Installation and user's guide
H-6516-8500-01-A

RENISHAW
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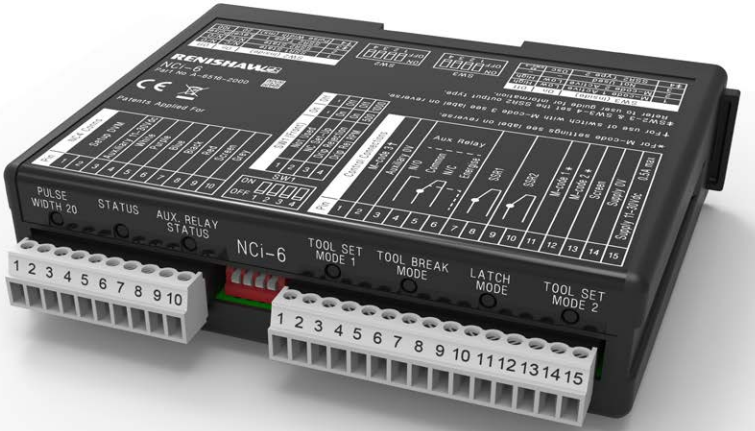
NCi-6 non-contact tool setting interface

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WWW

EN	Publications for this product are available by visiting **www.renishaw.com/nci-6**.
DE	Weitere Informationen zu diesem Produkt sind unter folgendem Link **www.renishaw.de/nci-6** abrufbar.
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English

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Renishaw part no: H-6516-8500-01-A

Issued: 09.2017

Warranty

Equipment requiring attention under warranty must be returned to your equipment supplier.

Unless otherwise specifically agreed in writing between you and Renishaw, if you purchased the equipment from a Renishaw company, the warranty provisions contained in Renishaw's CONDITIONS OF SALE apply. You should consult these conditions in order to find out the details of your warranty, but in summary, the main exclusions from the warranty are if the equipment has been:

- neglected, mishandled or inappropriately used; or
- modified or altered in any way except with the prior written agreement of Renishaw.

If you purchased the equipment from any other supplier, you should contact them to find out what repairs are covered by their warranty.

Changes to equipment

Renishaw reserves the right to change specifications without notice.

CNC machines

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

Care of the interface

Keep system components clean.

Patents

Features of the NCi-6 non-contact interface and related products are subject to the following patents and patent applications:

CN 100394139
CN 101674918
CN 103286639
CN 1202403
CN 1660541
EP 1050368
EP 1144944
EP 1502699
EP 1562020
EP 2152469
EP 2380698
JP 4520240
JP 4521094
JP 4695808
JP 5587393
TW I473681
TW NI-178572
US 6496273
US 6635894
US 6878953
US 7053392
US 7312433
US 8530823
US 9040899

EU declaration of conformity

Renishaw plc declares that the NCi-6 non-contact interface complies with the applicable standards and regulations.

Contact Renishaw plc or visit **www.renishaw.com/nci-6** for the full EU declaration of conformity.

WEEE directive

The use of this symbol on products and/or accompanying documentation indicates that the product should not be mixed with general household waste upon disposal. It is the responsibility of the end user to dispose of this product at a designated collection point for waste electrical and electronic equipment (WEEE) to enable reuse or recycling. Correct disposal of this product will help to save valuable resources and prevent potential negative effects on the environment. For more information, please contact your local waste disposal service or distributor.

FCC information to user (USA only)

47 CFR 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, and
2. This device must accept any interference received, including interference that may cause undesired operation.

47 CFR 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.

47 CFR 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 this installation guide, 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.

Safety

Information to the user

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

Information for the machine supplier

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

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

Information to the equipment installer

All Renishaw equipment is designed to comply with the relevant EC 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;
- 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, i.e. motor power supply cables etc. or be near high-speed data lines;
- cable lengths should always be kept to a minimum.

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 NCi-6 interface before carrying out maintenance on non-contact (NC) tool setting and tool breakage detection products.

CAUTION – Laser safety

The NCi-6 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.

NCi-6 maintenance

No routine maintenance is required.

Remove dust from the external surfaces with a dry cloth.

Electrical ratings

Absolute maximum supply voltage	11 Vdc to 30 Vdc
Maximum rated current	0.5 A
SSR contact ratings	±50 mA pk ±30 Vdc pk

Operating conditions

Protection provided by enclosure	IP20 BS EN 60529:1992+A2:2013 (IEC 60529:1989+A1:1999+ 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).

Introduction

CNC machine tools using Renishaw NC4 or NC4+ non-contact (NC) systems for tool setting or broken tool detection require an interface unit. The NCi-6 unit converts signals from the NC unit into voltage-free, solid-state relay (SSR) outputs for transmission to the CNC machine control.

The NCi-6 interface unit should be installed in the CNC control 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 NCi-6 unit before removing the cover.

Power supply

The NCi-6 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 60950-1:2006+A2:2013
(IEC 60950-1:2005+A2:2013).

The supply to the NCi-6 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:

NC4 or NC4+	120 mA @ 12 Vdc, 70 mA @ 24 Vdc

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

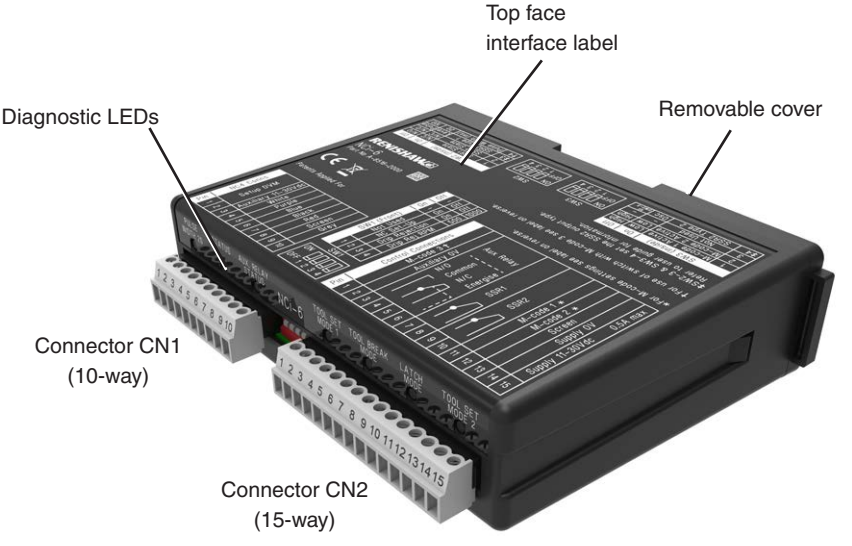
Input / output over-current protection

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

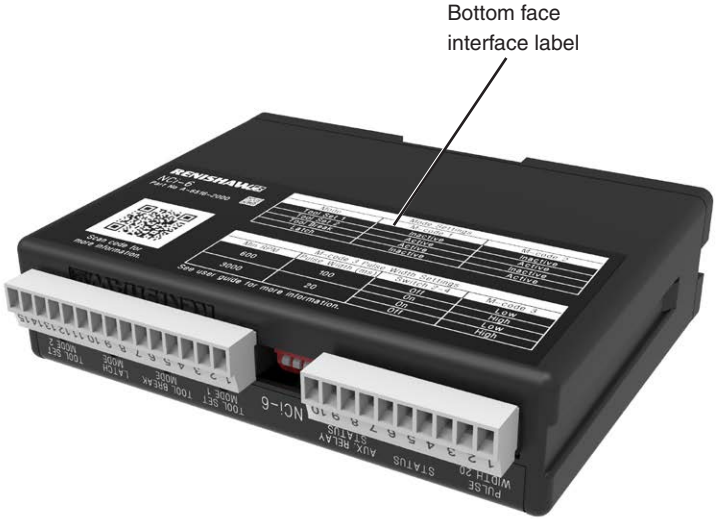
The auxiliary relay output is protected by a 200 mA resettable fuse.

The NC4 and NC4+ are protected by a resettable current protection circuit.

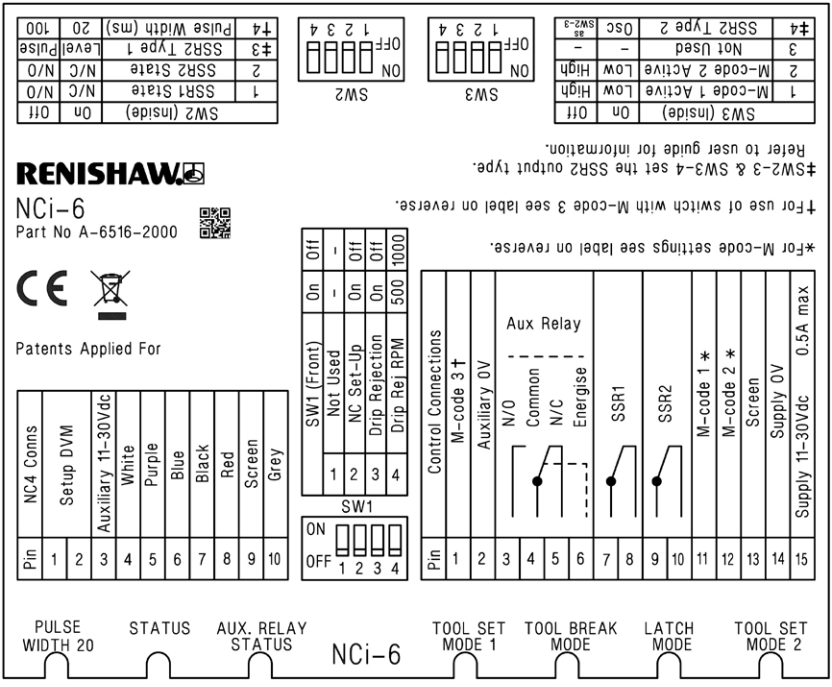
NCi-6 interface unit (top face)



NCi-6 interface unit (bottom face)



NCi-6 front label



NCi-6 back label

RENISHAW

NCi-6

Part No A-6516-2000

Scan code for more information.

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

See user guide for more information.

10-way connector (CN1)

Connector CN1 is used to connect the non-contact unit to the NCi-6 interface. The interface automatically detects which NC unit has been connected.

Terminals 1 – 2

Used to monitor the signal from the NC4 or NC4+. Voltage range: 0 Vdc to 9 Vdc.

15-way connector (CN2)

Connector CN2 is used to connect the NCi-6 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. Devices may include an LED, a buzzer or an air blast.

This output can also be used with a hardwired NC4 or NC4+ system 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 (N.O.) or normally closed (N.C.). The output is fused at 50 mA.

Terminals 9 – 10

This is an SSR output that can be configured to be either normally open (N.O.) or normally closed (N.C.), 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 LED states

Seven LEDs are fitted on the front of the NCi-6 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 table on pages 11 and 12.

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

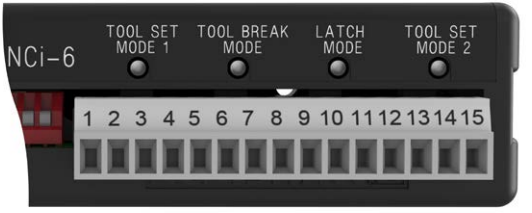
If the LED is green after exiting set-up mode, this indicates that set-up has been successful. If the LED is not green, this indicates that set-up has not been successful and must be repeated.

Pulse width LED

Green	20 ms
Not lit	100 ms

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 18, “Operating modes”.

NOTE: If no mode LEDs are lit, this indicates that the NCi-6 interface is in set-up mode.

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.

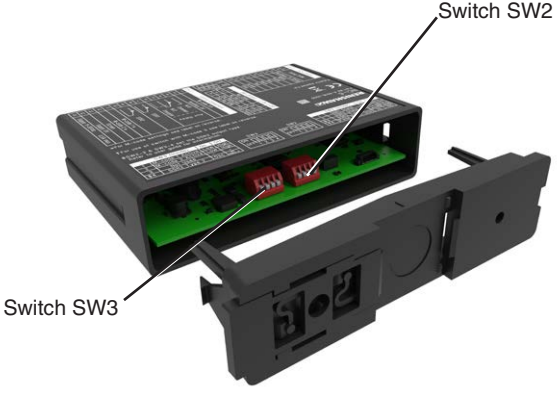
Refer to the applicable *installation and user's guide* (for *NC4*, Renishaw part number H-2000-5230 or *NC4+*, Renishaw part number H-6270-8501), for details of the possible actions required.

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), for details of the possible actions required.

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

1	Not used	On	Off	Not used.
2	NC set-up	On	Off	Used when setting up an NC4 or NC4+ system. 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 fine-tune 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 (N.O.), 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 control, the level output SSR1 must be used to guarantee a reliable probe status check.

Switch		On	Off	
1	SSR1	N.C.	N.O.	Sets the SSR output to either normally closed (N.C.) or normally open (N.O.).
2	SSR2	N.C.	N.O.	As above.
3	SSR2 Type1	Level	Pulsed	Sets the SSR2 output to level or pulsed. Refer to page 17.
4	Pulse width	20 ms	100 ms	Sets the pulse width to either 20 ms or 100 ms (For more information see page 18 to 23, “Operating modes”). 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 1 Active	Low	High	As above.
3	Not used	–	–	Not used.
4	SSR2 Type 2	Osc.	As SW2-3	Sets the SSR2 output to oscillating or as per SW2-3. Refer to the page 17.

NOTES:

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

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

SSR2 type 1 and SSR2 type 2

CAUTION: If using SSR2 as an oscillating or pulsed output for a trigger signal to the control, 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.

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.

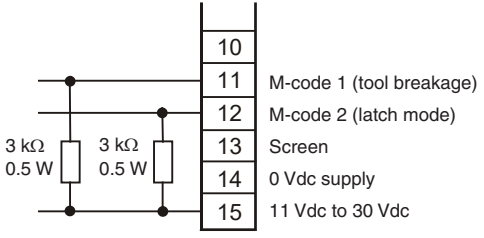
Latch mode

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 www.renishaw.com

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 opposite).



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

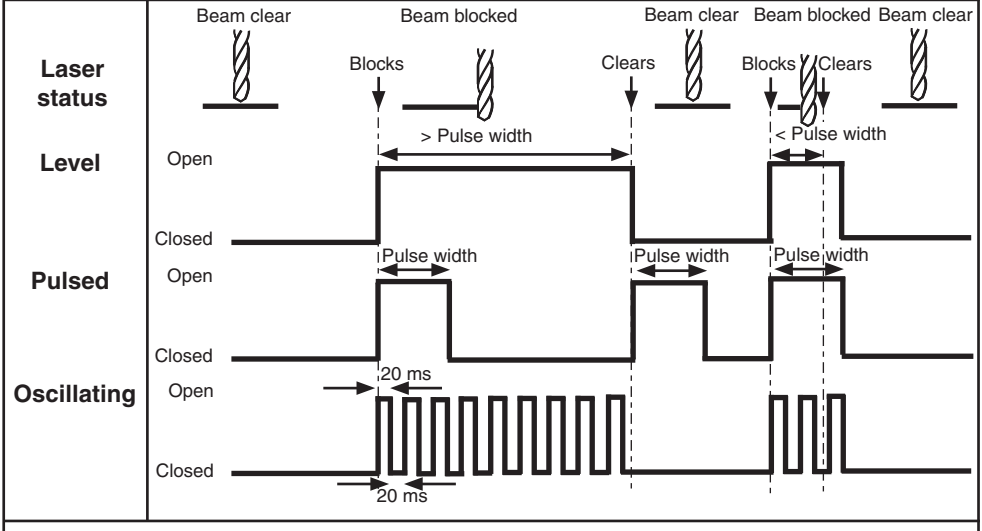
The pulse width setting has the following functions:

- 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)

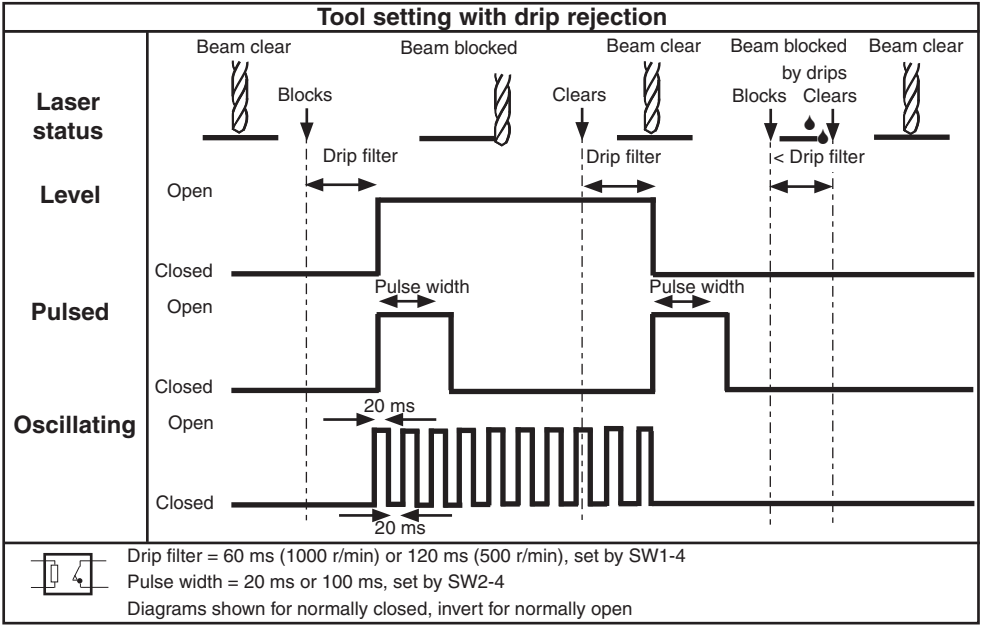
Tool setting without drip rejection



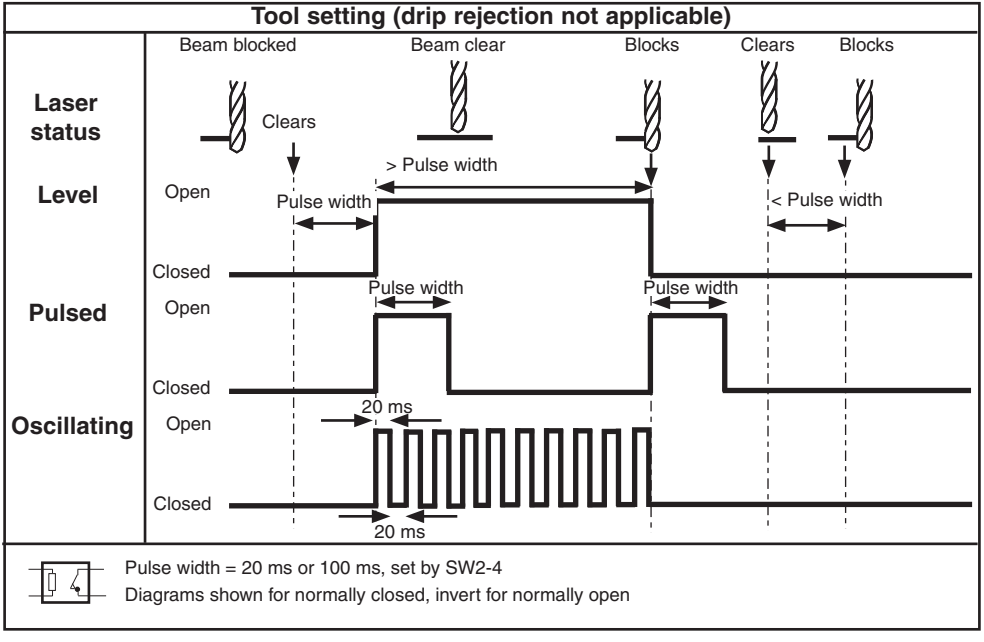
Pulse width = 20 ms or 100 ms, set by SW2-4

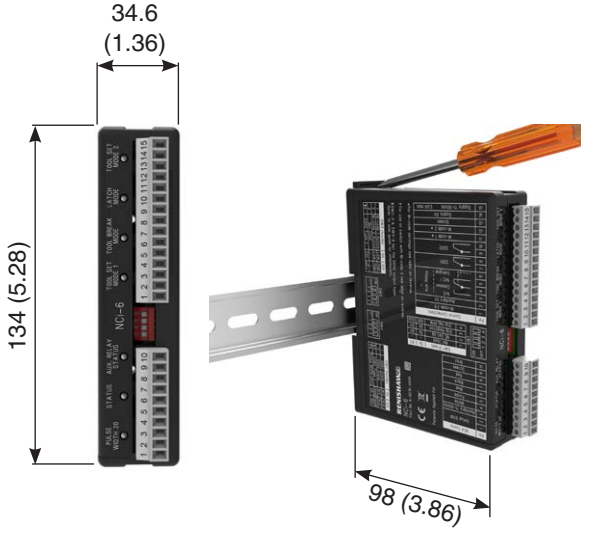
Diagrams shown for normally closed, invert for normally open

Tool set mode 1 (with drip rejection)

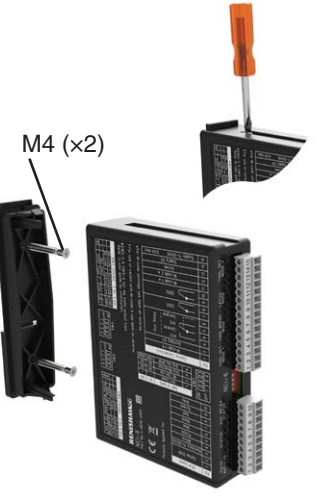


Tool set mode 2





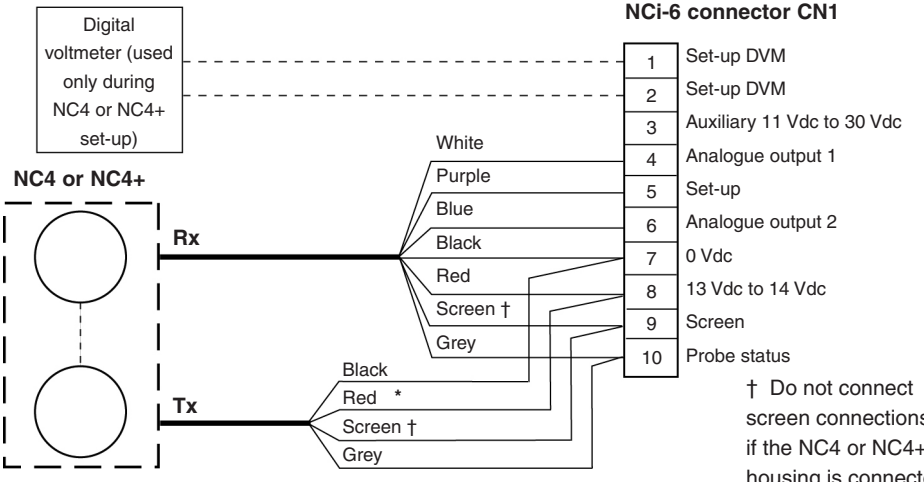
Standard DIN rail mounting



Alternative mounting

Dimensions in mm (in)

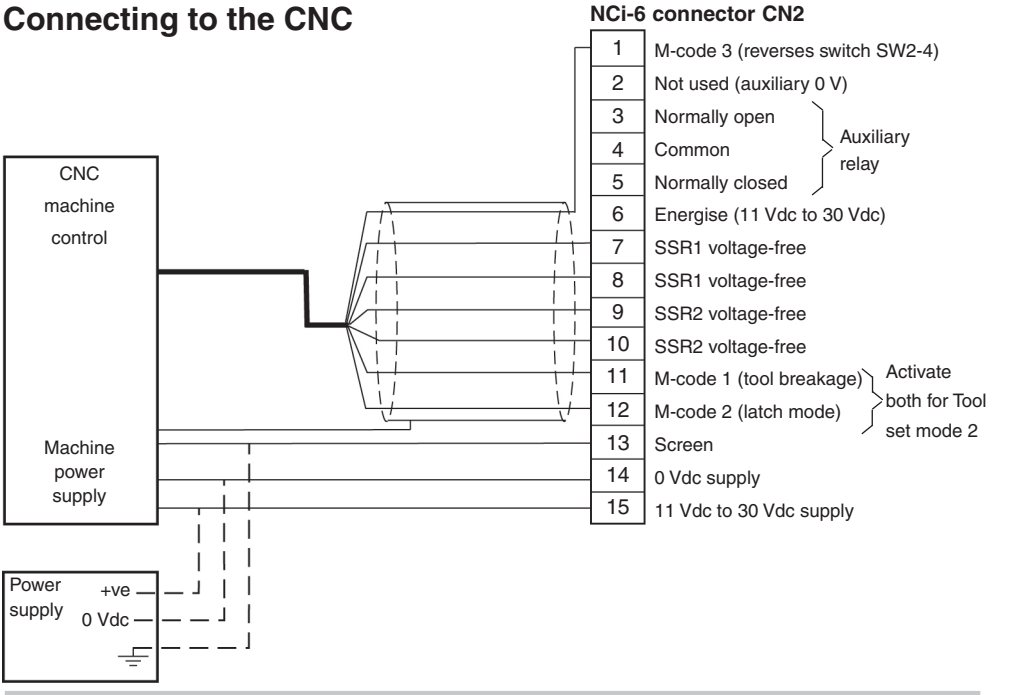
NC4 or NC4+ system



† Do not connect screen connections if the NC4 or NC4+ housing is connected to the machine ground reference (i.e. $R \leq 1\Omega$).

* 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 27.

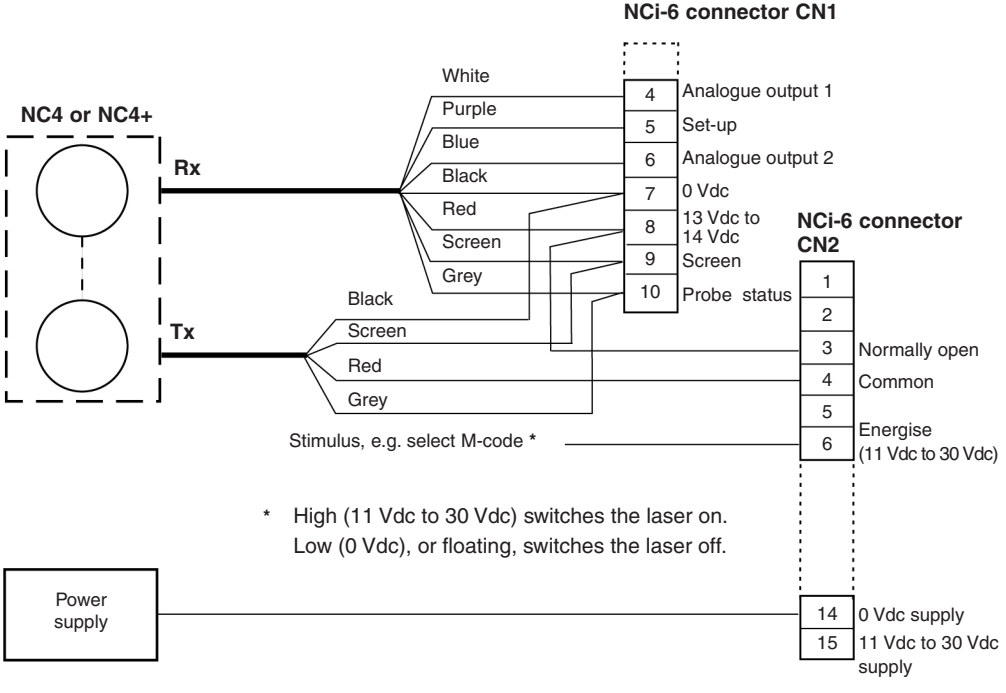
Connecting to the CNC



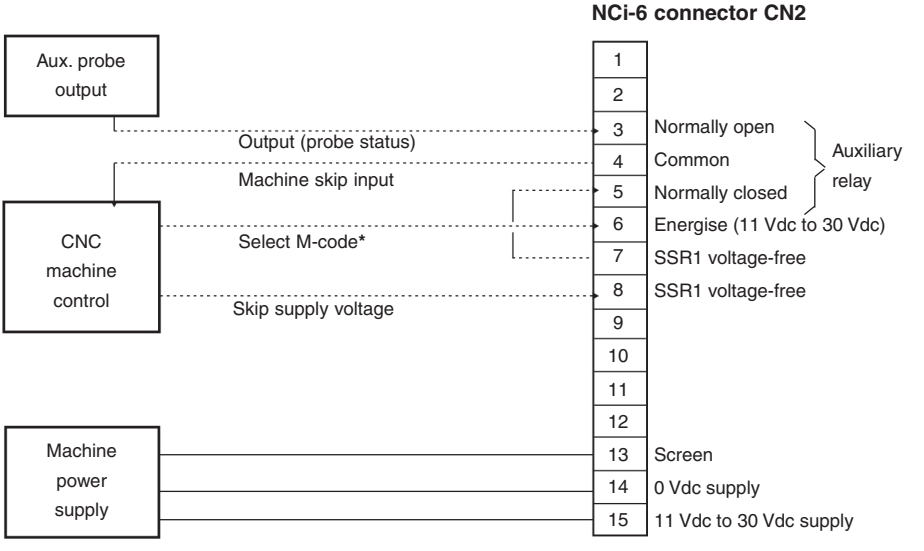
CAUTION: If using SSR2 as an oscillating or pulsed output for a trigger signal to the control, the level output SSR1 must be used to guarantee a reliable probe status check.

Controlling the laser of an NC4 or NC4+ system

This arrangement allows the transmitter of an NC4 or NC4+ system to be switched on and off independently of the receiver.

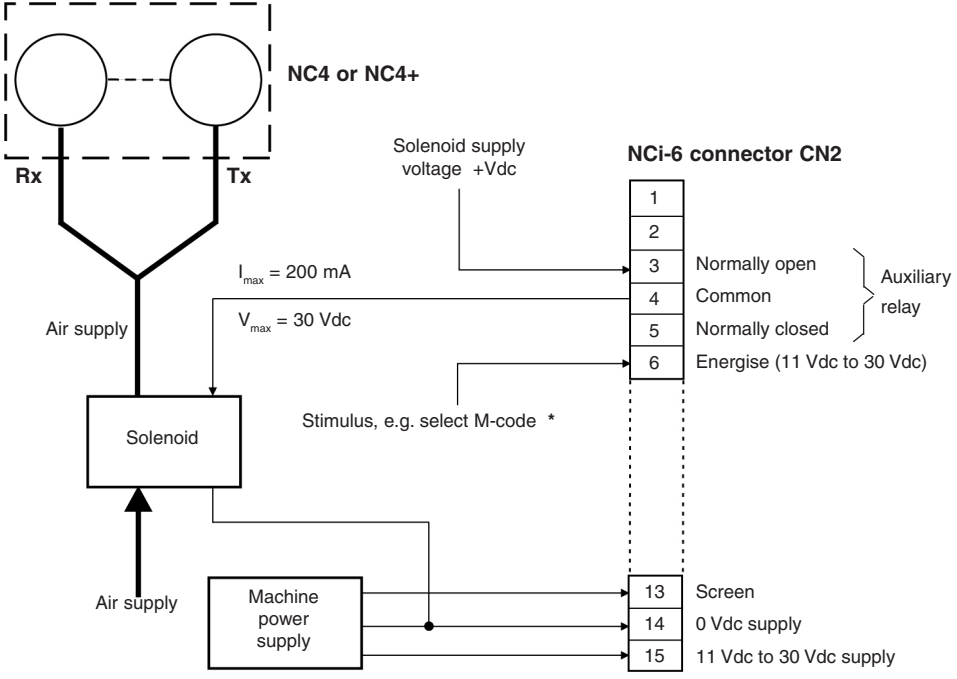


Sharing the skip with an auxiliary probe



* 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 NC4 or NC4+ system



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

Type	Part number	Description
NCi-6 interface	A-6516-2000	NCi-6 interface and box with DIN rail mounting and two terminal blocks.
NCi-6 terminal block (10-way)	P-CN25-1053	10-way socket terminal for NCi-6 interface.
NCi-6 terminal block (15-way)	P-CN25-0009	15-way socket terminal for NCi-6 interface.

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H-6516-8500-01