

## UCC S5 REVO-2 CMM controller installation guide

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# UCC S5 REVO-2 CMM controller installation guide

Documentation part number: H-1000-7598-01-A



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Renishaw plc warrants its equipment for a limited period (as set out in our Standard Terms and Conditions of Sale) provided that it is installed exactly as defined in associated Renishaw documentation.

Prior consent must be obtained from Renishaw if non-Renishaw equipment (e.g. interfaces and/or cabling) is to be used or substituted. Failure to comply with this will invalidate the Renishaw warranty.

Claims under warranty must be made from authorised service centres only, which may be advised by the supplier or distributor.

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### EC declaration of conformity

Renishaw PLC hereby declares that the UCC S5 is in compliance with the essential requirements and other relevant provisions of Directives 2004/108/EC.

Contact Renishaw plc or visit [www.renishaw.com/knowledgebase](http://www.renishaw.com/knowledgebase) for the full EC declaration.

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### FCC (USA only)

#### Information to user (47CFR 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 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 (47CFR 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.

#### Equipment label (47CFR section 15.19)

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

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

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### 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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### Environmental conditions

Indoor use	IP30* (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

**i** \* **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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### References and associated documents

It is recommended that the following documentation is referenced when installing the UCC S5:

#### Renishaw documents

Title	Document number
Installation guide: REVO-2	H-1000-7590
Installation guide: SPA3	H-1000-7566
Installation and user's guide: MCU	H-1000-5182
UCCassist-2 help	Found within UCCassist-2

These can be all downloaded from [www.renishaw.com/cmmmanuals](http://www.renishaw.com/cmmmanuals).

#### 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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### Introduction

The UCC S5 is the latest addition to the Renishaw CMM controller product range and supports the second generation REVO-2 measurement head.



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

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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 the Renishaw SPA3 servo power amplifier
- 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, MCU5-2, MCU W and MCU W-2 joysticks through the SPA3.

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 in order to fully understand the system's features, capabilities and operation.

The UCC S5 must be used in conjunction with a Renishaw SPA3. 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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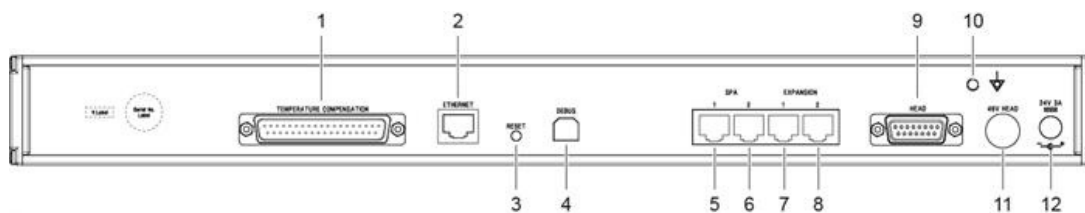
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## Front panel

### UCC S5



## 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	11	DC power jack 48 V
6	RJ45 connector to second SPA3 (not implemented at this time)	12	DC power jack 24 V

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# Installation

## Dimensions

Width: 440 mm (17.3 in)

Depth: 180 mm (7.1 in)

Height: 44 mm (1.7 in)

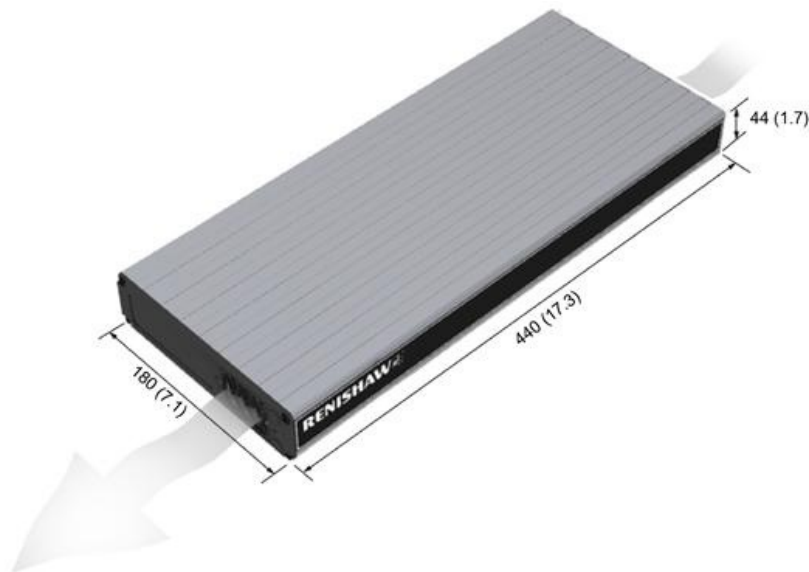
Weight: 2.1 kg (4 lb 10 oz)

UCC S5 can either be free standing or used in a 19 inch rack system.

**CAUTION:** Ensure the controller is disconnected from the mains supply during installation.

## Stand-alone 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.

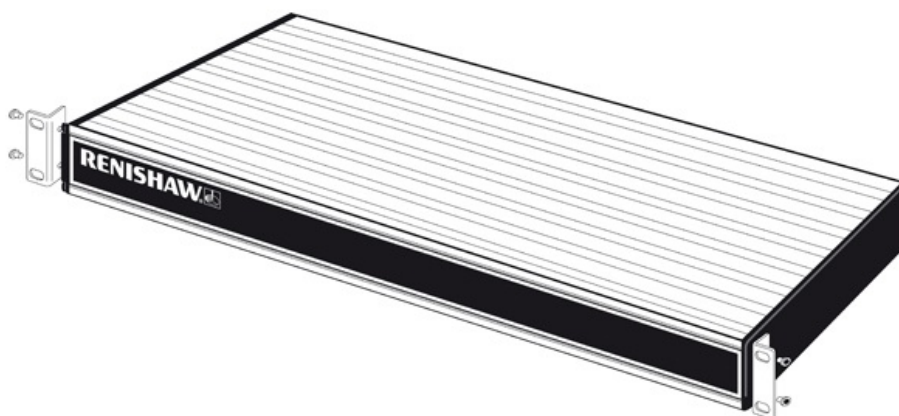


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### Mounting in a 19 inch rack

The rack mounting kit (part number A-1018-0189) 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 connection

The units are linked via a CAT 5 or STP/ FTP cable. 300 mm cables are supplied with the SPA3 kits. It is not recommended to use a cable over 400 mm.

#### Ethernet cable link to PC

This is a standard ethernet CAT 5 cross-over cable and a 5 m cable is supplied as part of the UCC S5 kit. Lengths up to a maximum of 20 m can be used.

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### 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
- 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 by the connector jack screws

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

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### 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.

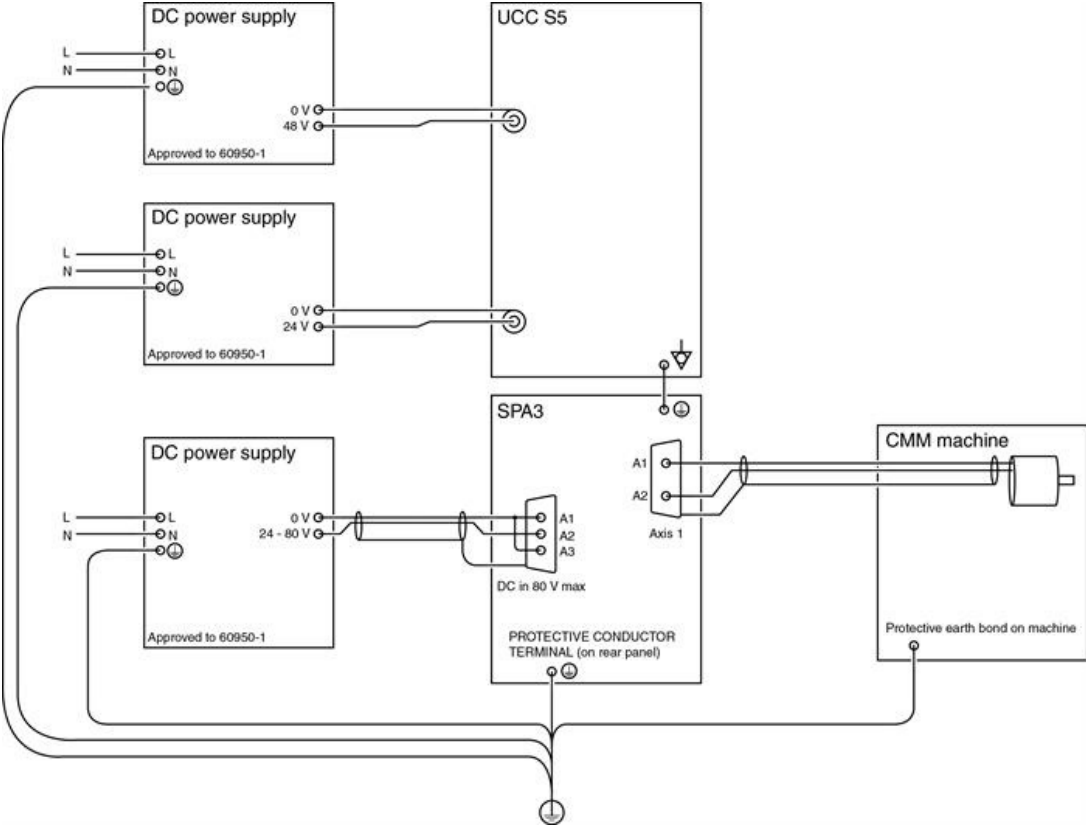
To enter IP configuration state when the unit is already running the control software, press and release the reset button twice.

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## System connection

### SPA3 earth bonding connections

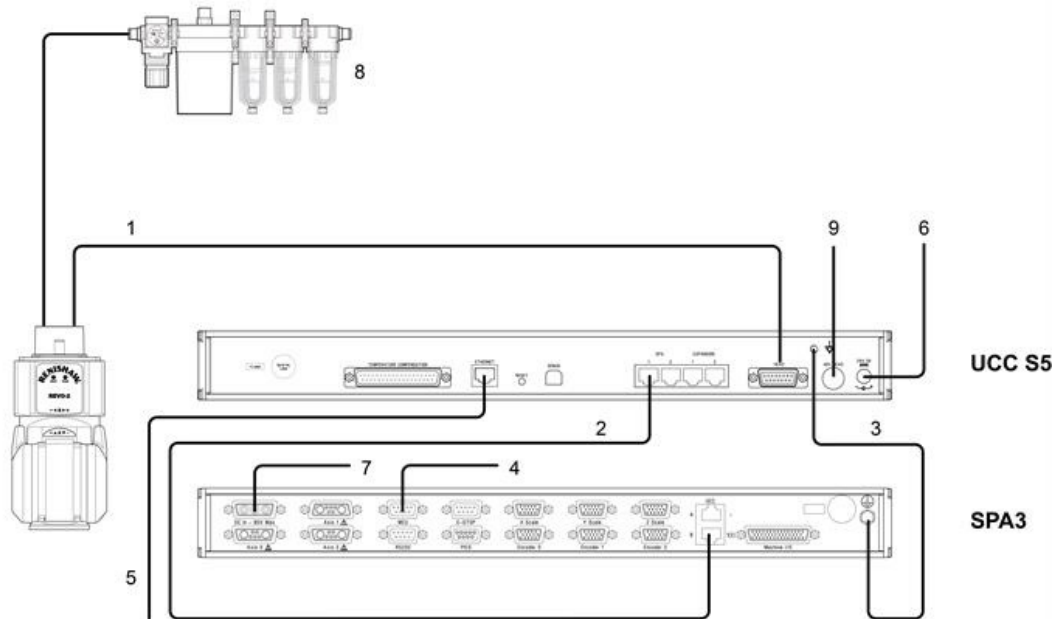




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### Interconnection diagram

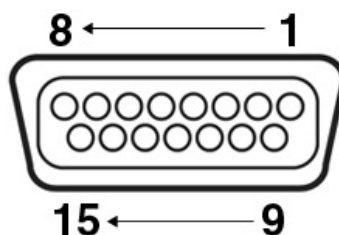


Key	Description	Key	Description
1	Head cable	6	24 V power supply (supplied)
2	CAT 5 300 mm cable (supplied)	7	25 V - 80 V power supply (optional purchase)
3	16 / 0.2 mm earth connection	8	Air filter
4	MCU connection	9	48 V power supply (supplied)
5	CAT 5 ethernet cable (5 m cross-over cable supplied)		

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### REVO-2 head connector



The cable connection to the REVO-2 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. The part number for a 15 metre length version is A-5669-0015. Other lengths are also available (refer to the price list for further detail).

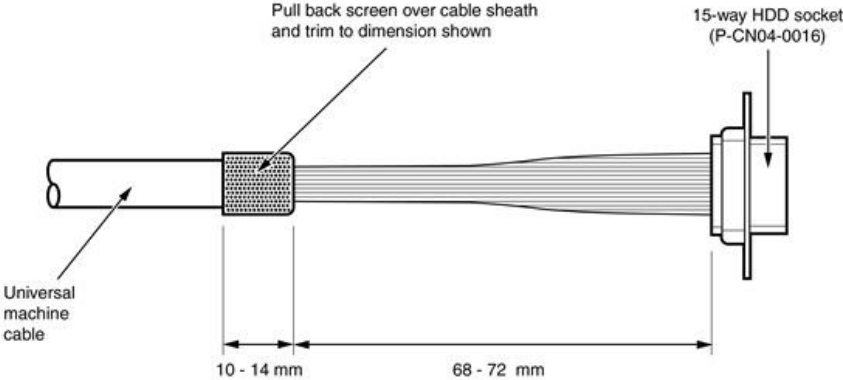
15-way HDD socket pin number (quill)	Function	Core colour	15-way D plug pin number (controller)
11	Comms D+	Green	1
2	0 V	Black	2
1	Comms U+	Orange	3
7	0 V	White	4
13	Motor B0	Blue	5
3	+20 V	Red	6
4	Motor A2	Grey	7
10	Motor A0	Pink	8
9	0 V	Green / yellow	9
12	Comms D-	Green / black	10
6	Comms U-	Orange / 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:** Ensure that the green / yellow core is not shorted to the outer screen at either end of the cable. This can be eliminated by using a small piece of heat shrink or other suitable method.

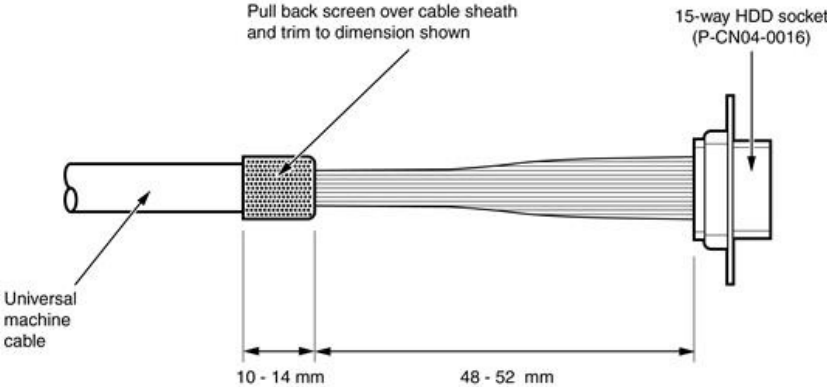
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## Preparation of Renishaw universal machine cable for quill mounted systems



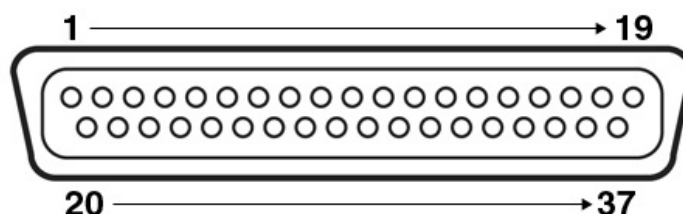
## Preparation of Renishaw universal machine cable for shank mounted systems



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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 connects 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.

**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 S5 to the host PC

### Hardware connection

The host PC must have a dedicated Ethernet connection to the UCC S5. It is recommended that this is not a USB plug-in adapter because of the reduction in speed these devices normally produce.

If the host PC is connected to a network, it is necessary to install additional hardware to allow a dedicated connection for UCC S5 communication. For details on how to install additional hardware on the host PC, please refer to the manufacturer user's guide.

The UCC S5 is capable of using 1 Gbps Ethernet (with appropriate cable).

A 5 m Ethernet cable is provided for this link as part of the UCC S5 kit. The cable included is a Cat 5E, cross-over type. Other lengths may be used, but the maximum length is determined by the generic specification for Ethernet connections which are sufficient for any CMM installation.

It is recommended that a shielded cable is used if there is a likelihood of EMC disruption due to the environment or location of the routed cable.

It is recommended that the cross-over cable is labelled to avoid being mistaken for a non cross-over cable.

### Software installation

UCCsuite 4.9 or newer software must be installed on the host PC prior to connection of the UCC S5. The UCC software suite can be downloaded from the [Renishaw website](#). After the software has been installed, run UCCassist-2 to set up and configure the CMM controller.

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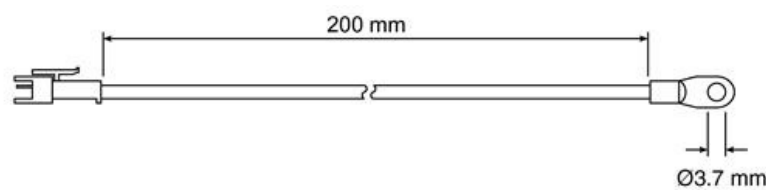
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# Temperature compensation

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

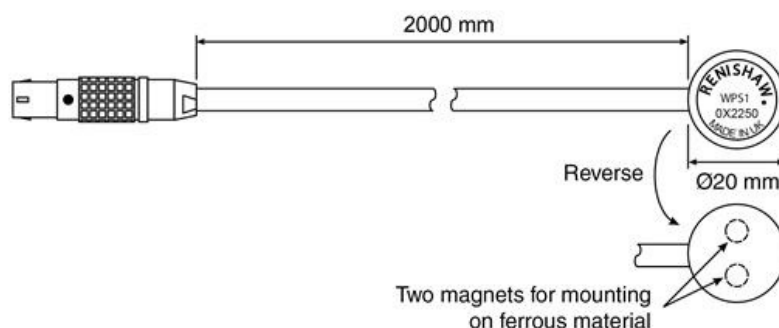
### Axis sensors

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 either panel mount or 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

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

### 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

Regulate the temperature of the CMM room to a constant temperature between 16 °C and 28 °C

- Allow the CMM to stabilise thermally for a minimum of one hour
- Measure the sensor resistance from the 37-way D-type socket that the sensors are wired into. This is the resistance that the UCC measures (cable plus sensor resistance).
- 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

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### 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

**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.

### 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

### System accuracy and calibration

The TEC system can be used without calibration. The system accuracy is  $\pm 0.2$  °C over the range 10 °C to 50 °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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# 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	Description
	LED on
	LED flashing off / on
	LED flashing red / green
	LED off
	LED flashing red / blue

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

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### 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.

### 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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### 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.

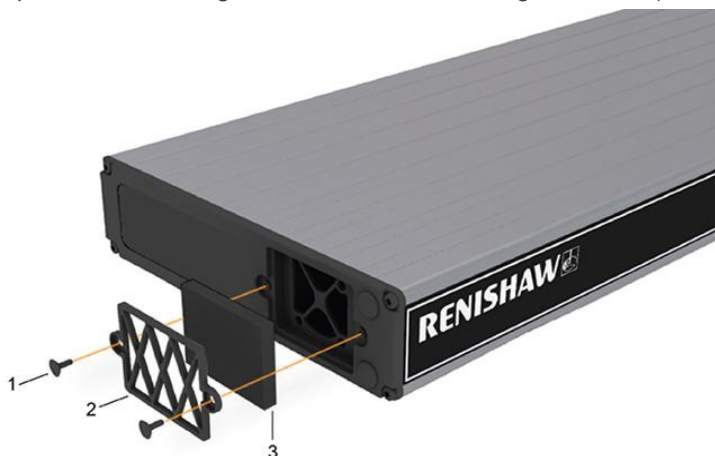
Remove dust from the external surfaces with a clean dry cloth as the unit is not sealed against liquid.

#### Filter replacement

UCC S5 has a positive, internal air flow for cooling purposes. This system has a replaceable filter to protect it from the ingress of dust. The machine operator should check the condition of this filter on a regular basis. It is recommended that this filter is removed and checked/replaced as necessary during the machine installer or retrofitter's regular maintenance routine.

The following procedure is recommended when replacing the air filter:

- Remove power from the controller
- Remove the 19 inch rack mounting brackets (if fitted) by removing the two fixing screws (not shown)
- Pull the head of both the filter retaining clips away from the unit so they disengage (1)
- Pull away the external filter cover (2)
- Remove the filter material from the filter recess (3)
- Replace the filter using the reverse of the method given above (the replacement filter part number is A-5518-0011)



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