Installation and user's guide
H-5259-8500-05-A

RENISHAW
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NCi-5 non-contact tool setting interface

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English

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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.

Patents

Features of the NCi-5 non-contact interface and related products are subject to the following patents and patent applications:

CN100394139	CN101674918
CN1202403	CN1660541
EP1050368	EP1144944
EP1502699	EP1506073
EP1562020	EP2152469

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JP4520240
JP4695808
WO2008/135744
TW-NI-178572
US6496273
US6878953
US7312433B2
JP4521094
KR0746932
TW200909120
US2010/0051783
US6635894
US7053392

Other patents pending.

EC DECLARATION OF CONFORMITY

CE

Renishaw plc declares that the NCi-5 non-contact interface complies with the applicable standards and regulations.

Contact Renishaw plc at www.renishaw.com/nci-5 for the full EC 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 (FCC Section 15.19)

This device complies with Part 15 of the FCC rules. Operation is subject to the following conditions:

1. This device may not cause harmful interference.
2. This device must accept any interference received, including interference that may cause undesired operation.

Information to user (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 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.

Information to user (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.

Information to user (FCC Section 15.27)

The user is cautioned that any peripheral device installed with this equipment, such as a computer, must be connected with a high-quality shielded cable to ensure compliance with FCC limits.

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-5 interface before carrying out maintenance on non-contact (NC) tool setting and tool breakage detection products.

Caution – Laser safety

The NCi-5 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 manufactirer, the protection provided by the equipment may be impaired.

CNC machine

CNC machine tools must always be operated by competent persons in accordance with the manufacturer's 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.

Do not rely on probe signals to stop machine movement.

NCi-5 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
Altitude	Maximum 2000 m
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).

Contents

Introduction

CNC machine tools using Renishaw NC1, NC3 or NC4 non-contact (NC) systems for tool setting or broken tool detection require an interface unit. The NCi-5 unit converts signals from the NC unit into voltage-free, solid state relay (SSR) outputs for transmission to the CNC machine control.

The NCi-5 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.

Only qualified persons should install and adjust switches on the interface. Remove the mains supply from the NCi-5 unit before removing the cover.

Power supply

The NCi-5 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 IEC 60950.

The supply to the NCi-5 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:

NC1 300 mA @ 12 Vdc, 130 mA @ 24 Vdc

NC3 or NC4 120 mA @ 12 Vdc, 70 mA @ 24 Vdc

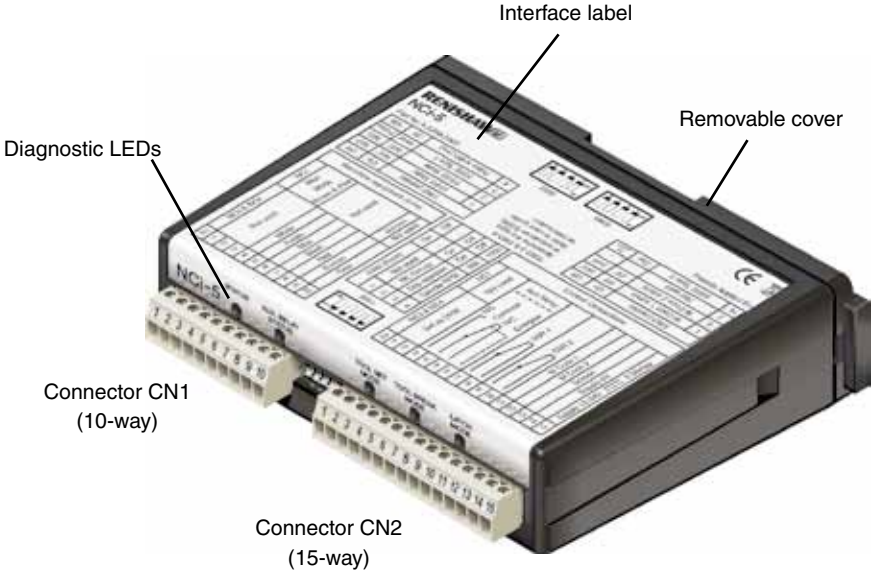
NOTE: To disconnect the power supply, remove the wires from the terminals.

Input / output over-current protection

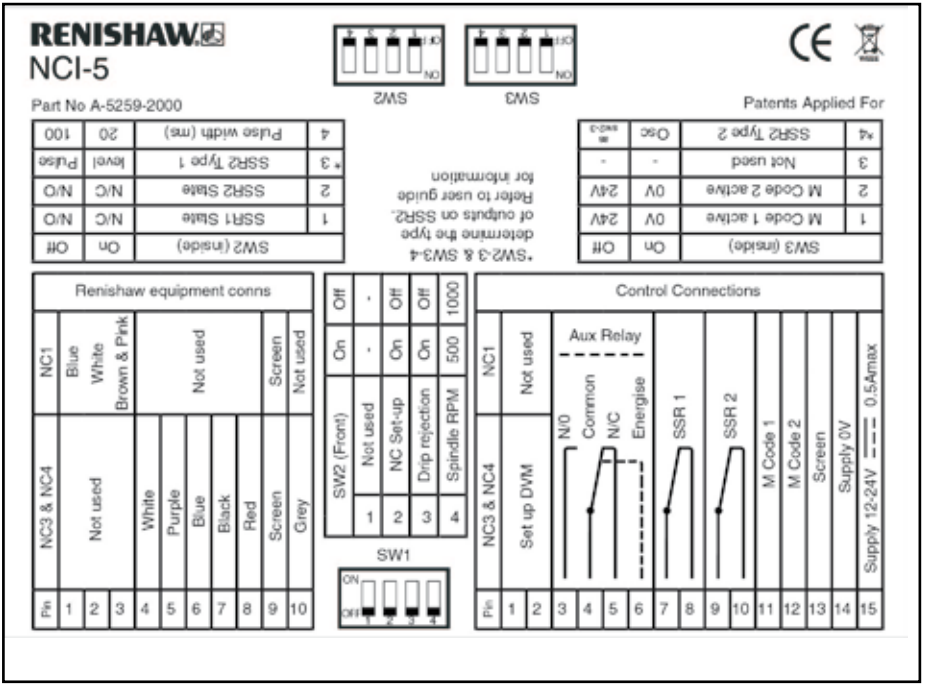
Each of the SSR (solid state relay) outputs is protected by a 50 mA resettable fuse.

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

The NC3 and NC4 are protected by a resettable current protection circuit.


Interface label
Removable cover
Diagnostic LEDs
Connector CN1
(10-way)
Connector CN2
(15-way)

NCi-5 interface label



10-way connector (CN1)

Connector CN1 is used to connect the non-contact unit to the NCi-5 interface. The interface automatically detects which NC unit has been connected.

15-way connector (CN2)

Connector CN2 is used to connect the NCi-5 interface to the CNC machine tool.

Terminals 1 – 2

Used to monitor the signal from the NC3 or NC4. Voltage range: 0 Vdc to 9 Vdc.

Terminals 3 – 6

This is an auxiliary output that can be used to control external devices. Devices may include an LED, a buzzer, an air blast.

This output can also be used with an NC1 separate system and NC4 systems 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 OMI/MI 12 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

Five LEDs are fitted on the front of the NCi-5 interface. These provide the operator with a visual indication of the system's status.

Status LED (when used with NC3 or NC4)

Following a successful set up, the Status LED indicates the status of the NC system to the operator. The colours and associated states are described in the table on page 1-7.

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

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

Status LED (when used with NC1)

Green	The probe is untriggered
Red	The probe is triggered

When the system is in the set-up mode, the LED displays red.

Aux. relay status LED

Green	Auxiliary relay energised
Not lit	Auxiliary relay not energised

Tool set mode LED

Green	Mode selected
Not lit	Mode not selected

Tool break mode LED

This is the high-speed tool breakage mode.

Green	Mode selected
Not lit	Not selected

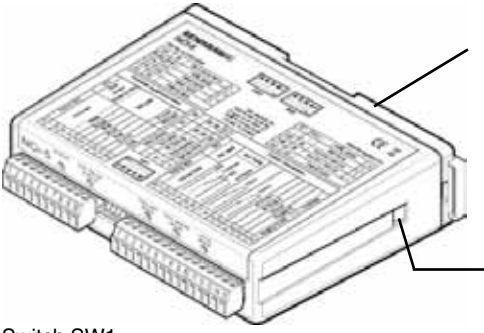
Latch mode LED

Green	Mode selected
Not lit	Not selected

LED colour	Tool setting mode	High speed broken tool detection mode	Latch mode
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.	Not applicable	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	The beam is clear. The probe is untriggered.	Not applicable	The beam is clear. The output is not latched.
Amber	The beam is partially blocked. ✷	The output is not latched. The beam is blocked.	The output is not latched. The beam is blocked by a rotating tool. ✷
Red	The beam is blocked. The probe is triggered.	The output is latched. The tool is broken.	The output is latched.
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.

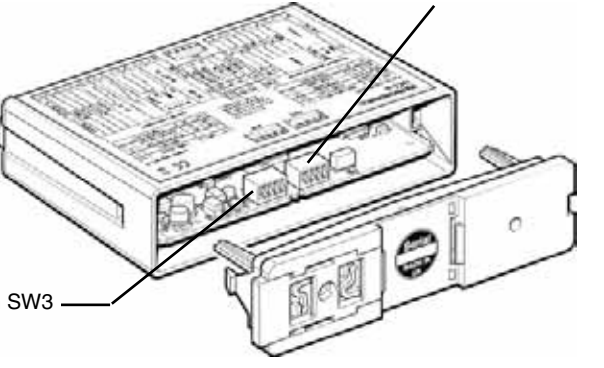
Refer to the publication *"NC4 installation and maintenance guide"*, Renishaw part number H-2000-5230, for details of the possible actions required.



Removable cover
(used to access switches SW2 and SW3. These switches only need to be accessed during installation)

Cover tab – depress to remove cover

Switch SW1
(used during installation and normal operation)



Switch SW2

Switch SW3

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 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. When setting up the NC1 or NC3, set this switch to On for 5 seconds then set it to Off. This automatically configures the NCi-5 interface to operate with the NC1 or NC3.
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.

Switch bank SW1 (continued)

4	Spindle rpm	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 Type 1	Level	Pulsed	Sets the SSR2 output to level or pulsed. Refer to page 1-13.
4	Pulse width	20 ms	100 ms	Sets the SSR2 pulsed output width to either 20 ms or 100 ms. It also sets the minimum pulse width of the SSR1 output 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 rpm of the tool is not exceeded.

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	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 1-13.

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**

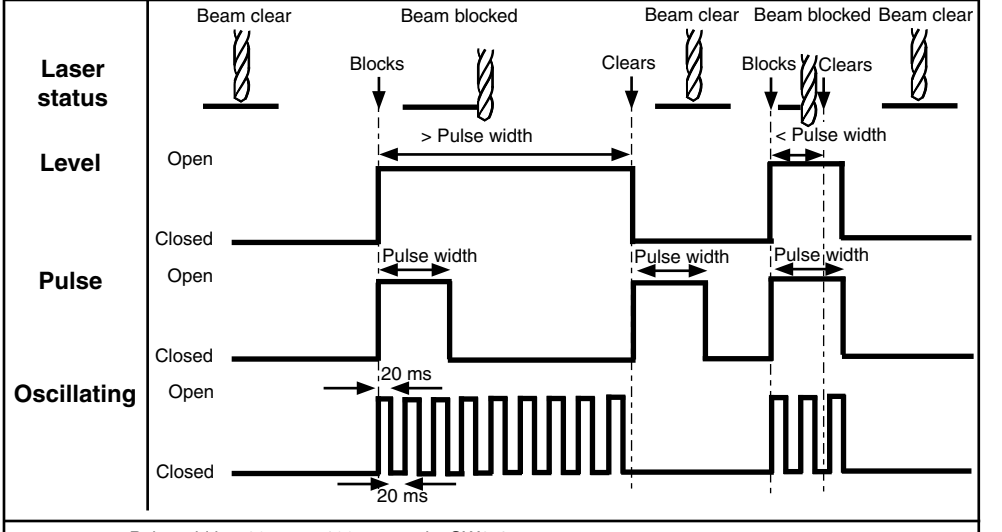
NOTE: On certain machine controllers there is a delay between the start of a measurement move and the machine controller becoming responsive to a change in trigger status. In this case use the oscillating output to ensure the trigger is detected when the machine controller becomes responsive.

Tool setting mode

This mode of operation allows functions such as system alignment, tool calibration, length and diameter tool setting, and thermal compensation tracking.

No M-codes are required.

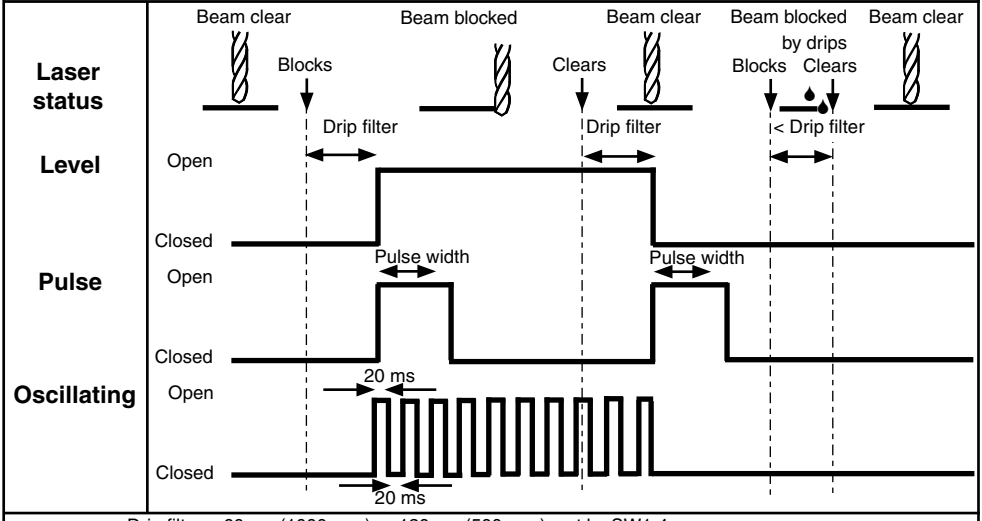
Tool setting without drip rejection



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

Diagrams shown for normally closed, invert for normally open

Tool setting with drip rejection



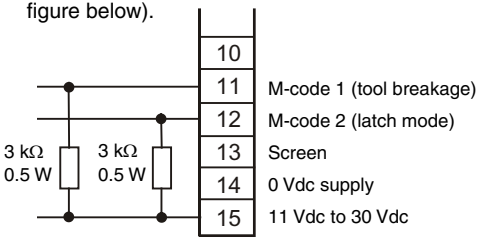
Drip filter = 60 ms (1000 rpm) or 120 ms (500 rpm), set by SW1-4
Pulse width = 20 ms or 100 ms, set by SW2-4
Diagrams shown for normally closed, invert for normally open

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.

An M-code is required to activate the tool breakage detection mode. The M-code must supply a constant voltage of between 11 Vdc and 30 Vdc to CN2-11. To deactivate the tool breakage function, the 11 Vdc to 30 Vdc supply must be removed from CN2-11.

These selection levels can be inverted using switch SW3-1, so that 0 Vdc is used to activate tool breakage detection 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 (see the figure below).



Latch mode

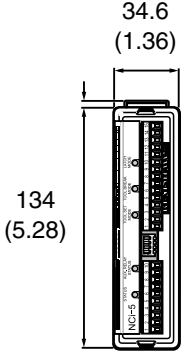
This mode of operation allows functions such as checking tools for missing inserts and profile checking.

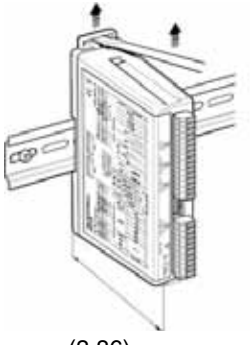
An M-code is required to activate the latch mode. The M-code must supply a constant voltage of between 11 Vdc and 30 Vdc to CN2-12. To deactivate the latch mode function, the 11 Vdc to 30 Vdc supply must be removed from CN2-12.

These selection levels can be inverted using switch SW3-2, so that 0 Vdc is used to activate tool breakage detection 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 between 11 Vdc and 30 Vdc (see the figure, left).

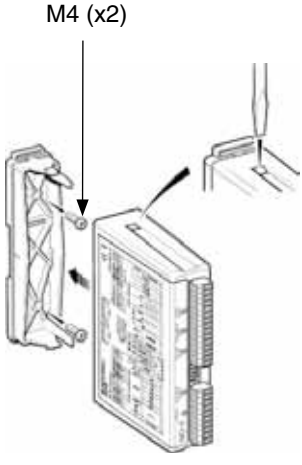
NOTE: If the status LED flashes red and green this indicates that the NCi-5 is in a mode that is not specified (both M-code 1 and M-code 2 have been activated).

Information about the software for these cycles is available from www.renishaw.com

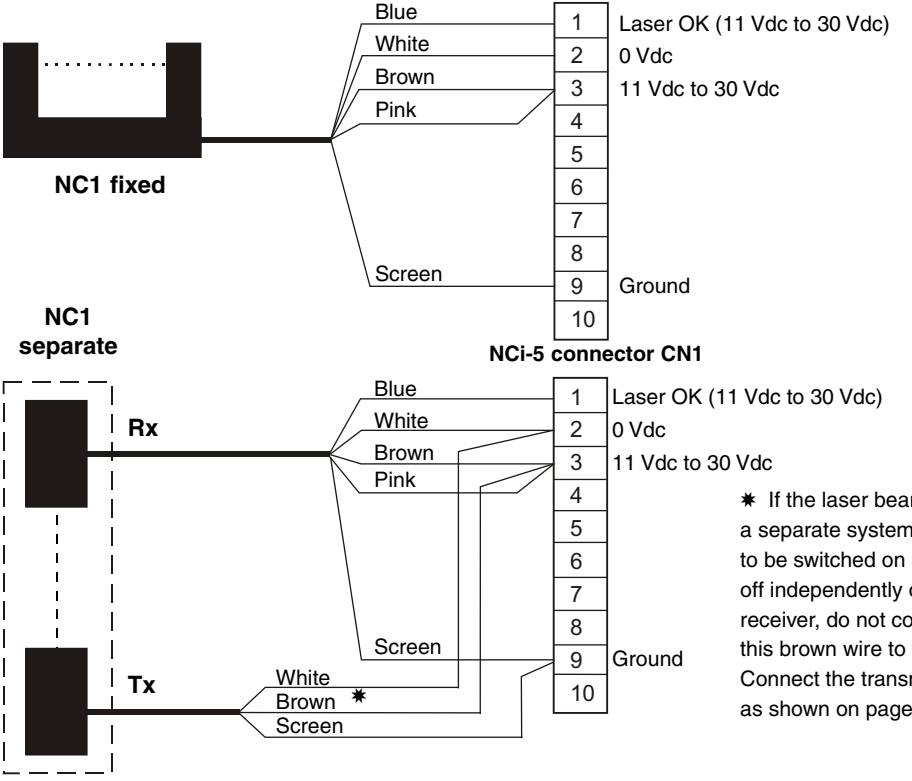




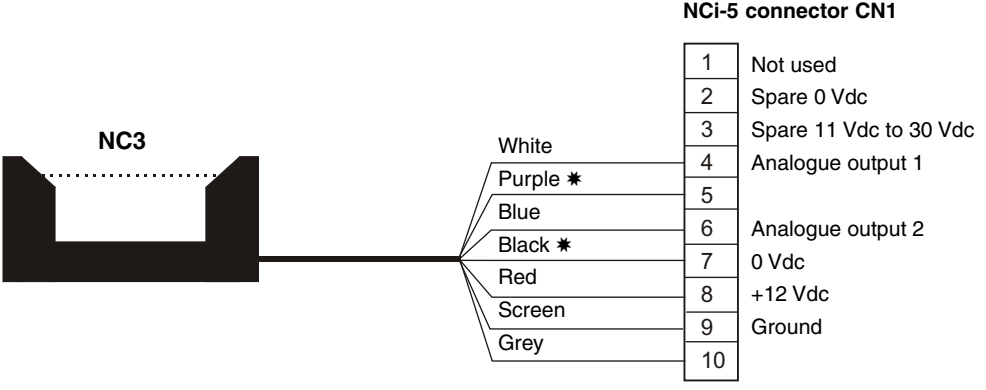
Standard DIN rail mounting



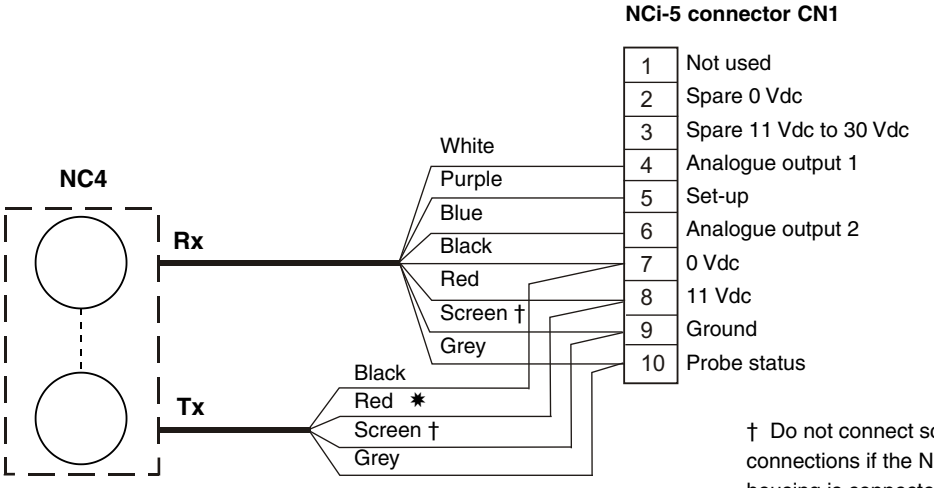
Alternative mounting



✷ If the laser beam on a separate system is to be switched on and off independently of the receiver, do not connect this brown wire to pin 3. Connect the transmitter as shown on page 1-22.

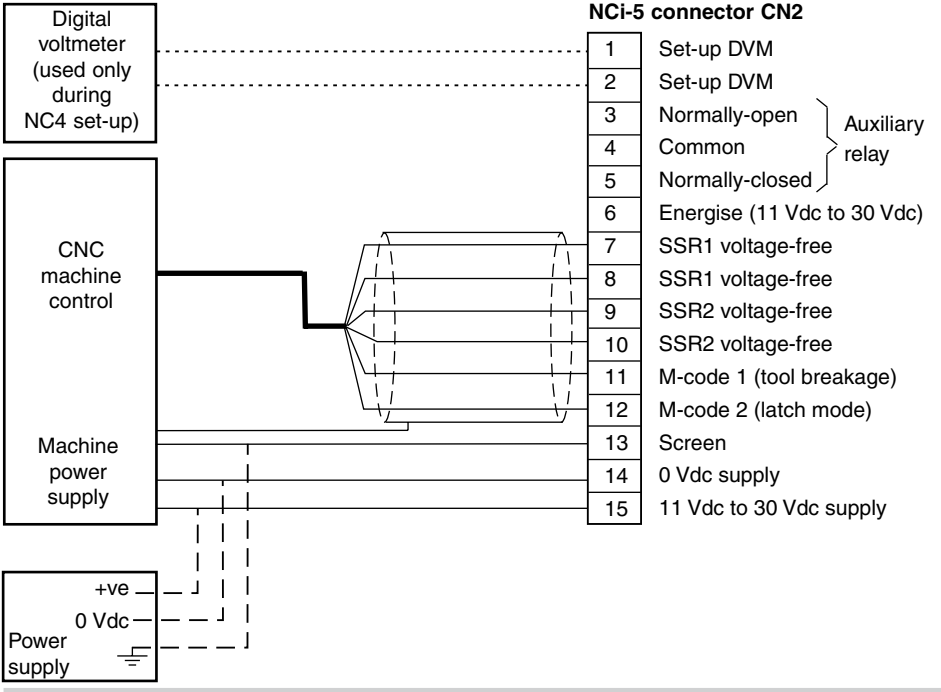


✷ Note that some early NC3 units do not have a purple coloured wire but have one additional black wire. Both black wires should be connected to pin 7.



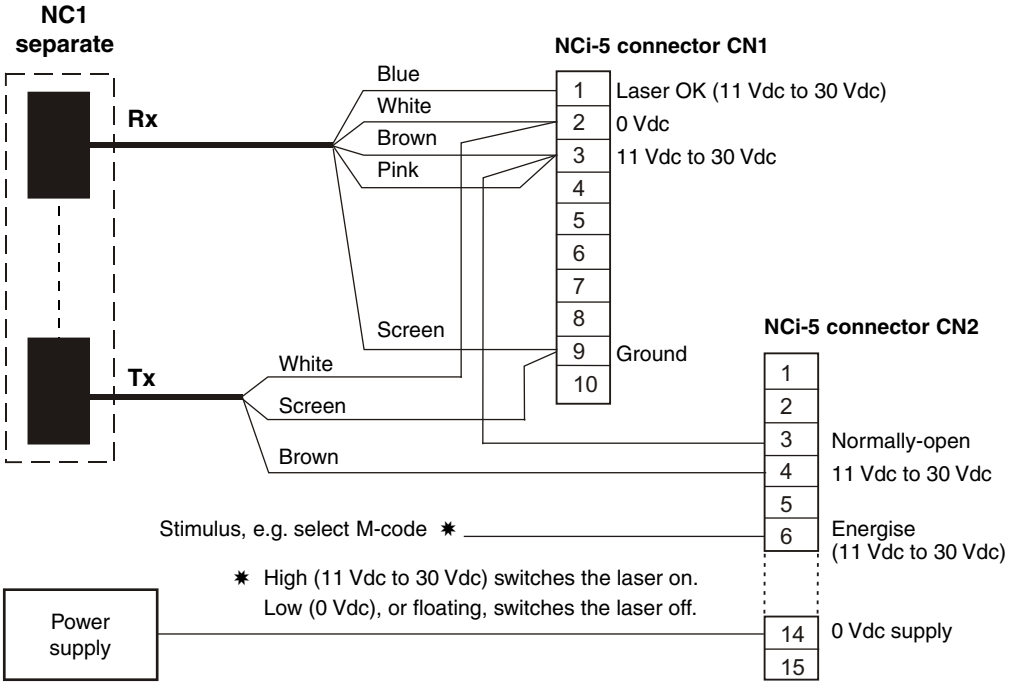
† Do not connect screen connections if the NC4 housing is connected to the machine ground reference (i.e. $R \leq 1\Omega$).

✷ 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 1-23.

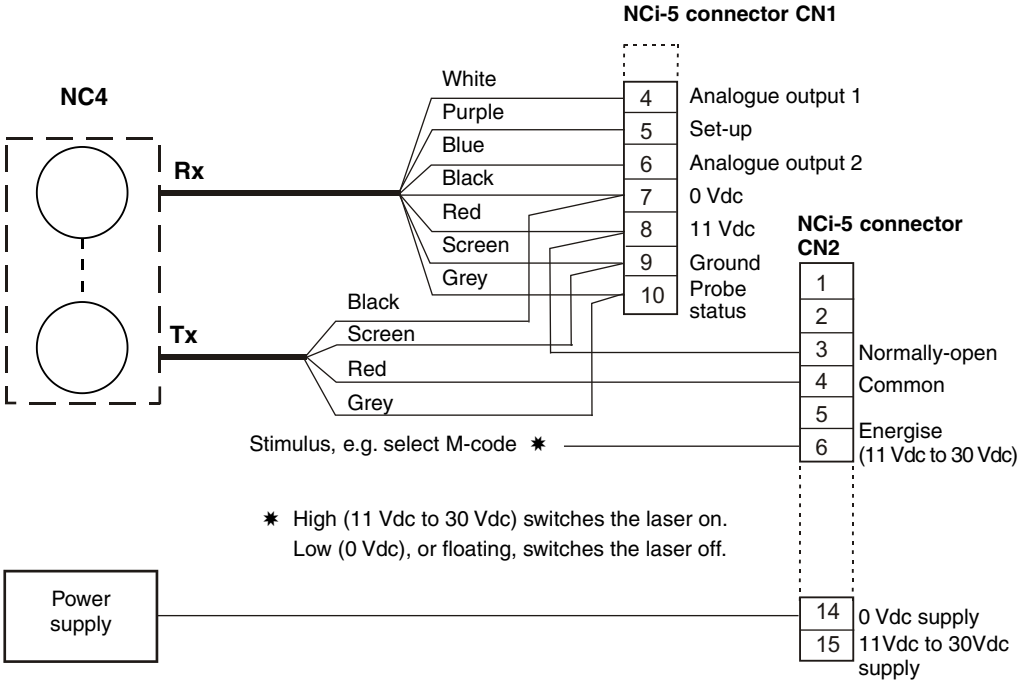


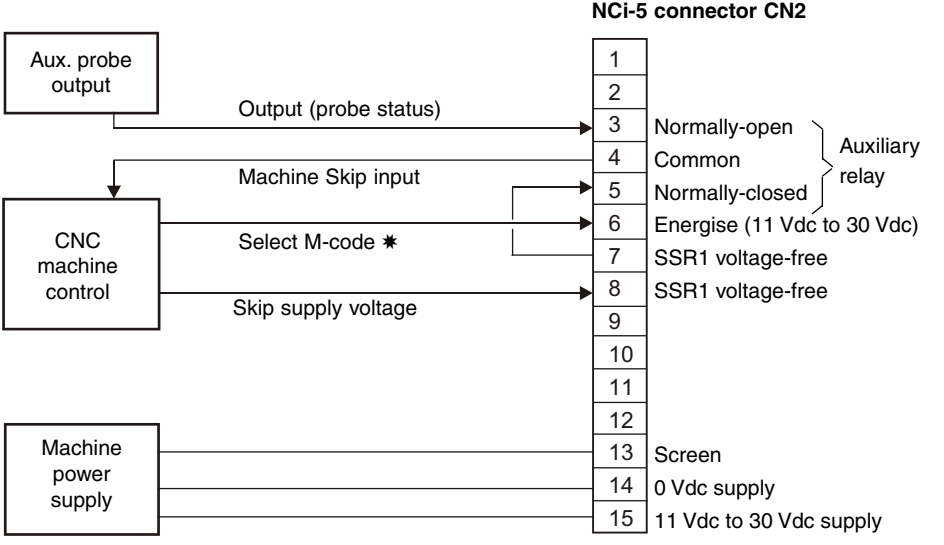
CAUTION: If using SSR2 as an oscillating or pulsed output for a trigger signal to the control, the level output SSR1 must be used to guarantee a reliable probe status check.

This arrangement allows the transmitter of an NC1 separate system to be switched on and off independently of the receiver.

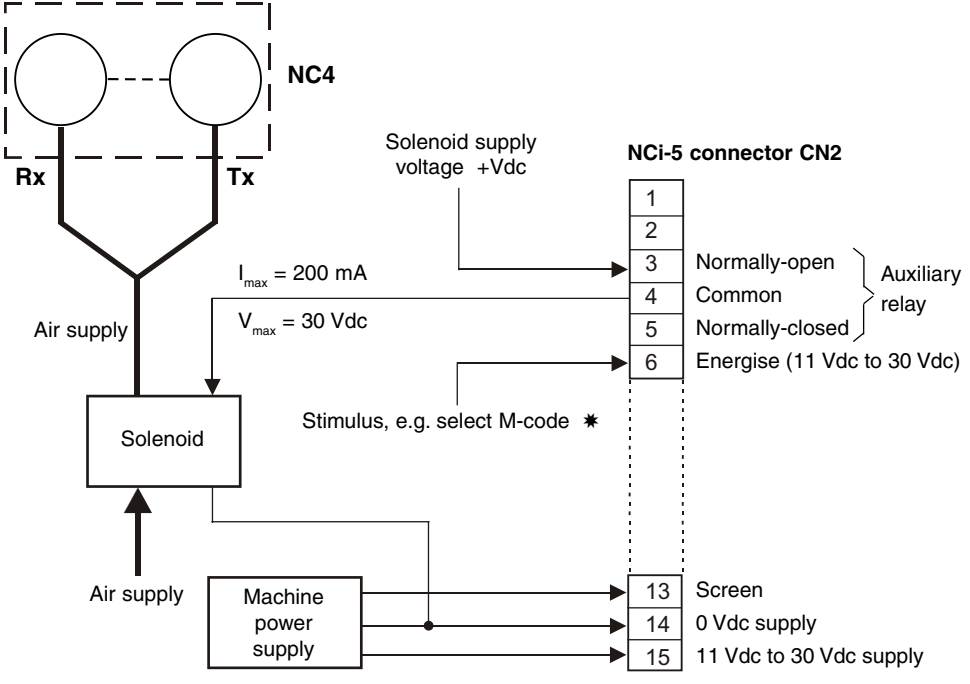


This arrangement allows the transmitter of an NC4 system to be switched on and off independently of the receiver.





✷ 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.



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

Type	Part number	Description
NCi-5 interface	A-5259-2000	NCi-5 interface and box with DIN rail mounting and two terminal blocks.
NCi-5 terminal block (10-way)	P-CN25-1053	10-way socket terminal for NCi-5 interface.
NCi-5 terminal block (15-way)	P-CN25-0009	15-way socket terminal for NCi-5 interface.

Renishaw plc
New Mills, Wotton-under-Edge,
Gloucestershire, GL12 8JR
United Kingdom

T +44 (0)1453 524524
F +44 (0)1453 524901
E uk@renishaw.com
www.renishaw.com

RENISHAW
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