

UCC S5 REVO-2 CMM controller installation guide

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Documentation part number: H-1000-7598-04-H



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UCC S5 general information

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 ORIGINAL LANGUAGE VERSION

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Care of equipment

Renishaw probes and associated systems are precision tools used for obtaining precise measurements and must therefore be treated with care.

Changes to Renishaw products

Renishaw reserves the right to improve, change or modify its hardware or software without incurring any obligations to make changes to Renishaw equipment previously sold.

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Packaging

To aid end user recycling and disposal the materials used in the different components of the packaging are stated here:

Packaging component	Material	94/62/EC code	94/62/EC number
Outer box	Cardboard - 70% recycled content	PAP	20
Packing foam	Polyurethane	PU	7
Packing foam	Cross-linked polyethylene	LDPE	4
Plastic bags	Low density polyethylene bag	LDPE	4

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UCC S5 product compliance

EU declaration of conformity

Contact Renishaw plc or visit www.renishaw.com/EUCMM for the full EU declaration.

UK declaration of conformity

Contact Renishaw plc or visit www.renishaw.com/UKCMM for the full UK declaration.

EMC conformity

This equipment must be installed and used in accordance with this installation guide. This product is intended for industrial use only and should not be used in a residential area or connected to a low voltage power supply network which supplies buildings used for residential purposes.

FCC (USA only)

Information to user (47 CFR 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 the instruction manual, 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 (47 CFR 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.

Equipment label (47 CFR 15.19)

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

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

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ICES-003 (Canada only)

Class A Equipment Statement (non-residential)

CAN ICES-003(A) / NMB-003(A)

REACH regulation

Information required by Article 33(1) of Regulation (EC) No. 1907/2006 ("REACH") relating to products containing substances of very high concern (SVHCs) is available at:

www.renishaw.com/REACH

China RoHS

Contact Renishaw plc or visit www.renishaw.com/ChinaRoHSCMM for the full China RoHS tabulation.



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UCC S5 safety

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

There are no user serviceable parts inside the equipment.

The UCC S5 controller is only warranted and approved for use with the provided PSU - Cincon TRG70A240-02E02 and XP AHM180PS48.

Cincon PSU electrical ratings

Supply voltage	100 V to 240 Vac +10%,-10%
Frequency range	50 Hz to 60 Hz
Power consumption	1.5 A
Output voltage	24 V
Transient voltages	Installation category II

XP PSU electrical ratings

Supply voltage	100 V to 240 Vac +10%,-10%
Frequency range	50 Hz to 60 Hz
Power consumption	2.2 A
Output voltage	48 V
Transient voltages	Installation category II

The UCC S5 is isolated from ac power by disconnection of the IEC mains connector from the supplied PSU. If any additional means of isolation is required, it must be specified and fitted by the machine manufacturer or installer of the product. The isolator / disconnection device must be sited within easy reach of the operator and comply with any applicable national wiring regulations for the country of installation.

The UCC S5 is provided with an equipotential bonding point which must be used to connect it to the rest of the installations ground structures.



WARNING: Switching off or isolating the UCC S5 may NOT prevent unexpected machine movement. The user is advised to isolate the machine from the electricity supply, compressed air or other energy sources in accordance with the machine manufacturer's instructions before entering the danger zone or performing any maintenance operations.

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UCC S5 enviromental conditions

Indoor use	IP10* (BS EN60529:1992)
Altitude	Up to 2000 m
Operating temperature	+5 °C to +50 °C
Storage temperature	-25 °C to +70 °C
Relative humidity	80% maximum (non-condensing) for temperatures up to +31 °C Linear decrease to 50% at +50 °C
Transient voltages	Installation category II
Pollution degree	2



* **NOTE:** It may be necessary to house UCC S5 in a suitable enclosure according to the installation's environmental conditions to obtain a higher IP rating.

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UCC S5 references and associated documents

The following Renishaw documents are referred to in this document or may be a source of further relevant information. They can easily be acquired from Renishaw website www.renishaw.com.

Renishaw documents

User guide: REVO-2 (H-1000-7590)

Installation guide: SPA3-2 (H-1000-5364)

Installation & user's guide: MCULite-2 and MCU5-2 (H-1000-5280)

Installation & user's guide: MCU W-3 (H-1000-5496)

UCCassist-2 help	Found within UCCassist-2
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External documents

National and international standards including the following may be applicable to the finished machine or installation: -

EN 292-2:1991 (Safety of machinery - Basic concepts, general principles for design - Part 2: Technical principles and specifications).

EN (IEC) 60204-1:1997 (Safety of machinery - Electrical equipment of machines - Part 1: General requirements).

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UCC S5 introduction

The UCC S5 is the 5-axis scanning motion and head controller product supporting the second generation REVO-2 measurement head.



Key	Description	Key	Description
1	Machine motors	5	UCC S5 and power amplifier SPA3-2 - these connect to the machine cabling
2	Machine scales and readheads	6	MCU joystick - MCULite-2, MCU5-2, MCU W-3 - connects to SPA3-2
3	Probe head - REVO-2 connects to UCC S5 via the orange machine cabling	7	PC - connects to UCC S5 via an ethernet cable
4	UCCassist-2 commissioning software and application software		

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The UCC S5 comprises a controller in a 19 inch rack-mountable enclosure. It is coupled to the CMM host computer by an ethernet link and to the CMM via external cable interface connectors.

The UCC S5 controller has the capability to:

- control three axes of a CMM (accepting digital readhead signals and generating three axes drive motor control signals)
- accept input signals from emergency stop, air pressure, crash detector, digital SPA, amplifier faults and all axis inner and outer travel limit switches
- accept two uncommitted general purpose input signals and generate one uncommitted general purpose output signal
- interface REVO-2
- directly support one or two Renishaw SPA3-2 servo power amplifiers (two SPA3-2 units will be required for machines with additional axes i.e. dual drive, rotary table)
- directly support the Renishaw TEC (16 channels) and RS232 (Mitutoyo) TEC systems
- provide a +24 V supply for use by the CMM switches

The UCC S5 supports the MCULite-2, MCU5-2 and MCU W-3 joysticks through the SPA3-2.

This guide gives information on physical installation, system connections and communications, as well as assistance in fault finding during the installation of the UCC S5.



WARNING: UCC S5 is not compatible with PH9, PHS, PH10 and the previous REVO systems. No attempt should be made to connect these system components to the UCC S5 as this will result in damage to the product or attached equipment.

Please use this guide in conjunction with the REVO-2 user's guide (Renishaw part number H-1000-7590) in order to fully understand the system's features, capabilities and operation.

The UCC S5 must be used in conjunction with a Renishaw SPA3-2. Setup and commissioning should be completed through Renishaw's UCCassist-2 software.

The UCC S5 uses an external power supply and manages full control of the REVO-2 head, CMM and probe signals and communicates with the CMM's computer.

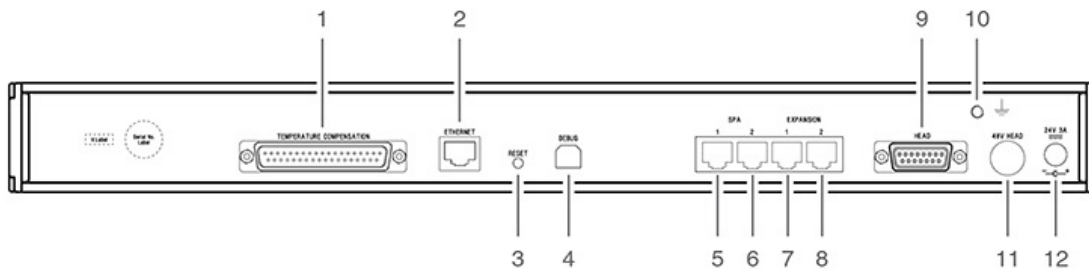
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Front panel



Rear panel layout

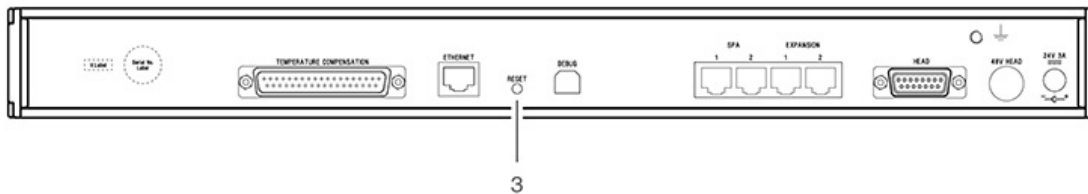


Key	Description	Key	Description
1	37-way D-type plug for temperature compensation	7	Reserved
2	Ethernet communications connector to CMM computer	8	Reserved
3	Reset button	9	15-way D-type socket for REVO-2 connection
4	Reserved - (USB type B socket)	10	Equipotential bond point
5	RJ45 connector to SPA3-2	11	DC power jack 48 V
6	RJ45 connector to second SPA3-2 (not implemented at this time)	12	DC power jack 24 V

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UCC S5 reset button



The rear panel reset button has two different functions. The function depends on the operational state of the controller.

1. Pressing and releasing the reset button within 15 seconds of switching on the unit will force the controller into IP configuration state.
2. Pressing and releasing the reset button after 35 seconds of switching on the unit will cause the unit to restart.

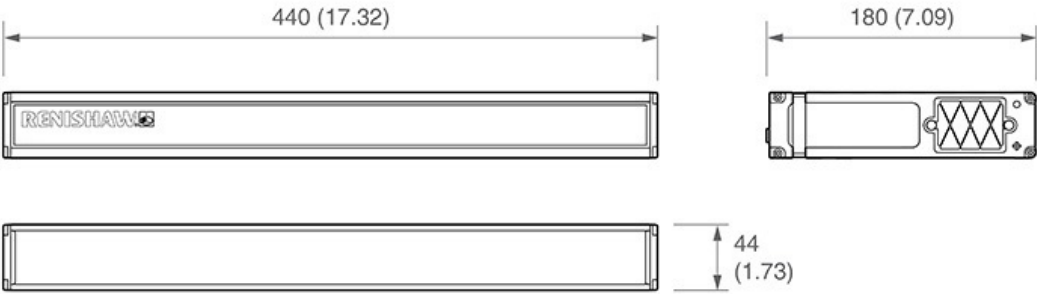
To enter IP configuration state when the unit is already running the control software, press and release the reset button twice.

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UCC S5 installation

Dimensions



i **NOTE:** Dimensions in mm (in).

Weight	2.1 kg (4 lb 10 oz)
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UCC S5 can either be free-standing or used in a 19 inch rack system.

! **WARNING:** Ensure the UCC S5 is disconnected from the mains supply during installation.

Free-standing installation

The UCC S5 unit draws air from the right hand side when viewed from the front and expels air out of the left hand side. A minimum clearance gap of 10 mm is necessary between the sides of the unit and any potential obstruction.



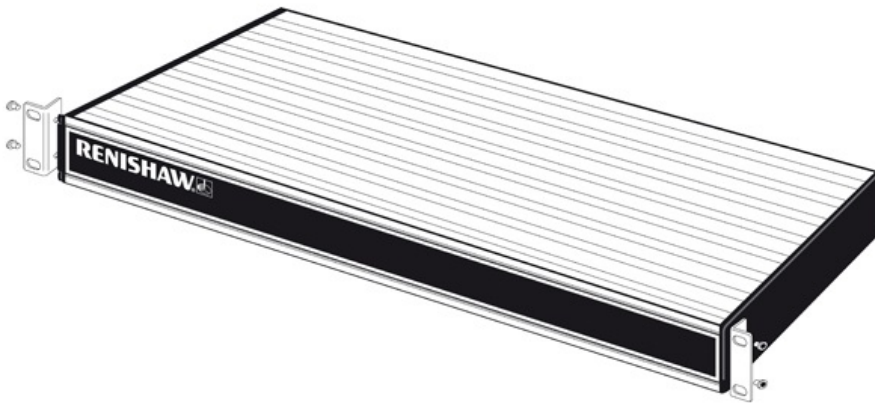
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Mounting in a 19 inch rack

The rack mounting kit (part number A-5518-0005) contains two brackets and four M5 × 6 mm screws.

Assemble the brackets to the UCC S5 as shown below:



Cable lengths

UCC S5 to SPA3-2 connection

The units must be linked by the supplied shielded CAT 5E 300 mm cable(s), no other cables are to be used.

Ethernet cable link to PC

This is a standard ethernet CAT 5E cross-over cable and a 5 m cable is supplied as part of the UCC S5 kit. Lengths up to a maximum of 100 m can be used.

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UCC S5 general wiring standards

To achieve reliable operation of the UCC S5 and the CMM's host computer, the following points should be observed:

- All signal cables **MUST** be screened and all cable screens must be connected electrically to the metal shells of the cable connectors
- It is recommended that cable screens should only be connected to the ground (via the connector shell) of the UCC S5 and SPA3-2
- To avoid earth loops, cable screens should not be directly attached to the CMM's protective earth
- The grounding must be continuous between the controller and all other equipment in the installation
- All cable connectors should be secured to the UCC S5 and SPA3-2 by the connector jack screws



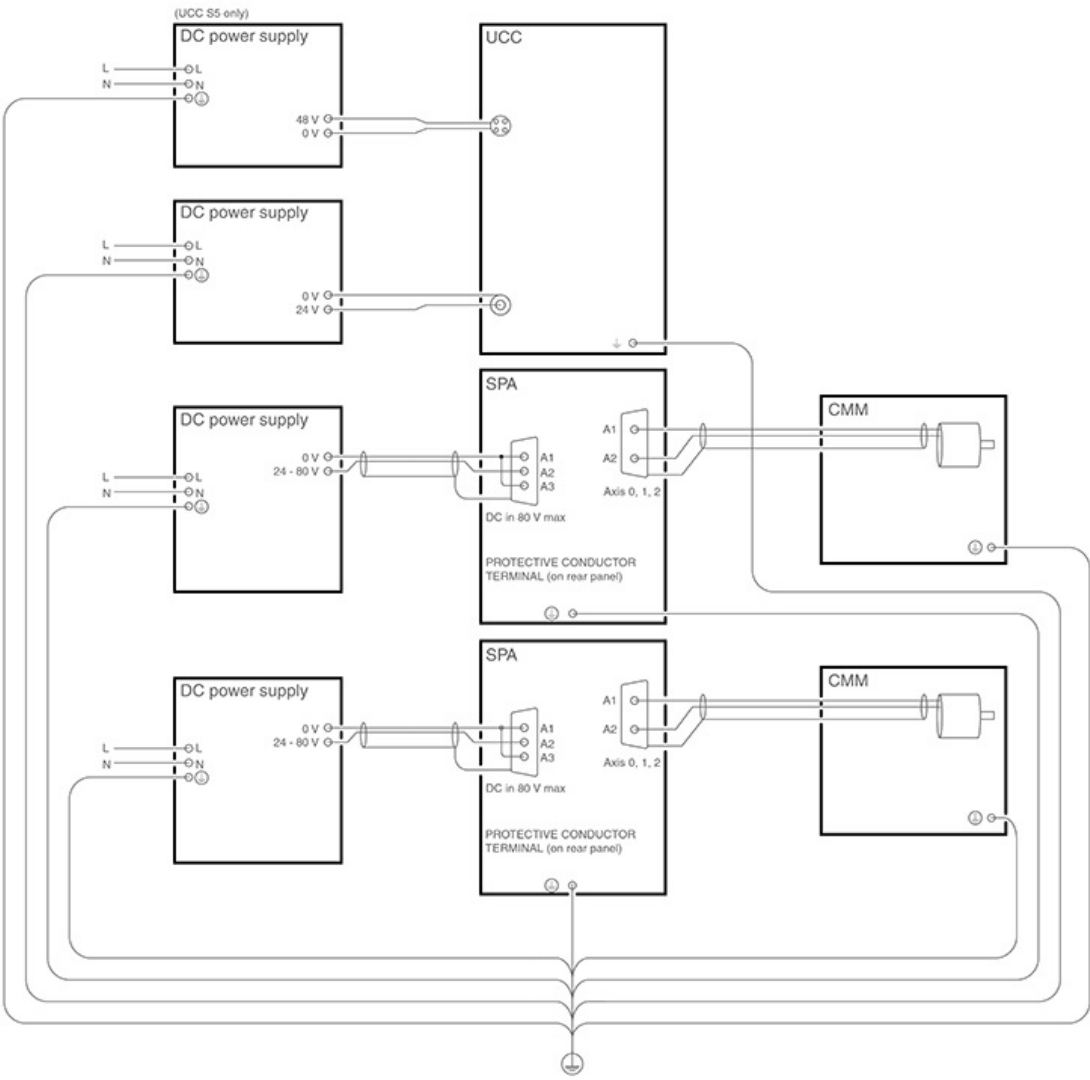
NOTE: The UCC S5 and SPA3-2 electronic zero volt rails are connected to their respective ground planes at star points within the UCC S5, the SPA3-2 and also to the protective ground of the ac supply.

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UCC S5 system connection

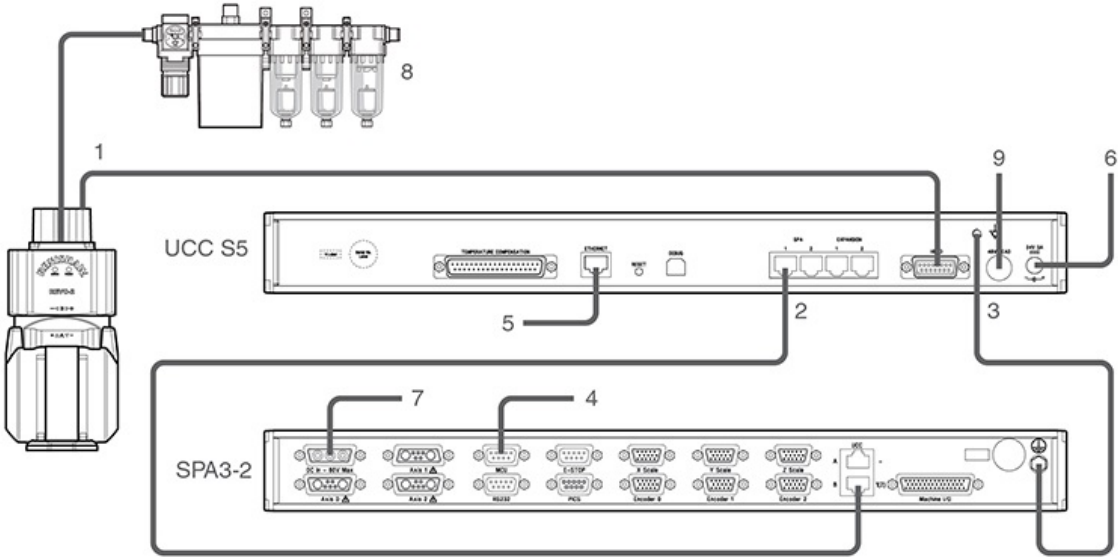
Earth bonding scheme



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Installation for up to 3 axes with head cable less than 25 m

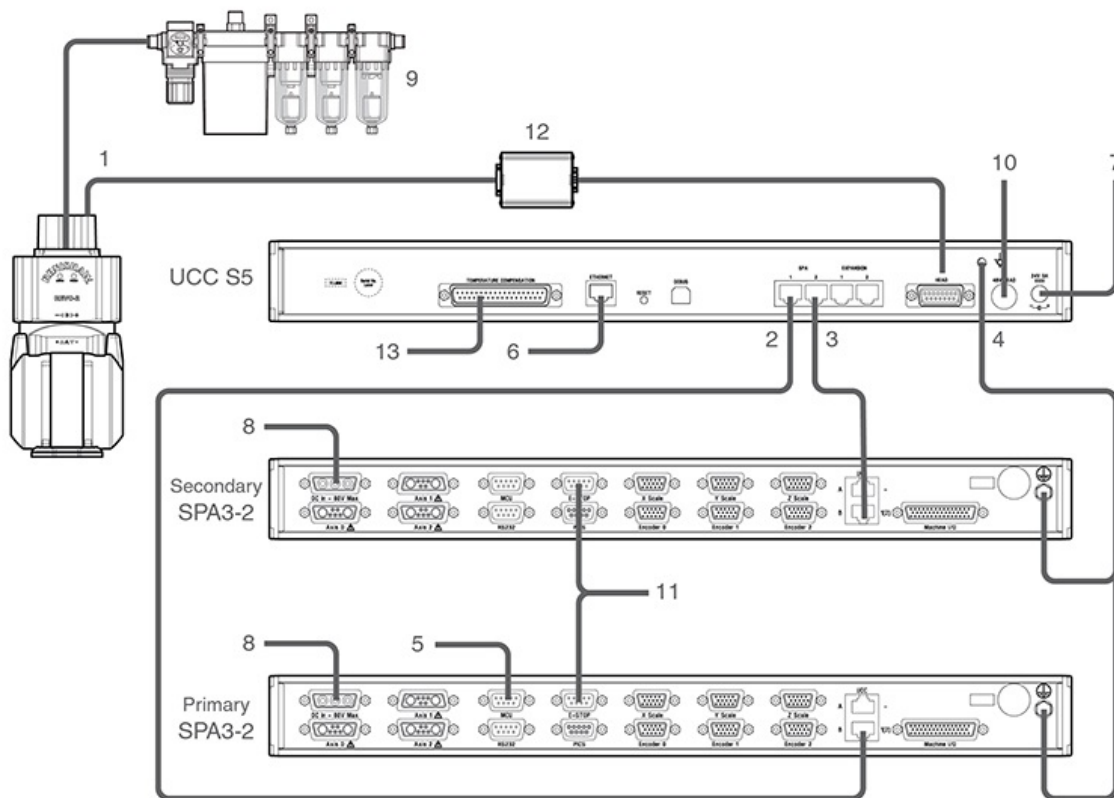


Key	Description	Key	Description
1	Orange head cable	6	24 V power supply (supplied)
2	CAT 5E 300 mm cable (supplied)	7	25 V - 80 V power supply (not supplied)
3	16 / 0.2 mm earth connection	8	Air filter (supplied)
4	MCU connection	9	48 V power supply (supplied)
5	CAT 5E Ethernet cable (5 m cross-over cable supplied) to host PC		

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Installation for 4 - 6 axes with head cable exceeding 25 m and thermal effect compensation (TEC)



Key	Description	Key	Description
1	Orange head cable	8	25 V - 80 V power supply (not supplied)
2	CAT 5E 300 mm cable (supplied) - primary	9	Air filter
3	CAT 5E 300 mm cable (supplied) - secondary	10	48 V power supply (supplied)
4	16 / 0.2 mm earth connection	11	E-STOP link cable (supplied)
5	MCU connection	12	Head comms signal booster
6	CAT 5E Ethernet cable (5 m cross-over cable supplied) to host PC	13	TEC input
7	24 V power supply (supplied)		

The REVO-2 head and CMM system are operated through UCCserver which uses I++DME command protocol to communicate between the system application software and the UCC S5.

Full 5-axis scanning capability is achieved through interaction between the UCC S5, the REVO-2 and the SPA3-2, to co-ordinate all the motion and metrology aspects across the three CMM axes and the two head axes.

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Head comms signal booster box installation

When using the Renishaw high-speed communications cable (orange cable) with Renishaw's 5-axis products, the maximum permissible cable length is 25 m. Where runs of greater than 25 m are needed between the machine controller and probe head, a head comms signal booster (HCSB) must be inserted. One HCSB is required for each additional 25 m of cable run.

The HCSB is powered from the machine cable so does not require an additional power supply. It simply connects between two machine cables as shown in the diagram below and can be attached to a suitable part of the machine structure if required.

Dimensions (L x W x H)	91 mm x 64 mm x 32 mm
Net weight	161 g
Power supply	20 Vdc supplied via machine cable
Connectors	15-way high-density 'D' type plug connects to cable from controller 15-way 'D' type socket connects to cable from head



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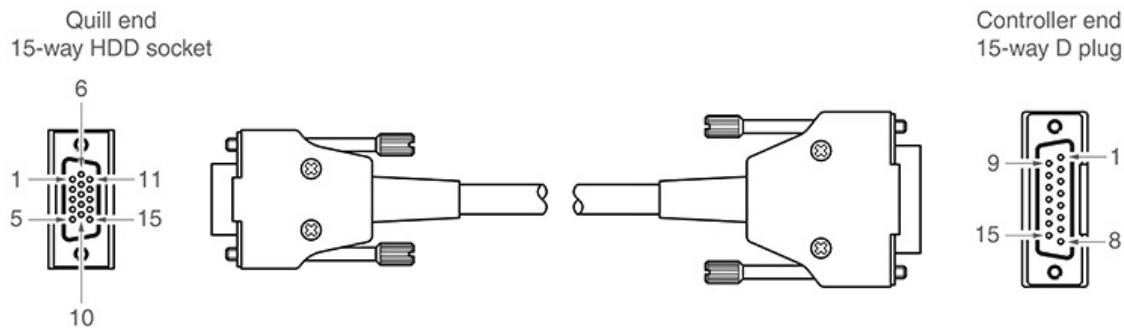
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Cable connections

The cable connection to the head uses a standard 15-way high-density D connector. The cable should be connected and terminated as detailed below. It is mandatory that the Renishaw universal machine cable is used.

Various lengths of cable are available and include pre-terminated options for ease of installation.

The following image shows the pin numbers for each connector end view of the Renishaw universal machine cable.



15-way HDD socket pin number (quill)	Function	Core colour	15-way D plug pin number (controller)
11	Comms D+	Green	1
2	0 V	Black	2
1	Comms U+	Orange	3
7	0 V	White	4
13	Motor B0	Blue	5
3	+20 V	Red	6
4	Motor A2	Grey	7
10	Motor A0	Pink	8
9	0 V	Inner screen *	9
12	Comms D-	Green / black	10
6	Comms U-	Orange / black	11
8	+20 V	Clear	12
14	Motor B1	Violet	13
15	Motor B2	Yellow	14
5	Motor A1	Brown	15
Shell		Outer screen	Shell



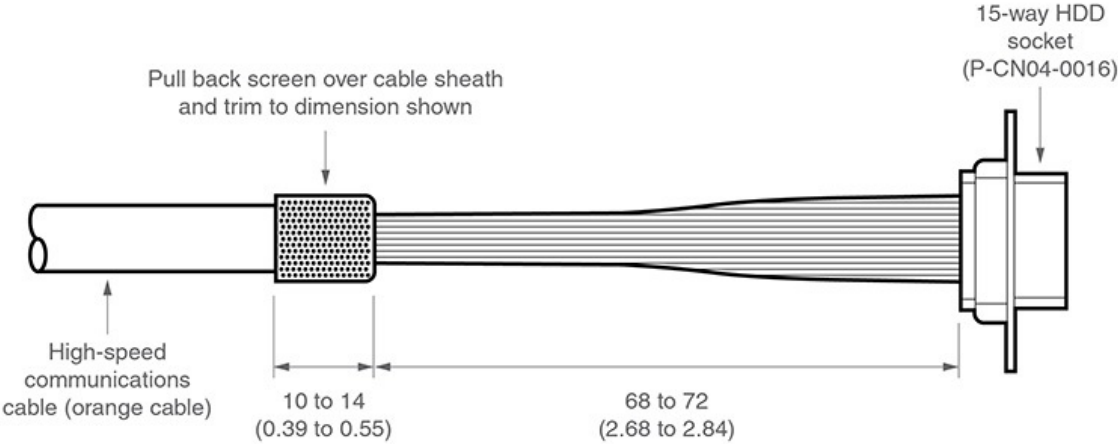
* **NOTE:** In pre-terminated cables this will be yellow / green.

Ensure that the inner screen is not shorted to the outer screen at either end of the cable. A short can be prevented by using a small piece of heatshrink or other suitable method.

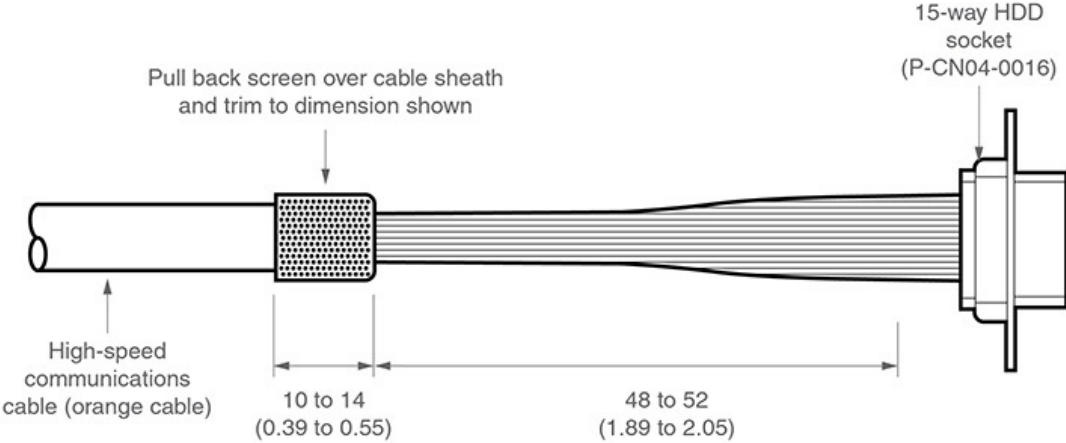
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Preparation of Renishaw universal machine cable for quill mounted systems



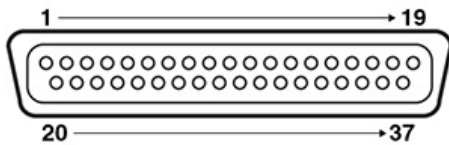
Preparation of Renishaw universal machine cable for shank mounted systems



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Temperature compensation connector



Pin number	Channel	Pin number	Channel
1	Channel 1 input	20	Channel 1 return
2	Channel 2 input	21	Channel 2 return
3	Channel 3 input	22	Channel 3 return
4	Channel 4 input	23	Channel 4 return
5	Channel 5 input	24	Channel 5 return
6	Channel 6 input	25	Channel 6 return
7	Channel 7 input	26	Channel 7 return
8	Channel 8 input	27	Channel 8 return
9	Channel 9 input	28	Channel 9 return
10	Channel 10 input	29	Channel 10 return
11	Channel 11 input	30	Channel 11 return
12	Channel 12 input	31	Channel 12 return
13	Channel 13 input	32	Channel 13 return
14	Channel 14 input	33	Channel 14 return
15	Channel 15 input	34	Channel 15 return
16	Channel 16 input	35	Channel 16 return
17	Reserved	36	Reserved
18	Reserved	37	Reserved
19	Reserved	Shell	GND

The thermistors for each channel connect between the CH input and CH return numbers. The return signals are NOT zero volts and MUST NOT be connected to any zero volt signal, GND or screen.

i **NOTE:** For more information regarding the set up and usage of axis and work piece sensors, please read the temperature compensation page of this installation guide.

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Connecting the UCC controller - UCC S5

Hardware connection

The host PC must have a dedicated ethernet connection to the UCC controller. It is recommended that this is NOT a USB plug-in adapter because of the reduction in speed of operation these devices normally produce.

If the host PC is also to be connected to a network, it is necessary to install additional hardware within the host PC to permit a dedicated connection to be available for UCC controller communication. For details on how to install additional hardware into the host PC, please refer to the PC's installation / users guide.

The UCC controller is capable of using 10 Mbps, 100 Mbps and 1 Gbps ethernet. The selection is determined by the capability of the network adaptor to which it is connected. It is recommended that a 100 Mbps network adaptor is used.

A 5 m CAT 5E cross-over ethernet cable is provided for this link as part of the UCC controller kit. Other lengths may be used, but the maximum is governed by the generic specification for ethernet connections (i.e. a hundred metres) which is sufficient for any CMM installation.

If there are concerns about EMC disruption due to the environment, or the routing of the cable, then the using a shielded cable is recommended.

It is suggested that the cross-over cable is labelled as a cross-over cable looks identical to a normal ethernet cable.

Software installation

The UCCassist-2 software must be installed on the host PC prior to connection of the UCC controller.

The latest version of UCCsuite can be downloaded from the Renishaw website for anyone with a MyRenishaw account. UCCsuite will install UCCassist-2 and UCCserver to enable the hardware set-up.

After the software has been installed, one of the utility sequences available is "IP Configurer" which is used to give the UCC controller an IP address and establishes the pairing of the PC and the UCC controller.

Configuration of IP addresses

This section describes the steps needed to connect the UCC controller to the host PC and configure the ethernet communication link.

 **NOTE:** The examples used in this section are for Windows10 Professional and will vary for other operating systems.

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IP addressing

Choose an IP address for the UCC controller and an IP address for the PC's network adaptor that are of the same class:

class A 1.0.0.1 – 126.255.255.254	For class A networks, a network is defined by the first number.
class B 128.0.0.1 – 191.255.255.254	For class B networks, a network is defined by the first two numbers.
class C 192.0.0.1 – 223.255.255.254	For class C networks, a network is defined by the first three numbers.

NOTE: The last number must not be 0 or 255.

If there is more than one network connection in the PC, choose a network class for the UCC - PC connection that is not currently in use to keep the connections clearly separate. To find out which IP address the other network interfaces use, bring up the command prompt, then type "ipconfig". Its output will look similar to this:

```

C:\> Command Prompt

Ethernet adapter Ethernet:

    Media State . . . . . : Media disconnected
    Connection-specific DNS Suffix . : renishaw.com

Ethernet adapter Ethernet 2:

    Media State . . . . . : Media disconnected
    Connection-specific DNS Suffix . :

Wireless LAN adapter Local Area Connection* 10:

    Media State . . . . . : Media disconnected
    Connection-specific DNS Suffix . :

Wireless LAN adapter WiFi:

    Connection-specific DNS Suffix . : renishaw.com
    IPv4 Address. . . . . : 172.17.1.130
    Subnet Mask . . . . . : 255.255.0.0
    Default Gateway . . . . . : 172.17.0.1

Mobile Broadband adapter Mobile:

    Media State . . . . . : Media disconnected
    Connection-specific DNS Suffix . :

Z:\>
    
```

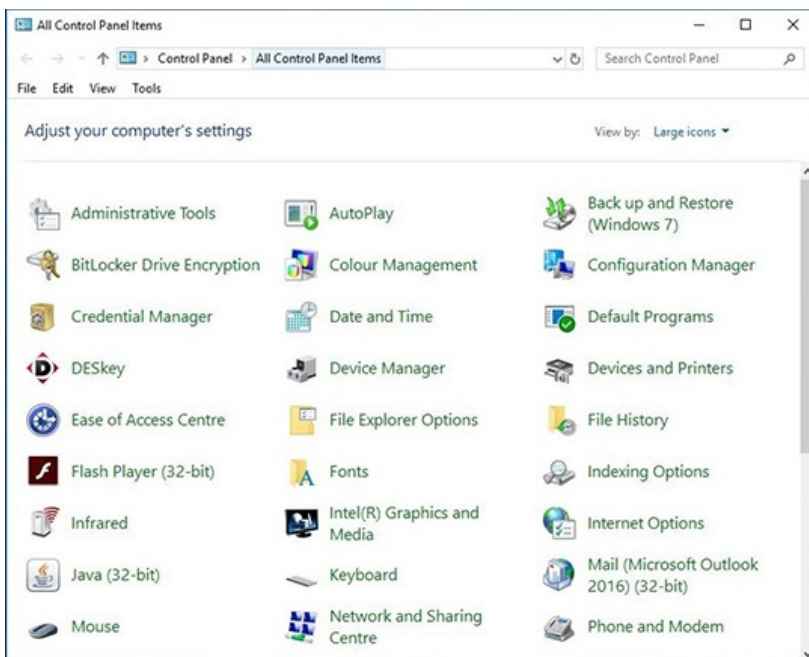
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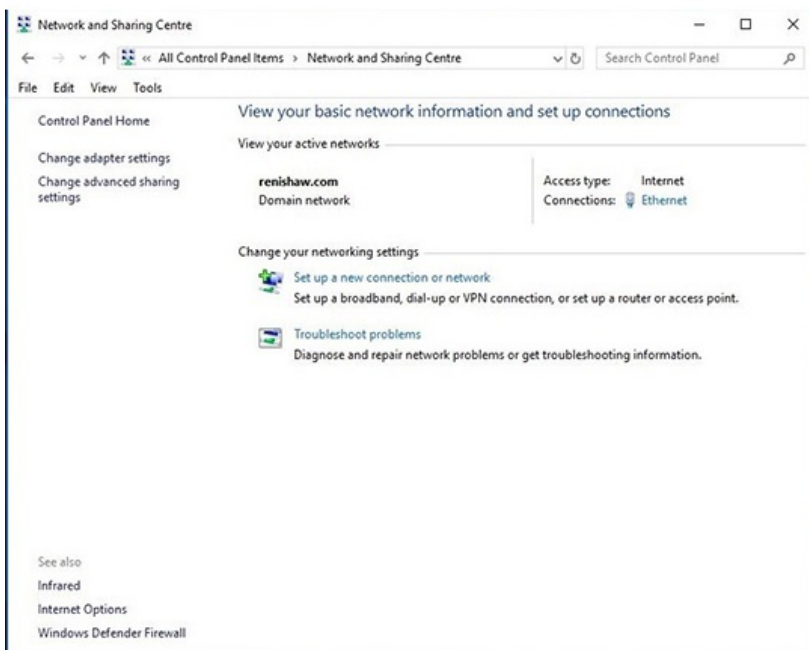
Setting the IP address of the PC

The process to set the IP address on the PC varies with each version of Windows. Administrator rights are needed in order to perform this operation.

a) Navigate to 'Control Panel', then select 'Network and sharing centre':



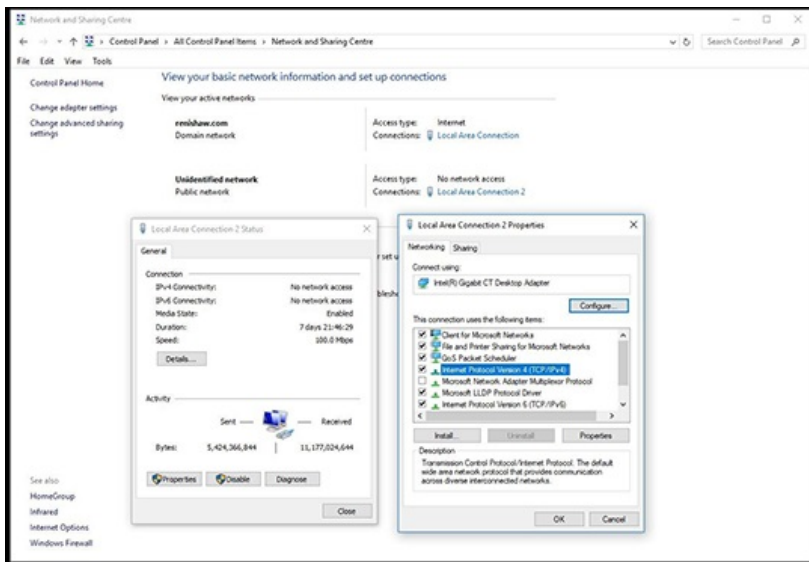
b) Select 'Ethernet' in 'Access type connections':



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c) Click on 'Properties' and select 'Internet Protocol (TCP/IPv4)' and click 'Properties'.



d) Select 'Use the following IP address' and type in the IP address to use for the PC end of the comms link. Click in the Subnet mask field. On Windows10 the Subnet mask will already be filled in. If you have to fill it in for yourself, here are the values:

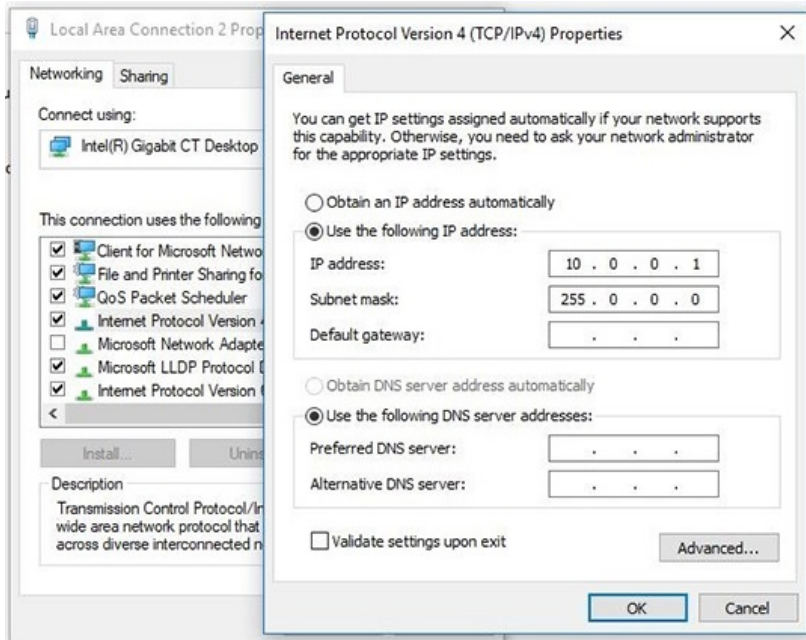
Class of network IP address belongs to	Subnet mask to use
A	255.0.0.0
B	255.255.0.0
C	255.255.255.0

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Leave the 'Default gateway' field blank.

Example:



e) Click 'OK' and then 'OK' again. On earlier versions of Windows the PC needs to be rebooted.


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Setting the IP address of the UCC controller

The UCC controller is not intended to be used on a corporate network. It is extremely important that the setting of the IP address of the UCC controller is on a dedicated connection. It is also important that the connection is not “firewalled” at the PC end. Administrator rights are needed in order to perform this operation.

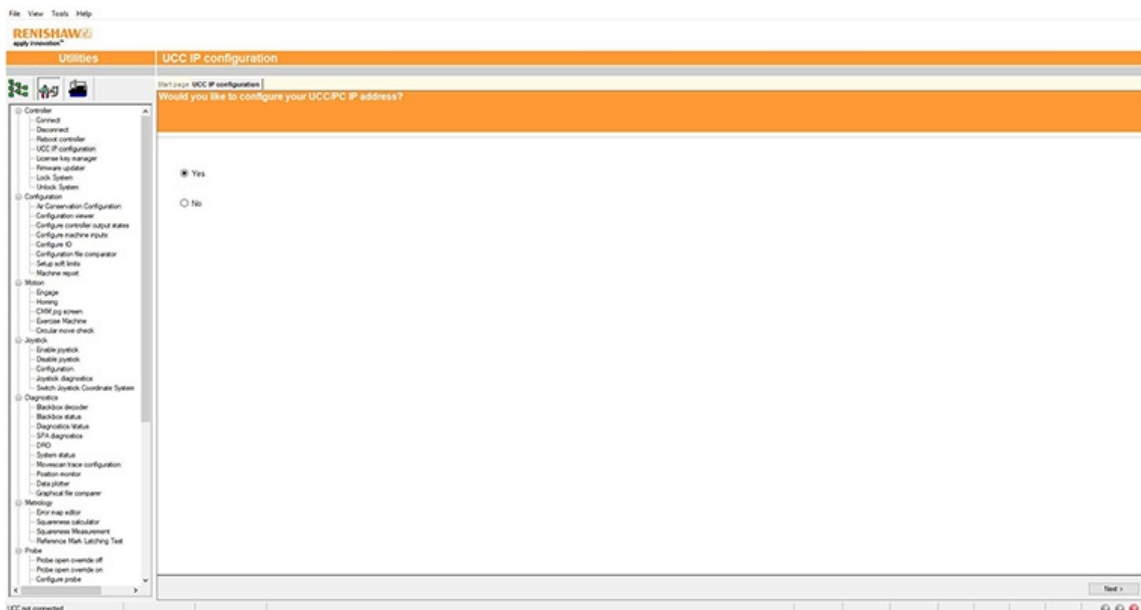
Turn on the UCC controller and press the reset button (within 15 seconds), then wait for it to boot up.

 **NOTE:** This will take about 15 seconds.

It will enter its IP configuration state, shown by the 'Error' LED flashing rapidly.

Now start UCCassist-2 and the UCC IP configuration utility or commissioning sequence on the PC.

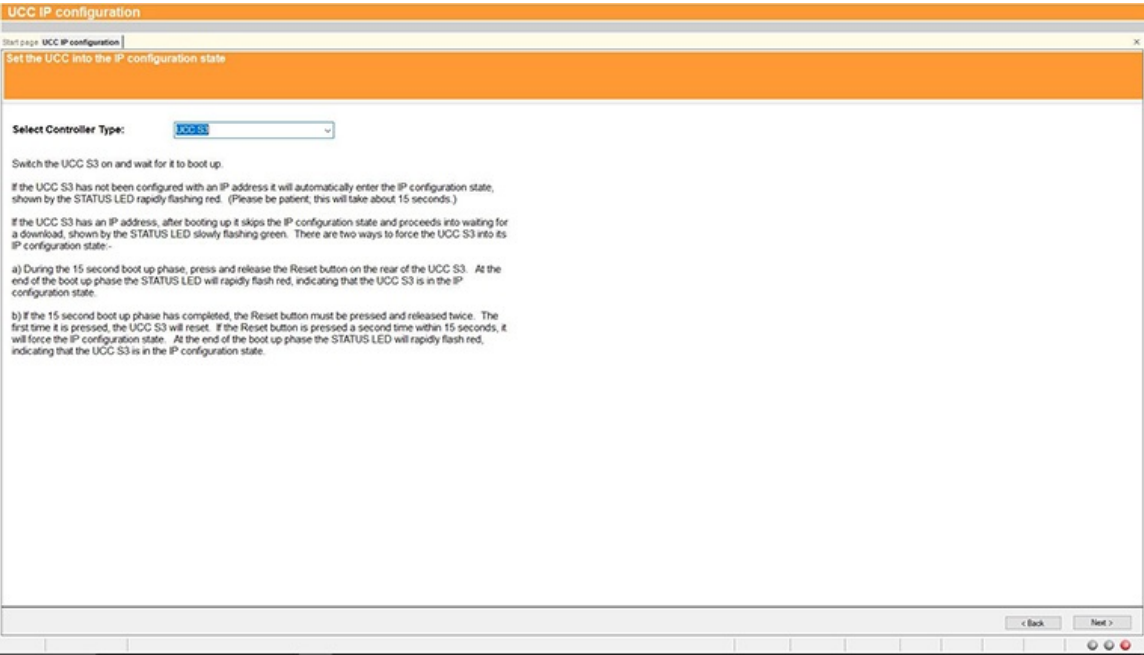
a) Login to UCCassist-2 → Go to 'Utilities bar' → Select 'IP Configure':



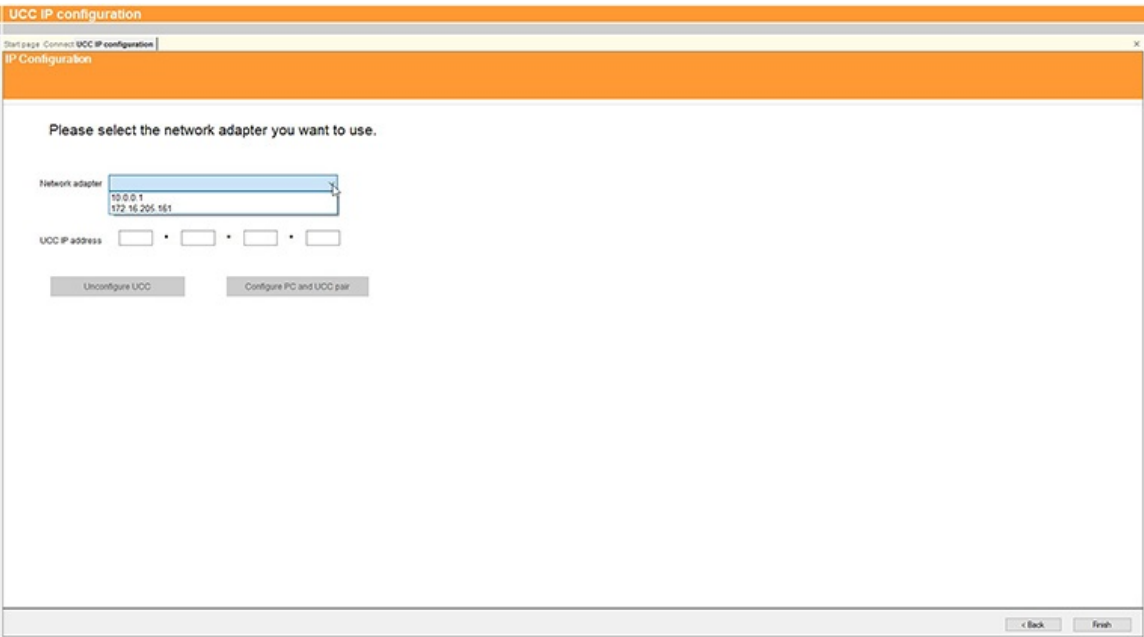
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b) Pressing 'Next' will bring up a screen to allow the specific controller to be selected. It will also give instructions on getting the controller into IP configure mode depending on if it has already been configured or has no current configuration.



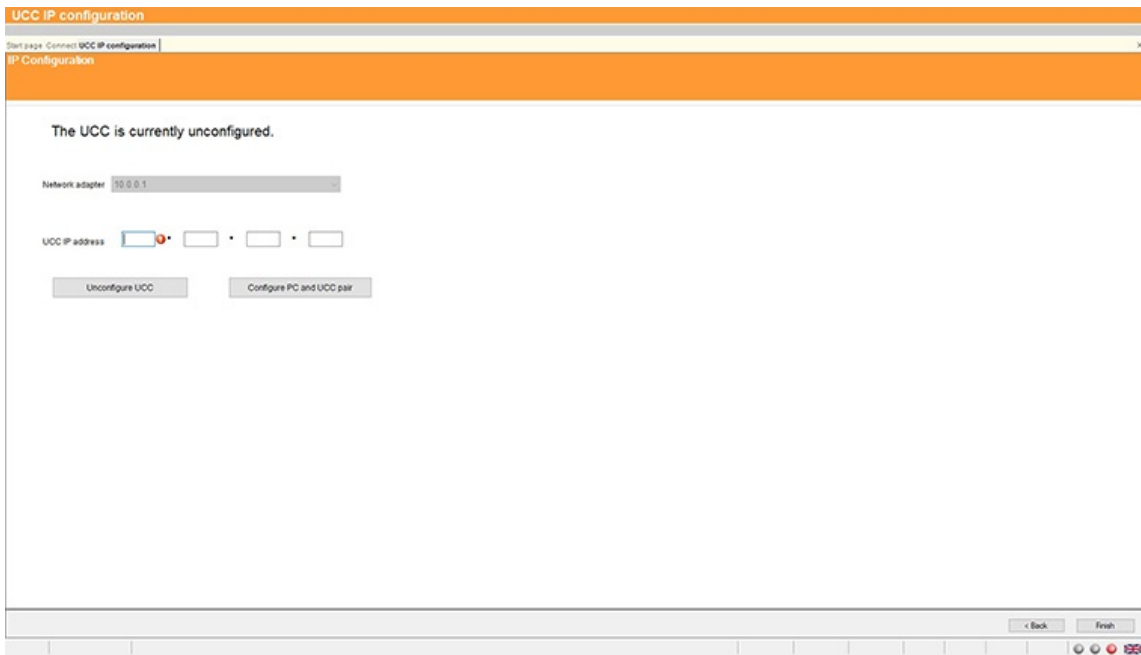
c) Click on the drop-down icon and select the IP address of the network adapter into which the UCC controller is plugged (this should be the one on which the IP address was set in 'Setting the IP address of the PC').



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d) The UCC controller does not have an IP address. Type in the relevant address to match the network adapter in the PC. In the case below this is 10.0.0.1:



The screenshot shows a web browser window titled "UCC IP configuration". The main heading is "IP Configuration". Below this, a message states "The UCC is currently unconfigured." There are two input fields: "Network adapter" with the value "10.0.0.1" and "UCC IP address" which is currently empty. Below the input fields are two buttons: "Unconfigure UCC" and "Configure PC and UCC pair". At the bottom right of the window, there are "Back" and "Finish" buttons.

e) Fill in the desired IP address. The IP configuration software has given you a head start by filling in the network part of the address appropriate for the network adapter selected (see section 'IP addressing' for a discussion of the choice and of IP addresses in general).

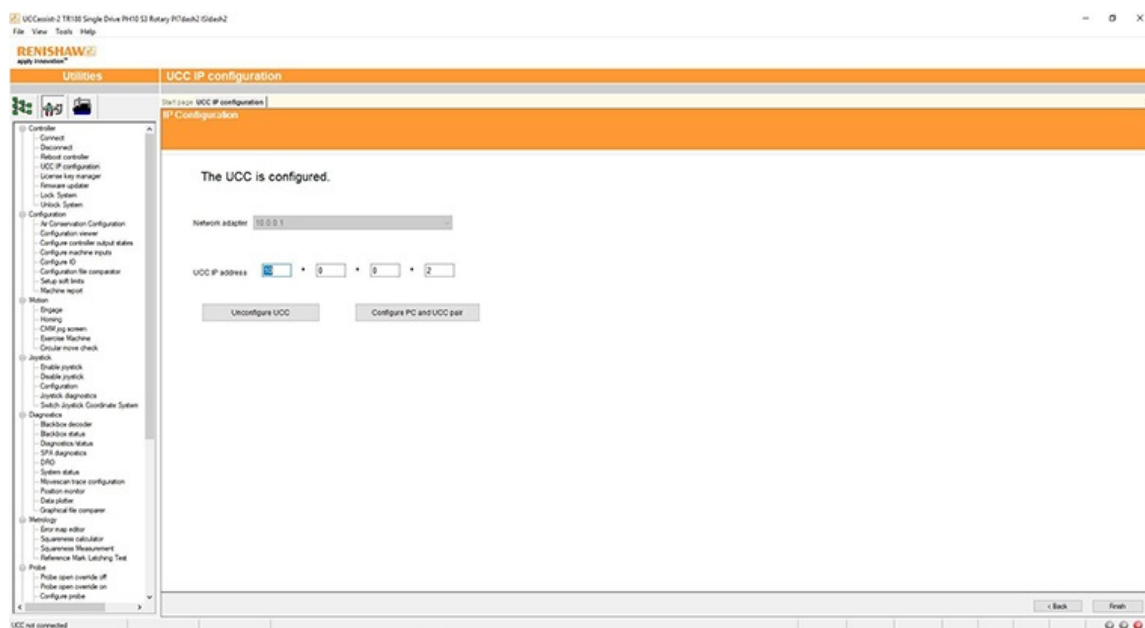


The screenshot shows the same "UCC IP configuration" window. The message now says "Listening." The "Network adapter" field remains "10.0.0.1". The "UCC IP address" field is now filled with "10.0.0.2". The "Unconfigure UCC" and "Configure PC and UCC pair" buttons are still present. The "Back" and "Finish" buttons are also visible at the bottom right.

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f) Click on 'Configure PC and UCC pair'. If all is well this will result in the address being applied to the controller and the IP configure screen will close. If the controller is already configured a dialogue box saying the UCC is configured will open. Click 'Next' to finish.



NOTE: Whenever one of the items in this pairing is changed, e.g. by connecting a different UCC controller to the PC, the UCCassist-2 IP configuration software must be re-run to establish the new UCC controller to the PC system.

Changing the IP address of the UCC

If the UCC controller already has an IP address, after booting up it skips its IP configuration state and proceeds into waiting for a download, shown by the status LED flashing slowly. There are two ways to force the UCC controller into its IP configuration state:

- During the 15 second power up phase, before the error LED comes on, press and release the 'Reset' button on the rear of the UCC controller. At the end of the power up phase the error LED will flash rapidly indicating it is in the IP configuration state.
- If the UCC controller has already powered up with the error light flashing slowly, i.e. about once per second, or even if the control software has been downloaded, the reset switch will need to be pressed twice. The first time to reset the controller then a second time, within 15 seconds, to force the IP configuration state.

The UCC controller is now in its IP configuration state, and the UCCassist-2 IP configuration software can be run on the PC, selecting the appropriate network adapter required. The current IP address of the UCC controller will be displayed. Type in the new one and click on 'Configure PC and UCC pair'.

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Establishing a new UCC - PC pairing

If a different UCC controller is connected to the PC, or a different PC to the UCC controller or even if the network settings on the PC are modified, ensure that they are a matched pair. To do this, go through the procedure in the 'Setting the IP address of the PC' section, even if you do not wish to change the IP address of the UCC controller (if the IP address is already suitable, then you do not need to re-type it). Clicking on 'Configure PC and UCC pair' will establish the new pairing.

Downloading

The name of the downloadable file is specific to the controller so the correct controller needs to be selected to select the correct downloadable. Other controller downloadables will not work on a different controller. Remember to change the name in any configuration settings appropriate for the front-end.

The UCC controller system should now be established.

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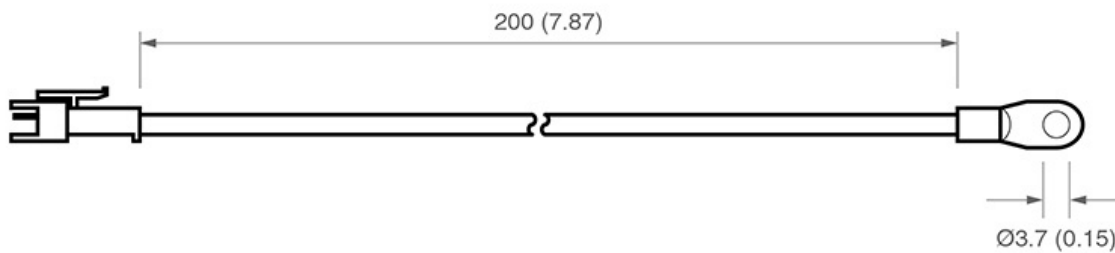
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Temperature compensation

i **NOTE:** Thermal compensation is activated and setup through UCCassist-2.

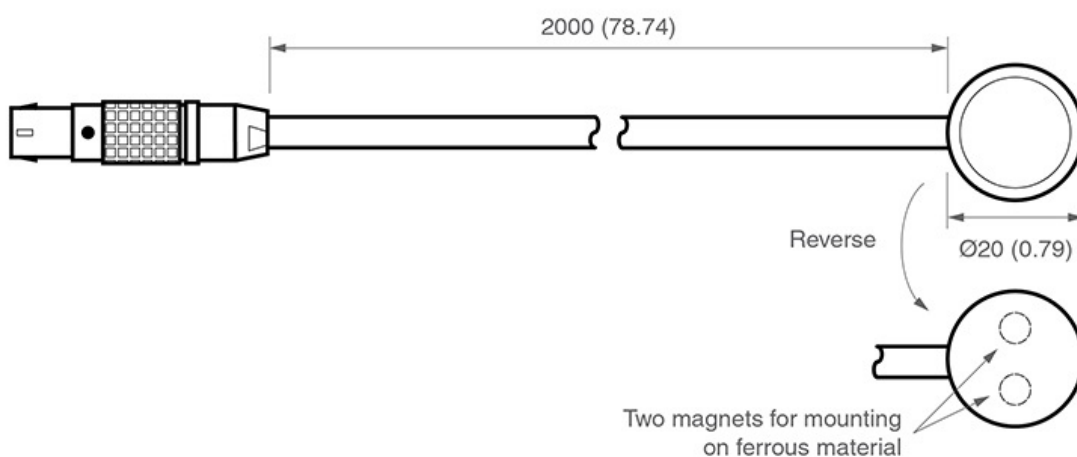
Axis sensors

Axis sensors are required to monitor and compensate for any temperature changes within the CMM's scale. The axis sensor is housed in a potted ring terminal with a $\text{Ø}3.7$ mm hole which can be screwed or glued in position using a thermally conductive glue. The axis sensors are supplied with a 200 mm cable (attached) with a male JST connector fitted to the end. The mating part of the connector is supplied as part of the axis sensor kit.



Workpiece sensors

Workpiece sensors are required to monitor and compensate for any temperature changes of the workpiece material. They can be magnetically mounted or clamped to the workpiece. The sensors are housed in a $\text{Ø}20$ mm aluminium body with a polyacetal sleeve. The sensors should always be handled by the polyacetal sleeve in order to reduce any thermal effects. The sensors are supplied with a cable length of 2000 mm and have a LEMO connector fitted. The mating part of the connector is supplied as part of the workpiece sensor kit in in-line form.

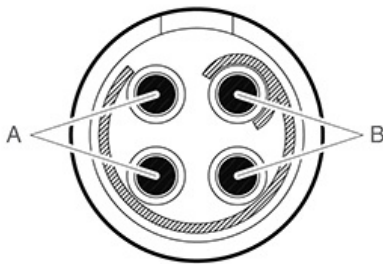


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Pin allocation

With the red dot on the LEMO pointing upwards:



- 'Pair A' - Top left pin and bottom left pin
- 'Pair B' - Top right and bottom right

i **NOTE:** Ensure the sensor is connected to the controller with one pin from 'pair A' and one pin from 'pair B'.

Workpiece sensor

Ensure the workpiece sensor is in full contact with the workpiece.

Aim to position the workpiece sensor in the middle of the workpiece or near where the measurement is taking place.

Electrically ground workpiece prior to using the thermal effect compensation system to avoid electrostatic discharge (ESD) through the workpiece sensor.

Use multiple sensors for large workpieces.

Handle the workpiece sensor by the white sleeve if possible or wait for five minutes once the sensor is in position before proceeding to take a measurement.

Keep the workpiece sensor cabling away from moving sections of the CMM.

i **NOTE:** It is not recommended to run axis thermal compensation without workpiece compensation (where axes and workpiece are at the same temperature) as it is unlikely that reliable results will be obtained.

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Axis sensors

Ensure the sensors are mounted as close as possible to the axis scales

It is recommended to have at least two sensors per axis to account for temperature gradient effects

On large or high specification CMMs, use more than three sensors per axis

Thermally conductive glue should be used when gluing axis sensors to an axis

All axis sensor cabling must be tightly secured to the axis body to prevent it getting trapped during moves

Sensor resistance checks

A resistance check test is recommended:

- During system installation once all sensor cabling has been completed
- After every hardware change to the system (e.g. sensor, cable or switch change)
- Every six months, after the system has been commissioned, to check for any sensor failure or cabling issues

Resistance check procedure

1. Regulate the temperature of the CMM room to a constant temperature between 16 °C and 28 °C.
2. Allow the CMM to stabilise thermally for a minimum of one hour.
3. Measure the sensor resistance from the CMM controller connector. This will ensure all intermediate cable and connections are correct.
4. All workpiece and axis sensor resistance measurements should be within this range; $8.4 \text{ k}\Omega < R < 15.7 \text{ k}\Omega$.

Best practise for using the thermal compensation system

- Ensure the CMM is not subjected to unnecessary changes in temperature (fans blowing, close to radiator, in direct sunlight or any other powerful radiant sources)
- Excessive humidity should be avoided
- Use the system as close as possible to the calibrated temperature
- Renishaw recommends that workpiece and axis sensors are verified at six month intervals

System accuracy and calibration

The TEC system can be used without calibration. The system accuracy is $\pm 0.2 \text{ }^\circ\text{C}$.

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Testing and verification

The machine manufacturer or the installer of the UCC S5 is responsible for ensuring that the following testing and verification is performed to the appropriate standard:

- Verification that the electrical equipment is in compliance with the technical documentation
- Continuity testing of the protective bonding circuit
- Insulation resistance tests
- Functional tests, particularly those related to safety and safeguarding

System performance

Advisory

It is recommended that periodical metrology tests are performed in order to identify any faults in subsystems e.g. air bearings, structure, cables, software etc.

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UCC S5 troubleshooting

UCC S5 visual diagnostics

A visual indication of the system status provided by a multicoloured LED on the front panel. The LED provides assistance in diagnosing system faults.


















LED status key:

LED	Description
	LED on
	LED flashing off / on
	LED flashing green / red
	LED off
	LED flashing red / blue

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LED	Description
	No LED - no power to UCC S5
	Continuous LED - problem with comms link - reboot UCC S5 and configure IP
	Slow flash - waiting for download
	Continuous light - download successful
	Fast flash (5 Hz) - IP configuration mode
	Slow flash - controller booting
	Internal timeout - reboot UCC S5
	REVO-2 head has problem - DSP watchdog triggered
	REVO-2 head has problem - overcurrent detected
	Fast flash (5 Hz) - communications error - reboot required
	Slow flash - scale error - reboot required
	Slow flash - problem with download - reboot required (check file type)
	Continuous LED - UCC S5 overheated
	Slow flash - unit does not have controller ID - return to Renishaw
	Fast flash (5 Hz) - no controller ID in IP configuration mode - return to Renishaw

Fatal faults

Situations can occur that make it inadvisable or dangerous to continue using the CMM servo system. These are known in this document and UCCassist-2 as fatal faults. A list of fatal faults are shown below and will be indicated through the user's software (for example UCCserver):

- A report of the emergency stop switch being active
- Air pressure is too low
- Crash switch operated, if fitted
- A scale reading failure
- An indicated overspeed (calculated from the rate of change of position)
- Outer limit switch active

 **NOTE:** Other faults not classed as fatal can prevent the CMM's operation.

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Motors will not engage / re-engage

Symptoms

Either the servo drives will not engage when the controller has been sent the 'engage' command, or the drives have disengaged automatically and will not re-engage.

Possible causes (or reported causes)

After the unit is switched on and before the system is allowed to engage, it must be configured for motion (i.e. the machine, servo and move parameters must be sent to the controller).

Any of the 'fatal faults' will prevent the system from engaging. In addition, the following will disengage the servo motors:

- A reported failure from a servo power amplifier (amplifier feedback signal)
- SPA being incorrectly configured.
- The absence of the feedback signal from the motor contactor

The following list can also inhibit drive engagement or re-engagement

- The probe being deflected
- Any inner limit switch being operated or a soft limit exceeded

Tests / cures

UCCassist-2 can be used for further help with this by displaying the system status, the status bytes and signals.

The amplifier and motor contactor feedback signals can also be examined using the 'input signals' window in UCCassist-2.



NOTE: A scale error will cause the UCC S5 to enter an error state which is not recoverable within a metrology application environment. If a scale error occurs it will be necessary to reinitialise the installation due to the possibility of lost scale counts and metrology being affected.

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UCC S5 maintenance



WARNING: Maintenance should only be carried out after the machine has been isolated from the electrical supply, compressed air supply or other energy sources in accordance with the machine manufacturer's instructions.

Periodically check that all mounting screws and electrical connectors are securely tightened. Electrical safety checks should include inspecting the mains cable for damage and the safety of the connections. Periodical safety checks should also include the function of the emergency stop system, including operation of all switches integrated into the system. After operating the emergency stop system, the servo amplifier system should be checked to ensure servo power can be engaged.

Advisory

It is recommended that periodical metrology tests are performed in order to identify any faults in subsystems eg air bearings, structure, cables, software etc.

Cleaning

Cleaning should be carried out with a lint free cloth on outer surfaces only as the unit is not sealed against liquid.

Filter replacement

Positive air flow is employed within the enclosure for cooling purposes. This equipment has a replaceable filter to protect it from the ingress of dust. The machine operator should inspect the condition of the filter on a regular basis. It is recommended that the filter is removed and checked / replaced as necessary during the machine installer or retrofitter's regular maintenance routine.

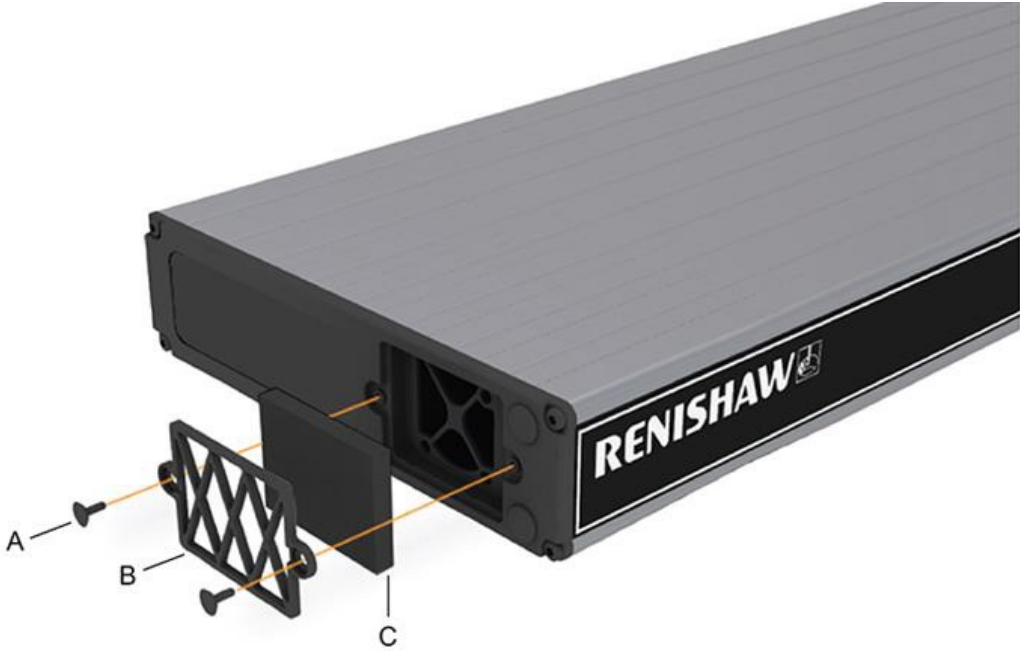
Exchanging / removing the air filter

The following procedure is recommended when exchanging / removing the air filter:

1. Isolate the controller via the ac power.
2. Remove the 19 inch rack mounting brackets (if fitted) by removing the two fixing screws on each side.
3. Pull both the filter retaining clips [A] away from the unit, this should permit the external filter cover [B] to be removed.
4. Remove the filter material [C] from the filter recess (replacement part number of filter is A-5518-0011).
5. Refit the filter cover and mounting brackets in the reverse order above.

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i NOTE: There are no user serviceable parts inside this unit.

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

T +44 (0)1453 524524
F +44 (0)1453 524901
www.renishaw.com/cmmsupport



**For worldwide contact details,
please visit our main website at
www.renishaw.com/contact**