Installation and maintenance guide H-6270-8501-01-A



NC4 non-contact tool setting system (integral air blast)





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한국어	이 제품 관련 자료는 www.renishaw.co.kr/nc4에서 확인할 수 있습니다.						

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English

Installation and maintenance guide

NC4 non-contact tool setting system (integral air blast)

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Renishaw part no: H-6270-8501-01-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

JP 4521094

JP 4695808

Features of the NC4 non-contact system (integral air blast) and related products are subject to the following patents and patent applications:

CN 100394139	TW NI-178572
CN 1202403	US 6496273
CN 1660541	US 6635894
EP 1050368	US 6878953
EP 1144944	US 7053392
EP 1502699	US 7312433
EP 1562020	
JP 4520240	

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EU declaration of conformity

Renishaw plc declares that the NC4 non-contact tool setting system (integral air blast) complies with the applicable standards and regulations.

Contact Renishaw plc or visit www.renishaw.com/nc4 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 CEB Section 15 19

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

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

47 CEB 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 beam not blocked. 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 the power supply before carrying out maintenance on the NC4 system.

When using the NC4 system, basic safety precautions must always be followed to reduce the risk of fire, electric shock and personal injury, including the following:

- Read all instructions before operating this product.
- The device must only be installed and used by competent, trained personnel.
- Use eye protection to protect against mechanical hazards, coolant and swarf.
- Avoid inhalation of coolant vapour from the machine tool.
- Do not block the air exiting from the transmitter, receiver or air blast apertures.
- The sound power emitted by the air blast equipment can range from 70.3 dB at 3.0 bar (43.51 psi) to 78.2 dB at 6.0 bar (87.02 psi). It is the responsibility of the integrator to ensure a suitable noise assessment is performed when the equipment is put into use.

 Prevent direct exposure of the eyes to the laser beam.
Ensure that the beam is not reflected into the eyes via any reflective surface.



The laser used in the Renishaw NC4 non-contact tool setting system emits visible red light at a wavelength of 670 nm and has a power output of less than 1 mW.

The NC4 is classified as a Class 2 laser product as defined by BS EN 60825-1:2014 (IEC 60825-1:2014).

The product complies with 21 CFR 1040.10 and 1040.11 except for deviations pursuant to Laser Notice No. 50 dated June 24, 2007.

BS EN 60825-1:2014 (IEC 60825-1:2014) directs to attach a laser warning label and explanatory label.

A warning label and explanatory label are permanently fixed to each side of the transmitter (Tx) housing (see page 1 for details). An adhesive warning label is provided for attachment outside the machine.

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the transmitter unit only.

Label A





LASER RADIATION DO NOT STARE INTO BEAM

CLASS 2 LASER PRODUCT

1mW MAXIMUM OUTPUT EMITTED WAVELENGTH 670nm

COMPLIES WITH 21 CFR 1040.10 * & 1040.11 AND IEC 60825-1:2014

Except for deviations pursuant to Laser Notice No. 50 dated June 24 2007 1



page 7).



The access panel is to be removed for service purposes only using the special tool supplied.

Before removing the panel, switch off electrical power to the transmitter unit to avoid exposure to the laser beam.

CAUTION symbol

The caution symbol on the access panel denotes the following:

CAUTION – Class 3R Laser radiation when open. Avoid direct eye exposure.

This text is not included on the access panel due to the limited space available.

Servicing

It is necessary to remove the access panel of the transmitter unit to perform some servicing procedures. A pin spanner is supplied for this service procedure. For more information see "Servicing - cleaning the optics" on page 59.

If electrical power is applied to the unit when this panel is removed, personnel can be exposed to laser radiation within the levels for Class 3R.

Before carrying out servicing procedures on the NC4 system, switch off electrical power.

Related publications

- NCi-6 non-contact tool setting interface installation and user's guide, Renishaw part no. H-6516-8500.
- Non-contact tool setting software programming guide. The appropriate guide is supplied with the NC software.

Introduction

This guide describes how to install, configure, maintain and service the Renishaw NC4 non-contact tool setting system.

The NC4 is a laser-based non-contact tool setting system that provides high-speed/high-precision measurement of cutting tools on a machining centre under normal operating conditions.

As a tool moves through the laser beam, the system detects when the beam is broken. Output signals sent to the controller allow the presence of a tool and the position of the tip (broken tool detection) to be established.

Guidelines for good practice

- The NC4 is a precision device and must be handled with care.
- Ensure that all mountings are secure.
- Keep electrical contacts clean.

- Mount the system in a position that limits the risk of it being subjected to impact when operating the machine.
- Mount the system in a position where it will not be affected by a build-up of swarf. Do not allow excessive waste material to build up around the NC4.
- Cables, piping, conduit, etc. should be suitably secured to avoid damage and loads being transferred to the NC4.
- Optimum performance is achieved by continuously supplying air and power to the NC4.
- The NC4 is protected by a continuous stream of clean air. Approximately once a month, inspect the optics for contamination. The service interval may be extended or reduced depending on experience.

How to install and configure the NC4 (integral air blast) system

Install and configure the NC4 system in the sequence described below:

- Install the air assembly kit (for more information see "Installing the air assembly kit" on page 26). Do not switch on the air supply or set the air pressure at this stage.
- Install the NC4 system (for more information see "Installing an NC4 (integral air blast) system" on page 27).
- Install the interface unit (for more information see "Installing the interface unit" on page 33).
- Switch on electrical power to the interface unit (for more information see "Applying electrical power to the interface unit" on page 35).

- Switch on the air supply to the NC4 system and set the air pressure (for more information see "Setting the NC4 (integral air blast) system air pressure" on page 36).
- Align and set up the NC4 system (for more information see "Aligning and setting up an NC4 (integral air blast) system" on page 43).
- Finally, calibrate the system as described in the appropriate publication non-contact tool setting software programming guide.
- If problems occur or for more information see page 48, "Troubleshooting".

General

Parts checklist

The following services and equipment are required to facilitate full system functionality:

Tool setting system

Ensure that the NC4 system supplied has the correct separation (for more information see pages 12 to 15). Contact your supplier if a different range is required.

Mounting

If mounting brackets are required, ensure that they are correct for the installation.

Air supply

The NC4 requires a clean, dry air supply to BS ISO 8573-1: 2010 air quality of class 1.7.2 If this is not achievable, a filter/regulator will be required (for more information see "Parts list – NC4 accessories" on page 89. The air blast requires an air supply, 6.0 bar (87.02 psi) maximum. Air supply to the air blast must conform to BS ISO 8573-1: 2010 Class 2.9.4. A solenoid valve is required to control the air blast (for more information see "Parts list – NC4 accessories" on page 87).

Interface unit

The NC4 requires use of the NCi-6 interface unit. This unit is included in each NC4 kit.

Software

Renishaw non-contact software is required to conduct tool checking and measurement cycles.

Accessories

Equipment such as conduit, fittings, etc. may be required, depending on the installation.

One of the following items of equipment is also needed during maintenance:

- Digital voltmeter
- NC4 set-up tool

Access panel identification markings

The access panel of each NC4 transmitter and receiver unit is engraved with identifying markings. The access panel information for each size of NC4 is shown in the table opposite.

Fixed systems

Туре	Transmitter	Receiver		
	engraving	engraving		
+F115	+50+	+50+		
+F145	+40+	+40+		
F230	20	18		
F300	20	20		

Access panel identification markings, denoting system range



Probe status LED function

The probe status LEDs on the transmitter and receiver units indicate to the user the status of the probe. The LEDs mimic each other.

Colours shown by the LEDs vary depending upon the mode of operation of the interface unit. The colours and associated states are described in the tables on page 9 and page 10.

NCi-6 NC set-up switch SW1-2 set to 'On'

The probe status LEDs will rapidly flash code which is used by the NC4 set-up tool.

The colours of the LEDs will vary between red, amber and green.

NCi-6 NC set-up switch SW1-2 set to 'Off'

For more information see the tables on page 9 and page 10.



(on transmitter and receiver units)

LED	Signal	Tool set mode 1 Tool set mode 2				
colour	voltage	Description				
Green/	>6.0 V	Flashing at 1 Hz.	Flashing at 1 Hz.			
amber		The system operating voltage is too	The system operating voltage is too			
		high.	high.			
		The system will continue to function,	The system will continue to function,			
		but for optimum performance repeat	but for optimum performance repeat			
		the set-up and alignment procedures.	the set-up and alignment procedures.			
		The probe is untriggered.	The probe is triggered.			
Green	4.0 V to	The beam is clear.	The beam is clear.			
	6.0 V	The probe is untriggered.	The probe is triggered.			
Amber	2.5 V to	The beam is partially blocked.	The beam is partially blocked.			
	4.0 V	The probe is untriggered.	The probe is triggered.			
Red	0.0 V to	The beam is blocked.	The beam is blocked.			
	2.5 V	The probe is triggered.	The probe is untriggered.			
No light	0.0 V	No power to the unit.				

The probe status LEDs can be used for diagnostic purposes as the NC4 constantly checks itself for signal and indicates the state of the system by the colours of the LEDs. If the laser beam is clear and the LEDs are either amber or flashing amber/green, this indicates that servicing is required. The system will continue to function as normal. For more information on possible action required, see page 48, "Troubleshooting".

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.			
Red	The output is latched.	The output is latched.		
	The tool is broken.			
No light	No power to the unit.			

The probe status LEDs can be used for diagnostic purposes as the NC4 constantly checks itself for signal and indicates the state of the system by the colours of the LEDs. If the laser beam is clear and the LEDs are either amber or flashing amber/green, this indicates that servicing is required. The system will continue to function as normal. For more information on possible action required, see page 48, "Troubleshooting".





Medel	Dimensions							
model	Α	В	С	D	E	F	G	н
E115	55.0	115.0	57.5	31.0	61.0	77.0	18.0	13.7
FIID	(2.17)	(4.53)	(2.26)	(1.22)	(2.40)	(3.03)	(0.71)	(0.54)
F115 (raised)	55.0	115.0	57.5	50.0	80.0	96.0	35.6	12.6
	(2.17)	(4.53)	(2.26)	(1.97)	(3.15)	(3.78)	(1.40)	(0.50)
E1/6	85.0	145.0	72.5	31.0	61.0	77.0	20.4	24.5
F 140	(3.35)	(5.71)	(2.85)	(1.22)	(2.40)	(3.03)	(0.80)	(0.96)
F145 (raised)	85.0	145.0	72.5	50.0	80.0	96.0	37.5	25.0
	(3.35)	(5.71)	(2.85)	(1.97)	(3.15)	(3.78)	(1.48)	(0.98)
E220	170.0	230.0	115.0	31.0	61.0	77.0	21.3	25.3
F230	(6.69)	(9.06)	(4.53)	(1.22)	(2.40)	(3.03)	(0.84)	(1.00)
F230 (raised)	170.0	230.0	115.0	50.0	80.0	96.0	40.3	44.3
	(6.69)	(9.06)	(4.53)	(1.97)	(3.15)	(3.78)	(1.59)	(1.74)
E300	240.0	300.0	150.0	31.0	61.0	77.0	21.4	25.4
F300	(9.45)	(11.81)	(5.91)	(1.22)	(2.40)	(3.03)	(0.84)	(1.00)
F300 (raised)	240.0	300.0	150.0	50.0	80.0	96.0	40.4	44.4
	(9.45)	(11.81)	(5.91)	(1.97)	(3.15)	(3.78)	(1.59)	(1.75)



Dimensions in mm (in)

	Dimensions							
Model	А	В	С	D	Е	F	G	н
F115C	55.0	155.0	97.3	31.0	61.0	77.0	18.1	13.8
	(2.17)	(6.10)	(3.83)	(1.22)	(2.40)	(3.03)	(0.71)	(0.54)
F115C (raised)	55.0	155.0	97.3	50.0	80.0	96.0	35.1	12.3
	(2.17)	(6.10)	(3.83)	(1.97)	(3.15)	(3.78)	(1.38)	(0.48)
F145C	85.0	185.0	112.3	31.0	61.0	77.0	21.3	25.3
	(3.35)	(7.28)	(4.42)	(1.22)	(2.40)	(3.03)	(0.84)	(1.00)
F145C (raised)	85.0	185.0	112.3	50.0	80.0	96.0	37.1	24.7
	(3.35)	(7.28)	(4.42)	(1.97)	(3.15)	(3.78)	(1.46)	(0.97)
F230C	170.0	270.0	155.0	31.0	61.0	77.0	21.3	25.3
	(6.69)	(10.63)	(6.10)	(1.22)	(2.40)	(3.03)	(0.84)	(1.00)
F230C (raised)	170.0	270.0	155.0	50.0	80.0	96.0	40.3	44.3
	(6.69)	(10.63)	(6.10)	(1.97)	(3.15)	(3.78)	(1.59)	(1.74)
F300C	240.0	340.0	190.0	31.0	61.0	77.0	21.3	25.3
	(9.45)	(13.39)	(7.48)	(1.22)	(2.40)	(3.03)	(0.84)	(1.00)
F300C (raised)	240.0	340.0	190.0	50.0	80.0	96.0	40.3	44.3
	(9.45)	(13.39)	(7.48)	(1.97)	(3.15)	(3.78)	(1.59)	(1.74)



View on A

Straight connector






Application	High-precision, high-speed non-contact tool setting and tool breakage detection on all sizes of vertical and horizontal machining centres, multi-tasking machines and gantry machining centres.
Repeatability	±1.0 μm (39.37 μin) 2σ
NC4 pneumatic supply	Hard-wired system Ø3.0 mm (0.12 in), connector system Ø4.0 mm (0.16 in) air pipe, 6.0 bar (87.02 psi) maximum. Air supply to the NC4 must conform to BS ISO 8573-1: 2010 Class 1.7.2.
Air blast pneumatic supply	Ø6.0 mm (0.24 in) air pipe, 6.0 bar (87.02 psi) maximum. Air supply to the air blast must conform to BS ISO 8573-1: 2010 Class 2.9.4.
Life	Tested to > 1 million on/off cycles
Cable	6-core plus screen cable. Each core 18/0.1 insulated. Ø6.0 mm (0.24 in) \times 12.5 m (41.01 ft).
Weight	450 g (1.0 lb) to 2000 g (4.4 lb) depending on configuration.
Current consumption (including interface unit)	120 mA @ 12 Vdc, 70 mA @ 24 Vdc
Sealing	IPX6 and IPX8, BS EN 60529:1992+A2:2013 (IEC 60529:1989+A1:1999+A2:2013)
Working temperature	+5 °C to +55 °C (+41 °F to +131 °F)
Storage temperature	-10 °C to +70 °C (+14 °F to +158 °F)

NC4 (integral air blast) system vs. minimum tool diameter

NOTE: The minimum tool diameter values listed in this table are typical values. They are provided for guidance purposes only.

NC4 (integral air blast) system	Separation	Minimum tool diameter
F115	55.0 (2.17)	0.03 (0.001)
F145	85.0 (3.35)	0.06 (0.002)
F230	170.0 (6.69)	0.20 (0.008)
F300	240.0 (9.45)	0.20 (0.008)

Dimensions in mm (in)

Introduction

The NC4 set-up tool is a battery-operated device that is used to provide a visual indication of the signal strength at the NC4 receiver unit. The signal strength is shown on a numerical display. The higher the number, the greater the signal received at the receiver unit.

The set-up tool is placed over the receiver unit and is rotated so that the display can be easily viewed. Placing the tool over an NC4 unit activates the numerical display. Removing the tool causes the display to power off.

NOTE: The numerical display provides only an indication of the signal strength. If a true reading of signal strength is required, a voltmeter must be connected to the appropriate connector pins on the interface unit.

The set-up tool can be used on hard-wired and connector NC4 systems.



Battery specification

The set-up tool requires one ½ AA size battery, rated at between 3.3 V and 3.6 V. It is important to ensure that the battery is supplied in standard form. Batteries that are described as tagged have additional connection tag features fitted to the terminal and are not suitable.

Typically, this specification can be provided by a cell containing Lithium-thionyl chloride (3.6 V). This is recommended for maximum battery life. A Lithium-thionyl chloride (3.6 V) battery will last the equivalent of 700 hours' continuous operation.

Battery supplier	Part number
Farnell	206-520 (Sonnenschein SL-350 S)
Radio Shack	2301243
RS Components (Radio Spares)	596-589 (Saft LS 14250)

Part number
ER3S
LS 14250C, LS 14250
CR 14250 SE
SL-350, SL-550, SL-750
TL-4902, TL-5902,
TL 2150, TL-5101
CR 1/2 AA
XL-050F

Introduction

The air supply to the NC4 must conform to BS ISO 8573-1: 2010 air quality of class 1.7.2 and be moisture-free. If the air quality cannot be guaranteed, an air filter unit is available from Renishaw (for more information see "Parts list – NC4 accessories" on page 89).

The NC4 requires a continuous regulated air supply up to 6.0 bar (87.02 psi) maximum.

Failure of the air supply allows a PassiveSeal inside each NC4 unit to protect the unit from the ingress of contaminants. This causes the unit to enter a trigger state. The laser beam will not be seen exiting the transmitter unit, and the status LEDs on the transmitter and receiver units will display red (when tool set mode 1 is selected).

The cause of the air failure should be determined and rectified.

The air blast requires an air supply, 6.0 bar (87.02 psi) maximum. The air supply to the air blast system must conform to BS ISO 8573-1: 2010 air quality of class 2.9.4. A solenoid valve is required to control the air blast (for more information see "Parts list – NC4 accessories" on page 88).

Best practices

- Where possible, tap into the air supply that exits the machine air supply filter/regulator unit. Do not connect the NC4 to an oiled air supply.
- Use blanking caps, supplied with the air assembly kit, when feeding air pipe through the conduit/machine.
- Before connecting the air pipes to the inlet of the NC4 unit or air blast, briefly switch on the air supply to clear out any debris from the pipe. When no more debris is emitted, switch off the air supply and connect to the NC4.
- When installing the air pipe supply to the NC4, keep runs as short as possible to minimise pressure drop.
- If the temperature of the air supply is greater than 5 °C (41 °F) above ambient and is humid, an air dryer will be required.

Minimum bend radius

Component	Diameter	Minimum static bend radius	Minimum dynamic bend radius
GP 9 conduit	14 (0.55)	40.0 (1.57)	-
GP18 conduit	24 (0.94)	75.2 (2.96)	-
Air pipe	3 (0.12)	6 (0.24)	-
	4 (0.16)	25 (0.98)	-
	6 (0.24)	30 (1.18)	-
NC4 cable	6 (0.24)	10 (0.39)	50 (1.97)

Dimensions in mm (in)

Electro-pneumatic integration



*NOTE: Solenoid valve can be controlled by an M-code connected using the auxiliary relay on NCi-6, CN2 pins 3, 4 and 5, or connected directly to the solenoid valve.

Installing the air assembly kit

WARNING: Before starting to install the kit, ensure that the machine is safe to work on.

- Secure the air regulator, vertically upright, to a suitable surface using the mounting bracket. This must be within 25.0 m (82.02 ft) of the NC4.
- Locate a source of clean air to BS ISO 8573-1: 2010: air quality class 5.9.4, and connect it to the regulator inlet. Where possible, use air that exits directly from the machine tool air filter unit.

If the compressed air source is suspected of being contaminated (e.g. if it is direct from the machine shop supply, if the machine tool filter is dirty, or if it is downstream of an oil mist lubricator) then a second air filter may be required. A suitable filter unit is available from Renishaw (for more information see "Parts list – NC4 accessories" on page 89).



After you have finished installing the air assembly kit, install the NC4 system (for more information see "Installing an NC4 (integral air blast) system" on page 27).

Do not switch on the air supply or set the air pressure until the NC4 system and interface unit have been installed and electrical power has been applied.

Installing an NC4 (integral air blast) system

This section describes how to install NC4 (integral air blast) systems. Refer to the figures on page 28, page 29 and page 30 as appropriate.

WARNING: Before starting to install the NC4 system, ensure that the machine is safe to work on. Switch off machine power when working in the control cabinet.

 Mount the system in a position where air can exit freely from the MicroHole[™] in the access panels.

Do not mount the system in a position where excessive quantities of swarf can build up.

2. Secure the mounting/adjuster plate to the machine table using one of the options shown in the figure on page 28. Align the plate so it is approximately parallel to the machine axis.

- Use a dial test indicator to determine the squareness of the adjuster pack or mounting/ adjuster plate relative to the machine axis. The top and sides of the pack/plate should be within 1.0 mm (0.039 in) over the length of the pack/plate.
- 4. Lay the conduit in the machine to check the length. Cut to length if necessary.
- Hard-wired systems: Feed the two cables and air pipes through the conduit. Do not apply excessive force to the cables or air pipes as this could damage the supplies or NC4. Apply an appropriate lubricant if necessary.

System with connector: Feed the cable through the conduit and feed the two air pipes through the spring covers.

Push the conduit onto the barbed gland and fit the securing O-clip.

(continued on page 30)



Optional 90° gland adaptor shown fitted to a typical hard-wired system





Fit the cable to the NC4 system by pushing the connector into the socket. Rotate knurled collar until it locks into place.

Place the NC4 system on the mounting/ adjuster plate and secure with the two X/Y-axis locking screws and single Z-axis locking screw. Route the conduit through the machine. If necessary, fit a cable gland where the supplies exit the enclosure.

NOTE: The radius of the conduit bend should be greater than 75.2 mm (2.96 in) for the GP18 conduit; greater than 40.0 mm (1.57 in) for the GP9 conduit.

(continued on page 32)

Cable with 90° connector shown fitted to a typical system with connector



Loosen grub screws \times 4 to adjust orientation. Tighten to 0.6 Nm to 0.7 Nm (0.4 lbf.ft to 0.5 lbf.ft).

- Route the cables to the electrical cabinet, taking care to avoid situating them next to sources of electrical noise, e.g. motors, power cables, etc.
- Before routing the air pipes, fit a straight adaptor pneumatic fittings and a blanking cap to the free end of each air pipe (refer to the figure on page 28). This prevents the ingress of debris into the air pipes.
- 9. Route the air pipes to the air regulator and air blast solenoid.

Remove the blanking caps from the end of the air pipes.

10. Using the air regulator, purge the Ø3.0 mm (0.12 in) hard-wired system or the Ø4.0 mm (0.16 in) connector system and Ø6.0 mm (0.24 in) air pipes to remove any debris.





11. **Hard-wired systems:** Connect the air pipes to the outlet of the air filter/regulator unit using the T-fittings and pneumatic adaptor fittings as appropriate.

Systems with connector: Connect the air pipes to the NC4 system and slide spring covers over air fittings.

- 12. Fit conduit clamps to secure the conduit in position on the table of the machine. This will ensure that loads are not transferred to the NC4 system when the machine operates.
- 13. Secure spring covers to conduit, if required.

Introduction

The interface unit should be installed in the CNC control cabinet. Where possible, locate the unit away from potential sources of interference such as transformers and motor controllers.

The interface processes signals from the NC4 and converts them into a voltage-free solid state relay (SSR) output. This is transmitted to the CNC machine control, which responds to the probe inputs.

Installing the interface unit

WARNING: Before installing the interface unit, ensure that the machine is safe to work on. Switch off machine power when working in the control cabinet.

Install and configure the interface as described in the publication *NCi-6 non-contact tool setting interface* installation and user's guide, Renishaw part no. H-6516-8500.



NC4 (integral air blast) system wiring details

The colour and intended function of each of the wires from the NC4 transmitter and receiver units are described below. The NC4 with connector has a single cable with one wire of each colour.

NC4 transmitter unit		NC4 receiver unit	
Wire colour	Function	Wire colour	Function
Green	Screen	Green	Screen
Black	0 V	Black	0 V
Red	12 V	Red	12 V
White	not used*	White	Analogue output 1
Blue	not used*	Blue	Analogue output 2
Purple	not used*	Purple	Set-up
Grey	Probe status	Grey	Probe status

* **NOTE:** That as this wire is not used, you should ensure that the free end is correctly insulated.

What to do next

After you have finished installing the interface unit, apply electrical power to the interface.

When the interface is powered up, switch on the air supply and set the correct air pressure.

Applying electrical power to the interface unit

WARNING: Before switching on electrical power, ensure that the machine is safe to work on.

- Ensure that the interface unit and air supplies have been connected correctly (for more information see the table on page 34).
- 2. Switch on electrical power to the interface.
- 3. Check that the status LED on each of the NC4 transmitter and receiver units is lit.

Power loss and restoration

If electrical power to the interface unit is lost and subsequently restored when the NC4 system is in a normal operating mode, the NC4 powers down and then powers up again without loss of the original gain settings.

Setting the NC4 (integral air blast) system air pressure

WARNING: Before setting the air pressure, ensure that the machine is safe to work on.

- 1. Ensure that electrical power is applied to the interface unit.
- Monitor the set-up voltage as shown on page 40 and page 41.
- 3. Switch on the air supply.
- 4. Gradually increase the air pressure until the laser beam is seen to exit the transmitter unit and the set-up voltage begins to rise.
- Note the pressure on the pressure gauge and increase the pressure by an additional 0.5 bar (7.25 psi). Check that the profile of the laser beam is circular.

NOTE: If the air supply pressure varies while the machine is operating, the air pressure to the NC4 system may need to be increased to allow for this pressure fluctuation.



Setting the air blast pressure

WARNING: Before setting the air blast pressure, ensure that the machine is safe to work on.

- 1. Switch on the air supply.
- 2. Activate the solenoid valve.

- Increase the air pressure until sufficient to remove the swarf and coolant contamination typical for the application and the tools used.
- 4. Typically 6.0 bar (87.02 psi) is most effective.
- 5. For very small tools, reduce the pressure in order to prevent damage to the tools.



Introduction

Before installing the NC software, read the guidelines contained in the Readme file on the software media.

Software routines

Software routines for tool setting using various machine controllers and available software packages from Renishaw plc are described in the data sheet *Probe software for machine tools – programs and features* Renishaw part no. H-2000-2298. For more information see **www renishaw com**.

Example programs for high-speed broken tool detection of solid tools are available for a wide range of machine controller types. Please refer to the Renishaw web site at **www.renishaw.com** and then search for "Non-contact tool setting software".

Aligning the NC4 (integral air blast) system

Aligning the NC4 system involves moving the NC4 system so that the laser beam is parallel/perpendicular to the machine's axes. The alignment should be adjusted so that it is within the recommended tolerances detailed in "Alignment tolerances" on page 42.

The beam alignment macro described in the relevant non-contact tool setting software programming guide is used for this process. The macro indicates how well the system is aligned. You can then use this information to make adjustments to the NC4.

Setting up the NC4 (integral air blast) system

Setting up the NC4 system involves adjusting the relative positions of the transmitter and receiver units to maximise a test signal obtained at the receiver unit. Do this with the interface unit in setup mode.

Either a voltmeter or an NC4 set-up tool is used to provide an indication of the signal strength received at the receiver unit.

NOTE: The NC4 systems are supplied correctly set-up. Only use the set-up procedure if it is suspected that the transmitter and receiver units have become misaligned.

Using a voltmeter

A standard voltmeter, that is within calibration, may be used for setting up and aligning the NC4 system.

- Position the voltmeter next to the receiver unit. Connect a wire between terminal CN1-1 on the NCi-6 interface unit and one of the voltmeter probes. Connect a second wire between terminal CN1-2 and the other voltmeter probe.
- On the interface unit, set switch SW1-2 (NC set-up) to 'On'.

NOTE: If a negative reading is obtained when you use the voltmeter, swap over the voltmeter probe connections.



Using the set-up tool

The set-up tool numerical display provides a correct reading only when the interface unit is in the set-up mode – that is, when the NC set-up switch (SW1-2) is set to 'On'.

- Check that the NC4 receiver unit is clean and free of swarf. Push the set-up tool onto the top of the receiver unit and rotate it so that the display is facing you.
- On the interface unit, set switch SW1-2 (NC set-up) to 'On'.



Alignment tolerances

The tolerances to which a tool can be set are dependent on the parallelism of the laser beam to the machine axes.

Tool setting applications

Over a span of 100 mm (3.94 in), the following alignment accuracies are easily achievable:

Spindle axis (P2 – P1): $\leq 10.0 \ \mu m \ (0.39 \ \mu in)$

Radial axis (P2 – P1): ≤1.0 mm (0.39 in)

These values are sufficient for the majority of tool setting applications.



Tool breakage detection applications

Over a span of 100 mm (3.94 in), the following alignment accuracies are easily achievable:

Spindle axis (P2 – P1): ≤0.2 mm (0.008 in)

Radial axis (P2 – P1): ≤1 mm (0.39 in)

These values are sufficient for the majority of tool breakage applications.

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Aligning and setting up an NC4 (integral air blast) system

The NC4 (integral air blast) systems are supplied with the transmitter and receiver units correctly set-up. After installing the system, you will need to align the system as described in this section.

Use the setting up procedure only when it is suspected that the transmitter and receiver units have become misaligned.

WARNING: Before aligning and setting up an NC4 system, ensure that the machine is safe to work on.

To align an NC4 (integral air blast) system

1. Run the beam alignment macro (for more information see the relevant non-contact tool setting software programming guide).

 If alignment is outside the values described in "Alignment tolerances" on page 42, make the appropriate adjustments to the system. Do this as follows (for more information see the figure on page 44).

Aligning to the X and Y axes

- a. Slacken the X and Y-axis locking screws.
- b. Align the unit to the X and Y axes by hand.
- c. Carefully tighten the X and Y-axis locking screws, taking care not to move the hard-wired unit.

Aligning to the Z-axis

- a. Slacken the Z-axis locking screw(s).
- b. Adjust the Z-axis adjusting screw(s).
- c. Carefully tighten the Z-axis locking screw(s), taking care not to move the unit.
- 3. After aligning the system, run the beam alignment macro again.

Location of locking and adjusting screws on the NC4 system





To set up an NC4 (integral air blast) system

Refer to the figure on page 45.

- Either connect the digital voltmeter as described in "Using a voltmeter" on page 40 or fit the NC4 set-up tool as described in "Using the set-up tool" on page 41.
- 2. Switch on electrical power to the interface unit.
- 3. Ensure that air is supplied to the NC4 and is at the correct pressure.
- 4. At the transmitter unit, unscrew the cover securing screw and remove the cover.
- 5. At the transmitter unit, slacken the pitch and rotation locking screws.
- On the interface unit, set switch SW1-2 (NC set-up) to 'On'.

 Adjust the rotation and pitch of the transmitter unit so that the laser beam shines on the centre of the receiver MicroHole and the maximum signal is obtained on the voltmeter or set-up tool.

Check that either:

- the voltmeter reading is between 1.0 V and 7.0 V, or
- the set-up tool reading is between 1.0 and 7.0.
- Repeat step 7 to check that the maximum reading is obtained on the voltmeter or set-up tool.
- 9. At the transmitter unit, tighten the pitch and rotation locking screws to 1.5 Nm (1.11 lbf.ft).
- 10. At the transmitter unit, refit the cover then refit and tighten the cover securing screw.

11. Check that the laser beam is not obstructed.

On the interface unit, set switch SW1-2 (NC set-up) to 'Off'.

Check that:

- the probe status LED is green, and
- the voltmeter reading is between 4.7 V and 5.3 V.

NOTE: If the set-up tool is used, ignore the reading on the display. A false reading is shown when the NC set-up mode is switched off.

12. If the beam is blocked when the switch is set to 'Off', the system will be unable to set itself correctly. If this occurs, remove the obstruction then set switch SW1-2 (NC set-up) to 'On' then back to 'Off'.

NC4 fails to turn on (Tx and Rx status LEDs are not lit)		
Cause	Rectification action	
Faulty connections.	Check that the wiring connections are correct.	
Wrong supply voltage.	Check the supply voltage to the interface unit.	
Blown fuse.	Check the connections for a short circuit.	
Damaged cable.	Replace the cable.	

No laser beam is exiting the transmitter (Tx and Rx status LEDs are lit)		
Cause	Rectification action	
The PassiveSeal is protecting the device.	Check that the air supply to the NC4 system is switched on (for more information see "Setting the NC4 (integral air blast) system air pressure" on page 36).	
Damaged air pipe.	Check the air pipe for damage or kinks.	

Poor repeatability/spurious readings	
Cause	Rectification action
Coolant or swarf on the tool.	Clean the tool with an air blast or high-speed spin.
	Check the air blast nozzle is not damaged or blocked.
	Replace if necessary.
Feedrate is too high.	Set the correct feedrate – 2.0 µm (78.74 µin) per
	revolution is the recommended value.
Electrical interference.	Ensure that the NC4 cables are not routed alongside
	cables carrying high current.
	Ensure that the earth wire is connected to the
	interface.
Thermal growth of the machine and the	Minimise temperature changes.
workpiece.	Increase the frequency of calibration.
Excessive machine vibration.	Eliminate vibration.
NC4 air pressure is set incorrectly.	Reset the air pressure (for more information see
	"Setting the NC4 (integral air blast) system air
	pressure" on page 36).
Calibration and updating of the offset is not	Check the software.
occurring.	
Measuring speed is different from the	Review the software program.
calibration speed.	
Measuring occurring during the machine	Review the software program.
acceleration and deceleration zones.	
Poor machine repeatability due to worn	Perform a health check on the machine.
slides, accident damage, loose encoders etc.	

Poor repeatability/spurious readings (continued)		
Cause	Rectification action	
Loose brackets.	Check and tighten the brackets as appropriate.	
Poor tool change repeatability.	Check repeatability of the NC4 without performing a tool change.	
Poorly regulated power supply.	Ensure that the power supply is correctly regulated.	
Coolant drips or mist.	Select tool set mode 2. If no M-codes are available or tool set	
	mode 2 cannot be implemented, use tool set mode 1 and select	
	the drip-rejection mode using the switch on the interface and the	
	NC software. Wait until the mist has cleared before measuring.	

Voltage is outside the range 1.0 V to 7.0 V when in set-up mode (interface unit set-up switch		
SW1-2 is set to 'On')		
Cause	Rectification action	
Incorrect separation.	Ensure that the NC4 system has the correct range installed.	
	Contact the supplier if a different system range is required.	
Poor connection.	Check that the voltmeter is operating correctly and is correctly	
	connected to the interface.	
NC4 air pressure is set	Reset the air pressure (for more information see "Setting the NC4	
incorrectly.	(integral air blast) system air pressure" on page 36).	
An object is blocking the beam.	Ensure that the laser beam is unobstructed.	
Dirty MicroHole or optics.	Clean the optics (for more information see "Cleaning the optics" on	
	page 59).	

Probe status LED is amber (this is a fault only in certain conditions - for more information see the		
table on page 9 and page 10)		
Cause	Rectification action	
System is not set for optimum	The system operating voltage has decreased since it was last set	
performance.	up. This may occur if:	
	• The optics are contaminated (for more information see page 59, "Cleaning the optics").	
	 The air pressure is incorrect (for more information see "Setting the NC4 (integral air blast) system air pressure" on page 36). 	
	 The system is out of alignment (for more information see page 43, "Alignment and set-up"). 	

Probe status LED is flashing amber/green		
Cause	Rectification action	
Flashing at 1 Hz. System is not set for optimum performance.	The system operating voltage has increased since it was last set up. This may occur if the system was not set up and aligned correctly (for more information see page 43, "Alignment and set-up").	
Amber/green flickering. NO FAULT.	If in tool set mode 2 or latch mode, amber/green flickering indicates the tool is rotating in the laser beam revealing the laser between tool teeth. The probe is untriggered. This is not a fault.	

Probe status LED is red	
Cause	Rectification action
No air supply to the NC4.	Check the air supply.
Damaged air pipes.	Ensure that the air pipes are not damaged or kinked.
Misalignment between the	Realign the transmitter and receiver units.
receiver and transmitter units.	
Laser beam is obstructed.	Clear the obstruction.
Lens is dirty or the air hole is	Refer to the servicing section of this guide for cleaning
blocked.	instructions. (Also for more information see the fault "Tx or Rx lens
	is dirty or the air hole is blocked".)

Tx or Rx lens is dirty or the air hole is blocked		
Cause	Rectification action	
Air supply to NC4 does not conform to BS ISO 8573-1: 2010 class 1.7.2.	Connect the air supply upstream of the oil mist lubricator or auto shut-off valve. Ensure that the machine shop air supply is to the required air quality.	
	If the temperature of the air supply is 5 $^{\circ}$ C (41 $^{\circ}$ F) or more greater than ambient and is humid, fit an air dryer.	
Non-Renishaw air filter is being used.	The air filter must conform to BS ISO 8573-1: 2010 class 1.7.2.	
Air filter bowl is full of liquid.	Empty the accumulated liquid from the filter bowl. Check the air supply.	
Air pipe is full of coolant or oil.	Purge or replace the air pipe.	

NC4 set-up tool does not power up		
Cause	Rectification action	
Faulty connection.	Check that the NC4 set-up tool is clean and free from swarf.	
	Check that the spring-loaded contact springs on the underside of	
	the tool are clean and are not damaged.	
Battery fitted incorrectly.	Fit the battery correctly.	
	Check that the correct battery is fitted.	
Flat battery.	Replace the battery.	

NC4 set-up tool gives incorrect reading		
Cause	Rectification action	
Incorrect reading	The numerical display of the set-up tool provides an indication only. This may differ from the reading obtained on a voltmeter that is connected to the NCi-6 interface. The reading may also vary when the set-up tool is swapped between the transmitter and receiver units. This variation in voltage is not greater than ± 0.2 V. An incorrect reading is obtained when the NC set-up mode is switched off.	
Dirty optics	Ensure that the NC4 status LED and the optical filter on the set-up tool are clean and are not damaged.	
Air blast problems		
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Cause	Rectification action	
Air blast makes a squealing noise.	Air pressure is too low. Increase air pressure until noise stops. DO NOT exceed 6.0 bar (87.02 psi) maximum.	
Jet of coolant from nozzle when air blast activated.	Check the nozzle isn't damaged and is correctly fitted. Replace nozzle.	
No air from air blast.	Check nozzle is fitted correctly and is not damaged. Check that the air supply is switched on.	

Introduction

The NC4 unit requires minimal maintenance as it has been designed to operate as a permanent fixture on all sizes of vertical and horizontal machining centres, multi-tasking machines and gantry machining centres where it is subject to an environment of hot metal chips and coolant.

Only the maintenance routines described in this guide should be undertaken.

Equipment requiring repair, overhaul or attention under warranty should be returned to your supplier.

Before carrying out any maintenance operations, ensure that the machine is safe to work on and electrical power to the interface is switched off.

Checking the liquid level

Regularly check the level of the accumulated liquid in each of the filter bowls. It is important that the level is kept below the filter element.

Draining the liquid

Drain the liquid that has accumulated in a filter bowl as follows:

- 1. Switch off the air supply. A quantity of liquid will drain from the bowl.
- Switch on the air supply and set the pressure as described in "Setting the NC4 (integral air blast) system air pressure" on page 36.
- 3. If the level of the liquid in the bowl is still too high, repeat steps 1 and 2 until the level reduces to a satisfactory level.



Replacing the battery

The set-up tool requires a $1\!\!\!/_2$ AA size battery that is rated between 3.3 V and 3.6 V.

- 1. Slide the top cover forward by hand to expose the battery.
- 2. Remove the battery.
- Carefully fit a new battery. Refer to the markings on the circuit board for correct orientation.
- 4. Refit the top cover.



Introduction

The servicing procedures described in this section should only be carried out by suitably qualified personnel.

Cleaning the optics and servicing the PassiveSeal should only be carried out by personnel who have received training in the use and operation of laser products. Special tools, such as the cleaning tool and pin spanner, should only be used by service personnel.

Cleaning the NC4

If the air to the NC4 becomes contaminated, the transmitter and receiver units may require cleaning.

Contamination will cause the system to stay in a triggered state. If contamination is suspected, identify the cause and rectify the problem before cleaning the NC4 system. If necessary, change the air pipe. Clean the units one at a time to reduce the risk of mixing up the access panels.

Equipment required

- Pin spanner.
- Cleaning tool.
- Solvent cleaner plus (RS Components No. 132-481) or similar.
- Dust remover clean air spray (RS Components No. 846-698).
- Polyester cleaning swabs (×2).

To clean the optics



CAUTION – Laser safety

The access panel of an NC4 transmitter unit is removed to allow access to the optics. Before removing the panel, switch off electrical power to the transmitter unit to avoid exposure to the laser beam.





- 1. Switch off electrical power to the interface unit.
- Remove the air supply from the NC4 by setting the pressure regulator to 0 bar (0 psi).
- 3. If an air pipe is damaged, replace the pipe.
- 4. Using the pin spanner, remove the access panel from the front of the NC4 unit.

- Insert the cleaning tool into the housing and rotate through 70 to 80 degrees until the PassiveSeal is clear of the optic glass.
- 6. Purge the air supply for approximately one minute to clear the lines.
- Access to the lens is through the centre of the cleaning tool. Spray the solvent cleaner, through the nozzle tube, onto the lens.

- Wipe the lens with the swab, using quarterturn movements. Take care not to apply excessive force to the lens as this may damage the optical surfaces.
- Purge the air supply for one minute to clear the lines.
- 10. Soak a cleaning swab with the solvent cleaner.
- Wipe the lens with the swab, using quarterturn movements. Take care not to apply excessive force to the lens as this may damage the optical surfaces.
- 12. Spray the clean air spray into the housing to remove all traces of solvent.
- Visually inspect for debris around the surfaces where the access panel fits into the NC4 unit and remove if applicable. Take care not to accidentally introduce debris into the housing.

- Using solvent cleaner and a clean, dry compressed air supply, blow all debris out of the MicroHole in the access panel.
- Remove the cleaning tool. Refit the access panel using the pin spanner. Tighten to 2.0 Nm (1.48 lbf.ft).
- 16. Repeat the cleaning procedure for the other NC4 unit.

After cleaning the NC4

- Switch on electrical power to the interface unit (for more information see "Applying electrical power to the interface unit" on page 35).
- Restore the air supply to the NC4 and adjust the pressure (for more information see "Setting the NC4 (integral air blast) system air pressure" on page 36).

- If realignment is not necessary, set switch SW1-2 (NC set-up) on the interface unit to 'On'. After approximately 5 seconds, set the switch to 'Off'.
- Check that the system triggers. To do this, pass an object through the laser beam and check that the status LED changes from green to red and back to green.

Replacing the air blast nozzle

The air blast nozzle can be replaced if it becomes damaged.

Identify the cause of the damage and rectify the problem before replacing the air blast nozzle.

Equipment required

- Nozzle replacement kit. Supplied with:
 - Nozzle key
 - Nozzle assembly
 - Washer

To replace the air blast nozzle

- 1. Switch off electrical power to the interface system.
- 2. Remove the air supply to the NC4 by setting the pressure regulator to 0 bar (0 psi).
- 3. Remove the air supply to the air blast system.

- 4. Using the nozzle key, remove the nozzle from the NC4.
- Fit the new nozzle to the NC4 system (for further information see the figure on page 65). Tighten to 2.0 Nm (1.47 lbf.ft.).

After replacing the air blast nozzle

- Switch on electrical power to the interface unit (see "Applying electrical power to the interface unit" on page 35).
- Restore the air supply to the NC4 and air blast and adjust the pressure (see "Setting the NC4 (integral air blast) system air pressure" on page 36).



Disassembling and reassembling a hard-wired system

CAUTION: Systems with connectors cannot be dismantled. Please contact your Renishaw supplier.

An NC4 hard-wired system can be partially dismantled to allow the air pipe to be replaced and to gain access to the PassiveSeal.

Before disassembling and reassembling the units, ensure that swarf and debris is removed from the system.

The following procedures are suitable for the transmitter and receiver units.

Before disassembling a hard-wired system

WARNING: Before disassembling a hard-wired system, ensure that the machine is safe to work on. Remove power and air from the NC4 system.



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CAUTION – Laser safety
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The access panel of the NC4 transmitter unit might be removed when disassembling the hard-wired system.

Before disassembling the system, switch off electrical power to avoid exposure to the laser beam.

To disassemble a hard-wired unit

Refer to the figure on page 67.

1. Switch off the electrical power to the interface unit.

(continued on page 68)



- Remove the air supply from the NC4 by setting the pressure regulator to 0 bar (0 psi).
- 3. Remove the NC4 hard-wired system housing from the mounting/adjuster plate.
- 4. Unscrew and remove the M3 cover plate screw then remove the cover plate.
- 5. Unscrew and remove the two M3 holding screws.
- Carefully pull the NC4 unit assembly out of the housing so that the air pipe and electrical cable are exposed.

The PassiveSeal and air pipe can now be accessed. The pneumatic fitting is of a push fit/release type.

To disassemble the PassiveSeal, for more information see "Disassembling the seal" on page 70.

7. Replace the air pipe if required.

To reassemble a hard-wired unit

Refer to the figure on page 67.

- 1. Ensure that the air pipe and PassiveSeal are fitted.
- Carefully feed any excess cable and air pipe back through the gland. Too much slack may damage the supplies when putting the system back together.
- Refit the NC4 unit assembly into the housing, taking care not to damage or kink the cable and air pipe. A slight twisting action will help these to lie in position.
- 4. Secure the NC4 unit to the housing with the two M3 holding screws.
- Refit the cover plate then refit and tighten the M3 cover plate screw.
- 6. Secure the compact hard-wired system to the mounting/adjuster plate.

 Finally, align and set up the compact hardwired system as described in "Aligning and setting up an NC4 (integral air blast) system" on page 43.

Disassembling the seal

CAUTION: Systems with connectors cannot be dismantled. Please contact your Renishaw supplier.

If an NC4 unit becomes heavily contaminated due to a dirty air supply, the PassiveSeal assembly within the unit must be removed to allow the unit to be cleaned thoroughly.

Disassemble and reassemble the PassiveSeal of one NC4 unit at a time. This will avoid mixing up the seals and access panels.

Refer to the figure on page 71.

CAUTION – Laser safety

The access panel of the NC4 transmitter unit is removed when disassembling the unit to gain access to the PassiveSeal.

Before disassembling the unit, switch off electrical power to avoid exposure to the laser beam.

- 1. Switch off electrical power to the interface unit.
- Remove the air supply from the NC4 by setting the pressure regulator to 0 bar (0 psi).
- 3. Unscrew the NC4 unit from the mounting pack or plate.
- 4. Using the pin spanner, unscrew and remove the access panel.
- 5. Using the pin spanner, unscrew the locking cover.
- 6. Remove the locking cover, diaphragm clamp, spring, and PassiveSeal assembly.

Reassembling the seal

- 1. Place the PassiveSeal assembly into the NC4 unit.
- 2. Insert the orientation tool into the unit to hold the PassiveSeal against the flats.

(continued on page 72)



- Insert the spring, diaphragm clamp and locking cover. Tighten the locking cover to 2.0 Nm (1.48 lb.ft).
- 4. Remove the orientation tool.
- Inspect the unit for contamination. Using a clean, dry compressed air supply, blow all debris out of the MicroHole in the access panel.
- Refit the access panel and tighten to 2.0 Nm (1.48 lb.ft).
- Disassemble and reassemble the PassiveSeal of the other unit if necessary.
- 8. Finally, remount and realign the NC4 as described in the following section.

Refitting and aligning the NC4

- Refit the NC4 as described in "Installing an NC4 (integral air blast) system" on page 27.
- Switch on electrical power to the interface unit (for more information see "Applying electrical power to the interface unit" on page 35).
- Restore the air supply to the NC4 and adjust the pressure (for more information see "Setting the NC4 (integral air blast) air pressure" on page 36).
- Realign the NC4 as described in "Aligning and setting up an NC4 (integral air blast) system" on page 43.
- Check that the system triggers. To do this, pass an object through the laser beam and check that the status LED changes from green to red and back to green.

Removing and refitting filter elements

Regularly inspect the filter elements. They should be replaced when dirty or wet and at least once each year. Do this as follows:

- 1. Switch off the air supply.
- 2. Unscrew the filter bowl by hand.
- 3. Remove the O-ring from the recess in the filter bowl. Discard the O-ring.
- 4. Unscrew and remove the filter element.
- 5. Fit the replacement filter and, where applicable, the O-ring. These are shown in the dotted box A in the figure on page 74.
- 6. Fit a new O-ring into the recess in the filter bowl.
- 7. Refit the filter bowl and screw hand-tight.

 Switch on the air supply and set the pressure as described in "Setting the NC4 (integral air blast) air pressure" on page 36.



Replacing other service kit components

- 1. Switch off the air supply.
- 2. Using a 38 mm A/F spanner, remove the regulator head.
- Remove the components (shown in the dotted box B) from the body of the regulator.
- 4. Fit the new components to the regulator body.
- Refit the regulator head and tighten to 7.7 Nm (5.68 lbf.ft).
- Switch on the air supply and set the pressure as described in "Setting the NC4 (integral air blast) system air pressure" on page 36.

NOTE: Items shown within dotted boxes A and B are included in the air filter service kit obtainable from Renishaw (for more information see the parts list on page 89).



NC4 hard-wired unit assemblies.

- Integral air blast
- Ø6.0 mm (0.24 in) × 5.0 m (16.40 ft) air tube
- Ø6.0 mm (0.24 in) × 12.5 m (41.01 ft) cable (× 2)
- Ø3.0 mm (0.12 in) × 5.0 m (16.40 ft) air tube (× 2)

- Mounting and adjuster plate
- Laser warning sign
- Installation and maintenance guide

Туре	Part number	Description
NC4+ F115 hard-wired unit assembly	A-6270-2000	F115+ assembly with hard-wired cable
NC4+ F115 (raised) hard-wired unit	A-6270-2100	F115+ assembly with raised columns
assembly		and hard-wired cable
NC4+ F145 hard-wired unit assembly	A-6270-2200	F145+ assembly with hard-wired cable
NC4+ F145 (raised) hard-wired unit	A-6270-2300	F145+ assembly with raised columns
assembly		and hard-wired cable
NC4 F230 hard-wired unit assembly	A-6270-2400	F230 assembly with hard-wired cable
NC4 F230 (raised) hard-wired unit	A-6270-2500	F230 assembly with raised columns
assembly		and hard-wired cable
NC4 F300 hard-wired unit assembly	A-6270-2600	F300 assembly with hard-wired cable
NC4 F300 (raised) hard-wired unit	A-6270-2700	F300 assembly with raised columns
assembly		and hard-wired cable

NC4 hard-wired 90° unit assemblies.

- Integral air blast
- Ø6.0 mm (0.24 in) × 5.0 m (16.40 ft) air tube
- 90° cable fitting
- Ø6.0 mm (0.24 in) × 12.5 m (41.01 ft) cable (× 2)

- Ø3.0 mm (0.12 in) × 5.0 m (16.40 ft) air tube (× 2)
- Mounting and adjuster plate
- Laser warning sign
- Installation and maintenance guide

Туре	Part number	Description
NC4+ F115 90° hard-wired unit assembly	A-6270-2020	F115+ assembly with 90° fitting and
		hard-wired cable
NC4+ F115 (raised) 90° hard-wired unit	A-6270-2120	F115+ assembly with raised columns,
assembly		90° fitting and hard-wired cable
NC4+ F145 90° hard-wired unit assembly	A-6270-2220	F145+ assembly with 90° fitting and
		hard-wired cable
NC4+ F145 (raised) 90° hard-wired unit	A-6270-2320	F145+ assembly with raised columns,
assembly		90° fitting and hard-wired cable
NC4 F230 90° hard-wired unit assembly	A-6270-2420	F230 assembly with 90° fitting and
		hard-wired cable
NC4 F230 (raised) 90° hard-wired unit	A-6270-2520	F230 assembly with raised columns,
assembly		90° fitting and hard-wired cable
NC4 F300 90° hard-wired unit assembly	A-6270-2620	F300 assembly with 90° fitting and
		hard-wired cable
NC4 F300 (raised) 90° hard-wired unit	A-6270-2720	F300 assembly with raised columns,
assembly		90° fitting and hard-wired cable

NC4 unit with connector assemblies.

- Integral air blast
- Ø6.0 mm (0.24 in) × 5.0 m (16.40 ft) air tube
- Ø4.0 mm (0.16 in) × 5.0 m (16.40 ft) air tube
- Mounting and adjuster plate

- Laser warning sign
- Installation and maintenance guide

Туре	Part number	Description
NC4+ F115C assembly	A-6270-2010	F115+ assembly with connector socket
NC4+ F115C (raised) assembly	A-6270-2110	F115+ assembly with raised columns
		and connector socket
NC4+ F145C assembly	A-6270-2210	F145+ assembly with connector socket
NC4+ F145C (raised) assembly	A-6270-2310	F145+ assembly with raised columns
		and connector socket
NC4 F230C assembly	A-6270-2410	F230 assembly with connector socket
NC4 F230C (raised) assembly	A-6270-2510	F230 assembly with raised columns
		and connector socket
NC4 F300C assembly	A-6270-2610	F300 assembly with connector socket
NC4 F300C (raised) assembly	A-6270-2710	F300 assembly with raised columns
		and connector socket

NC4 hard-wired kits.

- Integral air blast
- Ø6.0 mm (0.24 in) × 5.0 m (16.40 ft) air tube
- Ø6.0 mm (0.24 in) × 12.5 m (41.01 ft) cable (× 2)
- Air filter/regulator
- Ø4.0 mm (0.16 in) × 25.0 m (82.02 ft) air tube
- Ø3.0 mm (0.12 in) × 5.0 m (16.40 ft) air tube (× 2)
- Ø4.0 mm (0.16 in) pneumatic tee fitting
- Ø4.0 mm (0.16 in) to Ø4.0 mm (0.16 in) pneumatic fitting
- Ø3.0 mm (0.12 in) to Ø4.0 mm (0.16 in) pneumatic fitting (× 2)
- Blanking cap (× 3)
- 4.0 m (13.12 ft) length GP18 steel braided conduit
- NCi-6 interface
- Pin spanner

- Hexagonal wrenches (2 mm, 2.5 mm and 3 mm)
- Bootlace ferrule (× 12)
- Conduit clamp (x 2)
- Cleaning swab (× 2)
- Cleaning tool
- Orientation tool
- Mounting and adjuster plate
- Laser warning sign
- Installation and maintenance guide

Туре	Part number	Description
NC4+ F115 kit	A-6270-3000	F115+ kit with hard-wired cable
NC4+ F115 (raised) kit	A-6270-3100	F115+ kit with raised columns and
		hard-wired cable
NC4+ F145 kit	A-6270-3200	F145+ kit with hard-wired cable
NC4+ F145 (raised) kit	A-6270-3300	F145+ with raised columns and
		hard-wired cable
NC4 F230 kit	A-6270-3400	F230 kit with hard-wired cable
NC4 F230 (raised) kit	A-6270-3500	F230 with raised columns and
		hard-wired cable
NC4 F300 kit	A-6270-3600	F300 kit with hard-wired cable
NC4 F300 (raised) kit	A-6270-3700	F300 with raised columns and
		hard-wired cable

NC4 hard-wired 90° kits

Supplied with:

- Integral air blast
- Ø6.0 mm (0.24 in) × 5.0 m (16.40 ft) air tube
- 90° cable fitting
- Ø6.0 mm (0.24 in) × 12.5 m (41.01 ft) cable (× 2)
- Air filter/regulator
- Ø4.0 mm (0.16 in) × 25.0 m (82.02 ft) air tube
- Ø3.0 mm (0.12 in) × 5.0 m (16.40 ft) air tube (× 2)
- Ø4.0 mm (0.16 in) pneumatic tee fitting
- Ø4.0 mm (0.16 in) to Ø4.0 mm (0.16 in) pneumatic fitting
- Ø3.0 mm (0.12 in) to Ø4.0 mm (0.16 in) pneumatic fitting (× 2)
- Blanking cap (× 3)
- 4.0 m (13.12 ft) length GP18 steel braided conduit
- NCi-6 interface

- Pin spanner
- Hexagonal wrenches (2 mm, 2.5 mm and 3 mm)
- Bootlace ferrule (× 12)
- Conduit clamp (x 2)
- Cleaning swab (× 2)
- Cleaning tool
- Orientation tool
- Mounting and adjuster plate
- Laser warning sign
- Installation and maintenance guide

(continued on next page)

Туре	Part number	Description
NC4+ F115 kit 90°	A-6270-3020	F115+ kit with 90° fitting and
		hard-wired cable
NC4+ F115 (raised) kit 90°	A-6270-3120	F115+ kit with raised columns,
		90° fitting and hard-wired cable
NC4+ F145 kit 90°	A-6270-3220	F145+ kit with 90° fitting and
		hard-wired cable
NC4+ F145 (raised) kit 90°	A-6270-3320	F145+ with raised columns, 90° fitting
		and hard-wired cable
NC4 F230 kit 90°	A-6270-3420	F230 kit with 90° fitting and hard-wired
		cable
NC4 F230 (raised) kit 90°	A-6270-3520	F230 with raised columns, 90° fitting
		and hard-wired cable
NC4 F300 kit 90°	A-6270-3620	F300 with 90° fitting and hard-wired
		cable
NC4 F300 (raised) kit 90°	A-6270-3720	F300 with raised columns, 90° fitting
		and hard-wired cable

NC4 with straight connector kits.

Supplied with:

- Integral air blast
- Ø6.0 mm (0.24 in) × 5.0 m (16.40 ft) air tube
- Ø4.0 mm (0.16 in) × 5.0 m (16.40 ft) air tube
- Ø6.0 mm (0.24 in) × 12.5 m (41.01 ft) cable with straight connector
- Air filter/regulator
- Ø4.0 mm (0.16 in) × 25.0 m (82.02 ft) air tube
- Ø4.0 mm (0.16 in) pneumatic tee fitting
- Ø4.0 mm (0.16 in) to Ø4.0 mm (0.16 in) pneumatic fitting
- Blanking cap (× 3)
- 4.0 m (13.12 ft) length GP9 steel braided conduit
- 4.0 m (13.12 ft) length × Ø4.0 mm (0.16 in) spring conduit
- 4.0 m (13.12 ft) length × Ø6.0 mm (0.24 in) spring conduit
- NCi-6 interface

- Pin spanner
- Hexagonal wrenches (2 mm, 2.5 mm and 3 mm)
- Bootlace ferrule (× 12)
- Conduit clamp (× 2)
- Cleaning swab (× 2)
- Cleaning tool
- Orientation tool
- Mounting and adjuster plate
- Laser warning sign
- Installation and maintenance guide

(continued on next page)

Туре	Part number	Description
NC4+ F115C kit	A-6270-3010	F115+ kit and cable with straight
		connector
NC4+ F115C (raised) kit	A-6270-3110	F115+ kit with raised columns and
		cable with straight connector
NC4+ F145C kit	A-6270-3210	F145+ kit and cable with straight
		connector
NC4+ F145C (raised) kit	A-6270-3310	F145+ with raised columns and cable
		with straight connector
NC4 F230C kit	A-6270-3410	F230 kit and cable with straight
		connector
NC4 F230C (raised) kit	A-6270-3510	F230 with raised columns and cable
		with straight connector
NC4 F300C kit	A-6270-3610	F300 kit and cable with straight
		connector
NC4 F300C (raised) kit	A-6270-3710	F300 with raised columns and cable
		with straight connector

NC4 with 90° connector kits.

- Integral air blast
- Ø6.0 mm (0.24 in) × 5.0 m (16.40 ft) air tube
- Ø4.0 mm (0.16 in) × 5.0 m (16.40 ft) air tube
- Ø6.0 mm (0.24 in) × 12.5 m (41.01 ft) cable with 90° connector
- Air filter/regulator
- Ø4.0 mm (0.16 in) × 25.0 m (82.02 ft) air tube
- Ø4.0 mm (0.16 in) pneumatic tee fitting
- Ø4.0 mm (0.16 in) to Ø4.0 mm (0.16 in) pneumatic fitting
- Blanking cap (× 3)
- 4.0 m (13.12 ft) length GP9 steel braided conduit
- 4.0 m (13.12 ft) length × Ø4.0 mm (0.16 in) spring conduit
- 4.0 m (13.12 ft) length × Ø6.0 mm (0.24 in) spring conduit
- NCi-6 interface

- Pin spanner
- Hexagonal wrenches (2 mm, 2.5 mm and 3 mm)
- Bootlace ferrule (× 12)
- Conduit clamp (x 2)
- Cleaning swab (× 2)
- Cleaning tool
- Orientation tool
- Mounting and adjuster plate
- Laser warning sign
- Installation and maintenance guide

Туре	Part number	Description
NC4+ F115C kit 90°	A-6270-3030	F115+ kit and cable with 90° connector
NC4+ F115C (raised) kit 90°	A-6270-3130	F115+ kit with raised columns and
		cable with 90° connector
NC4+ F145C kit 90°	A-6270-3230	F145+ kit and cable with 90° connector
NC4+ F145C (raised) kit 90°	A-6270-3330	F145+ with raised columns and cable
		with 90° connector
NC4 F230C kit 90°	A-6270-3430	F230 kit and cable with 90° connector
NC4 F230C (raised) kit 90°	A-6270-3530	F230 with raised columns and cable
		with 90° connector
NC4 F300C kit 90°	A-6270-3630	F300 kit and cable with 90° connector
NC4 F300C (raised) kit 90°	A-6270-3730	F300 with raised columns and cable
		with 90° connector

Туре	Part number	Description
Adjuster pack	A-6270-0302	Replacement adjuster pack for fixed system
NCi-6 interface kit	A-6516-2000	NCi-6 interface and box with DIN rail
		mounting and two terminal blocks
Conduit (GP18) per metre	M-6270-0278	Conduit for hard-wired integral air blast
		systems (GP18). Order by the metre
Conduit (GP9) per metre	P-HO01-0010	Conduit for integral air blast systems with
		cable connector (GP9). Order by the metre
Conduit kit (GP18)	A-6270-0390	4.0 m (13.12 ft) conduit kit for hard-wired
		integral air blast systems (GP18)
Conduit P-clip (GP18)	P-CA70-0220	Conduit clamp for GP18 conduit
Conduit P-clip (GP9)	P-CA71-0045	Conduit clamp for GP9 conduit
Conduit O-clip (GP18)	P-HO01-0069	O-clip for GP18 conduit
Conduit O-clip (GP9)	P-MA01-0041	O-clip for GP9 conduit
Cable with connector assembly	A-6270-0480	12.5 m (41.01 ft) cable with straight
(straight, no conduit)		connector
Cable with connector assembly (90°,	A-6270-0490	12.5 m (41.01 ft) cable with 90° connector
no conduit)		
Cable with connector assembly	A-6270-0485	12.5 m (41.01 ft) cable with straight
(straight, with conduit)		connector and 4.0 m (13.12 ft) of GP9
		conduit, O-clip and P-clips (× 2)

Туре	Part number	Description
Cable with connector assembly	A-6270-0495	12.5 m (41.01 ft) cable with 90° connector and
(90° with conduit)		4.0 m (13.12 ft) of GP9 conduit, O-clip and
		P-clips (× 2)
Hard-wired 90° conversion kit	A-6270-0380	Parts required to convert hard-wired system to
		90° exit
Conduit gland (GP18)	M-6270-0277	Cable/conduit gland for hard-wired integral air
		blast systems. M20 \times 1.5P
Conduit gland (GP9)	A-6270-0383	Cable/conduit gland for integral air blast
		systems with cable connector
18 access panel	A-6270-0315	Access panel 0.18
20 access panel	A-6270-0320	Access panel 0.20
+40+ access panel	A-6270-0340	Access panel 0.40+
+50+ access panel	A-6270-0350	Access panel 0.50+
Straight fitting Ø6.0 mm (0.24 in)	P-PE02-0295	Ø6.0 mm (0.24 in) to Ø6.0 mm (0.24 in) push-fit
to Ø6.0 mm (0.24 in)		pneumatic adaptor
Ø4.0 mm (0.16 in) tube	A-6270-0365	Ø4 mm (0.16 in) × 5.0 m (16.40 in) air tube,
installation kit		Ø4 mm (0.16 in) to Ø4 mm (0.16 in) straight
		fitting, blanking cap
Ø6.0 mm (0.24 in) tube	A-6270-0366	Ø6 mm (0.24 in) × 5.0 m (16.40 in) air tube,
installation kit		Ø6 mm (0.24 in) to Ø6 mm (0.24 in) straight
		fitting, blanking cap
PU tube Ø6 mm (0.24 in)	P-PF26-0018	Ø6 mm (0.24 in) air tube. Order by the metre

Туре	Part number	Description
NC4 installation and	H-6270-8501	Installation and maintenance guide for NC4 systems
maintenance guide		with integral air blast
(integral air blast)		
NCi-6 installation and	H-6516-8500	Installation and user guide for the NCi-6 interface
user's guide		
Air blast solenoid kit	A-5299-2933	Solenoid valve kit to control air supply to the integral
		air blast
Air blast nozzle	A-6270-0395	Air blast nozzle assembly and fitting tool
replacement kit		
Spring cover Ø4.0 mm	M-6270-0248	4.0 m (13.12 ft) length to protect Ø4 mm (0.16 in) air
(0.16 in)		tube
Spring cover Ø6.0 mm	M-6270-0249	4.0 m (13.12 ft) length to protect Ø6 mm (0.24 in) air
(0.24 in)		tube
NC4 tool kit	A-4114-4110	Pin spanner, hexagonal wrenches (2 mm, 2.5 mm and
		3 mm), bootlace ferrule (× 12), cleaning swab (× 2),
		cleaning tool, orientation tool
Rotary cover	M-4114-0130	Manually rotatable cover to block the laser beam
NC4 set-up tool	A-4114-8000	Battery operated tool used for setting up the NC4
		system
Battery	P-BT03-0007	Battery for NC4 set-up tool

Туре	Part number	Description
Air assembly kit	A-2253-5120	Filter/regulator
		Ø4.0 mm (0.16 in) × 25.0 m (82.02 ft) air tube
		Ø4.0 mm (0.16 in) T-fitting
Nylon tube Ø3.0 mm (0.12 in)	P-PF26-0014	Ø3.0 mm (0.12 in) by the metre
Nylon tube Ø4.0 mm (0.16 in)	P-PF26-0010	Ø4.0 mm (0.16 in) \times 25 m (82.02 ft) air tube (coil)
Equal tee fitting	P-PF04-0010	Ø4.0 mm (0.16 in) push-fit pneumatic adaptor
Straight fitting Ø4.0 mm	P-PE02-0020	Ø4.0 mm (0.16 in) to Ø4.0 mm (0.16 in) push-fit
(0.16 in) to Ø4.0 mm (0.16 in)		pneumatic adaptor
Straight fitting Ø4.0 mm	P-PE02-0019	Ø4.0 mm (0.16 in) to Ø3 mm (0.12 in) push-fit
(0.16 in) to Ø3.0 mm (0.12 in)		pneumatic adaptor
Air filter service kit	P-FI01-S002	Replacement filter and seals for air filter/regulator
		unit
De luxe air filter	P-FI01-0008	For filtering large quantities of contaminated air
Locknut	P-NU03-0200	Locknut, M20 \times 1.5P, for use with GP11 and GP16
		cable/conduit glands
NCi-6 terminal block (10-way)	P-CN25-1053	10-way socket terminal block, for use with NCi-6
		interface
NCi-6 terminal block (15-way)	P-CN25-0009	15-way socket terminal block, for use with NCi-6
		interface
Laser warning sign	P-LA01-1066	Adhesive-backed sign

For available software see the *Probe software for machine tools – programs and features* (Renishaw part no. H-2000-2298). For more information see **www renishaw.com**.

Machine tool apps

NC4 is supported by Smartphone and on-machine apps.

Smartphone apps provide information at a user's fingertips in a simple, convenient format. Available globally in a wide range of languages, our free-of-charge apps are perfect for new and less experienced users.



Renishaw apps are available in China via Baidu and Tencent.

On-machine apps can be seamlessly integrated with a wide range of CNC controls. Apps are installed onto a Microsoft® Windows®-based CNC control or a Windows tablet connected to the control via Ethernet.

With touch interaction and intuitive design, smartphone and on-machine apps provide significant benefits to machine tool probe users.

For more information, visit www.renishaw.com/machinetoolapps.


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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



For worldwide contact details, visit www.renishaw.com/contact

