Installation guide and parts list
H-2000-5048-08-A

RENISHAW
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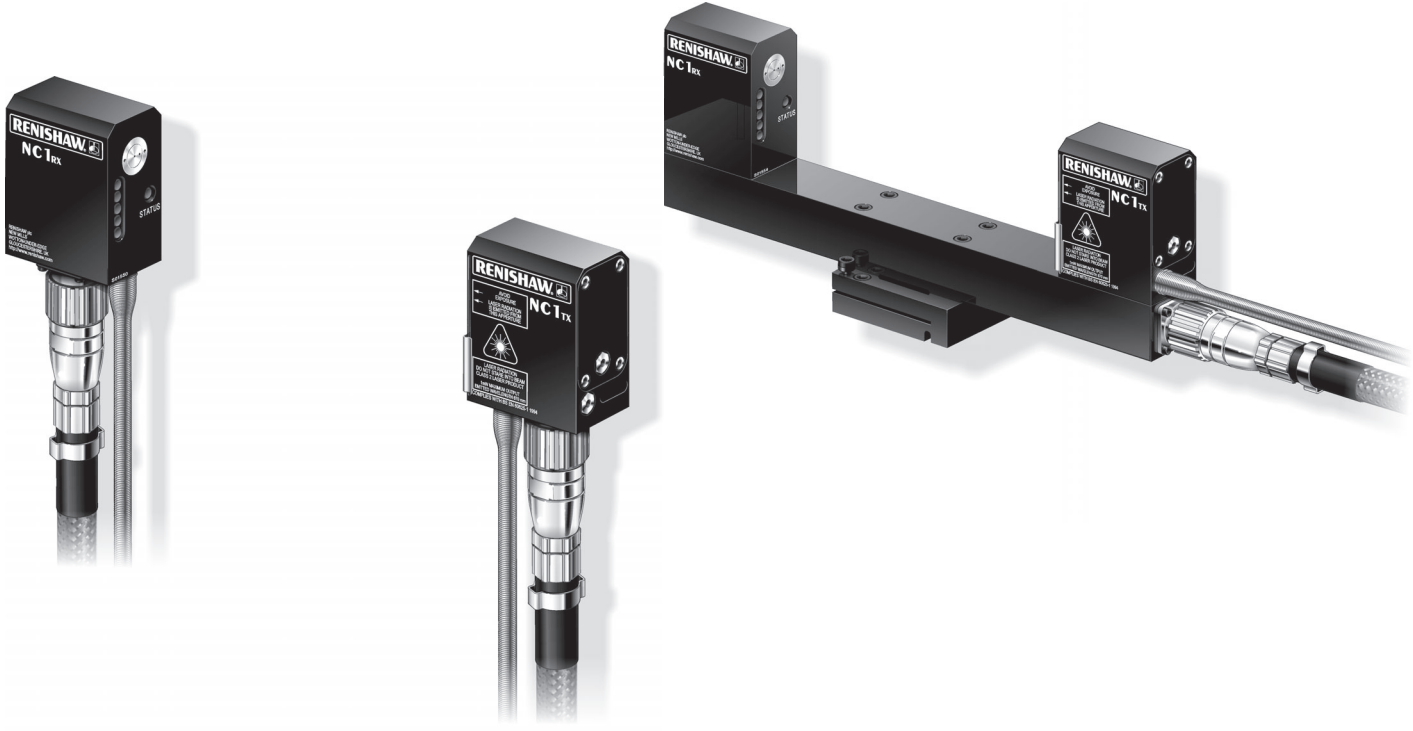
NC1 non-contact tool setting systems



Disclaimer

Considerable effort has been made to ensure that the contents of this document are free from inaccuracies and omissions. However, Renishaw makes no warranties with respect to the contents of this document and specifically disclaims any implied warranties. Renishaw reserves the right to make changes to this document and to the product described herein without obligation to notify any person of such changes.

Trademarks

MicroHole™ is a trademark of Renishaw plc

All other brand names and product names used in this document are trade names, service marks, trademarks, or registered trademarks of their respective owners.

Renishaw part no: H-2000-5048-08-A

Issued: 03 2004

Warranty

Equipment requiring attention under warranty must be returned to your supplier. No claims will be considered where equipment has been incorrectly installed or misused, or where repairs or adjustments have been attempted by unauthorised persons. Prior consent must be obtained in instances where Renishaw equipment is to be substituted or omitted. Failure to comply with this requirement will invalidate the warranty.

Patents

Features of the NC1 non-contact tool setting system, and similar products, are subject to the following patents and patent applications:

CN 1339040A
EP 1050368
EP 1208351
JP P2000-346614
TW NI-153868
TW NI-178572
US 2003-0060919
US 6,496,273 B1
US 6,635,894 B1
WO 01/38822
WO 01/55670

NC1 non-contact tool setting systems

Installation guide and parts list

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CE

EC DECLARATION OF CONFORMITY

Renishaw plc declare that the product:-

Name	**Description**
NC1	Non-contact tool setting system - transmitter and receiver

has been manufactured in conformity with the following standards:-

BSEN 61326:1998/ A1:1998/A2:2001	Electrical equipment for measurement, control and laboratory use - EMC requirements. Immunity to annex A - industrial locations. Emissions to class A (non-domestic) limits.
EN 60825-1:1993/ A1:1997/A2:2001	Safety of laser products. Part 1: Equipment classification, requirements and user's guide

and that it complies with the protection requirements of directives (as amended):

89/336/EEC	Electromagnetic compatibility (EMC)
73/23/EEC	Low voltage

The above information is summarised from the full Declaration of Conformity. A copy is available from Renishaw on request.

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 the electrical power before carrying out maintenance of the NC1 system.

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.

Contents

CAUTION: Laser safety
The laser used in the Renishaw NC1 non-contact tool setting system emits continuous visible red light at a wavelength of 670 nm and has a power output of less than 1 mW. The NC1 is classified as:

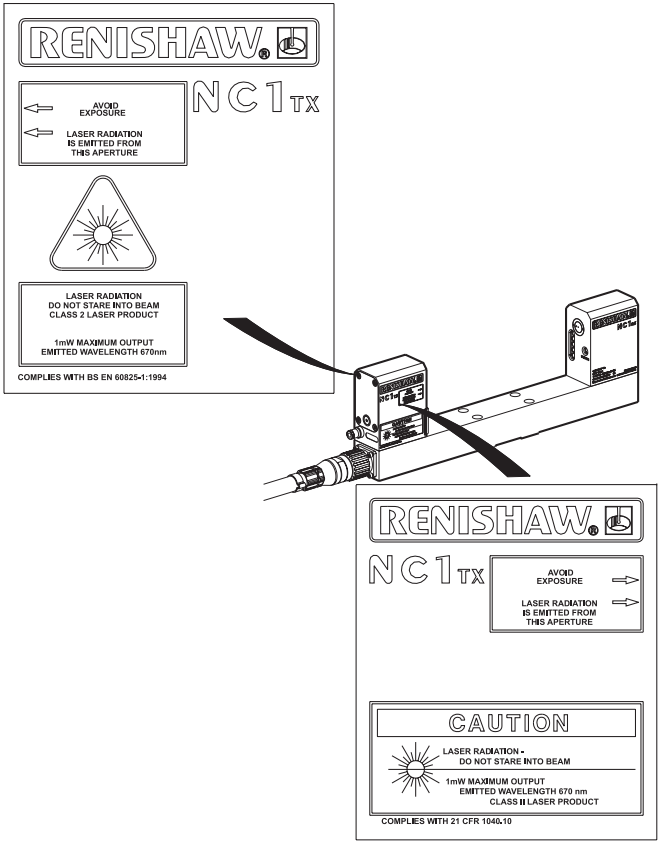
- A Class 2 product as defined by European Laser Safety Standard EN 60825-1:1993/A1:1997/A2:2001
- A Class II product as defined by the US Code of Federal Regulation 21 CFR 1040.10.

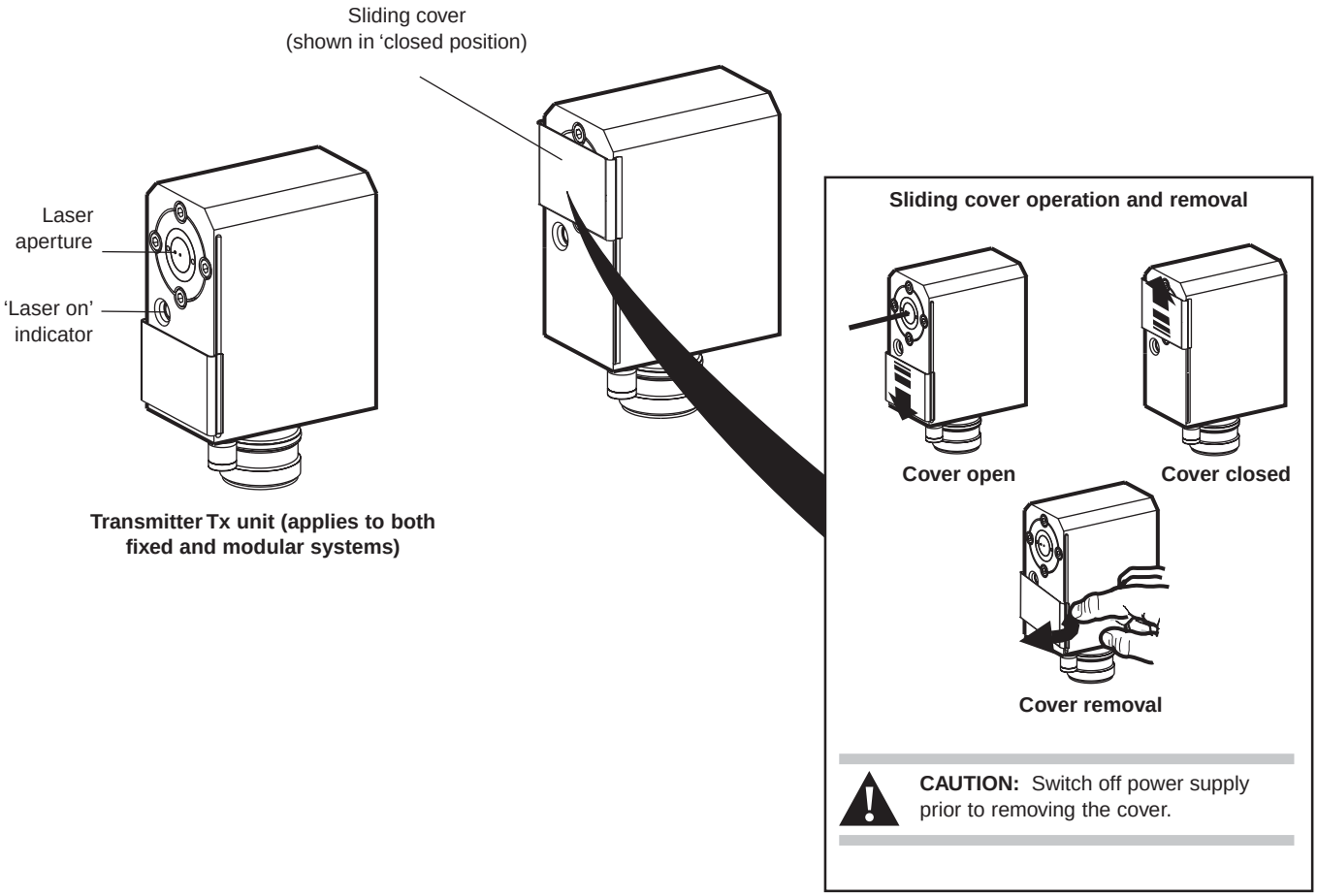
The standard EN 60825-1 directs to attach a laser warning label and explanatory label.

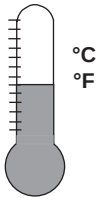
A warning label and explanatory label are permanently fixed to the transmitter (Tx) housing. A sticker is provided for attachment outside the machine.

Safety rules:

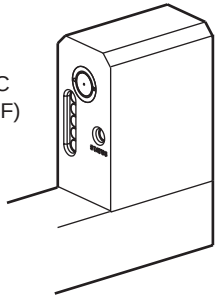
- Avoid direct eye exposure.
- Avoid visual exposure to the beam with optical appliances.
- Instruct all operators about the hazards of direct eye contact, or long skin exposure, with the laser.
- Attach the laser warning label supplied in an easily visible location on the machine.



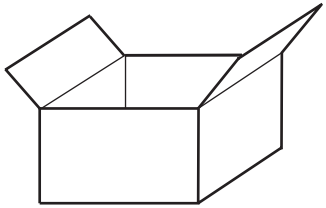

Sliding cover
(shown in ‘closed position)
Laser
aperture
‘Laser on’
indicator
Transmitter Tx unit (applies to both
fixed and modular systems)
Sliding cover operation and removal
Cover open
Cover closed
Cover removal
CAUTION: Switch off power supply
prior to removing the cover.

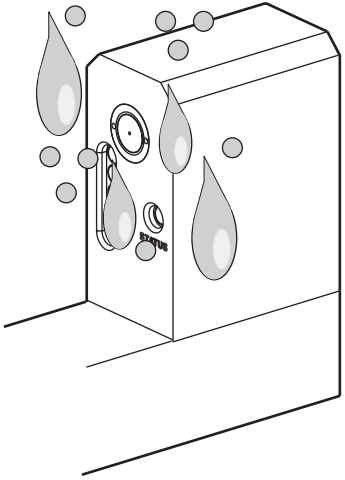


+10 °C to +40 °C
(+50 °F to +104 °F)



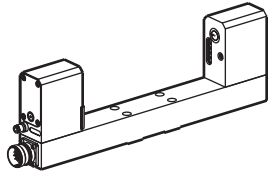
-20 °C to +70 °C
(-4 °F to +158 °F)





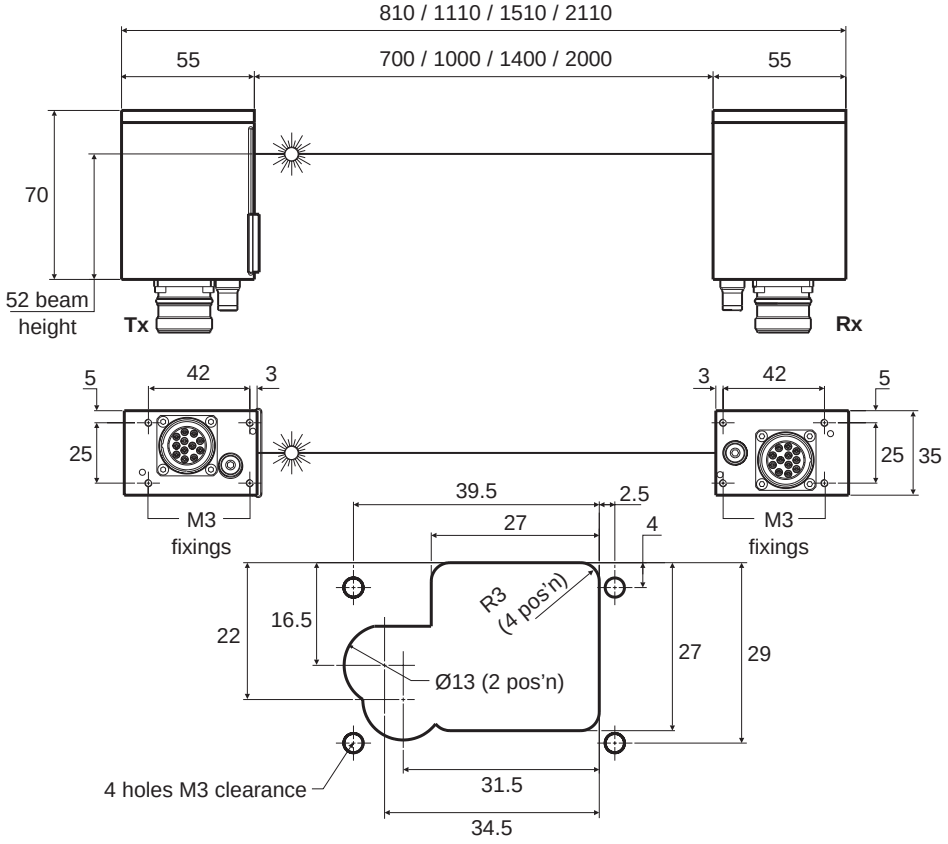
IPX8 (air on)

2σ repeatablity



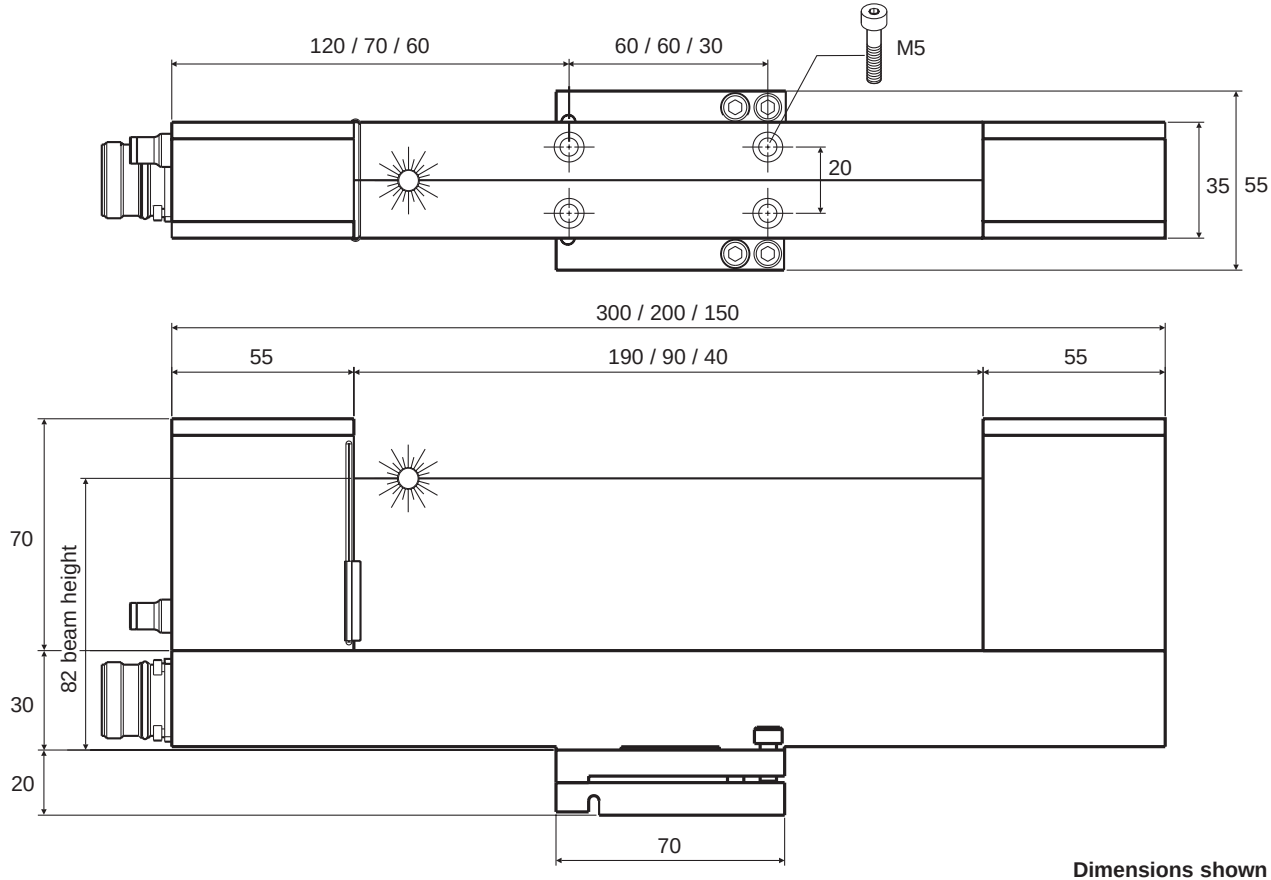
±1µm

±2µm

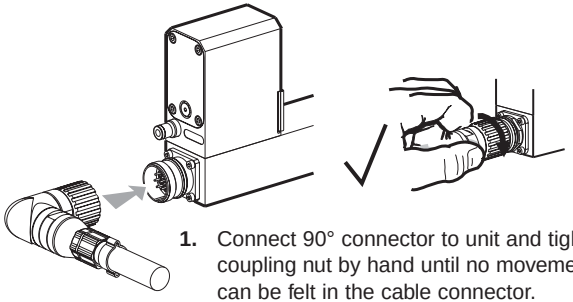


Machine details for mounting plate

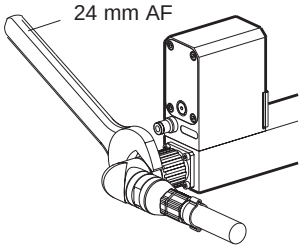
Dimensions shown in mm



Dimensions shown in mm

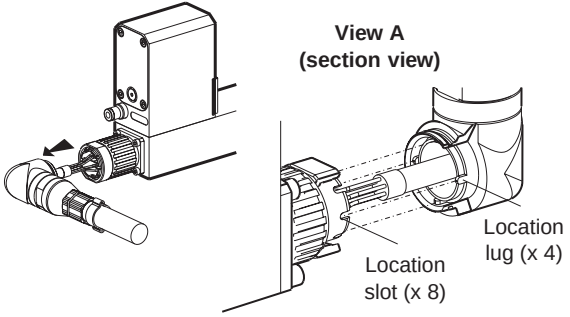


1. Connect 90° connector to unit and tighten coupling nut by hand until no movement can be felt in the cable connector.

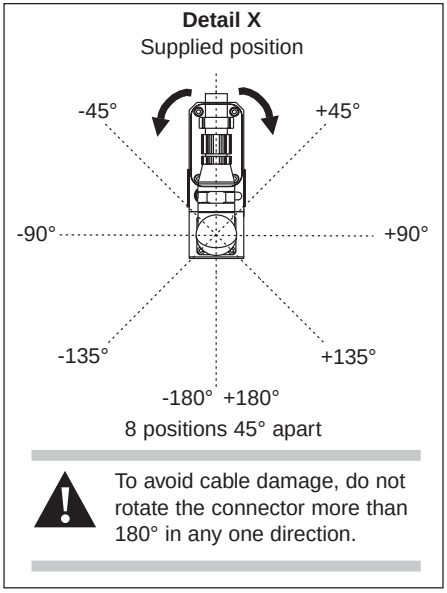


2. Release locking nut from right angled shell and gently separate components.

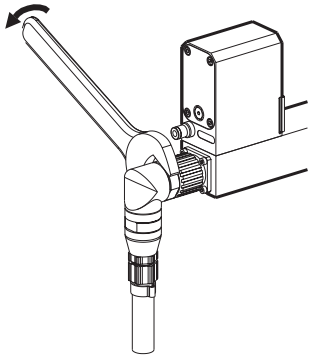
Coupling nut must be fully tightened to ensure an effective seal otherwise damage will be caused by coolant ingress.



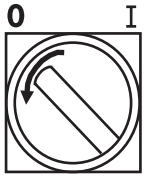
3. Rotate 90° connector to required position (see detail X).



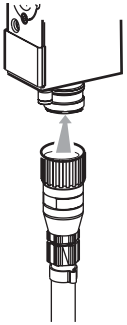
To avoid cable damage, do not rotate the connector more than 180° in any one direction.



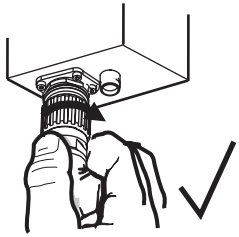
4. Tighten locking nut.



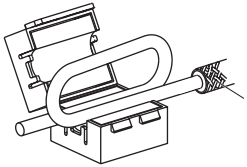
1. Switch off power supply.



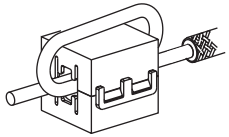
2. Push connectors together.



3. Rotate coupling nut clockwise to secure connector in position until no movement can be felt in the cable connector.

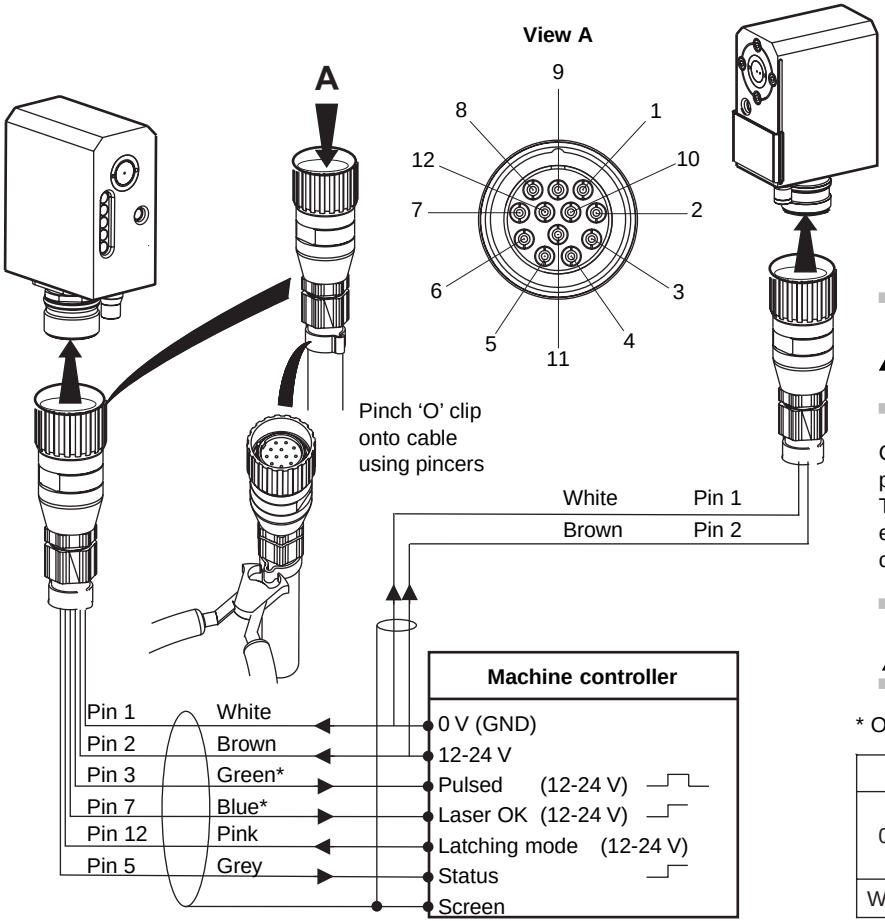


4. Loop cable, as near steel braid as possible, and place ferrite as shown.



5. Snap ends of ferrite together to secure cable in position.

Coupling nut must be fully tightened to ensure an effective seal otherwise damage will be made by coolant ingress.



To use 'latching mode', remove 12-24 V supply from the pink wire via an 'M-code' or I/O. To reset 'latching mode', reapply 12-24 V to the pink wire. When 'latching mode' is not required, the pink wire must be connected to the 12-24 V supply.

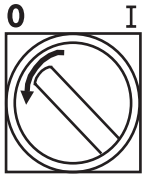
If the cable conduit moves, relative to the NC1 unit, suitable strain relief must be provided.

Cable comprises: 7 x 0.14 mm² core, screened, polyurethane outer sheath, 6.4 mm outside diameter. The cable screen must be connected to the machine earth. For extra functionality, the NC1 can be connected to the machine via the NCi-4 interface.

Volts in (e.g. 18 V) = volts out (e.g. 18 V).

* Optional

1	2	3*	7*	12	5
0 V	12-24 V	Pulsed	Laser OK	12-24 V latching mode	Status
White	Brown	Green	Blue	Pink	Grey



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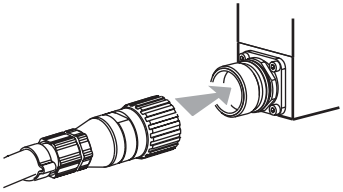

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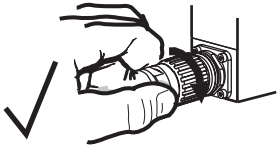

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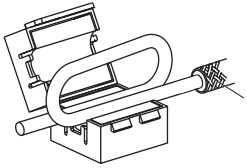

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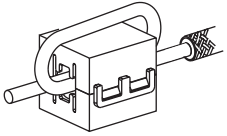

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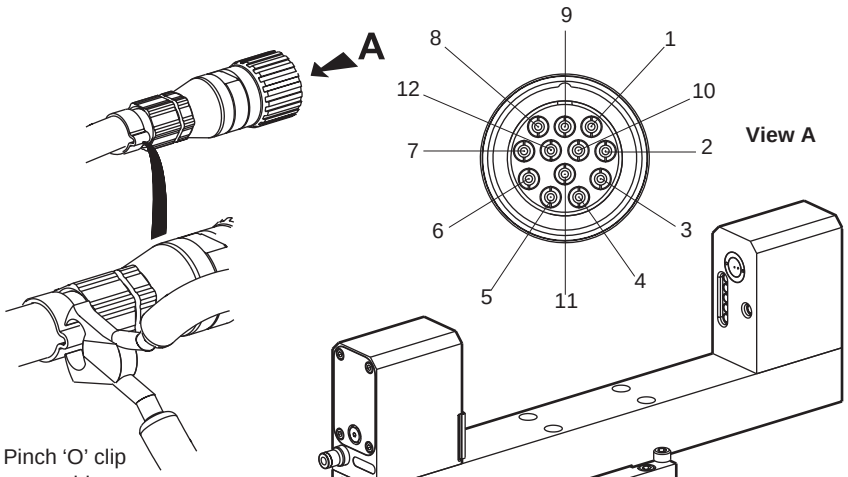

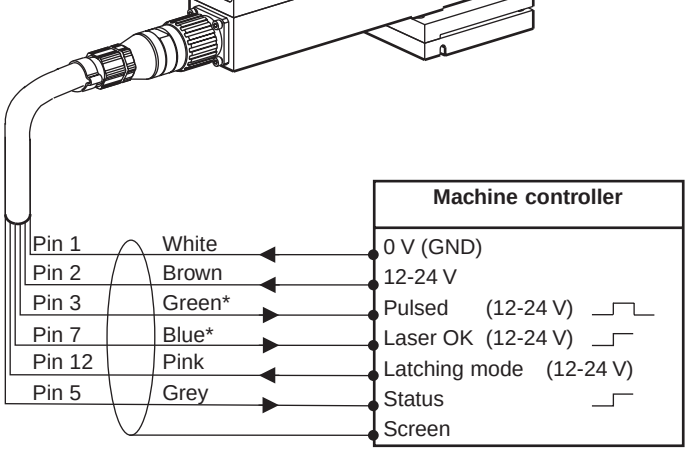

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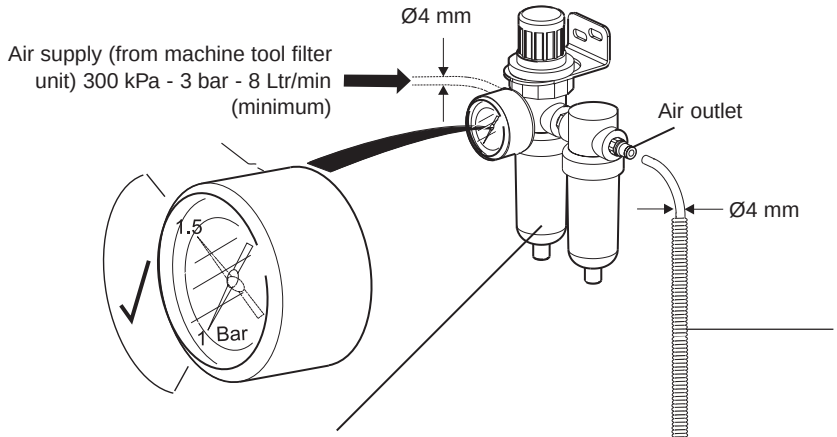
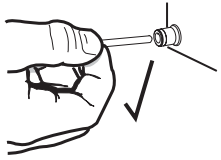
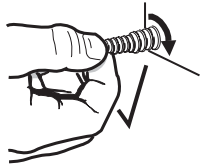




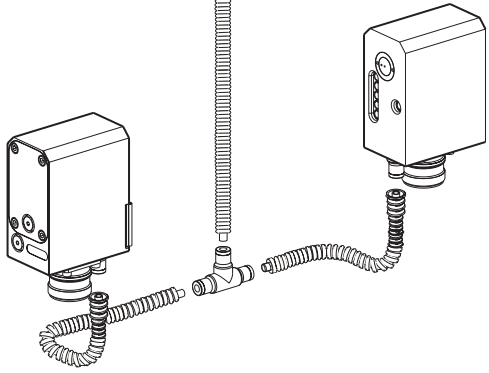
Connect airline by hand (push fit)

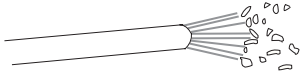


Screw spring conduit over air connector

Protect all airlines with machine tool cabinet using spring conduit supplied.

Keep accumulated liquids below filter element. Inspect elements regularly and replace annually (order part number P-FI01-S002)





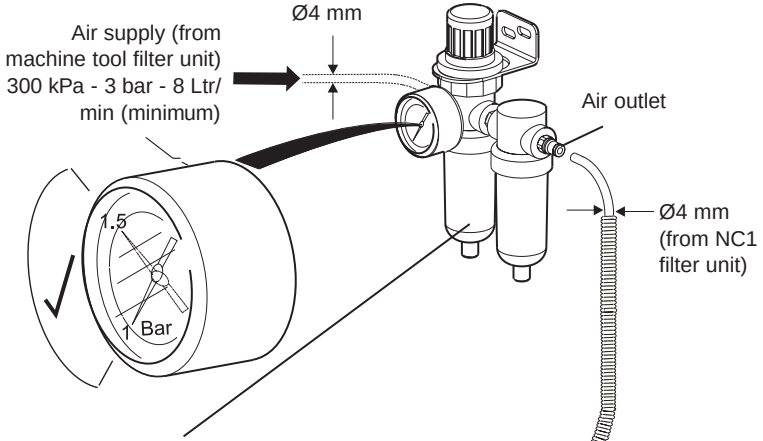
Purge air supply to dislodge debris from pipework prior to connection as small particles may block the air nozzle.

Air supply to NC1 filter unit must conform to ISO 8573-1: Air quality of class 5.7.

Air supply to NC1 units must conform to ISO 8573-1: Air quality of class 1.7.2. The air regulator must be installed up-stream of any auto shut-off valve or mist lubricator.

It is recommended that the air is permanently switched on otherwise coolant may enter the NC1.

Air must be switched on prior to powering up the units.



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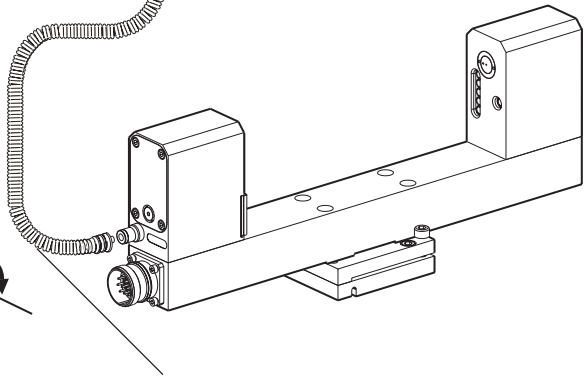

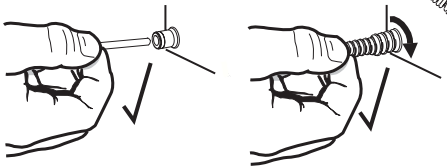

Connect airline by hand (push fit)

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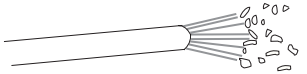
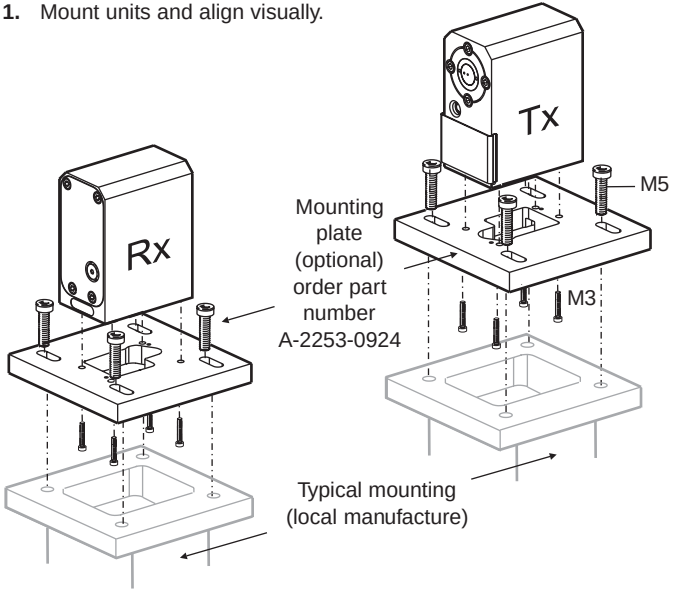
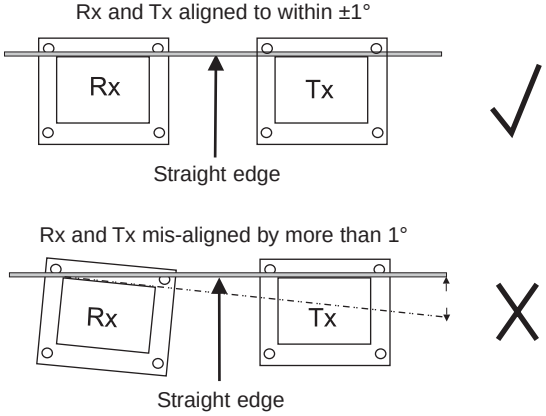


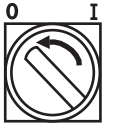
Purge air supply to dislodge debris from pipework prior to connection as small particles may block the air nozzle.

1. Mount units and align visually.

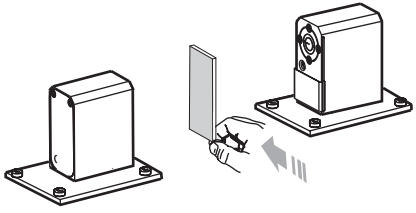




Ensure the Rx, and especially the Tx, are firmly mounted to a rigid surface. Ensure also that any surface used will be free of vibration. Air must be switched on before commencing set up and alignment.



2. Ensure power is switched off.



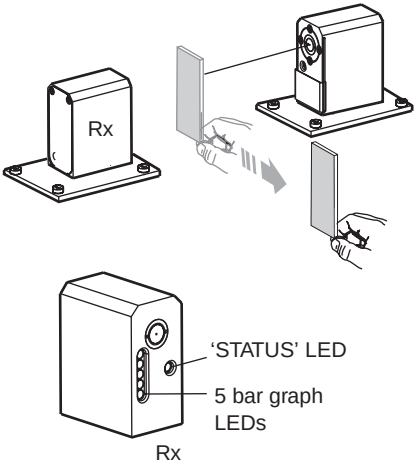
3. Place non-reflective object between Tx and Rx units.

4. Switch on power.

Wait 5 seconds

Go to step 5

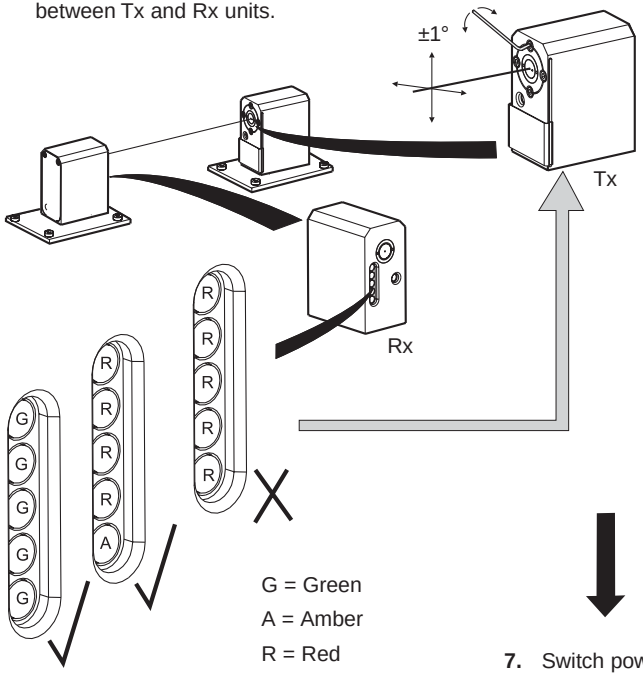
5. Remove obstruction to place Rx in set-up mode (indicated by 'STATUS' LED illuminating orange). When in 'SET-UP MODE', the probe status output toggles at approximately four times per second.



If 'STATUS' LED fails to illuminate, or bar graph LEDs fail to flash, repeat steps 2 to 5.

6. Adjust beam alignment between Tx and Rx units.

Tighten to 1.3 Nm



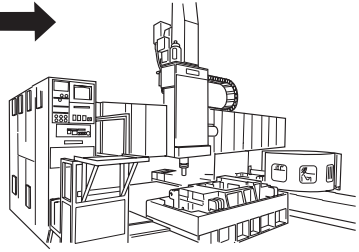
G = Green
A = Amber
R = Red

If the Rx unit receives too much light its LED display will begin to scroll red. The Tx and Rx are too close - return to supplier if a different system is required.

7. Switch power off.

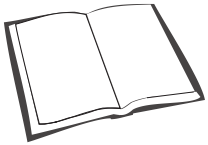
Go to step 8

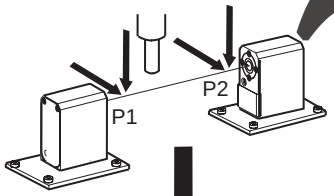
8. Switch on power and check beam alignment between Rx and Tx units (correct alignment is indicated by the 'STATUS' LED illuminating green).



9. Run beam alignment macro.

Refer to your NC1 non-contact tool setting system programming guide (beam alignment macro)

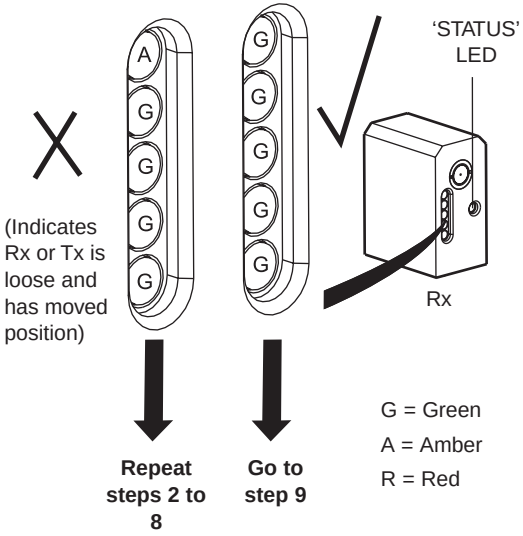




For tool measurement:
Spindle axis (P2-P1) ≤10 µm
Radial axis (P2-P1) ≤1 mm

For tool breakage only:
Spindle axis (P2-P1) ≤100 µm
Radial axis (P2-P1) ≤5 mm

Go to step 10



(Indicates Rx or Tx is loose and has moved position)

Repeat steps 2 to 8

Go to step 9

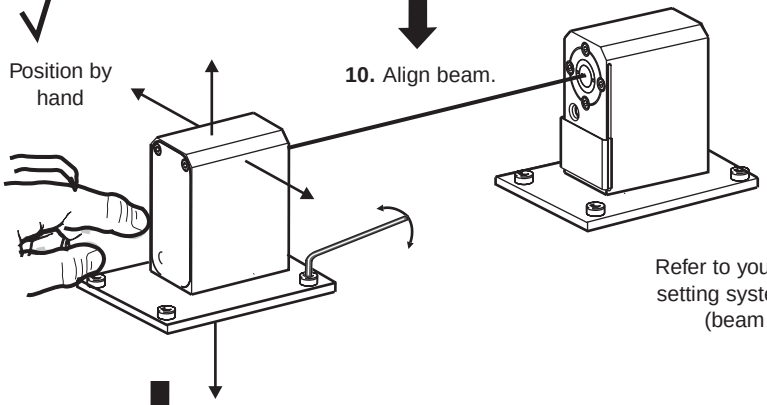
G = Green
A = Amber
R = Red

If the NC1 is to be used for tool breakage detection only, it is not necessary for the laser beam to be parallel to the machine's axes.

The NC1 requires 3 seconds after power up before it is ready for measuring. It must be powered up with line of sight between the Tx and Rx. If the beam is blocked during power up the NC1 will enter set-up mode (status LED illuminating orange). Switch off power, remove the blockage and switch power back on. NC1 will then be ready for measuring (status LED illuminating green).

Position by hand

10. Align beam.



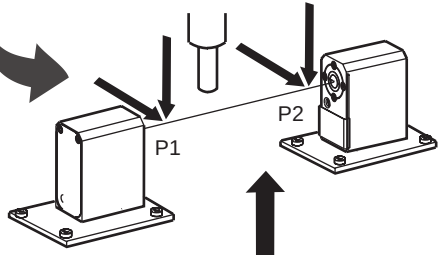
NO

YES
(set-up complete)

For tool measurement:
Spindle axis (P2-P1) ≤10 µm
Radial axis (P2-P1) ≤1 mm

For tool breakage only:
Spindle axis (P2-P1) ≤100 µm
Radial axis (P2-P1) ≤5 mm

Refer to your NC1 non-contact tool setting system programming guide (beam alignment macro)

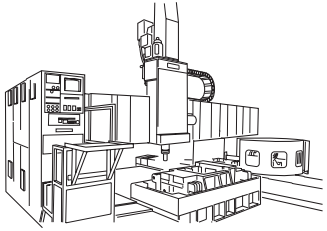


It is recommended that the distance between P1 and P2 is at least the size of the maximum tool diameter.

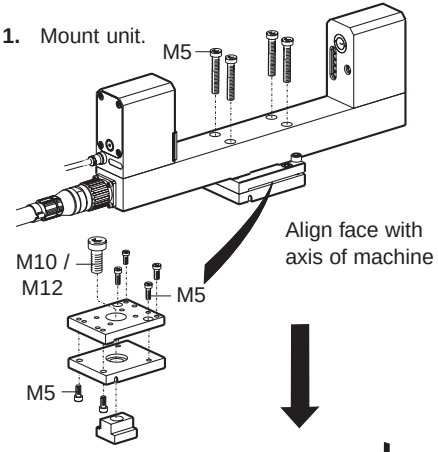
Repeat steps 2-8 to re-check beam alignment between Tx and Rx units.

11. Re-check alignment.

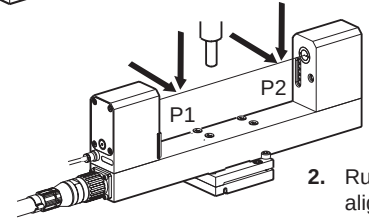
If length measurements are made off-centre near the outside diameter of the tool then the beam does not need to be accurately aligned in the spindle axis (P2 - P1) ≤ 100µm



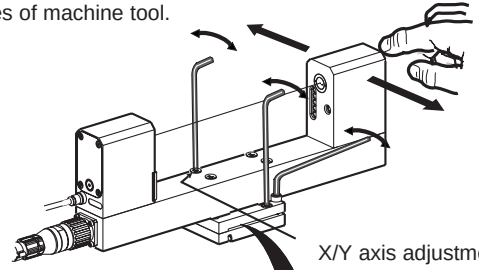
1. Mount unit.

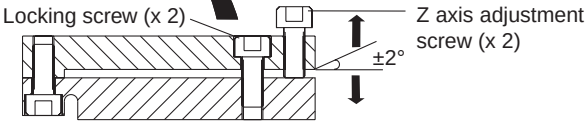


2. Run beam alignment macro.



3. Align unit to axes of machine tool.





To align NC1 to Z axis of machine slacken 2 locking screws and adjust 2 adjustment screws. When alignment is achieved, gently tighten the 2 locking screws.
Re-check alignment by returning to step 2.

NO

Refer to your NC1 non-contant tool setting system programming guide (beam alignment macro)

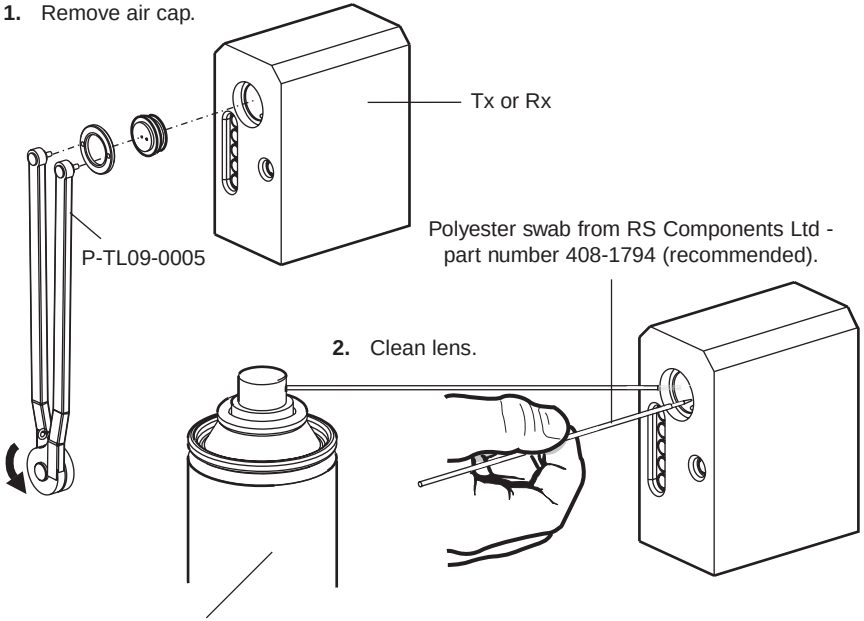
For tool measurement:
Spindle axis (P2-P1) ≤10 µm
Radial axis (P2-P1) ≤1 mm

For tool breakage only:
Spindle axis (P2-P1) ≤100 µm
Radial axis (P2-P1) ≤5 mm

YES
(set-up complete)

Prior to cleaning the lens, ensure both the power and air supplies have been switched off.

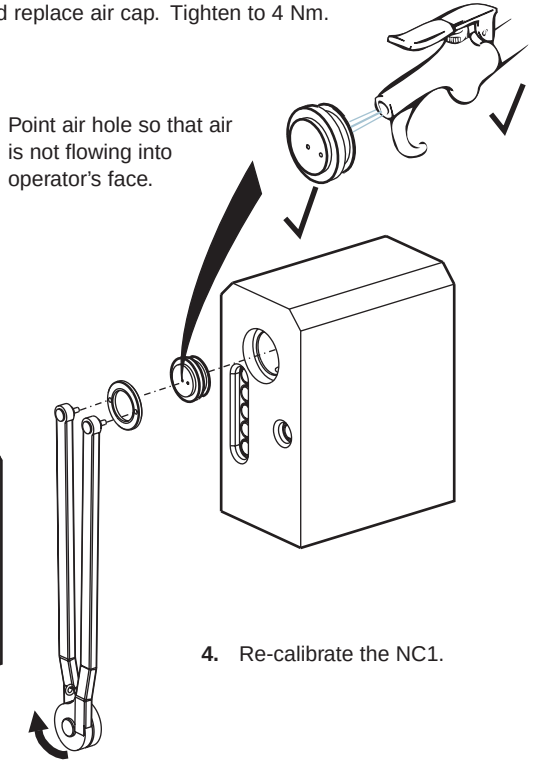
1. Remove air cap.



Cleaning solvent from RS Components Ltd - part number 266-0856 (recommended). Alternatively, a mixture of 75% isopropyl alcohol with 25% water may be used.

To order the above parts, please contact RS Components Ltd at: www.rs-components.com.

3. Clean and replace air cap. Tighten to 4 Nm.



4. Re-calibrate the NC1.

The Rx cap has a brass insert. As the Tx air cap has no insert, it is important that the air caps are not substituted.

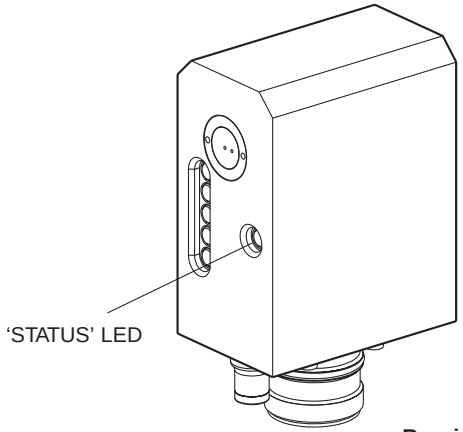
When the NC1 is switched on, the ‘STATUS’ LED flashed four times to provide a visible indications of the system output dipswitch settings of switches SW1, SW2, SW3 and SW4.

The ‘STATUS’ conditions during the flash sequence are as follows:

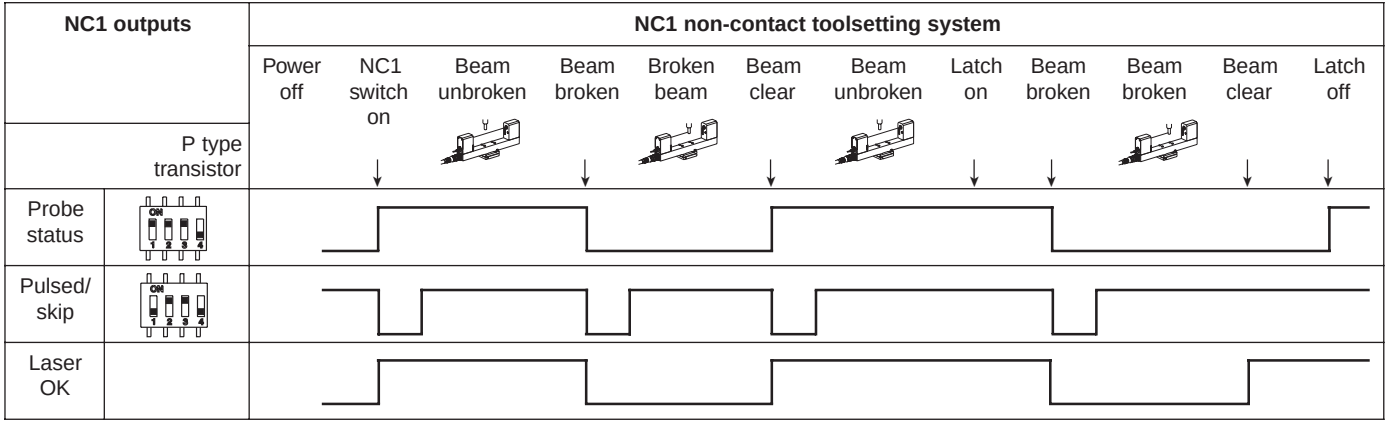
Flash sequence	Switch number	LED red (switch OFF)	LED green (switch ON)
1	SW1	Outputs inverted	Outputs non-inverted.
2	SW2	Switch set to OFF.	Switch set to ON.
3	SW3	Pulse output set to 1 ms or 50 ms. If red LED follows two green LEDs (SW1 and SW2 are set to ON), the pulse output is set at 50 ms.	Pulse output set to 20 ms or 100 ms. If green LED follows two red LEDs (SW1 and SW2 set to OFF), the pulse output is set at 20 ms.
4	SW4	Activates dwell mode on.	Cancels dwell mode.

Following the flash sequence, the ‘STATUS’ LED also indicates the operating status of the NC1 as follows:

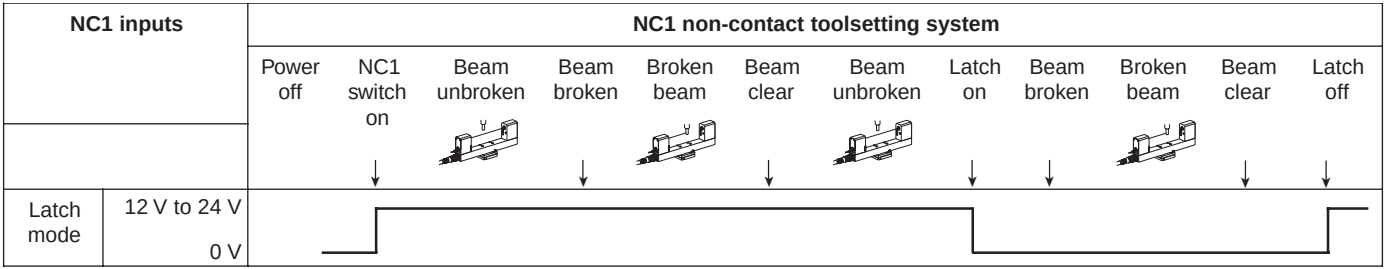
LED colour	Status
Amber	NC1 is performing a 'power-up' calibration cycle 'SET UP MODE'.
Flashing amber	Electronic fuse failure, outputs are disabled.
Red	Laser beam is obstructed, NC1 is triggered.
Green	Laser beam is unobstructed, NC1 is ready to be triggered



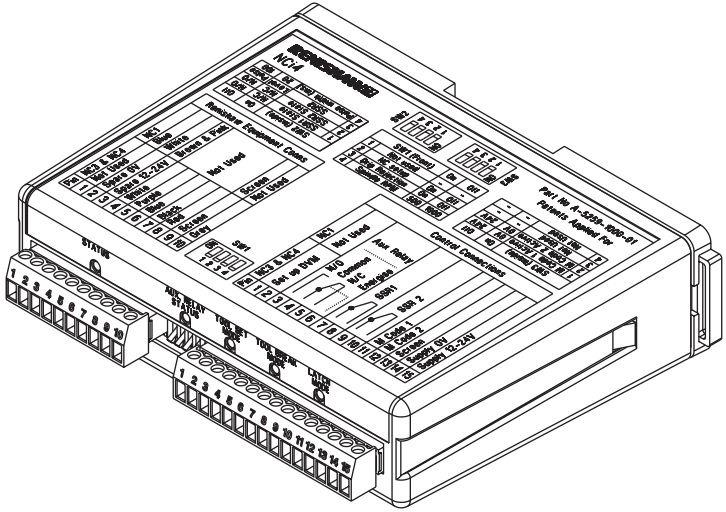
Receiver (Rx) unit



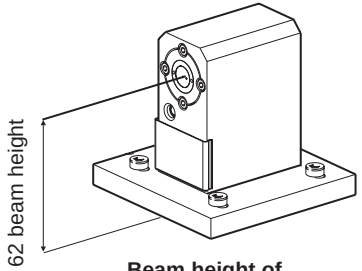
The output signals from the NC1 must be compatible with the machine control input.



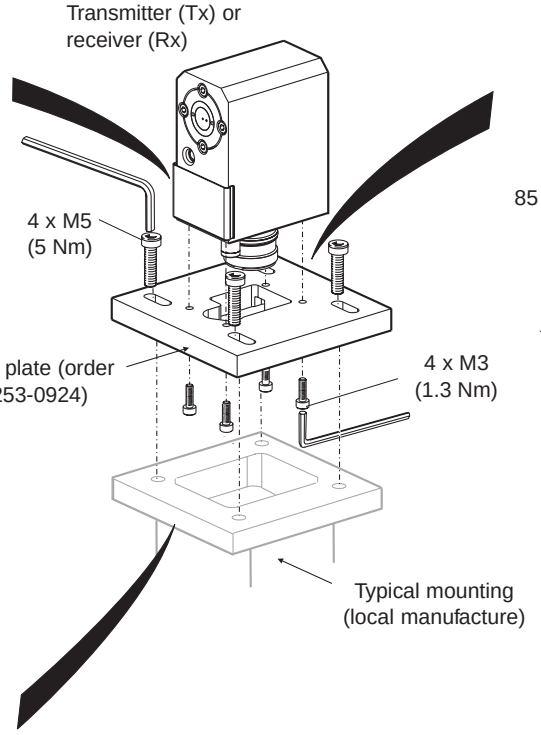
To use 'latching mode', remove 12-24 V from the pink wire via an 'M-code' or I/O. To reset 'latching mode', reapply 12-24 V to the pink wire. When in 'set-up mode', the probe status output toggles approximately four times per second.

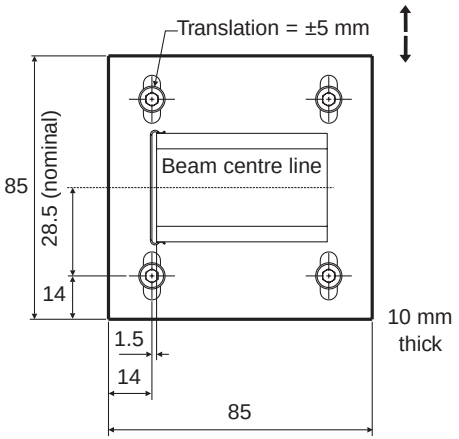


For installation instructions relating to the NCi-4 interface, please refer to the NCi-4 installation and user's guide (Renishaw part number H-2000-5236)



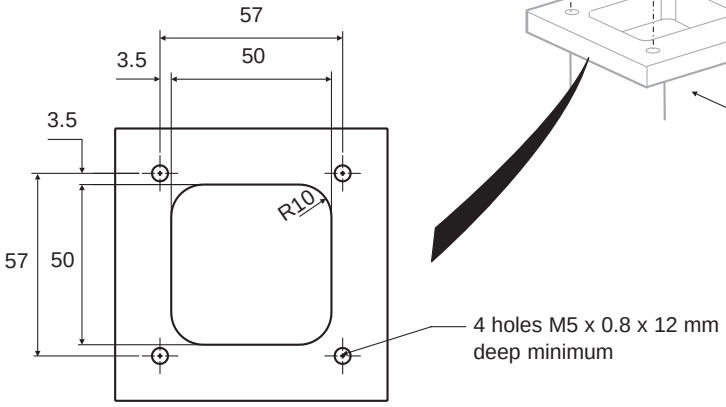
Beam height of assembled unit





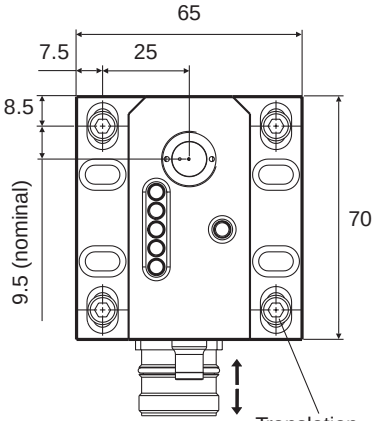
Mounting plate details (showing Tx or Rx mounted)

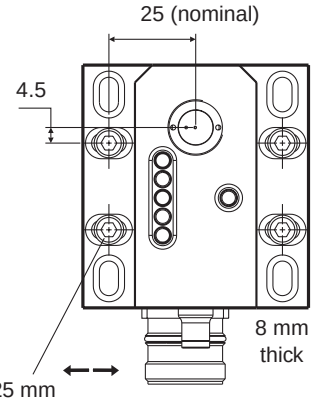
Dimensions shown in mm



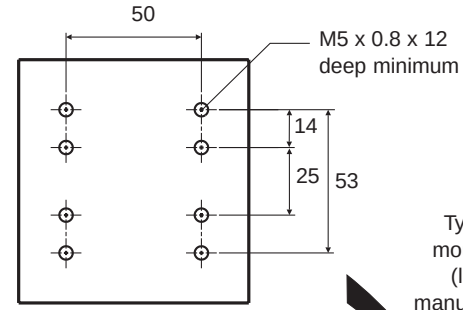
Machining details for typical mounting

Dimensions shown in mm

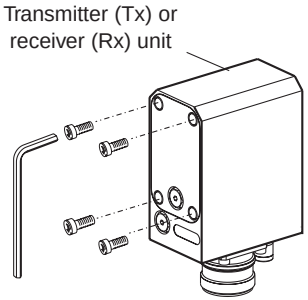




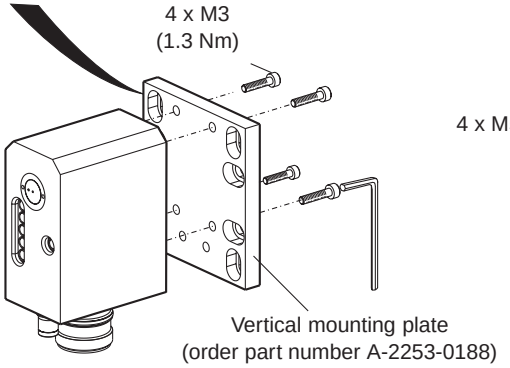
Mounting plate details showing unit attached



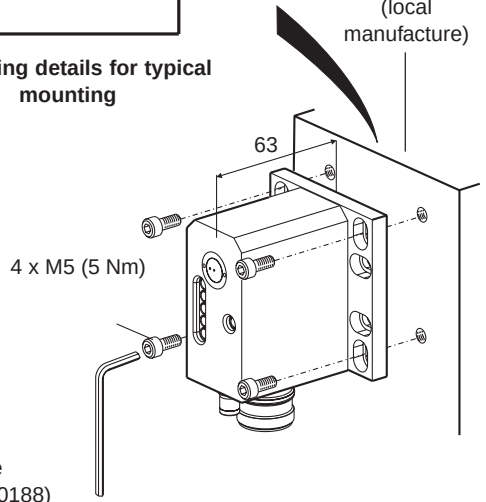
Machining details for typical mounting



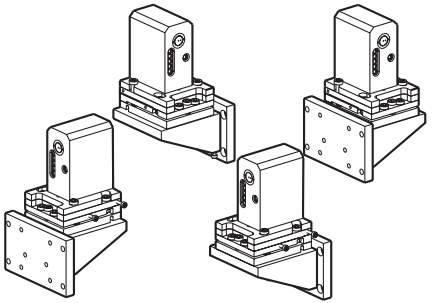
1. Release and remove four screws securing rear cover of unit.



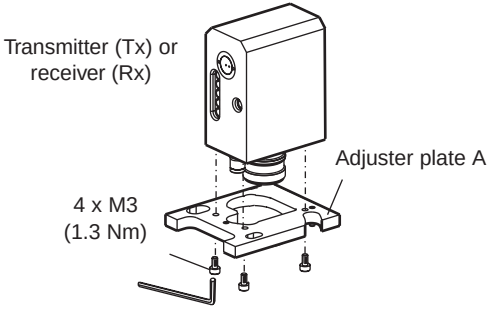
2. Secure mounting plate to unit using the four screws provided.



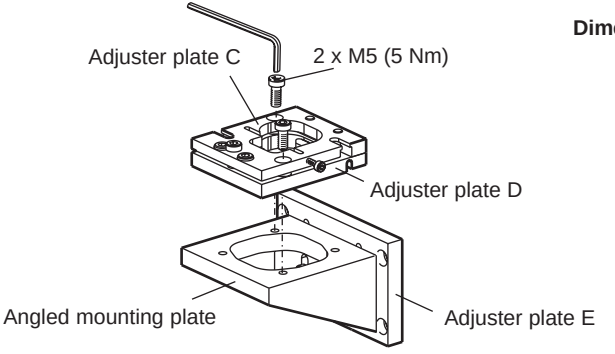
3. Secure mounting plate to bracket using the four M5 screws supplied.



NOTE: When using the adjuster pack or spacer pack to mount either the Tx or Rx, the unit may be orientated to any one of the four positions shown.

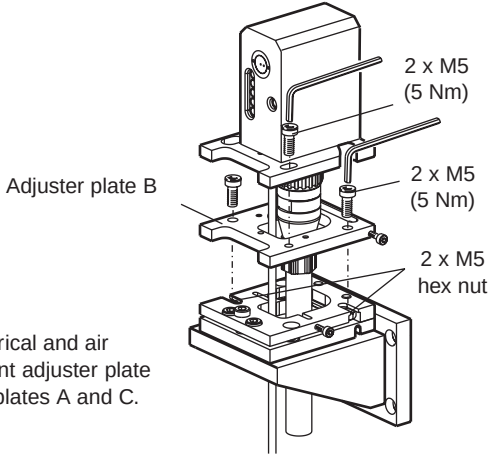


1. Mount adjuster plate A to Tx or Rx.



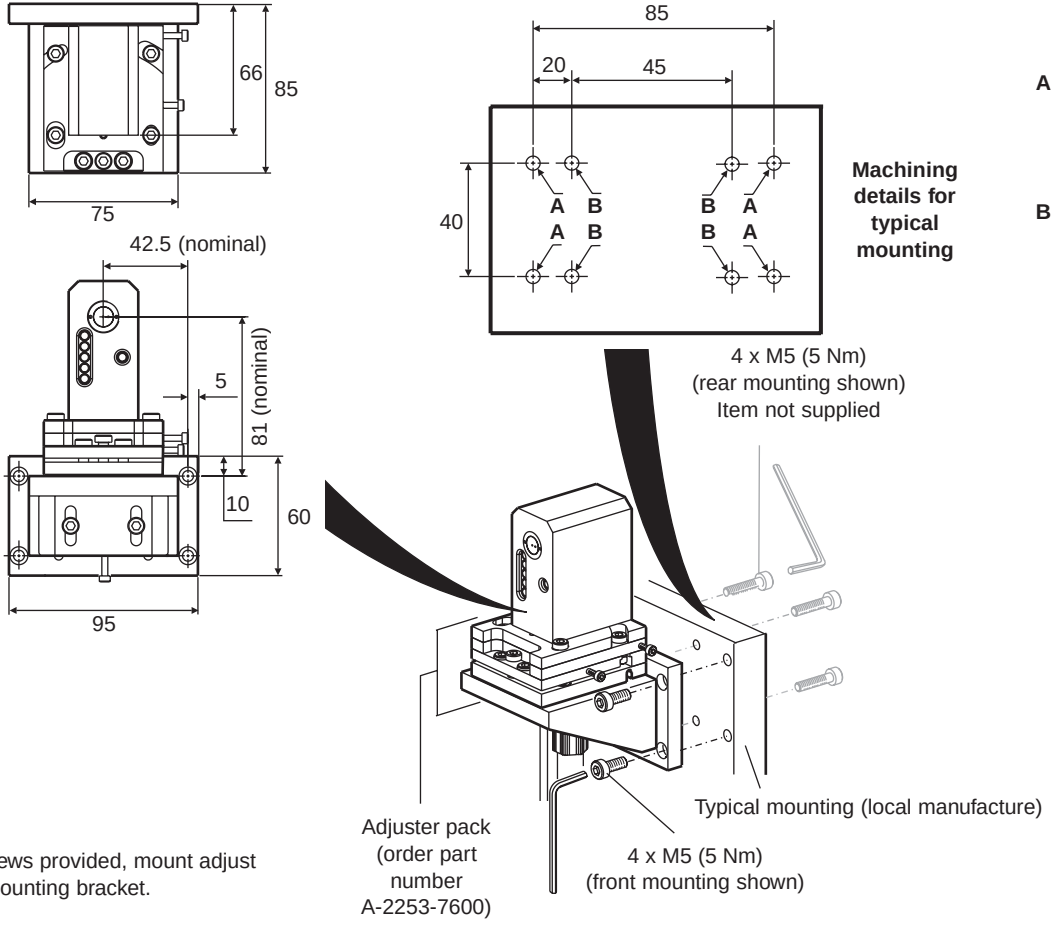
2. Orientate and mount adjuster plates C and D to angled mounting plate.

Dimensions shown in mm



3. Connect electrical and air supplies. Mount adjuster plate B to adjuster plates A and C.

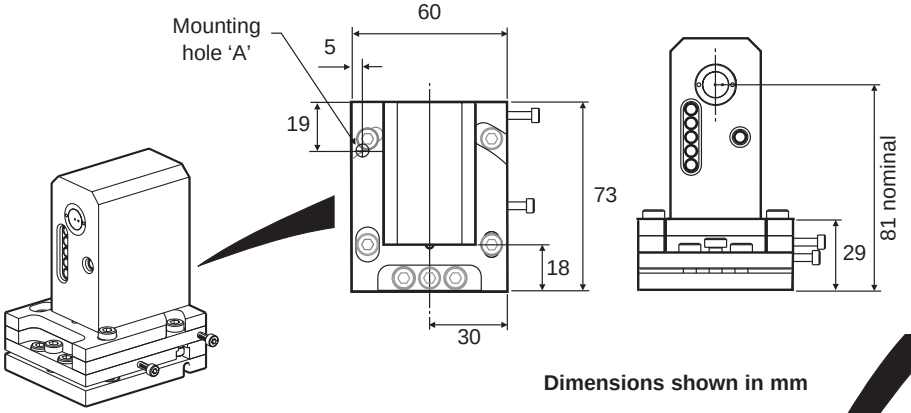
Go to step 4



A 4 holes tap M5 x 0.8 x 12 deep minimum (front mounting only)

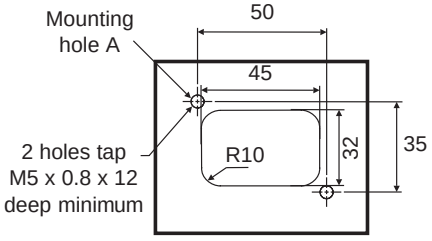
B 4 holes M5 clearance (rear mounting only)

4. Using screws provided, mount adjust pack to mounting bracket.

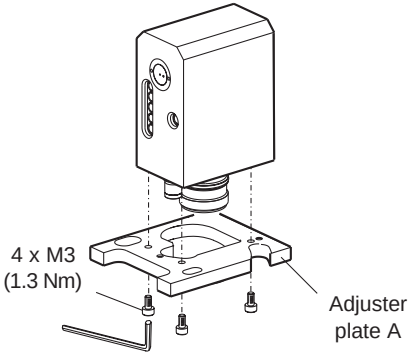


4 plate adjuster pack
(order part number A-2253-0265)

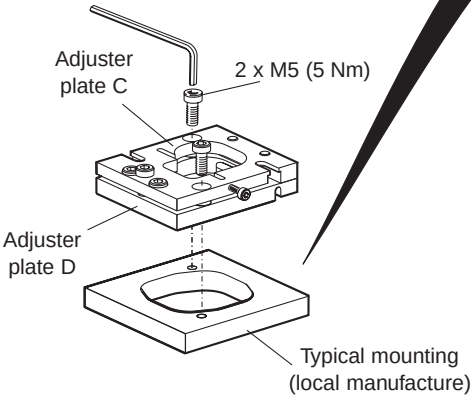
Dimensions shown in mm



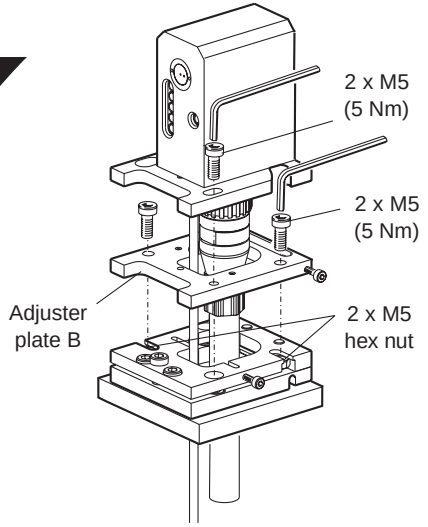
Machining details for typical mounting



1. Mount adjuster plate A to Tx or Rx.



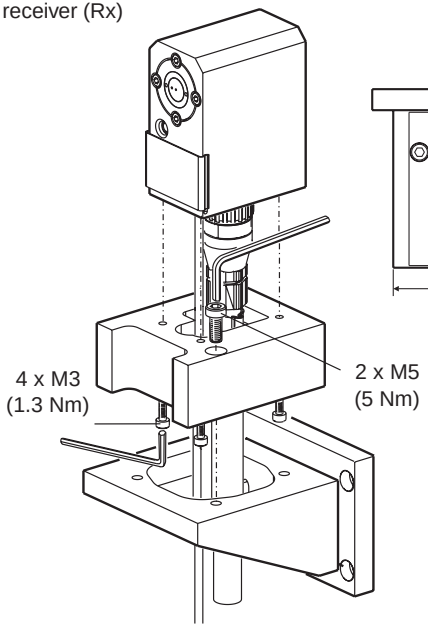
2. Orientate and mount adjuster plates C and D to mounting plate.

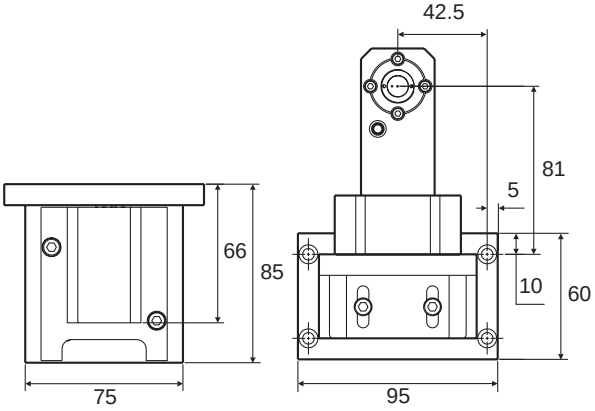


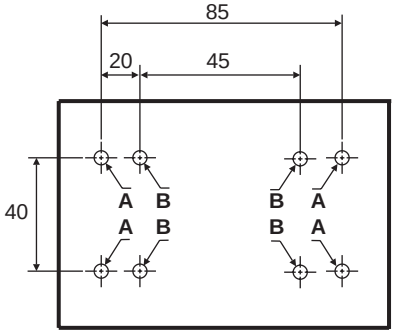
3. Connect electrical and air supplies. Mount adjuster plates B to adjuster plates A and C. Take care that the spirol pins do not push out.

Dimensions shown in mm

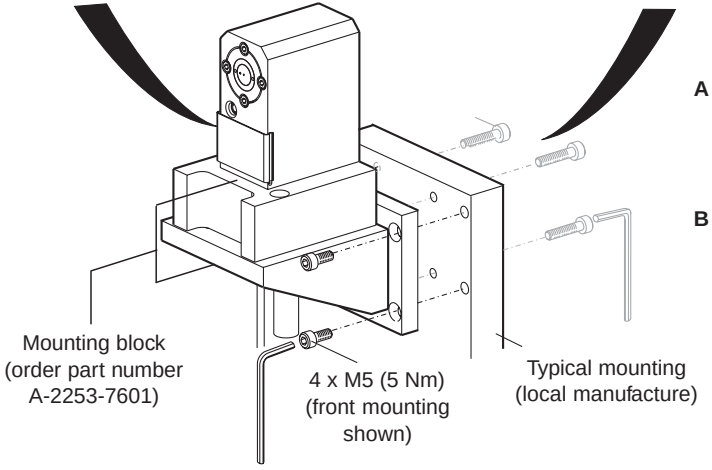
Transmitter (Tx) or receiver (Rx)







Machining details for typical mounting

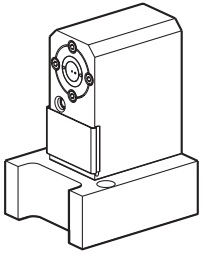


A 4 holes tap M5 x 0.8 x 12 deep minimum (front mounting only)

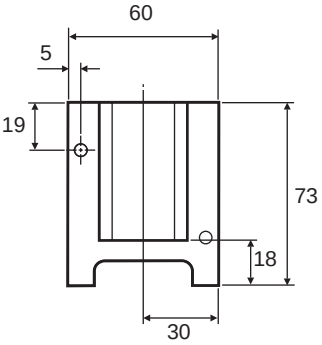
B 4 holes M5 clearance (rear mounting only)

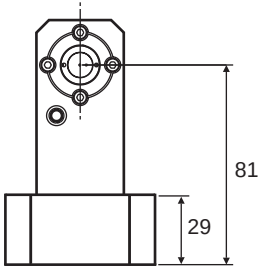
1. Connect electrical and air supplies. Assemble mounting block and mount to unit.

2. Assembly mounting block to bracket (mounting may be from front or from rear).

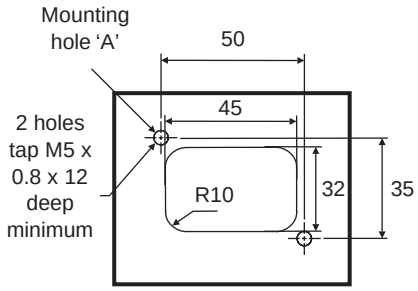


Spacer plate
(order part number A-2253-0270)



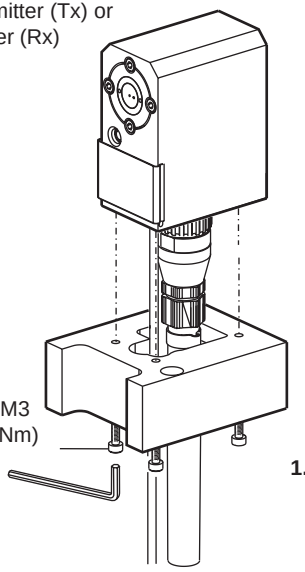


Dimensions shown in mm

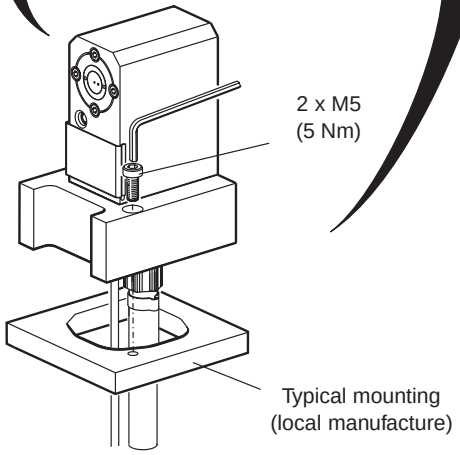


Machining details for typical mounting

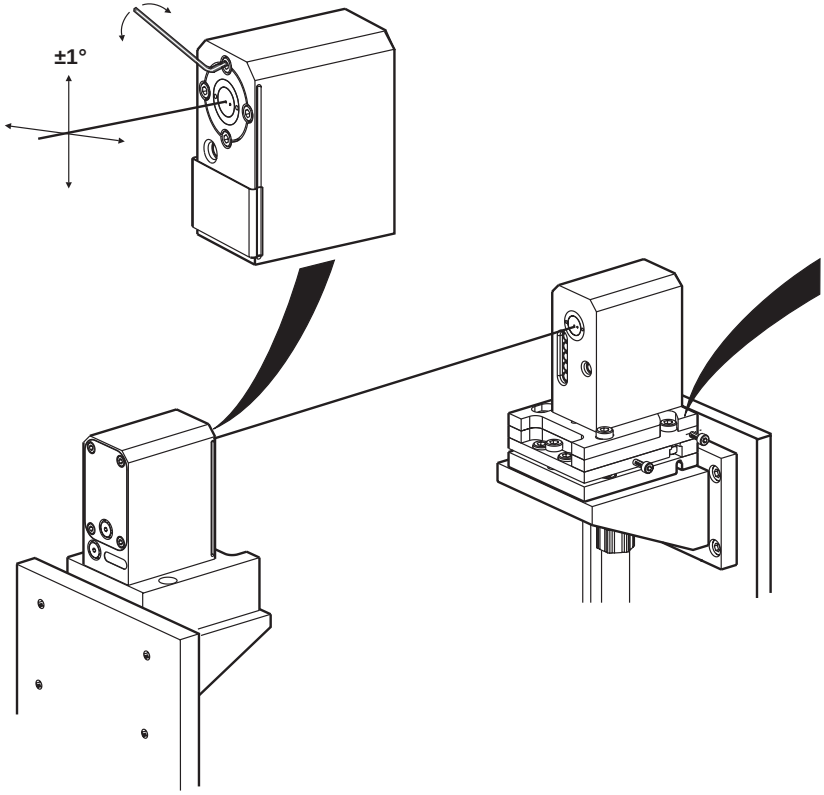
Transmitter (Tx) or
receiver (Rx)

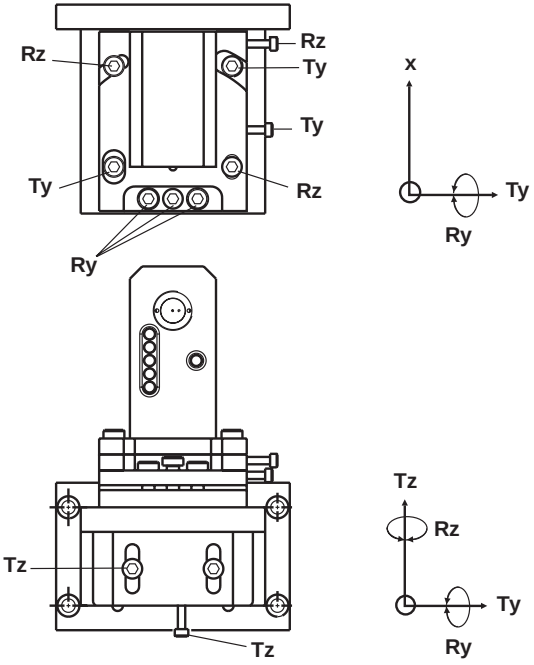


1. Connect electrical and air supplies. Assemble mounting block and mount to unit.



For instructions on how to align the Tx and Rx units, refer to the NC1 separate system - set-up and alignment section of the document.





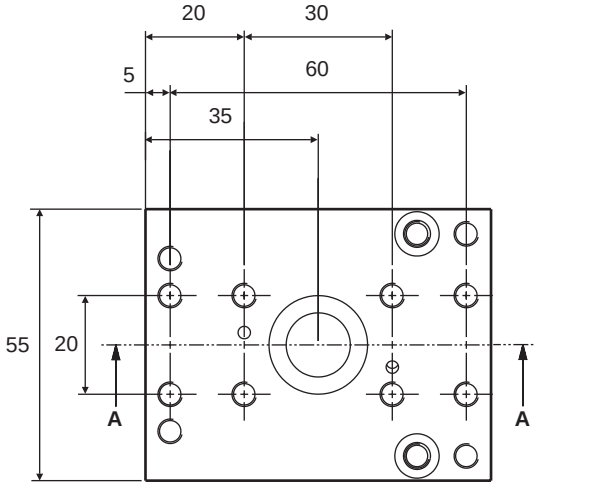
Translation Y (Ty) = ±2.5 mm

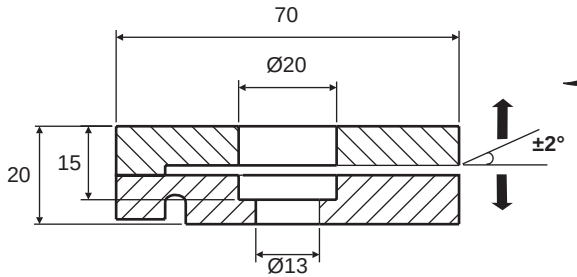
Rotation Y (Ry) = ±2°

Translation Z (Tz) = ±5 mm

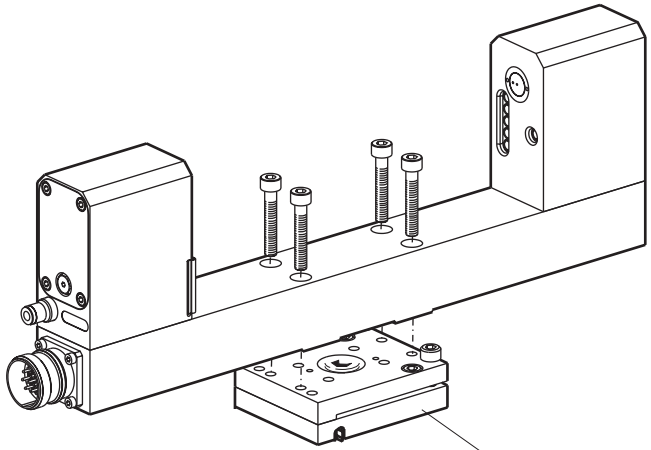
Rotation Z (Rz) = ±5°

Dimensions shown in mm



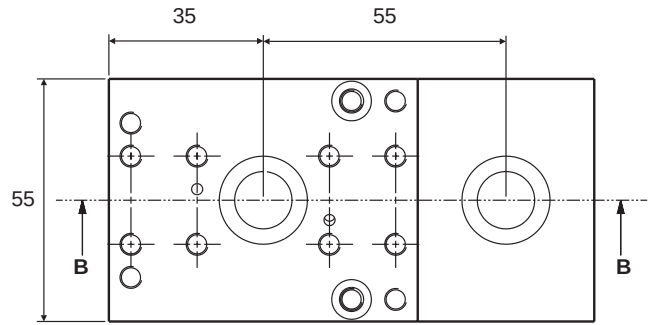


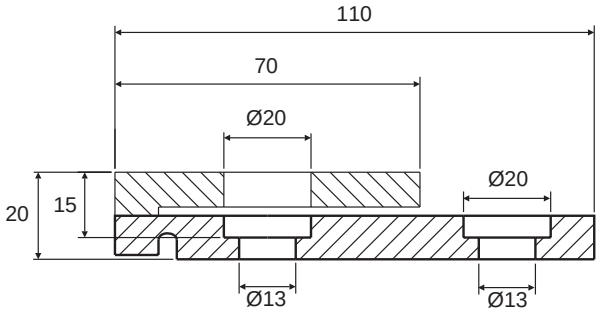
Section A-A



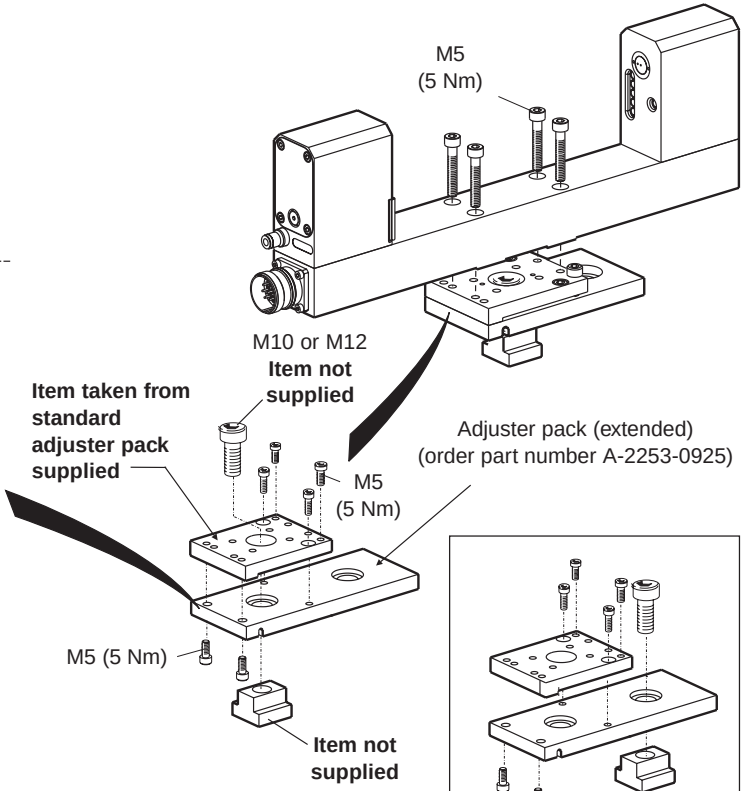
Adjuster pack (order part number A-2253-7650)

Dimensions shown in mm





Section B-B



Alternative assembly of adjuster pack

For instructions on how to align the NC1 fixed system, refer to the NC1 fixed system - set-up and alignment section of this document.

Make sure machine tool is safe to work on. Turn off machine power when working in control cabinet and before connecting the NCi-4 and NC1.

1. Mounting brackets

- Attach NC1 unit(s) to mounting bracket(s) (Please note that on separate systems the air pipe and electrical cable may need to be attached first).
- Ensure NC1 system has correct range for the installation. Contact the supplier if a different system range is required.
- Attach mounting bracket(s) to the machine.

2. Cable

- Feed cable from NC1 to machine control cabinet. Avoid routing next to sources of electronic noise e.g. motors, power cables etc.
- Cut cable conduit to length.
- Fit cable conduit to cable and seal to connector with O-clip using pincers.
- Cut cable to length if required.
- Fit cable gland P-CA61-0050 or P-CA61-0054 where cable exits enclosure. Tighten with lock nut P-NU09-0016.
- Seal conduit to cable gland with O-clip using pincers.
- Loop cable through ferrite as near to end of conduit as possible.

3. Air supply

- Locate a source of clean air to ISO 8573-1:Air quality of class 5.7-, ideally air coming directly from machine tool air filter unit.
- If compressed air source is suspected of being contaminated (e.g. it is direct from machine shop supply, machine tool air filter is dirty, it is downstream of an oil mist lubricator etc.) then a second air filter may be required. A filter unit is available from Renishaw, part number P-FI01-0008.
- If air supply is more than 5 °C above ambient and is humid an air drier will be required.
- Mount NC1 air filter (or equivalent) to a suitable surface using mounting bracket. Must be within 25 m of NC1 unit.
- Feed air pipe from NC1 to air filter unit. Use T-piece to connect air pipes from Rx and Tx together. Ensure that all lengths of air pipe used are kept to the minimum required in order to minimise pressure loss.
- Cut air pipe to length.
- Fit spring conduit to air pipe at NC1 end.
- Connect air filter to source compressed air supply with ∅ 4 mm air pipe.
- Connect air pipe to air filter, but DO NOT connect it to NC1.
- Turn on air and set air pressure on NC1 filter to 1 to 1.5 bar.
- Leave for 1 minute to purge air line of debris.
- Connect air pipe to NC1. Connect spring conduit to NC1 by screwing it on over air connector.
- Re-adjust air pressure to 1 to 1.5 bar if required.

4. Electrical supply

- Connect NC1 cable to 10-way connector on NCi-4. Refer to the appropriate connection diagram within the NCi-4 installation and user's guide (H-2000-5236).
- Ensure cable screen is connected to earth pin on NCi-4.
- Connect 15-way connector to machine control. Ensure screen is connected to machine earth.
- If there is no 12-24 V supply available in control, a power supply A-2019-0018 can be purchased from Renishaw.
- If required, change the default switch settings on the NCi-4 (e.g. drip rejection mode is selected in this way). SW2 and SW3 are accessed by depressing tabs on side of the NCi-4 and removing rear panel.
- Do not use a pencil to change switch settings – a small screw driver is suitable.
- Re-assemble rear panel onto the NCi-4 and plug in both connectors.
- Connect NC1 cable to NC1 if not already connected. Ensure connector is fully tightened, otherwise coolant can leak in and cause failure.

5. Switch on power to machine.

6. Install NC1 software by following instructions in Read-me file.

7. Follow instructions in installation guide to set up and align NC1 to machine axes.

NOTE: If in doubt, please contact you supplier.

NC1 fails to turn on (Rx-status LED not lit, Tx-laser on LED not lit)	
Fault	**Rectification**
Faulty connections.	Check wiring connections are correct.
Wrong supply voltage.	Check supply voltage.
Blown fuse.	Check connections for short circuit. Fuses in NC1and NCi-4 are reset by turning power off and on.
Damaged cable.	Replace cable.
Coolant ingress into loose connector.	Ensure cable connector is fully tightened by hand until there is no movement.

Poor repeatability	
Fault	**Rectification**
Coolant or swarf on the tool.	Clean the tool with air blast or high speed spin.
Feed rate too high.	2 microns/rev is recommended.
Electrical interference.	Move transmission cables away from other cables carrying high current. Fit ferrite to cable. Connect earth to NCi-4 and NC1.
Thermal growth of machine and work piece.	Minimise temperature changes. Increase frequency of calibration.
Excessive machine vibration.	Eliminate vibration.
Calibration and updating of offset not occurring.	Check software.
Measuring speed different from calibration speed.	Review software.
Measuring during machine acceleration and deceleration zones.	Review software.
Poor machine repeatability due to worn slides, accidental damage, loose encoders etc.	Perform health check on machine.
NC1 brackets loose.	Check and tighten brackets as appropriate.
Tool change repeatability poor.	Check NC1 repeatability without performing a tool change.

NC1 will not exit set-up mode (status LED amber)	
Fault	**Rectification**
Air hole blocked when unit is power up.	Check Tx and Rx air holes and clean as required.
Lens is dirty.	Check Tx and Rx lenses and clean as required.
Tx and Rx out of alignment when unit is powered up.	Align Tx and Rx.
Laser beam blocked (e.g. by a tool).	Remove blockage and switch power on.
LED bar graph display is scrolling red	
Fault	**Rectification**
Rx unit is receiving too much light.	Move Rx and Tx further apart. Contact supplier if a different range is required.

NC1 is outputting spurious readings	
Fault	**Rectification**
Damaged cable.	Check and replace cable if damage if found.
Electrical interference.	Move NC1 cable away from cables carrying high current. Fit ferrite. Connect cable screen to machine earth.
NC1 is in set-up mode.	If drip rejection mode is not selected, NC1 status output toggles four times per second when in set-up mode.
Poorly regulated power supply.	Ensure power supply is correctly regulated.
Loose mountings.	Check and tighten loose mountings as appropriate.
Coolant drops or mist.	Turn on drip rejection mode using switch on NCi-4 interface and NC1 software. Wait until mist has cleared before measuring.
Cable connector not tight.	Clean electrical connections. Ensure cable connector is fully tightened by hand until there is no movement.
Status not triggering.	Check that 12-24 V is applied to the pink wire (latch mode).

Probe status LED is red	
Fault	**Rectification**
Misalignment between Rx and Tx.	Realign Rx and Tx units.
Laser beam is obstructed.	Clear obstruction.
Lens is dirty/air hole is blocked.	Clean parts (see next section).
Rx or Tx lens is dirty/air hole blocked	
Fault	**Rectification**
Air pressure is too low to prevent coolant/swarf ingress.	Ensure air pressure to NC1 is set at 1 to 1.5 bar. Minimise length of air pipe.
Air supply is turned off.	Air supply must be permanently turned on.
Air supply to NC1 does not conform to ISO 8573-1: Air quality of class 5.7.	Connect air supply upstream of oil mist lubricator or auto shut-off valve. Ensure machine shop air supply is to the required air quality. If air supply is over 5 °C above ambient and is humid, fit an air drier.
Air pipe is damaged.	Check air pipe and ensure spring conduit is fitted.
Non-Renishaw air filter is being used.	Air filter must conform to ISO 8573-1: Air quality of class 1.7.2.
Air filter bowl is full of liquid.	Empty accumulated liquid from filter bowl. Check air supply.
Air pipe full of coolant or oil.	Purge and/or replace the air pipe.

Type	Part number	Description
NC1 F150* kit	A-2253-8507	NC1 F150 assembly, 12.5m cable with straight connector, air regulator with 2 x Ø4 mm air fittings & gauge, 25 m x Ø4 mm air pipe, 4 mm T connector, 4 m x Ø15 mm steel braided conduit, 4 m x Ø7 mm stainless steel air pipe protector, adjuster pack, tool kit, laser warning sign, installation guide.
NC1 F200** kit	A-2253-8506	NC1 F200 assembly, other items in kit as per A-2253-8507.
NC1 F300*** kit	A-2253-8500	NC1 F300 assembly, other items in kit as per A-2253-8507.
NC1 F150 kit and NCi-4 interface	A-2253-8608	NC1 F150 assembly, NCi-4 interface, 12.5 m cable with straight connector, air regulator with 2 x Ø4 mm air fittings & gauge, 25 m x Ø4 mm air pipe, 4 mm T connector, 4 m x Ø15 mm steel braided conduit, 4 m x Ø7 mm stainless steel air pipe protector, adjuster pack, tool kit, laser warning sign, installation guide.
NC1 F200 kit and NCi-4 interface	A-2253-8609	NC1 F200 assembly, other items in kit as per A-2253-8608.
NC1 F300 kit and NCi-4 interface	A-2253-8610	NC1 F300 assembly, other items in kit as per A-2253-8608.

* F150 relates to a fixed system with an overall length of 150 mm and a working range of 40 mm.

** F200 relates to a fixed system with an overall length of 200 mm and a working range of 90 mm.

*** F300 relates to a fixed system with an overall length of 300 mm and a working range of 190 mm.

Type	Part number	Description
NC1 F150 90 degree kit	A-2253-8518	NC1 F150 assembly, 12.5 m cable with 90 degree connector, air regulator with 2 x Ø4 mm air fittings & gauge, 25 m x Ø4 mm air pipe, 4 mm T connector, 4 m x Ø15 mm steel braided conduit, 4 m x Ø7 mm stainless steel air pipe protector, adjuster pack, tool kit, laser warning sign, installation guide.
NC1 F200 90 degree kit	A-2253-8519	NC1 F200 assembly, other items in kit as per A-2253-8518.
NC1 F300 90 degree kit	A-2253-8520	NC1 F300 assembly, other items in kit as per A-2253-8518.
NC1 F150 90 degree kit and NCi-4 interface	A-2253-8621	NC1 F150 assembly, NCi-4 interface, 12.5 m cable with 90 degree connector, air regulator with 2 x Ø4mm air fittings & gauge, 25 m x Ø4 mm air pipe, 4 mm T connector, 4 m x Ø15 mm steel braided conduit, 4 m x Ø7 mm stainless steel air pipe protector, adjuster pack, tool kit, laser warning sign, installation guide.
NC1 F200 90 degree kit and NCi-4 interface	A-2253-8622	NC1 F200 assembly, other items in kit as per A-2253-8621.
NC1 F300 90 degree kit and NCi-4 interface	A-2253-8623	NC1 F300 assembly, other items in kit as per A-2253-8621.
NCi-4 interface	A-5259-1000	NCi-4 interface and box with DIN rail mounting and two terminal blocks.
NC1 F150 assembly	A-2253-8524	NC1 F150 assembly, laser warning sign, installation guide.
NC1 F200 assembly	A-2253-8525	NC1 F200 assembly, laser warning sign, installation guide.
NC1 F300 assembly	A-2253-8526	NC1 F300 assembly, laser warning sign, installation guide.

Type	Part number	Description
NCi-4 terminal block (10 way)	P-CN25-1053	10 way socket terminal for NCi-4 interface.
NCi-4 terminal block (15 way)	P-CN25-0009	15 way socket terminal for NCi-4 interface.
Cable 12.5m with straight connector	A-2253-6105	12.5 m cable with straight connector, 4 m x Ø15 mm steel braided conduit, ferrite.
	A-2253-6107	12.5 m cable with straight connector, ferrite.
Cable 12.5m with 90 degree connector	A-2253-6106	12.5 m cable with 90° degree connector, 4 m x Ø15 mm steel braided conduit, ferrite.
	A-2253-6108	12.5 m cable with 90° connector, ferrite.
Ferrite ring	P-CA59-0013	Ferrite ring core 6.8 mm ID.
NC1 tool kit	A-2253-3500	Spanner, 2.5 mm AF hex wrench, O-clip, 4 x M3 x 6 mm cap head screws, 10 x bootlace ferrules.
NC1 air assembly kit	A-2253-5120	Air regulator with 2 x Ø4 mm air fittings and gauge, 25 m x Ø4 mm air pipe, T connector.
NC1 air filter service kit	P-FI01-S002	Service kit for air regulator, parts for both filter bowls.
NC1 adjuster pack – fixed system	A-2253-7650	Adjuster pack with four mounting screws to align NC1 fixed system to axis of machine tool.

Type	Part number	Description
	A-2253-0925	Adjuster pack with extended base plate and four mounting screws to align NC1 fixed system to axis of machine tool.
NC1 installation guide	H-2000-5048	A5 installation guide, English.
NC1 installation guide	H-2000-5127	A5 installation guide, German.
NC1 installation guide	H-2000-5128	A5 installation guide, French.
NC1 installation guide	H-2000-5129	A5 installation guide, Italian.
15 mm steel braided conduit	P-HO01-0010	Ø15 mm PVC hose with steel braid – sold per metre.
NC1 air pipe conduit – 2 metres	M-2253-0207	2 m x Ø7 mm stainless steel air pipe protector.
NCi-4 installation guide	H-2000-5236	A6 installation guide.

Type	Part number	Description
Cover	M-2253-0225	Sliding cover.
Laser warning sign	P-LA01-1066	Laser warning sign.
NC1 air nozzle kit	A-2253-0264	2 x locking rings, aircap (Tx unit), aircap (Rx unit), pin spanner.
Cable gland	P-CA61-0050	Hose/cable gland (spigot).
Cable gland	P-CA61-0054	Cable gland (domed).
O-clip	P-MA01-0041	O-clip.
Locknut	P-NU09-0016	M16 x 1.5 locknut.

NC1 software kit	Part number	Description
Mazak	A-4013-0062	Software for Mazak Fusion 640, M32 & M-Plus controllers, programming guide.
Haas	A-4012-0895	Software for Haas controllers, programming guide.
Yasnac	A-4014-0020	Software for Yasnac MX3, J50, I80 & J300 controllers, programming guide.
Siemens	A-4014-0157	Software for Siemens 810D & 840D controllers, programming guide.
Heidenhain	A-4014-0165	Software for Heidenhain 426 & 430 controllers, programming guide, integration guide (OEM only).
Meldas	A-4013-0050	Software for Mitsubishi Meldas M3, M64, M310, M500 series, M635 controllers, programming guide.
Okuma	A-4016-1021	Software for Okuma 700M/7000M, U10M and U100M controllers, programming guide.
Fanuc	A-4012-0820	Software for Fanuc 0, 6, 10-15, 16-21 M and MI controllers, programming guide.
Heidenhain i530	A-4014-0223	Software for Heidenhain i530 controller, programming guide, integration guide (OEM only).
Brother	A-4012-0904	Software for Brother controllers, fitted with macro option. Programming guide.
Allen Bradley	A-4016-1025	Software for Allen Bradley OSAI (series 10) controller, programming guide, integration guide (OEM only).
Hitachi	A-4012-0840	Software for Sigma 16M and 18M.
Makino	A-4012-0900	Software for Pro 3 - equivalent to Fanuc 16 - 18M.

Type	Part number	Description
NC1 S700* kit	A-2253-8533	NC1 S700 assembly, air regulator with 2 x Ø4 mm air fittings & gauge, 25 m x Ø4 mm air pipe, 4 mm T connector, two x 12.5 m cable with straight connector, two x 4 m x Ø15 mm steel braided conduit, 8 m x Ø7 mm stainless steel air pipe protector, tool kit, laser warning sign, installation guide.
NC1 S1000** kit	A-2253-8534	NC1 S1000 assembly, other items in kit as per A-2253-8533.
NC1 S1400*** kit	A-2253-8535	NC1 S1400 assembly, other items in kit as per A-2253-8533.
NC1 S2000**** kit	A-2253-8536	NC1 S2000 assembly, other items in kit as per A-2253-8533.
NC1 S700 kit and NCi-4	A-2253-8637	NC1 S700 assembly, NCi-4 interface, air regulator with 2 x Ø4 mm air fittings & gauge, 25 m x Ø4 mm air pipe, 4 mm T connector, two x 12.5 m cable with straight connector, two x 4 m x Ø15 mm steel braided conduit, 8 m x Ø7 mm stainless steel air pipe protector, tool kit, laser warning sign, installation guide.
NC1 S1000 kit and NCi-4	A-2253-8638	NC1 S1000 assembly, other items in kit as per A-2253-8637.
NC1 S1400 kit and NCi-4	A-2253-8639	NC1 S1400 assembly, other items in kit as per A-2253-8637.
NC1 S2000 kit and NCi-4	A-2253-8640	NC1 S2000 assembly, other items in kit as per A-2253-8637.

* S700 refers to a separate system, tuned to operate with a separation from Tx to Rx of between 500 mm and 700 mm.

** S1000 refers to a separate system, tuned to operate with a separation from Tx to Rx of between 700 mm and 1000 mm.

*** S1400 refers to a separate system, tuned to operate with a separation from Tx to Rx of between 1000 mm and 1400 mm.

**** S2000 refers to a separate system, tuned to operate with a separation from Tx to Rx of between 1400 mm and 2000 mm.

Type	Part number	Description
NC1 S700 assembly	A-2253-8541	NC1 S700 assembly, laser warning sign, installation guide.
NC1 S1000 assembly	A-2253-8542	NC1 S1000 assembly, laser warning sign, installation guide.
NC1 S1400 assembly	A-2253-8543	NC1 S1400 assembly, laser warning sign, installation guide.
NC1 S2000 assembly	A-2253-8544	NC1 S2000 assembly, laser warning sign, installation guide.
NC1 mounting plate for horizontal face	A-2253-0924	Mounting plate for mounting the NC1 Tx or Rx from a horizontal face.
NC1 mounting plate for vertical face (Tx)	A-2253-0188	Mounting plate for mounting the NC1 Tx or Rx from a vertical face.
NC1 adjuster pack for vertical face - separate	A-2253-7600	Adjuster pack and four mounting screws to align NC1 separate system to axis of machine tool. Includes angled mounting plate with vertical adjustment.
NC1 spacer pack	A-2253-7601	Spacer pack and four mounting screws for mounting either Tx or Rx opposite the adjuster pack. Includes angled mounting plate with vertical adjustment.
NC1 4 plate adjuster pack for horizontal face	A-2253-0265	4 plate adjuster pack and two mounting screws to align NC1 separate system to axis of machine tool. No vertical adjustment.
NC1 spacer plate	A-2253-0270	Spacer plate and two mounting screws for mounting either Tx or Rx opposite the 4 plate adjuster pack.
Airpipe	P-PF26-0010	4 mm diameter black nylon tube (25 m long).
Tee piece	P-PF04-0010	4 mm diameter equal tee piece connector.

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