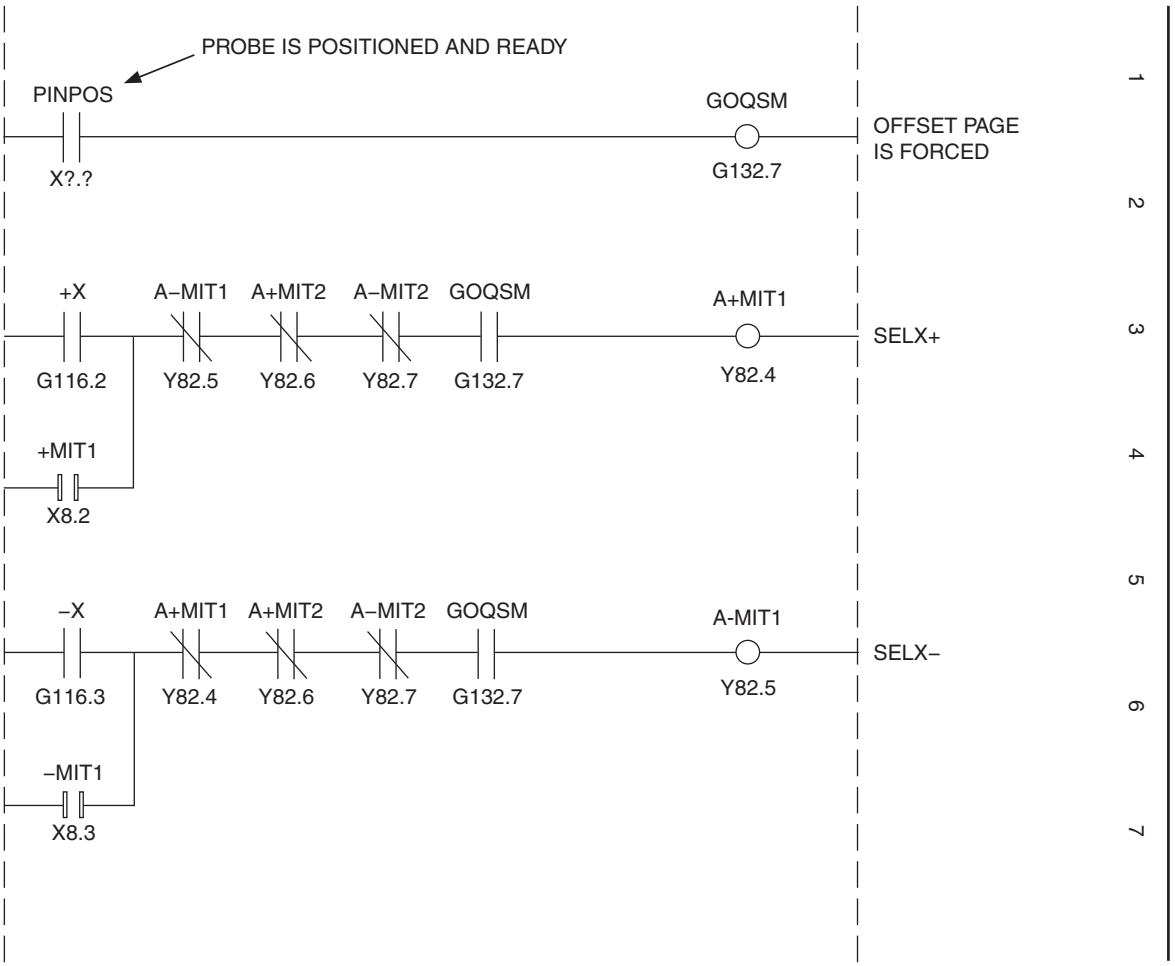
Machine movement indicating LEDs

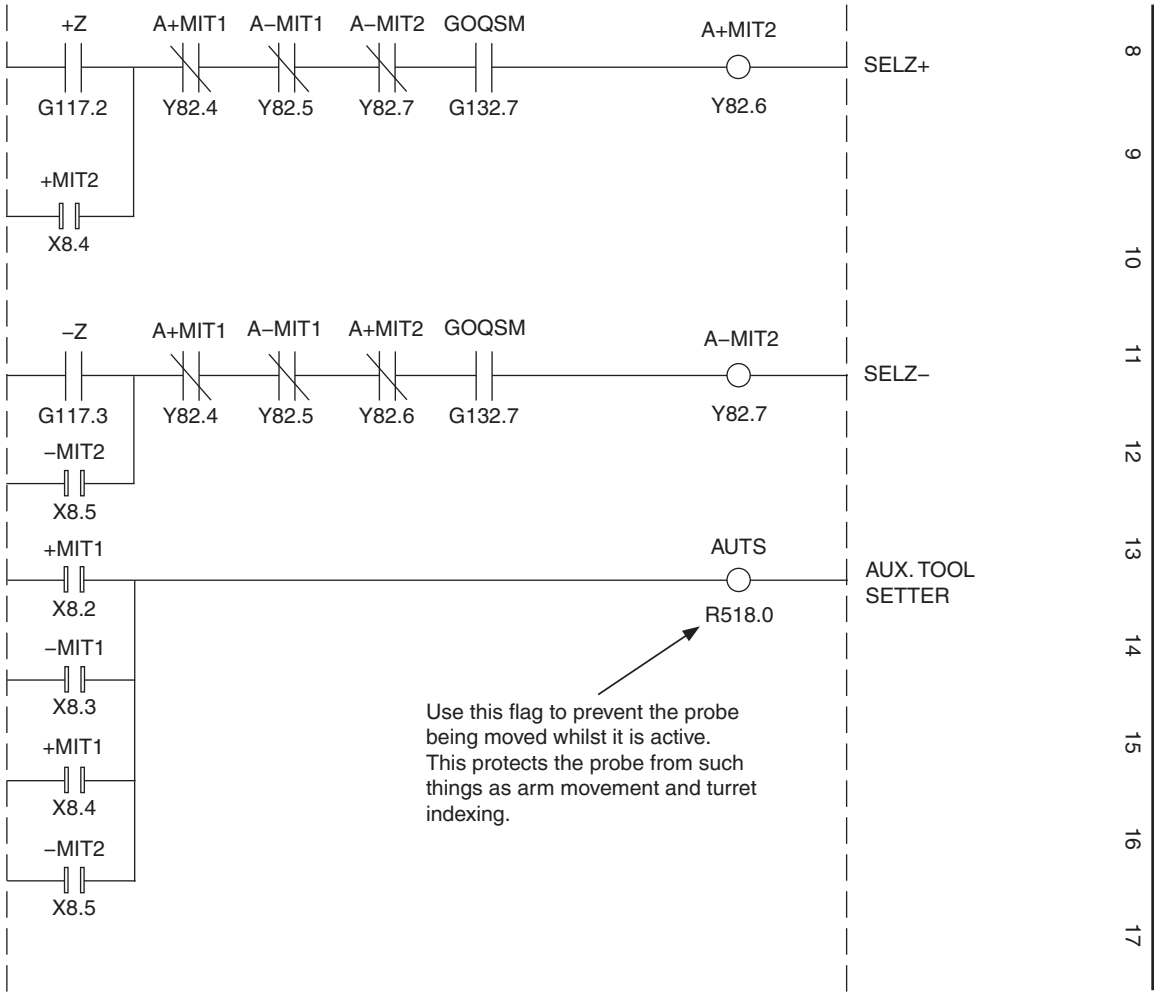
Four green diagnostics LEDs are also provided to indicate which machine axis is moving, for example, during an X– move the X– LED will illuminate.



Fanuc OTC controller

Example of a typical PMC ladder logic diagram




+Z
A+MIT1
A–MIT1
A–MIT2
GOQSM
A+MIT2
G117.2
Y82.4
Y82.5
Y82.7
G132.7
Y82.6
SELZ+
+MIT2
X8.4
–Z
A+MIT1
A–MIT1
A+MIT2
GOQSM
A–MIT2
G117.3
Y82.4
Y82.5
Y82.6
G132.7
Y82.7
SELZ–
–MIT2
X8.5
+MIT1
AUTS
X8.2
R518.0
AUX. TOOL SETTER
–MIT1
X8.3
+MIT1
X8.4
–MIT2
X8.5
Use this flag to prevent the probe being moved whilst it is active. This protects the probe from such things as arm movement and turret indexing.
8
9
10
11
12
13
14
15
16
17

MI 8-4 specification

Principal application	Transmission interface for hard-wired workpiece inspection and tool setting probes which conveys and processes signals between a probe and the CNC machine controller.	
Transmission type	Hard-wired	
Probes per system	Two	
Compatible probes	LP2 and variants, TS20, TS27R and TS34	
Supply voltage	15 Vdc to 30 Vdc.	
Supply current	80 mA maximum (each XAE/ZAE output connection will add to the supply current). Supply protected by internal fuse FS1.	
Output signal	**Probe status** Isolated 'totem-pole' transistor output, configurable to normally high or normally low. Configurable as TTL compatible. **Four selectable axis outputs** Non-isolated 'totem-pole' transistor output, configurable to normally high or normally low.	
Output protection	10 mA maximum at 30 V. All outputs are protected against short circuit by current limiting circuitry.	
Diagnostic LEDs	Probe status, axis movement (Z+, Z–, X–, X+)	
Mounting	DIN rail mounting or dual lock pads.	
Environment	Storage temperature	–25 °C to +70 °C (–13 °F to +158 °F)
	Operating temperature	+5 °C to +55 °C (+41 °F to +131 °F)

Power supply

The MI 8-4 will draw its power from the CNC machine 24 V nominal d.c. supply.

Probe input

Normally closed, open for trigger.

Inhibit, inspection select and machine axis moving inputs

These inputs are open collector transistor (OCT), totem-pole, and relay compatible.

They can be configured as active low or active high and can be terminated by pull-up or pull-down resistors.

With the input resistors common (A9) connected to 0 V, all inputs have 2K4 pull-down resistors. With it connected to the supply voltage, all inputs have 2K4 pull-up resistors.

Switch **SW1-3** controls the polarity of the input signals.

SW1-3 OFF	=	Inputs active high
SW1-3 ON	=	Inputs active low

Input signal low voltage (maximum)	=	4.0 V
Input signal high voltage (minimum)	=	11.0 V

If the inputs are not to be used, then SW1-3 should be in the default state of OFF and the input resistors common (A9) should be connected to 0 V. This makes all inputs inactive.

Inhibit input

When inhibit is active, the outputs are in the seated state irrespective of the actual probe state.

Two probe operation – tool setting and inspection

The MI 8-4 has the facility to connect an output from a different Renishaw probe system (inspection) and then select which probe input (tool setter or inspection) is routed out through the outputs. The selection of the probe is controlled by a machine controller input to the MI 8-4 (M-code).

When the inspection select input is active, the inspection system input is routed through to the outputs. When inactive, the probe input (tool setter) is routed through the outputs.

The inspection system input can be driven by a normally closed relay (open for trigger) or a totem-pole output (high for triggered).

Probe status XAE/ZAE outputs

Switch **SW1-1** controls the polarity of all the output signals.

SW1-1 OFF	=	Triggered output – high
SW1-1 ON	=	Triggered output – low

Probe status output

This is an isolated totem-pole output which requires a three wire connection: signal, power and ground. It works over a 4.75 V to 30 V supply range and will source and sink up to 20 mA.

High output voltage levels

V out high (minimum with 20 mA load)	=	V supply minus 3.5 V
V out high (minimum with 10 mA load)	=	V supply minus 2.8 V

Low output voltage levels

V out low (maximum with 20 mA load)	=	0.6 V
V out low (maximum with 10 mA load)	=	0.4 V

TTL compatibility

The probe status output is TTL compatible with a 5 V ±5 % supply voltage. If this supply voltage is not available, **SW1-4** ON will convert the controller's input/output supply levels (4.75 Vdc to 30 Vdc) to TTL levels.

V out high (minimum with 2.5 mA load)	=	2.5 V
V out low (maximum with 10 mA load)	=	0.4 V

With **SW1-4** ON, the probe status output will be TTL compatible irrespective of the supply voltage.

Maximum output current with **SW1-4** ON,

I out (maximum with 30 V supply)	=	22 mA
I out (maximum with 10 V supply)	=	15 mA

Fanuc 'automatic length measurement'

The four 'machine axis moving' inputs (B4, B6, B8, B10) to the MI 8-4 are open collector transistor (OCT), totem-pole and relay compatible.

The four 'machine axis moving' outputs (B5, B7, B9, B11) are non-isolated totem-pole outputs supplied by the MI 8-4 interface's power supply on (B1, B2).

High output voltage levels

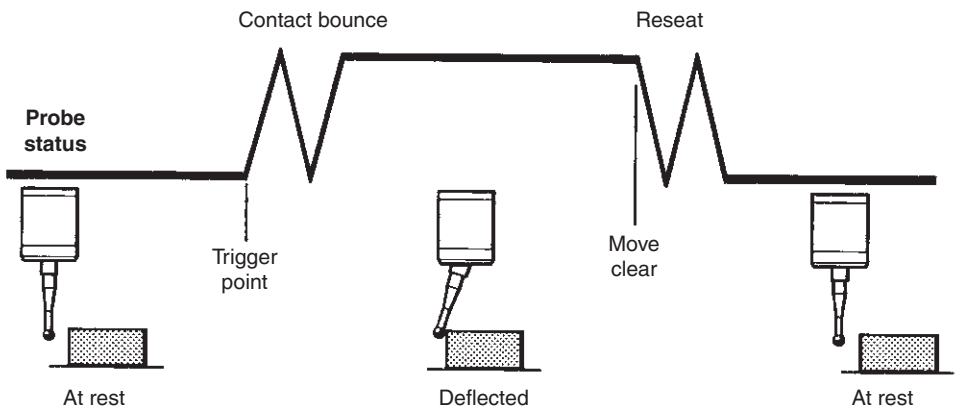
V out high (minimum with 20 mA load)	=	V supply minus 4.0 V
V out high (minimum with 10 mA load)	=	V supply minus 3.4 V

Low output voltage levels

V out low (maximum with 20 mA load)	=	1.5 V
V out low (maximum with 10 mA load)	=	1.0 V

These outputs are protected against short circuit by current limiting circuitry.

MI 8-4 output waveforms

Probe status and selected XAE/ZAE output options	
Status normally low SW1-1 OFF	
Status normally high SW1-1 ON	

The output signals from the interface must be compatible with the machine controller.

NOTE: Change of state debounce time is 20 ms ±5 ms. Debounce time is the time delay after the MI 8-4 has responded to a probe trigger, before it can be used again.

MI 8-4 outputs

Diagram of outputs for XAE, ZAE

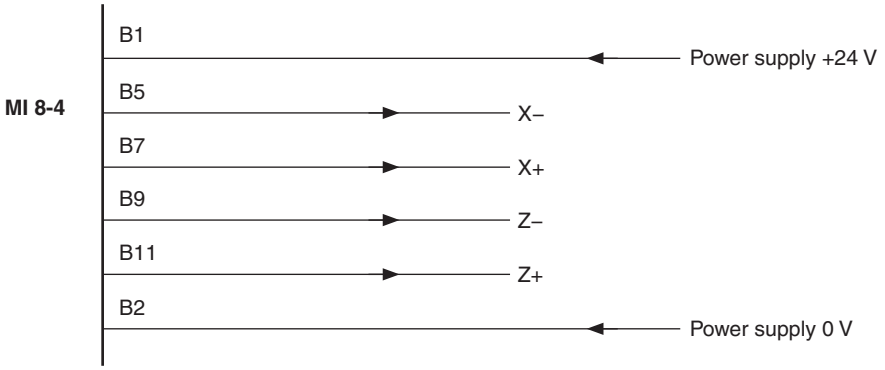
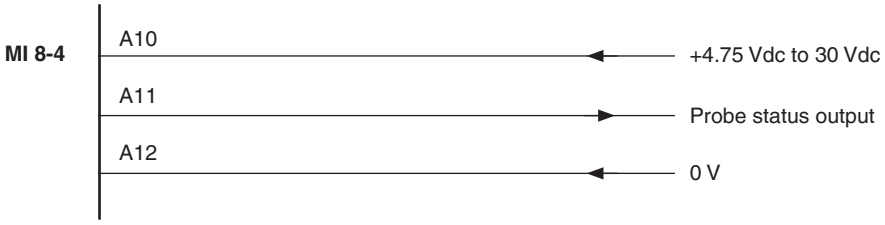


Diagram of probe status output



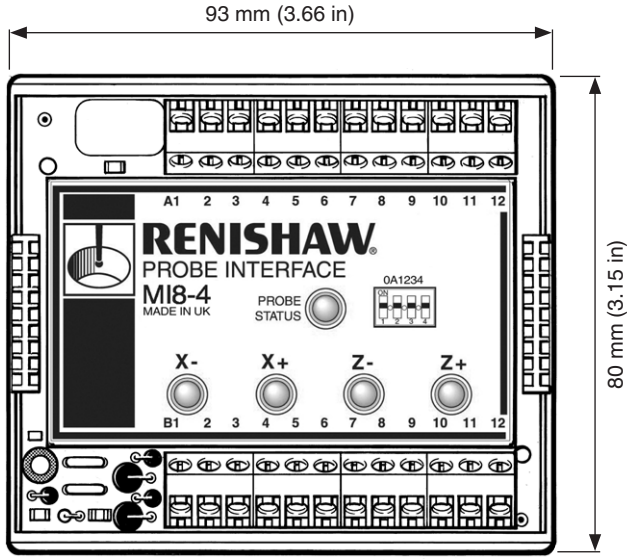
System installation

MI 8-4 assembly

MI 8-4 installation

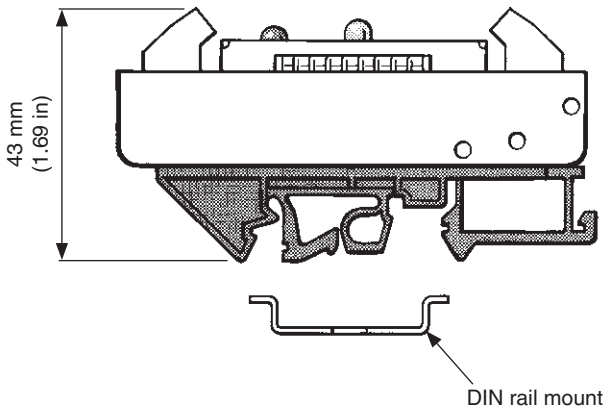
Ideally, install the interface in the CNC machine controller cabinet.

Take care to avoid potential sources of interference, such as three-phase transformers and motor controllers.

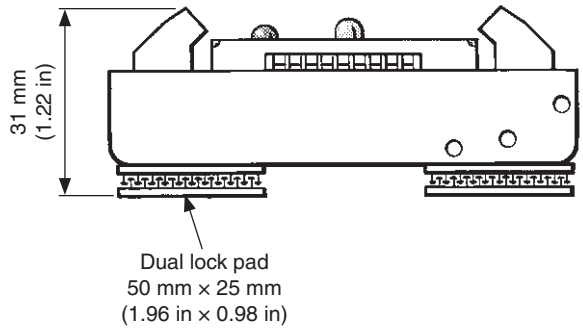


MI 8-4 mounting

The MI 8-4 is DIN rail mounted and is compatible with all DIN EN carrier rails.

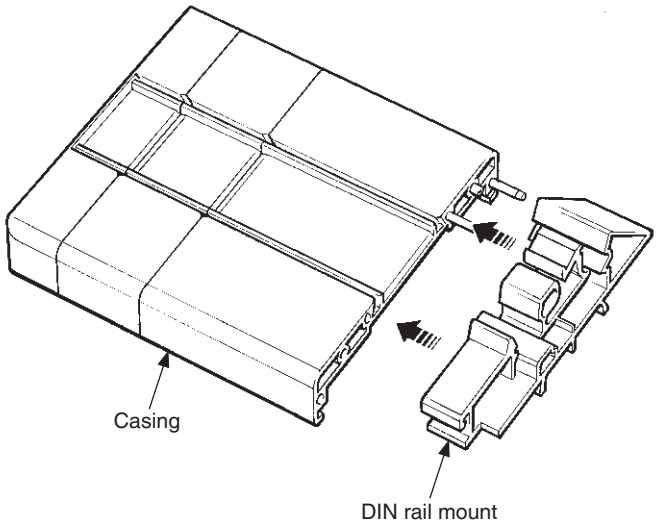


The alternative dual lock fixing allows the MI 8-4 to be attached to any flat surface.



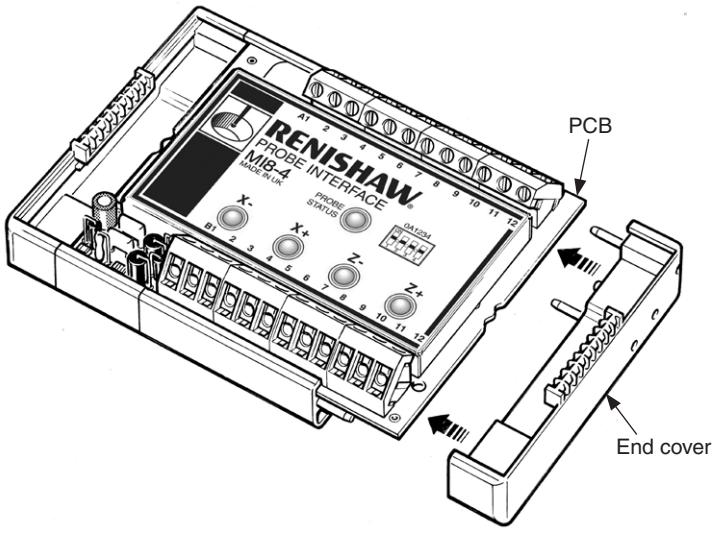
Both forms of mounting are supplied. Select the appropriate parts and assemble as shown.

1. Fit the DIN rail mount onto back of casing (not required for the dual lock fixing).



2. Slide the PCB into the casing.

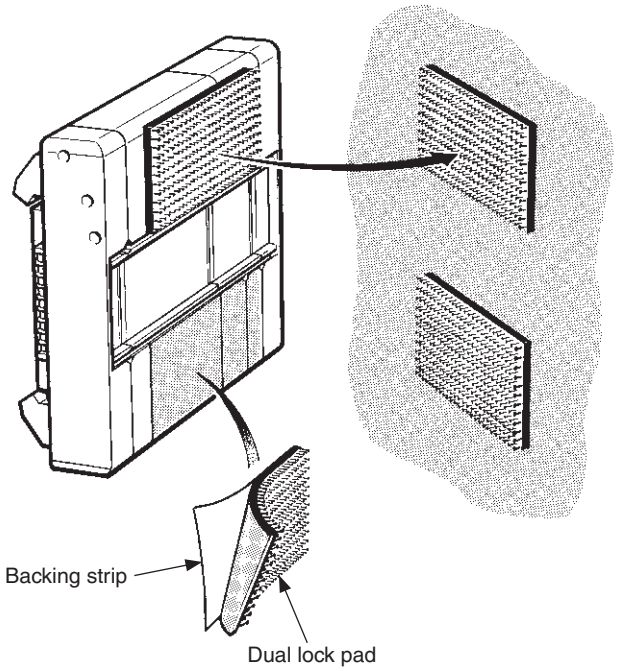
3. Fit the end cover. Press in to make a snap fit.



Dual lock pad (if applicable)

4. Remove backing strip from dual lock pad.

5. Stick two pads on back of casing and two equally spaced pads onto flat surface.

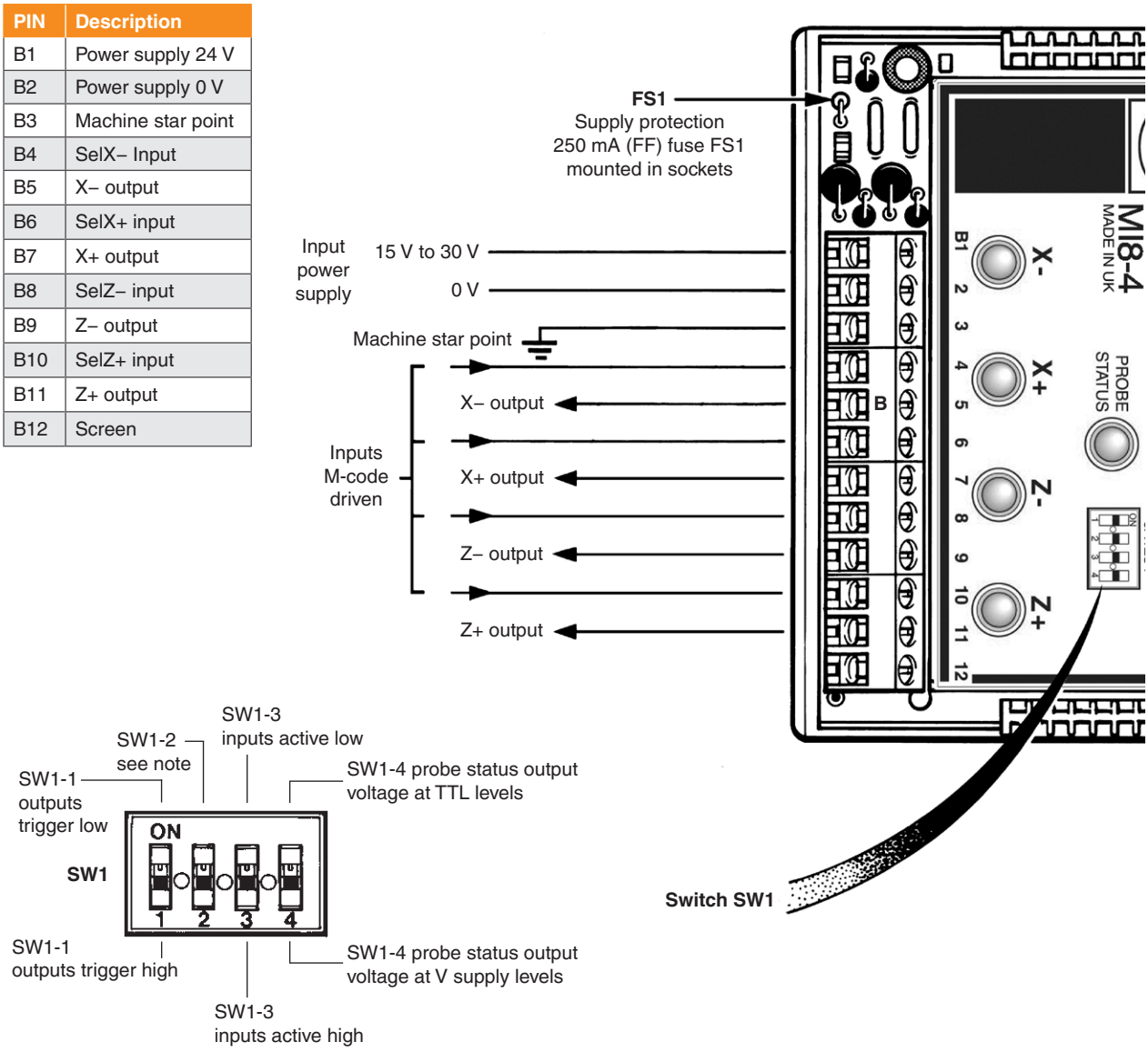


6. Press the dual lock pads together to mount MI 8-4.

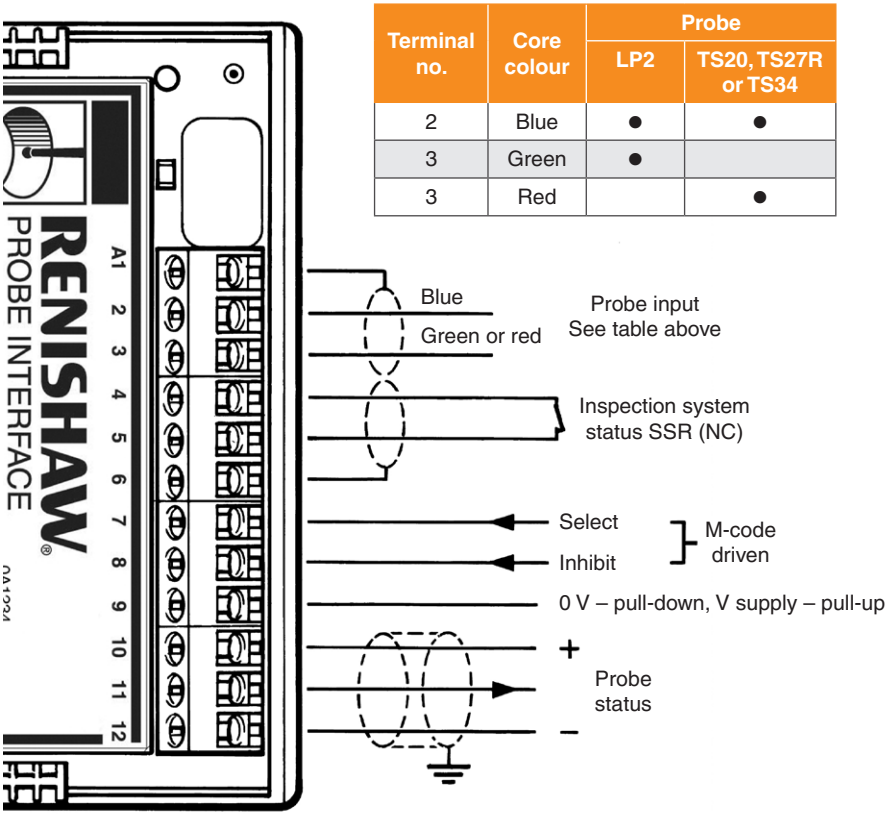
7. Pull apart to remove MI 8-4 from mounting surface.

MI 8-4 terminal connections and switch SW1

PIN	Description
B1	Power supply 24 V
B2	Power supply 0 V
B3	Machine star point
B4	SelX– Input
B5	X– output
B6	SelX+ input
B7	X+ output
B8	SelZ– input
B9	Z– output
B10	SelZ+ input
B11	Z+ output
B12	Screen



NOTE: When measuring tool radius, rotating fluted tool diameter or tool length that is off-centre, then SW1-2 should be off. When SW1-2 is on, an 8 ms nominal delay is added and is only compatible with on-centre tool length measurement, non-rotating tools or turning tools.



Terminal no.	Core colour	Probe	
		LP2	TS20, TS27R or TS34
2	Blue	●	●
3	Green	●	
3	Red		●

PIN	Description
A1	Screen
A2	Probe input +
A3	Probe input –
A4	Inspection system input +
A5	Inspection system input –
A6	Screen
A7	Inspection select
A8	Inhibit
A9	Input resistors common
A10	Output supply +
A11	Probe status output
A12	Output supply –

Wiring – Probe to MI 8-4

Use two core screened cable.
Each core Ø2.5 mm sq. (Ø0.10 in sq.) maximum.
Maximum permitted length 30 m (98 ft).

Wiring – MI 8-4 to CNC controller

Use single wires.
Each wire Ø2.5 mm sq. (Ø0.10 in sq.) maximum.
Maximum permitted length 3 m (9.8 ft).

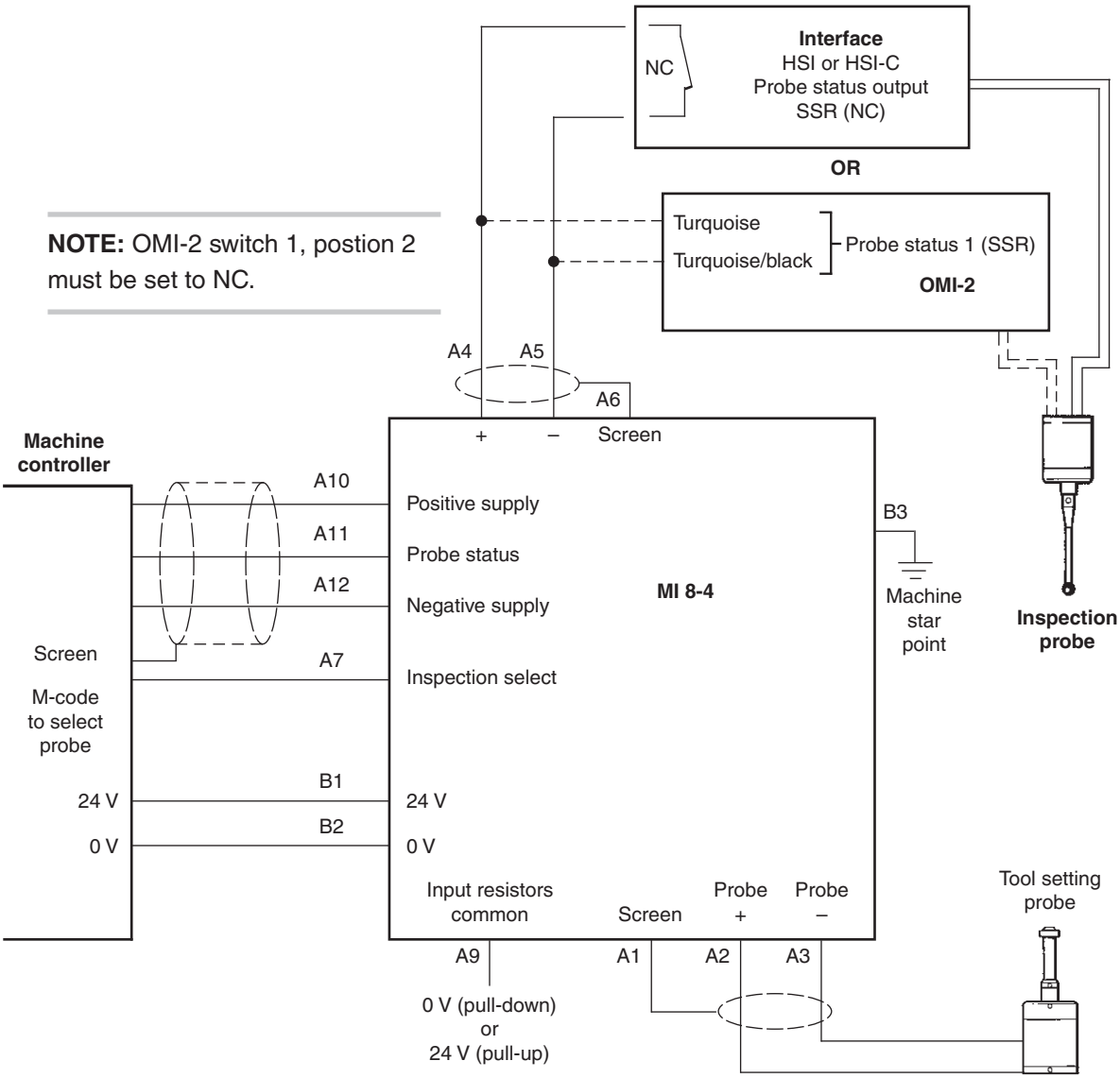
For installations in excess of 3 m:
A screened cable is recommended for probe status when driving a TTL input. Also for all MI 8-4 to CNC controller connections where cable lengths of 3 m to 10 m (9.8 ft to 32.8 ft) are used and interference may be encountered.

Wiring for two probes

Probe select functions for an inspection probe and a tool setting probe

For installations where an inspection probe and a tool setting probe are fitted to the same machine, the MI 8-4 features a circuit that allows the machine controller to select which probe is to be used.

An M-code will select which probe signal is sent to the machine controller probe inputs.



LP2 hard-wired inspection system

To ensure operator safety

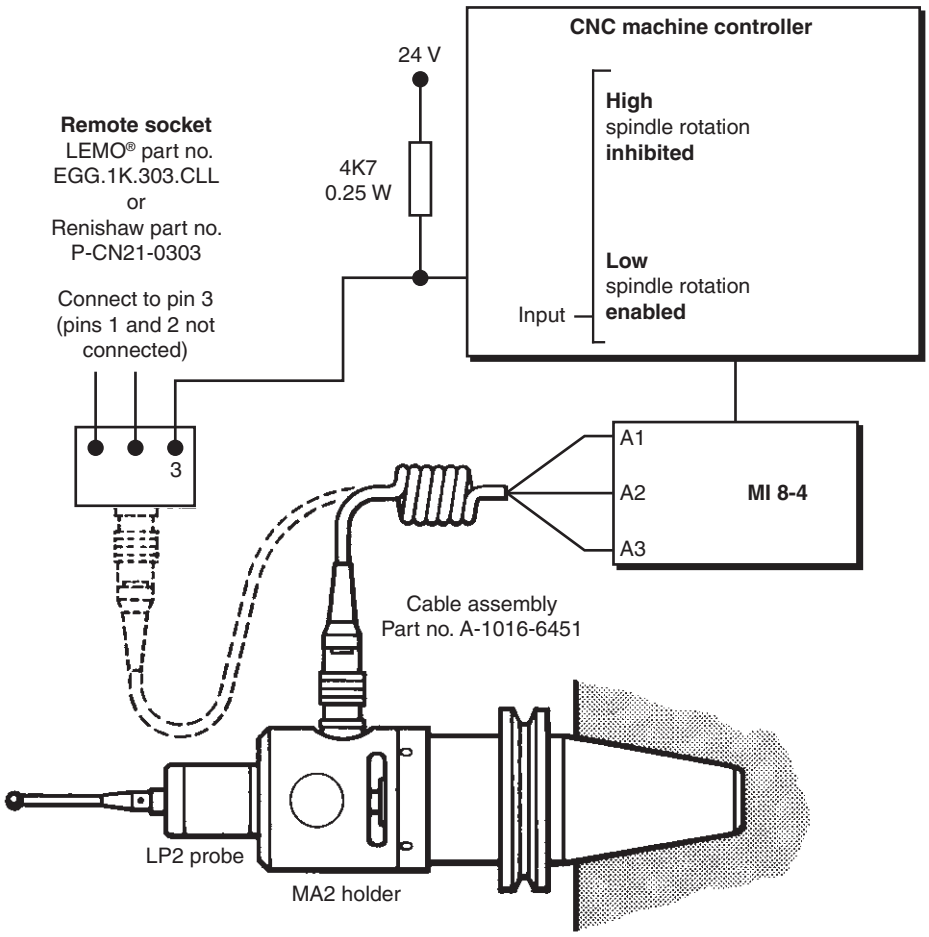
It is recommended that a fail safe **spindle rotation inhibit** is built into the machine installation.

The example shows the probe cable plugged into a remote socket before spindle rotation is enabled. This prevents spindle rotation when the probe is used.

Wiring table

Wire colour	Plug pin no	MI 8-4 terminal block
* Screen	3	A1
Blue	1	A2
Green	2	A3

* **NOTE:** Screen must be connected to machine star point.



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Parts list

Type	Part number	Description
MI 8-4 interface	A-2157-0001	MI 8-4 interface unit, DIN rail, dual lock pads, support card and packaging.
Fuse	P-FS20-1A25	250 mA (FF) fuse FS1.
Publications. These can be downloaded from our website at **www.renishaw.com**		
TS20	H-2000-5010	Installation guide: for set-up of the TS20 probe system.
TS27R	H-2000-5018	Installation guide: for set-up of the TS27R tool setting probe.
LP2	H-2000-5021	Installation guide: for set-up of the LP2 probe system.
TS34	H-2197-8500	Installation guide: for set-up of the TS34 tool setting probe.
OMI-2	H-5191-8504	Installation guide: for set-up of the OMI-2 optical machine interface.
HSI	H-5500-8554	Installation guide: for set-up of the HSI interface.
HSI-C	H-6527-8501	Installation guide: for set-up of the HSI-C interface.

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