Installation guide

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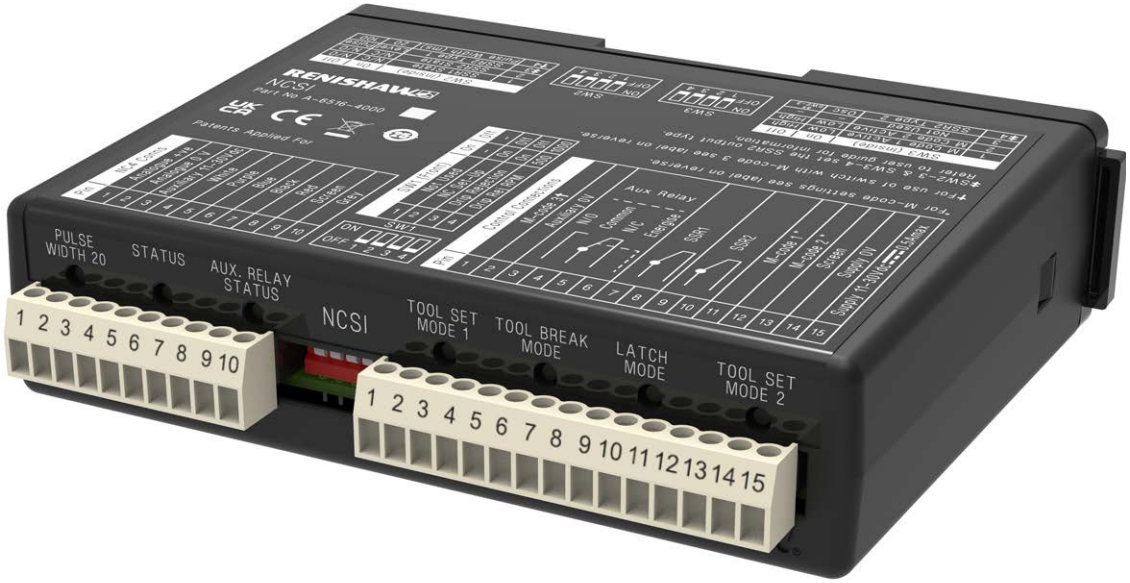
NCSI non-contact scanning interface



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Compliance information for this product is available by scanning the QR code or visiting **www.renishaw.com/mtpdoc**

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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

Features of the NCSI non-contact scanning interface and related products are subject to the following patents and patent applications:

EP 3679318
EP 4080160
JP 2020532438
US 11371830
US 2022-0316859

Intended use

The NCSI non-contact scanning interface is used in conjunction with NC4, NC4+ or NC4+ Blue non contact tool setters. The NCSI non-contact scanning interface converts signals from the non-contact tool setter into voltage-free, solid-state relay (SSR) outputs for transmission to the CNC machine controller.

The NCSI non-contact scanning interface also converts signals from the non-contact tool setter into an analogue output signal that can be read by the CNC controller with a suitable analogue input, or equipped with the NCi-E interface. This enables analysis of laser obscuration, from a scanned object, synchronised with machine position.

Safety

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

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.

The NCSI unit interfaces with Renishaw laser-based non-contact tool setting and tool breakage detection systems. If any of the components within the system fail, the system may falsely indicate that the laser beam is not blocked. Do not rely on signals from the NCSI non-contact scanning interface or Renishaw laser-based non-contact tool setting and tool breakage detection products 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, i.e. power transformers, servo drives etc.;
- 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;
- screens must be connected as outlined in the user 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.

Equipment operation

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

WARNINGS

Use of controls or adjustments or performance of procedures other than those specified within this publication may result in hazardous radiation exposure.

Switch off electrical power to the NCSI non-contact scanning interface before carrying out maintenance on non-contact (NC) tool setting and tool breakage detection products.

CAUTION – LASER SAFETY

The NCSI non-contact scanning interfaces with Renishaw laser-based non-contact tool setting and tool breakage detection products. Laser safety guidelines and safety rules are described in the appropriate NC tool setting product guides.

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

Specification

Absolute maximum supply voltage	11 Vdc to 30 Vdc
Maximum rated current	0.5 A
SSR contact ratings	±50 mA pk ±30 Vdc pk
Protection provided by enclosure	IP20 BS EN 60529:1992+A2:2013
Altitude	Maximum 2000 m (6562 ft)
Operating temperature	+5 °C to +55 °C (+41 °F to +131 °F)
Storage temperature	–25 °C to +70 °C (–13 °F to +158 °F)
Relative humidity	Maximum relative humidity 80% for temperatures up to +31 °C (+87.8 °F) decreasing linearly to 50% relative humidity at +40 °C (104 °F).

NCSI basics

Introduction

CNC machine tools using Renishaw NC4, NC4+ or NC4+ Blue non-contact (NC) units for tool setting or broken tool detection require an interface unit. The NCSI non-contact scanning interface converts signals from the NC unit into voltage-free, solid-state relay (SSR) outputs for transmission to the CNC machine controller. The NCSI non-contact scanning interface also converts signals from the non-contact tool setter into an analogue output signal that can be read by the CNC controller with a suitable analogue input, or equipped with the NCi-E interface. This enables analysis of laser obscuration, from a scanned object, synchronised with machine position.

The NCSI non-contact scanning interface should be installed in the CNC controller cabinet. Where possible, site the unit away from potential sources of interference such as transformers and motor controllers.

CAUTION: Only qualified persons should install and adjust switches on the interface. Remove the DC power supply from the NCSI non-contact scanning interface before removing the cover.

Power supply

The NCSI non-contact scanning interface can draw its power from the CNC machine's nominal 12 Vdc to 24 Vdc supply. This must be an appropriate single fault tolerant power supply which must comply to BS EN IEC 62368-1.

The supply to the NCSI non-contact scanning interface is protected by a 0.5 A resettable fuse. To reset the fuse, remove the power then identify and rectify the cause of the fault.

The nominal current when connected to an NC unit is as follows:

120 mA @ 12 Vdc,
70 mA @ 24 Vdc

NOTE: To disconnect the power supply, remove the wires from the terminals.

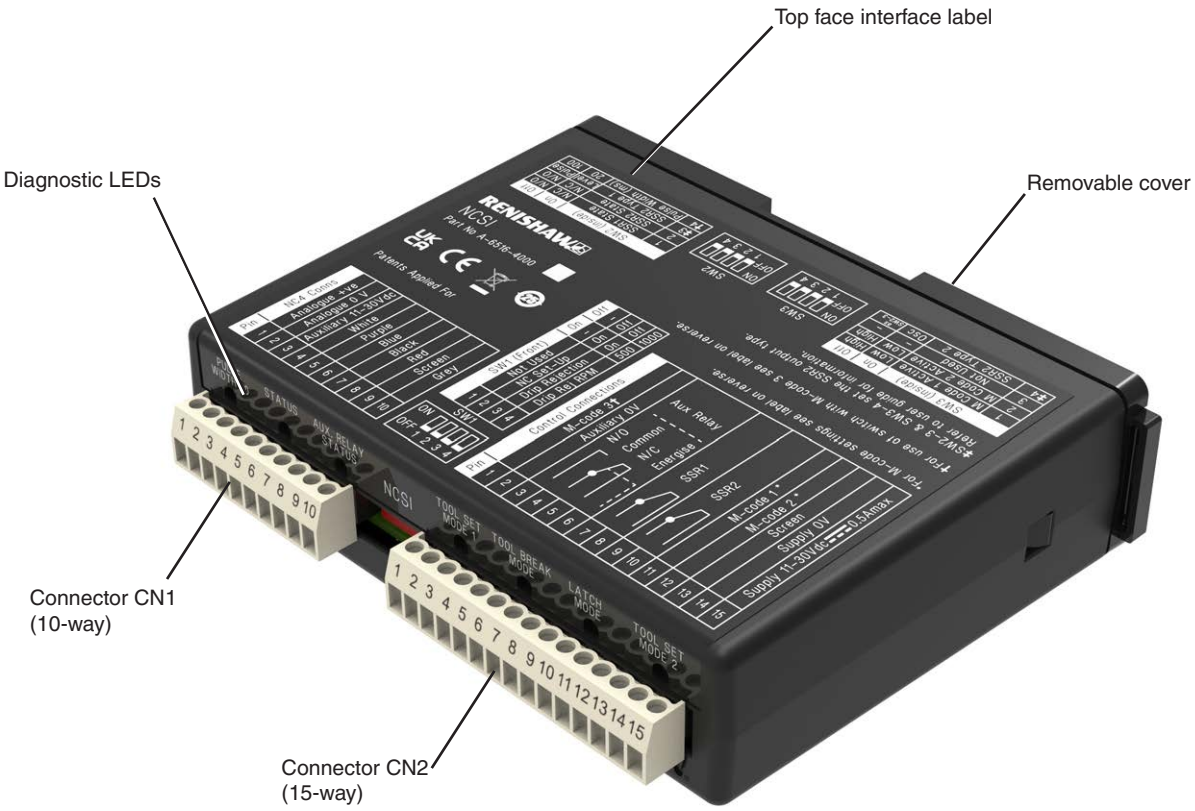
Input / output over-current protection

Each of the SSR outputs is protected by a 50 mA resettable fuse.

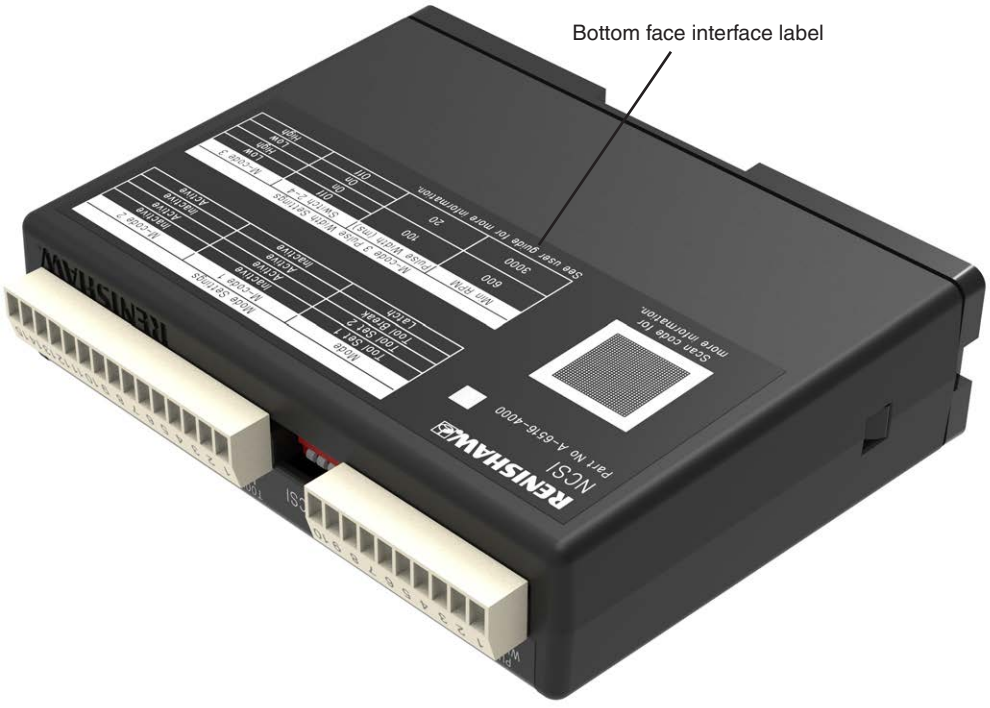
The auxiliary relay output is protected by a 200 mA resettable fuse.

The NC unit is protected by a resettable current protection circuit.

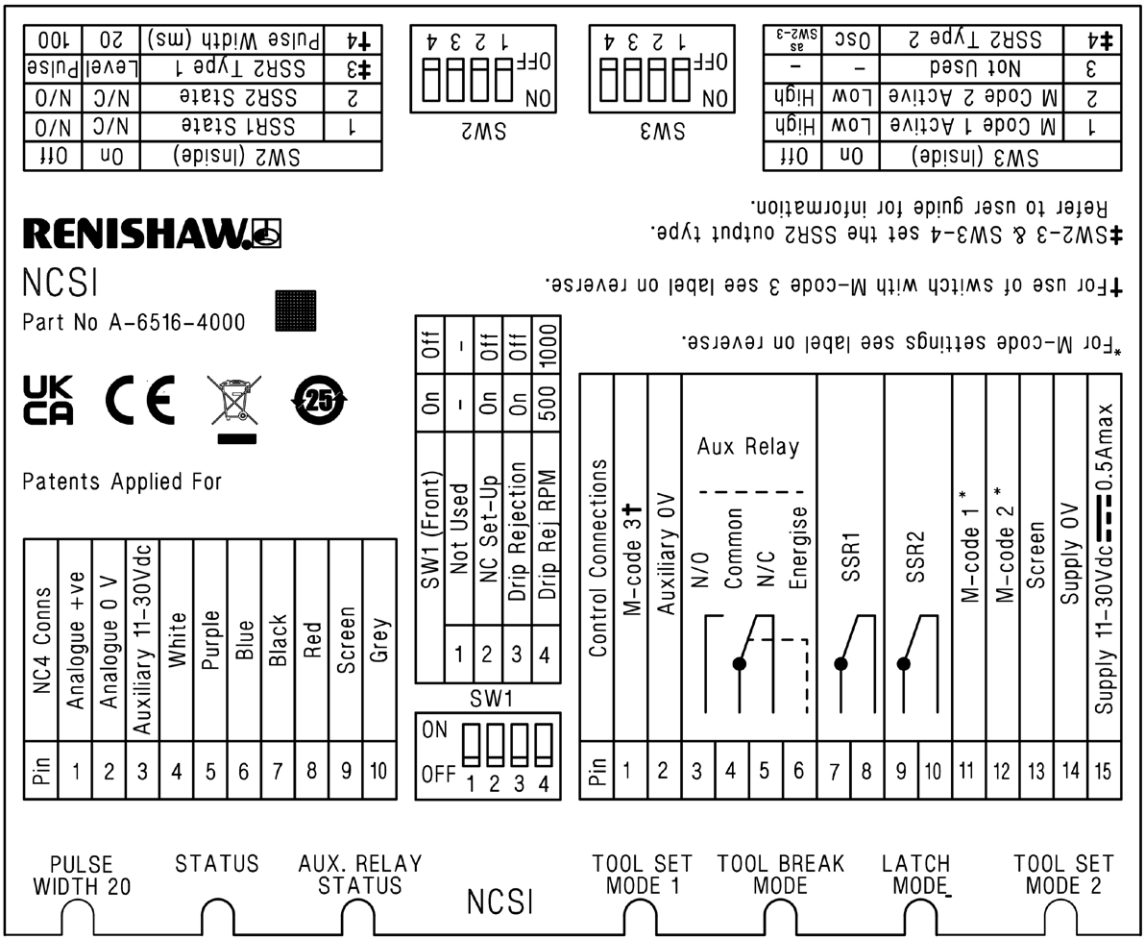
NCSI non-contact scanning interface unit (top face)



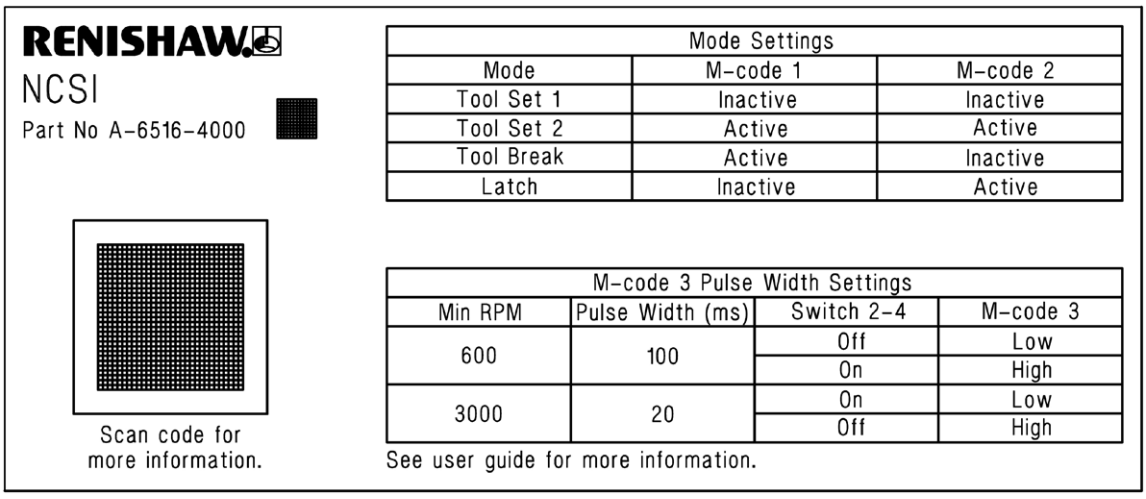
NCSI non-contact scanning interface unit (bottom face)



NCSI non-contact scanning interface unit top label



NCSI non-contact scanning interface unit bottom label



Mode Settings		
Mode	M-code 1	M-code 2
Tool Set 1	Inactive	Inactive
Tool Set 2	Active	Active
Tool Break	Active	Inactive
Latch	Inactive	Active

M-code 3 Pulse Width Settings			
Min RPM	Pulse Width (ms)	Switch 2-4	M-code 3
600	100	Off	Low
		On	High
3000	20	On	Low
		Off	High

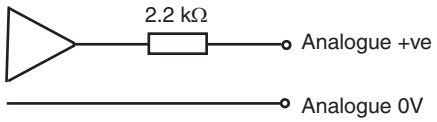
Connectors CN1 and CN2

10-way connector (CN1)

Connector CN1 is used to connect the non-contact unit to the NCSI non-contact scanning interface.

Terminals 1 – 2

Used to monitor the signal from the NC unit. Voltage range: 0 Vdc to 9 Vdc.



15-way connector (CN2)

Connector CN2 is used to connect the NCSI non-contact scanning interface to the CNC machine tool.

Terminal 1

Used to select the pulse width in consideration with switch SW2-4.

Terminals 3 – 6

This is an auxiliary output that can be used to control external devices such as LED, a buzzer or an air blast.

This output can also be used with a hardwired NC unit to switch the transmitter unit on/off independently of the receiver.

Alternatively, it can act as a skip-sharing module to switch between a non-contact tool setting device and an interface for spindle probing.

This output is fused at 200 mA.

Terminals 7 – 8

This is an SSR output that can be configured to be either normally open (NO) or normally closed (NC). The output is fused at 50 mA.

Terminals 9 – 10

This is an SSR output that can be configured to be either normally open (NO) or normally closed (NC), as well as providing a pulsed, level or oscillating output. The output is fused at 50 mA.

Terminals 11 – 12

This is used to select the operating mode.

Terminals 13 – 15

This is used to supply power to the interface.

Interface LEDs

Interface LED states

Seven LEDs are fitted on the front of the NCSI non-contact scanning interface. These provide the operator with a visual indication of the system's status.

Status LED

The Status LED indicates the status of the NC system to the operator. The colours and associated states are described in the tables on **page 2-6.**

When the system is in set-up mode, the LED changes from red to amber to green as the beam voltage increases.

If the LED is green after exiting set-up mode, this indicates that set-up has been successful. If the LED is not green, this indicates that set-up has not been successful and must be repeated.

Pulse width LED

Green:	20ms	Not lit:	100ms

Auxiliary relay status LED

Green:	Auxiliary relay energised	Not lit:	Auxiliary relay not energised

Mode LEDs: (Tool set 1, Tool break, Latch and Tool set 2)

Green:	Mode selected	Not lit:	Mode not selected

For more information, see **page 3-1** "Mode selection".

NOTE: If no mode LEDs are lit, this indicates that the NCSI non-contact scanning interface is in set-up mode.

Interface LEDs – status LED

LED colour	Tool set mode 1	Tool set mode 2
Green/amber	Flashing at 1 Hz. The system operating voltage is too high. The system will continue to function, but for optimum performance repeat the set-up and alignment procedures. The probe is untriggered.	Flashing at 1 Hz. The system operating voltage is too high. The system will continue to function, but for optimum performance repeat the set-up and alignment procedures. The probe is triggered.
Green	The beam is clear. The probe is untriggered.	The beam is clear. The probe is triggered.
Amber	The beam is partially blocked. * The probe is untriggered.	The beam is partially blocked. * The probe is triggered.
Red	The beam is blocked. The probe is triggered.	The beam is blocked. The probe is untriggered.
No light	No power to the unit	

* If the laser beam is clear and the LED is amber, this indicates that the system will continue to function, but for optimum performance maintenance is required.

Refer to the applicable *installation and user's guide* (for *NC4*, Renishaw part number H-2000-5230 or *NC4+*, Renishaw part number H-6270-8501 or *NC4+ Blue*, Renishaw part number H-6435-8501), for details of the possible actions required.

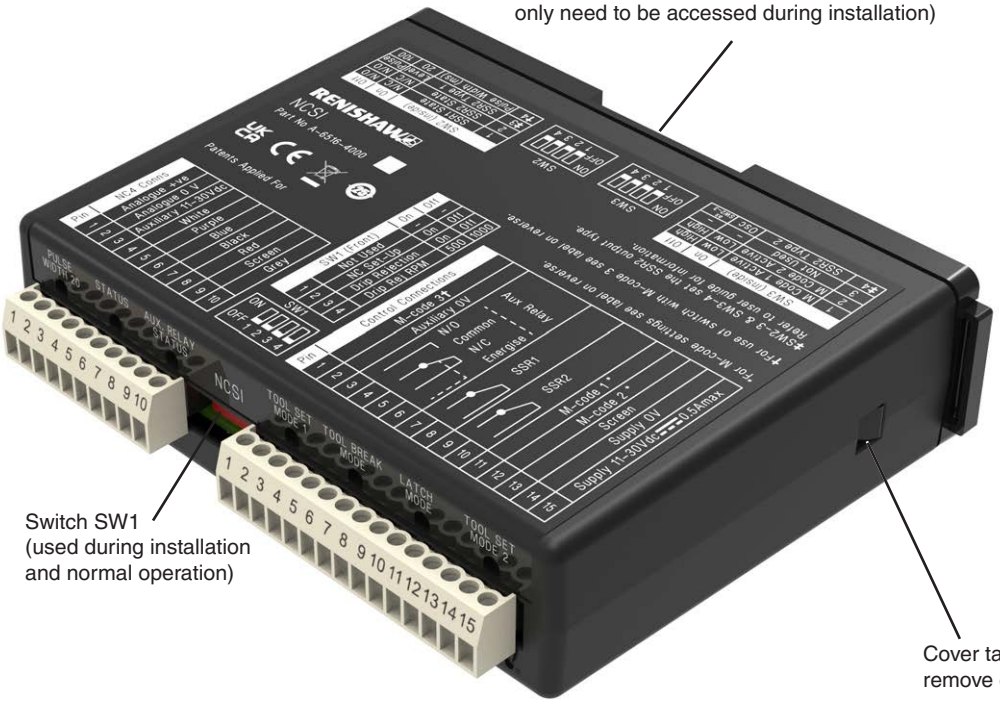
LED colour	High speed broken tool detection mode	Latch mode
Green/amber	Not applicable.	Flashing at 1 Hz. The output is not latched. The system operating voltage is too high. The system will continue to function, but for optimum performance repeat the set-up and alignment procedures.
Green	Not applicable.	The beam is clear. The output is not latched.
Amber	The output is not latched. The beam is blocked.	The output is not latched. The beam is blocked. *
Red	The output is latched. The tool is broken.	The output is latched.
No light		

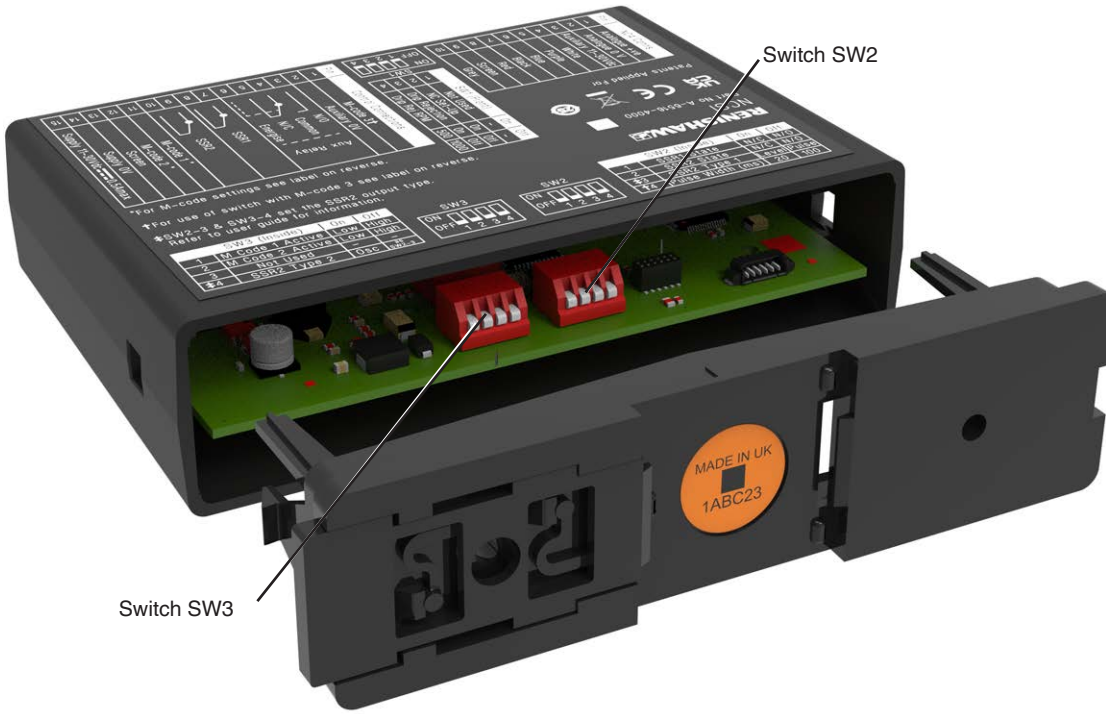
* If the laser beam is clear and the LED is amber, this indicates that the system will continue to function, but for optimum performance maintenance is required.

Refer to the applicable *installation and user's guide* (for *NC4*, Renishaw part number H-2000-5230 or *NC4+*, Renishaw part number H-6270-8501 or *NC4+ Blue*, Renishaw part number H-6435-8501), for details of the possible actions required.

Switches

Switch locations





IMPORTANT: Setting a switch

When setting a switch to either the On or Off position, apply firm pressure to make sure it is fully in position.

Switch bank SW1

Switch		On	Off	
1	Not used	On	Off	Not used.
2	NC set-up	On	Off	Used when setting up an NC unit. Set this switch to On so that the alignment voltage can be maximised. After maximising the voltage, set the switch to Off so that the automatic gain circuitry can set the operating voltage.
3	Drip rejection	On	Off	When the drip rejection mode is set to On, the effects of individual drops of coolant on measurements are filtered out. **NOTE:** For safe operation, set the spindle speed and spindle override as described below.
4	Spindle r/min	500	1000	Used with drip rejection. For safe operation, the spindle speed must be fixed at a whole multiple, e.g. 1000, 2000, or 3000; or 500, 1000, or 1500, and the spindle override must be disabled.

Switch bank SW2

CAUTIONS:

With the SSR output switch(es) set to Off, i.e. normally open (NO), the respective output will remain in a non-triggered state if the power supply is interrupted and/or a poor connection is made to the SSR.

If using SSR2 as an oscillating or pulsed output for a trigger signal to the controller, the level output SSR1 must be used to guarantee a reliable probe status check.

Switch		On	Off	
1	SSR1	NC	NO	Sets the SSR output to either normally closed (NC) or normally open (NO).
2	SSR2	NC	NO	As above.
3	SSR2 Type1	Level	Pulsed	Sets the SSR2 output to level or pulsed (for more information, see **page 2-9**, “SSR2 output selections”).
4	Pulse width	20 ms	100 ms	Sets the pulse width to either 20 ms or 100 ms (for more information, see **page 3-2**, “Pulse width setting”). M-code 3 may be used to invert the switch setting. **NOTE:** For the cycle to work, the pulse width value selected must be the same as the value that is configured in the tool setting software.

Switch bank SW3

Switch		On	Off	
1	M-code 1 Active	Low	High	Determines whether the input responds to an active – high or active – low signal.
2	M-code 2 Active	Low	High	Determines whether the input responds to an active – high or active – low signal.
3	Not used	–	–	Not used.
4	SSR2 Type 2	Osc.	As SW2-3	Sets the SSR2 output to oscillating or as per SW2-3 (for more information, see **page 2-9**, “SSR2 output selections”).

NOTES:

If an M-code is not connected to terminal 11, SW3-1 must be set to Off (M-code active high).

If an M-code is not connected to terminal 12, SW3-2 must be set to Off (M-code active high).

SSR2 output selections

SSR2 type 1 and SSR2 type 2

CAUTION: If using SSR2 as an oscillating or pulsed output for a trigger signal to the controller, the level output SSR1 must be used to guarantee a reliable probe status check.

The SSR2 output can be configured for three different types, pulsed, level or oscillating.

The selection of SSR2 type is derived from the position of two switches, SW2-3 and SW3-4.

The table for this logic is as follows:

SW2-3 SSR2 Type 1	SW3-4 SSR2 Type 2	Output type
Off	Off	Pulsed
On	Off	Level
Off	On	Oscillating
On	On	Oscillating

NOTE: On certain machine controllers there is a delay between the start of a measurement move and the machine controller becoming responsive to a change in trigger status. In this case use the oscillating output to ensure the trigger is detected when the machine controller becomes responsive.

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System installation

Standard operating modes

Tool set mode 1

This mode of operation allows functions such as system alignment, tool calibration, length and diameter tool setting, and thermal compensation tracking. Measurement takes place as the tool enters the laser beam. No M-codes are required. Typically drip rejection is activated.

Tool set mode 2

This mode of operation allows length and diameter measurement of cutting tools, measures run-out and allows cutting edge checking. It uses “Dual Measurement” technology. Measurement takes place as the tool exits the laser beam providing shorter cycle times and is more robust in wet conditions. M-codes are required to activate this mode. Drip rejection is not used.

High-speed tool breakage detection

This mode of operation allows rapid detection of broken tools that are solid at the centre – for example, drills and taps.

Latch mode

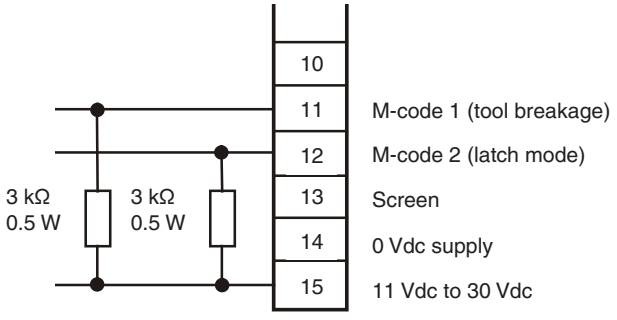
This mode of operation allows functions such as checking tools for missing inserts and profile checking.

For further information about the software for these cycles, see the *Probe software for machine tools: programs and features* data sheet (Renishaw part number H-2000-2298), or the relevant Renishaw NCTS software manual for your machine tool.

Mode selection

These modes can be activated using M-codes supplying a constant voltage of between 11 Vdc and 30 Vdc connected to CN2-11 and/or CN2-12 (see the table below). These selection levels can be inverted using switches SW3-1 and SW3-2 respectively so that 0 Vdc is used to activate the mode and 11 Vdc to 30 Vdc is used to deactivate. If the M-code voltage is floating when deactivated, a resistor is required to pull up the voltage to the supply voltage (refer to the figure below).

Mode	M-code 1 (CN2-11)	M-code 2 (CN2-12)
Tool set 1	Inactive	Inactive
Tool set 2	Active	Active
Tool break	Active	Inactive
Latch	Inactive	Active



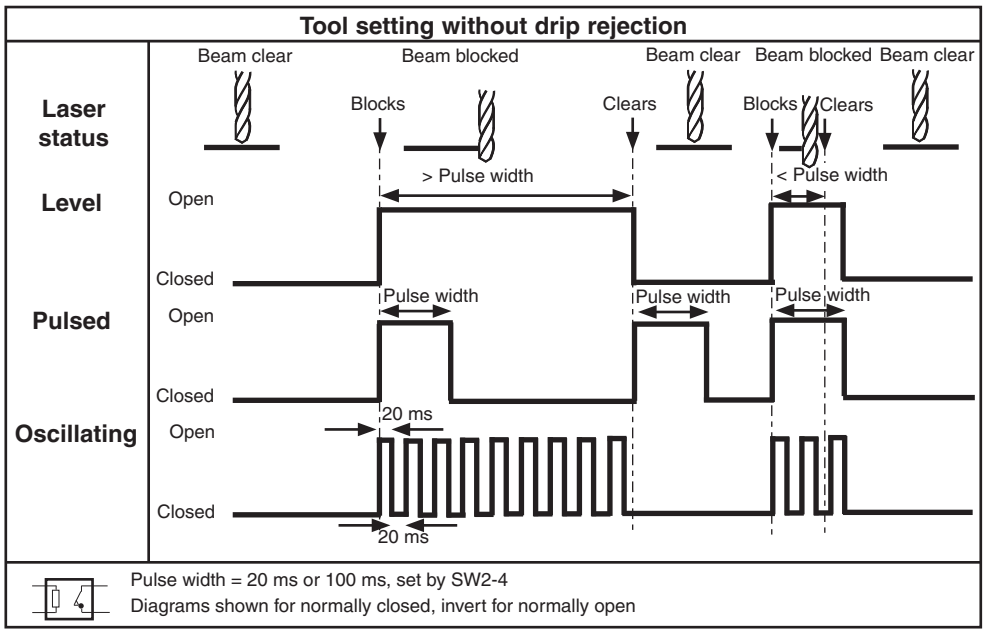
Pulse width setting

The pulse width setting has the following functions:

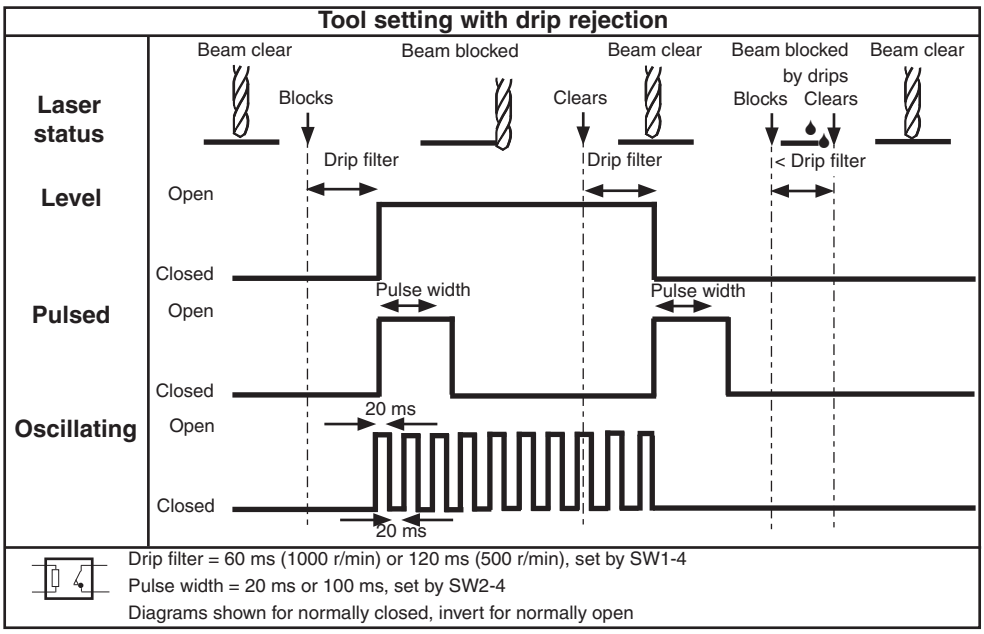
- Sets the SSR2 pulsed output width to either 20 ms or 100 ms. It also sets the minimum pulse width of SSR1 to either 20 ms or 100 ms.
- If the pulse width is set to 20 ms, the cycle time for the latch mode functions is reduced and the spindle speed is five times faster. In certain cycles ensure the maximum r/min of the tools is not exceeded.
- Sets the minimum r/min of the tools in tool set mode 1, without drip rejection active, and in tool set mode 2.
- Switch SW2-4 sets the pulse width to 20 ms or 100 ms. M-code 3 can be used to invert the switch setting as shown in the table below.

Min r/min	Pulse width ms	Switch 2-4	M-code 3
600	100	Off	Low
		On	High
3000	20	On	Low
		Off	High

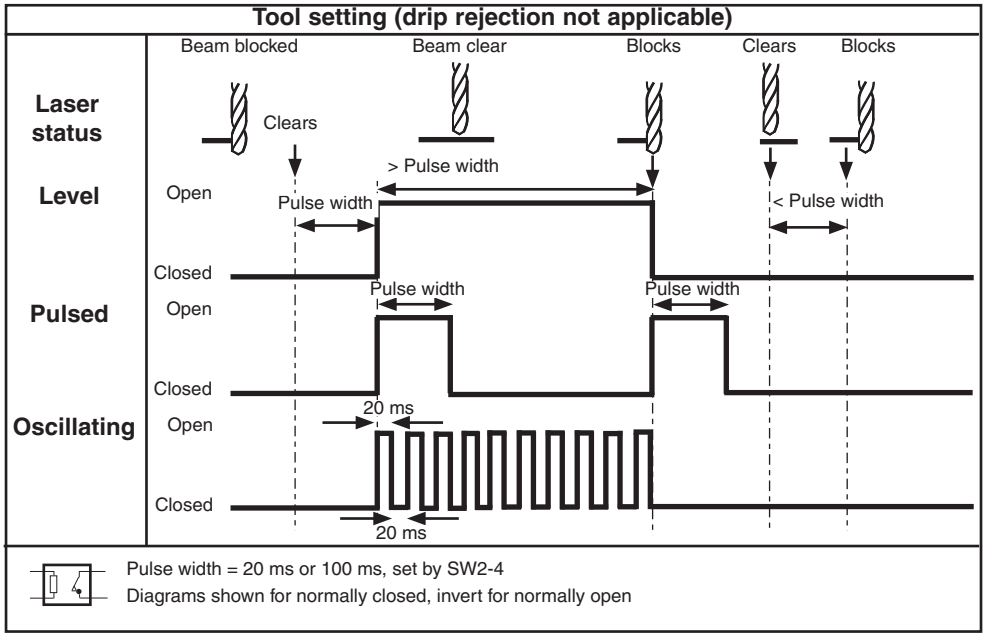
Tool set mode 1 (without drip rejection)



Tool set mode 1 (with drip rejection)



Tool set mode 2



Scanning

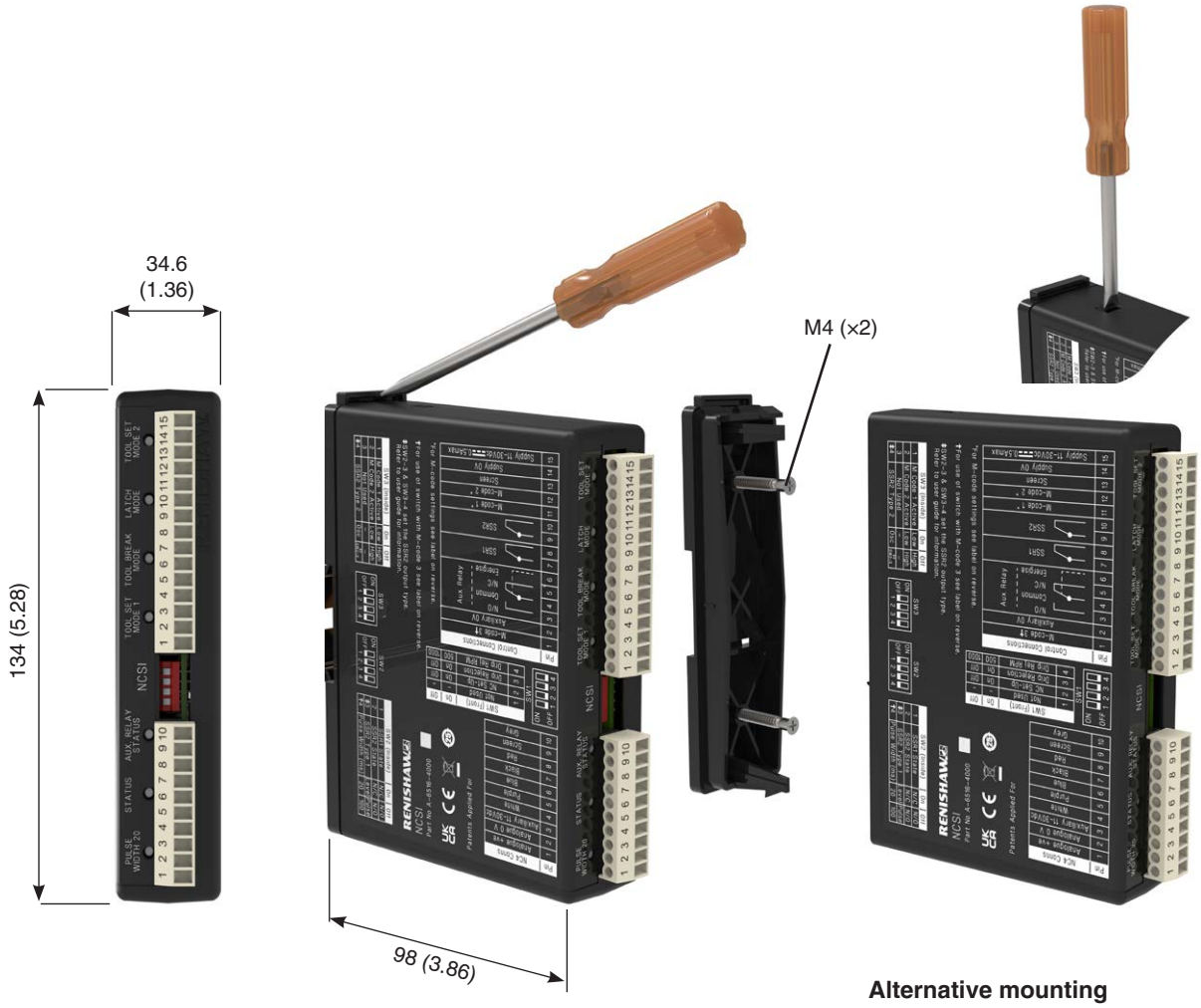
Analogue scanning is available in all operating modes. The analogue voltage is typically:

5 V when the beam is clear

0 V when the beam is fully blocked

2.5 V when the beam is 50% blocked

Dimensions and mounting arrangements



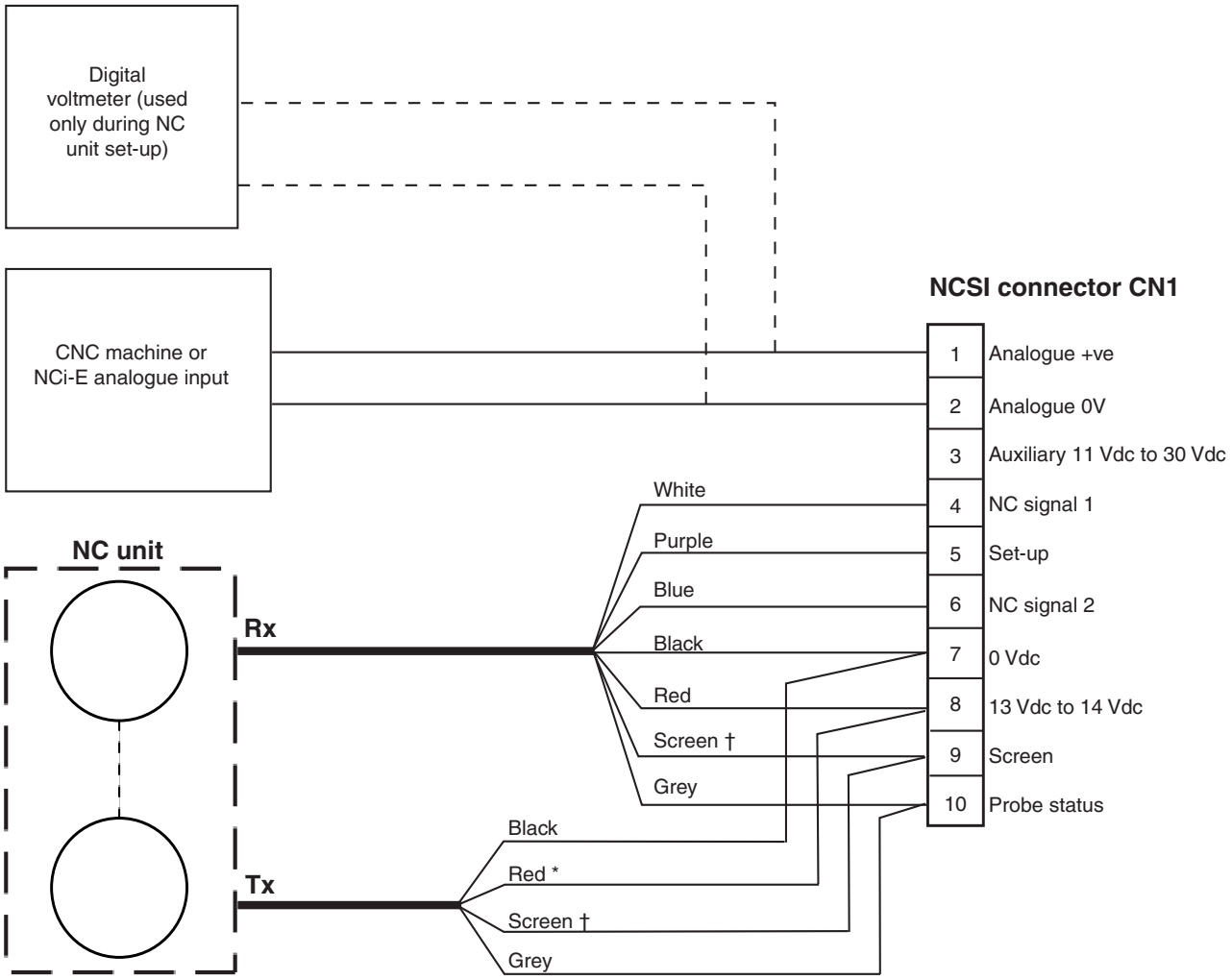
Standard DIN rail mounting

Alternative mounting

Dimensions in mm (in)

Wiring

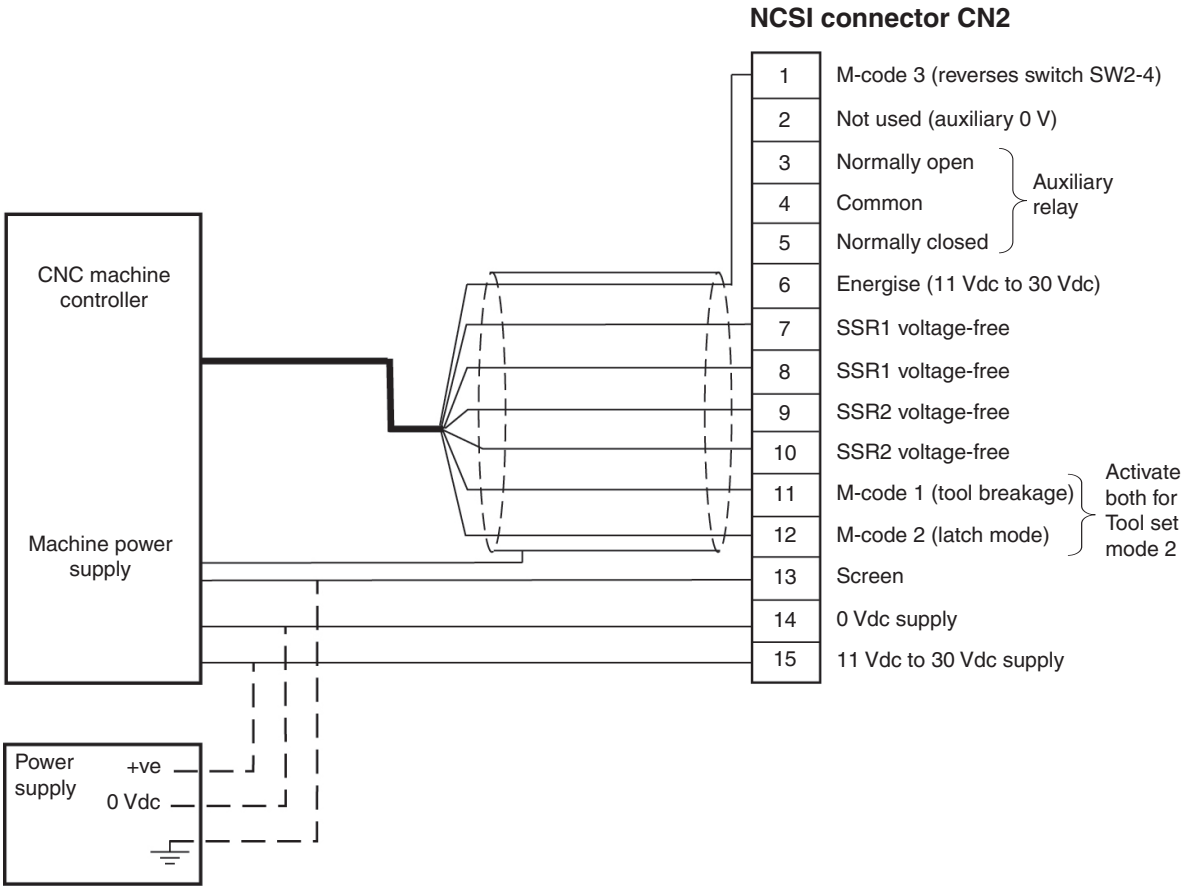
Connecting to the NC unit



* If the laser beam is to be switched on and off independently of the receiver, do not connect this red wire to pin 8. Connect the transmitter as shown on page **3-8**, “Controlling the laser system”.

† Do not connect screen connections if the NC unit housing is connected to the machine ground reference (i.e. R ≤ 1Ω).

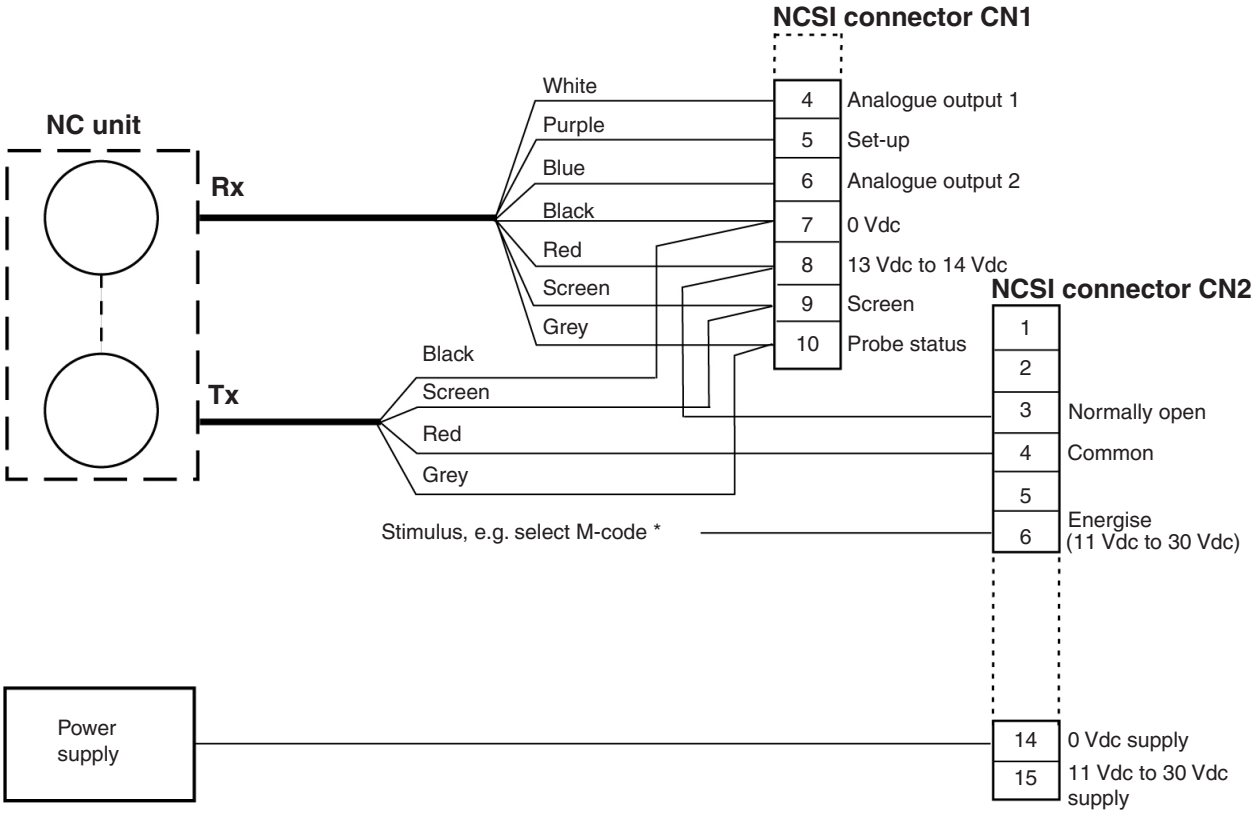
Connecting to the CNC



CAUTION: If using SSR2 as an oscillating or pulsed output for a trigger signal to the controller, the level output SSR1 must be used to guarantee a reliable probe status check.

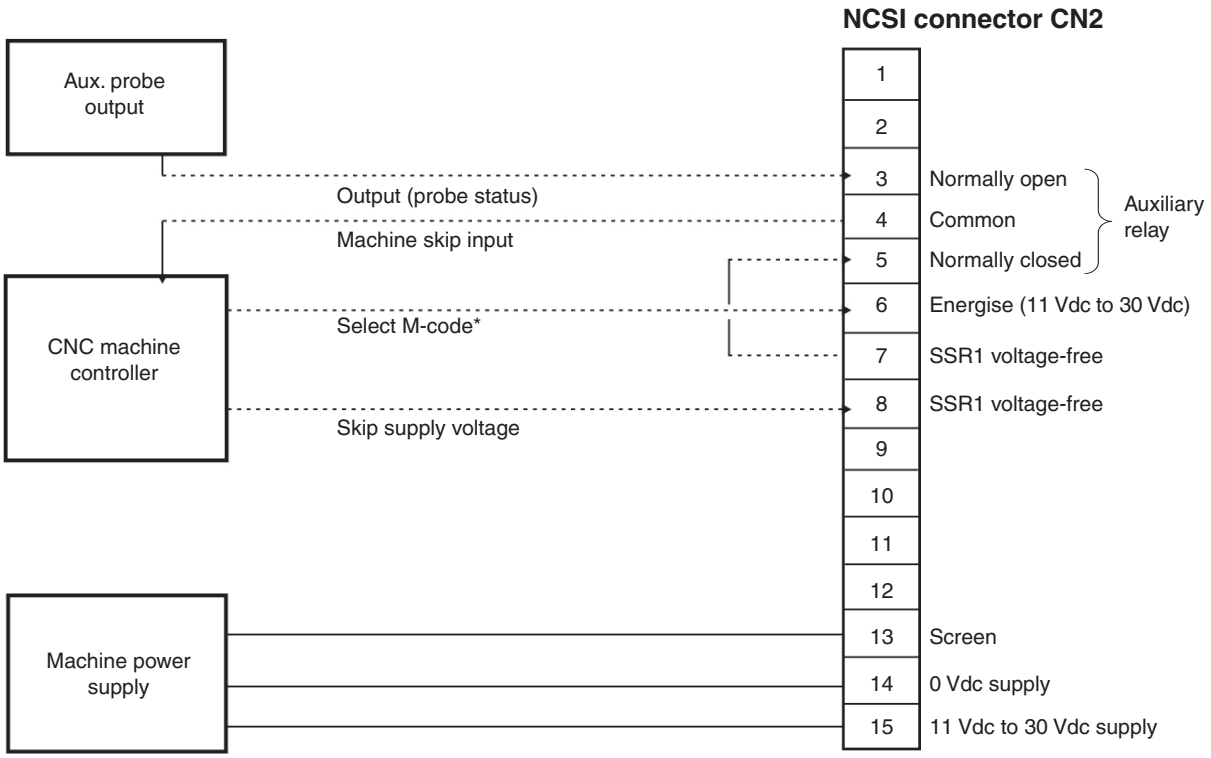
Controlling the laser of an NC unit

This arrangement allows the transmitter of an NC unit system to be switched on and off independently of the receiver.



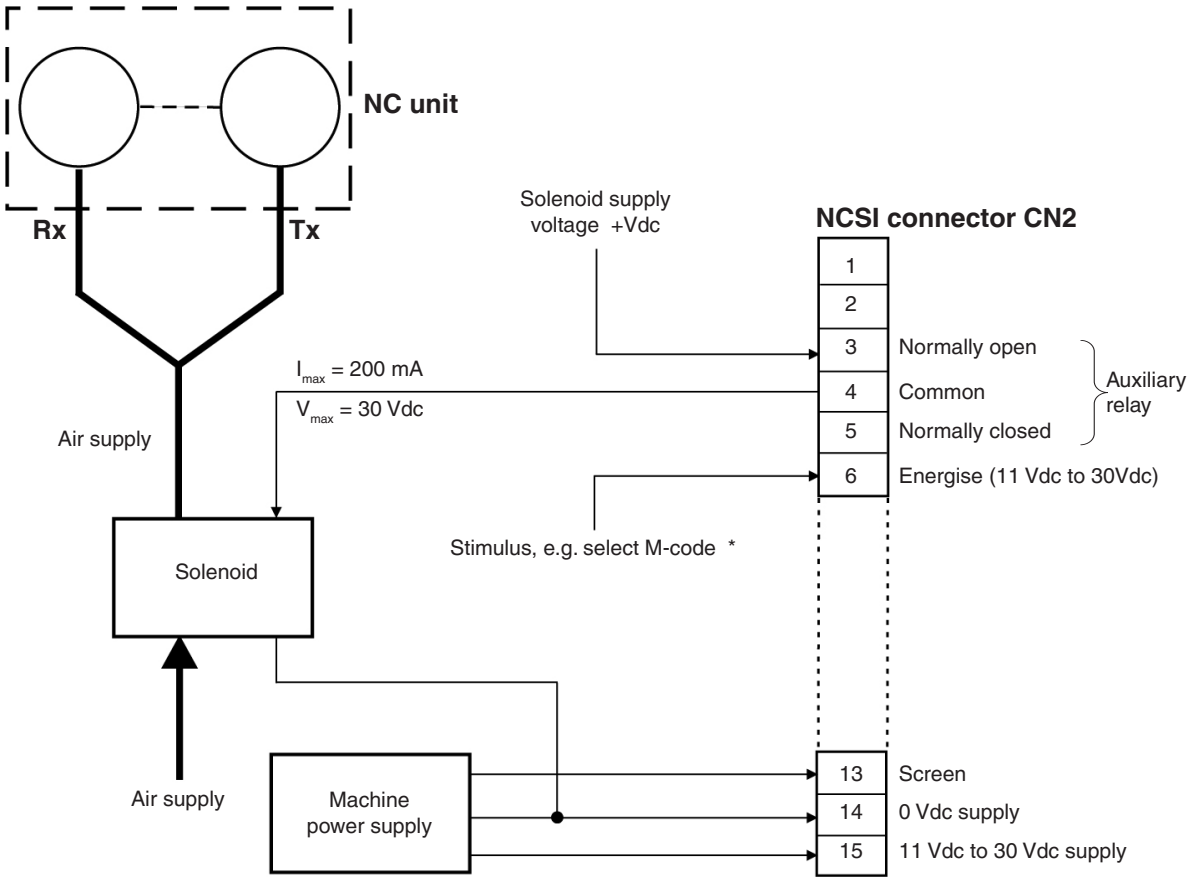
* High (11 Vdc to 30 Vdc) switches the laser on.
Low (0 Vdc), or floating, switches the laser off.

Sharing the skip with an auxiliary probe



* High (11 Vdc to 30 Vdc) selects the AUX probe (and may also send the start code).
Low (0 Vdc) or floating selects the NC probe.

Controlling the air supply to an NC unit



* High (11 Vdc to 30 Vdc) switches the air on.
Low (0 Vdc) or floating switches the air off.

Maintenance

NCSI maintenance

No routine maintenance is required.

Remove dust from the external surfaces with a dry cloth.

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Parts list

Type	Part number	Description
NCSI interface	A-6516-4000	NCSI interface and box with DIN rail mounting and two terminal blocks.
NCSI terminal block (10-way)	P-CN25-1053	10-way socket terminal for NCSI interface.
NCSI terminal block (15-way)	P-CN25-0009	15-way socket terminal for NCSI interface.

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Part no.: H-6515-8550-01-A
Issued: 10.2024