

## UCC2 and UCC2-2 installation guide

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# UCC2 and UCC2-2 installation guide

Documentation part number: H-1000-5223-06-A



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# General information

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## Warranty

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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### 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.

### 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	Corrugated fibreboard	PAP	20
Packaging insert	Corrugated fibreboard	PAP	20
Plastic bags	Low density polyethylene bag	LDPE	4
Padded bag	Paper	PAP	21

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# Product compliance

## EU declaration of conformity

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

## 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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## 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:

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## China RoHS

Contact Renishaw plc or visit [www.renishaw.com/ChinaRoHS](http://www.renishaw.com/ChinaRoHS) for the full China RoHS tabulation.

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# Safety

## Electrical requirements

The UCC2 and UCC2-2 is powered from the ac mains supply via an IEC 320 connector. The operating voltages of the unit are as follows:

100 Vac - 120 Vac and 220 Vac - 240 Vac – 15%, +10%	50 Hz / 60 Hz ±5%	120 W maximum
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This equipment must be connected to a protective earth conductor via a three core mains (line) cable. The mains plug shall be inserted only into a socket outlet provided with a protective earth contact. Connect the unit to mains power using a suitably rated cord and plug conforming to local regulations. The cord and plug must be capable of carrying 264 Vac / 3 A. Do not use an extension cable without a protective conductor.

An earth stud is provided to allow bonding of the CMM's metal parts to the protective earth.



**CAUTION:** Any interruption of the protective conductor may make the equipment dangerous. Make sure that the grounding requirements are strictly observed.

## Machine safety



**WARNING:** Switching off or isolating the UCC2 and UCC2-2 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.

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

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# Environmental conditions

The following environmental conditions comply with (or exceed) BS EN 61010-1:1993:

Indoor use	IP30 (no protection against water)
Altitude	Up to 2000 m
Operating temperature	0 °C to +50 °C
Storage temperature	-10 °C to +70 °C
Relative humidity	80% maximum (non-condensing) for temperatures up to +31 °C Linear decrease to 50% at +40 °C
Transient overvoltages	Installation category II
Pollution degree	2



**NOTE:** If a higher IP rating is required, an additional external enclosure will be required to house the UCC2 and UCC2-2. This enclosure must facilitate an airflow to allow the internal temperature to maintain the ambient within the operating temperature range.

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# References and associated documents

It is recommended that the following documentation is referenced when installing the UCC2 and UCC2-2:

### Renishaw documents

Title	Document number
H-1000-5172	MCU1 installation guide
H-1000-5220	UCC daughtercard installation guide
H-1000-5247	SPA2-2 installation guide
H-1000-5107	SPAlite user's guide

### 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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# Specifications

## Physical specification

The UCC2 controller is housed inside a 3U high enclosure which can be mounted in a 19 inch rack. Alternatively, it can be used as a desktop unit.

A rack mounting kit (Renishaw part number A-5121-0006) is available as an optional extra.

- Height: 127 mm
- Depth: 330 mm
- Width: 435 mm
- Weight: 8 kg (without cables and daughtercards)

## Cable lengths

### UCC2 to CMM measuring scale readhead

The maximum specified cable length is 18 metres assuming that individual cable wire cross-sectional area is a minimum of 0.055 mm<sup>2</sup>. For further details please refer to "[CMM readhead input connections](#)".

### UCC2 to CMM servo power amplifier input

Dependent on the servo power amplifier, *SPA/ite*, SPA1 or SPA2-2, this link is either a dedicated 25-way D-type cable or a pair of ethernet cables. One metre cables are supplied as standard with the SPA kits. Other lengths can be fitted but it is recommended that the cable is kept as short as possible with a maximum cable length of 2 metres.

### Ethernet cable link to PC

This is a standard ethernet cat 5 cross-over cable and a 5 metres cable is supplied as part of the UCC2 kit.

Other lengths can be fitted up to a maximum of 100 metres.

### Scale readhead signal speed

The maximum frequency of any one of the scale readhead quadrature signals, with ideal waveforms and phase displacement, is 12.5 MHz. However, it is recommended that the maximum frequency of any one of the scale readheads should be 10 MHz.

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### Electrical power requirements

#### Controller output supplies

The UCC2 produces a +24 V current limited supply with a maximum output current of 1 A. This supply is available for use by the CMM system to supply status switches, etc.

The UCC2 also provides protected supplies for other external devices such as scale read-heads, the probe, joystick, etc.

These supplies are:

+ 5 Vdc\* at 1 A max

+15 Vdc at 1 A max

- 15 Vdc at 1 A max

\* The supply to the scale readheads is a nominal 5.2 Vdc but, providing the sensor lines are connected through to the readhead, this voltage servoed within the range 5 Vs to 7 Vs to ensure the supply is 5.2 V at the readhead i.e. it compensates for the cable volt drop. If the sensor lines are not connected the supply defaults to 5.2 Vdc.

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# General wiring standards

To achieve reliable operation of the UCC2, UCC2-2 and the CMM's host computer, the following should be observed:

**WARNING:** It is essential that the UCC2 and UCC2-2 controller is connected to a mains supply earth. The recommended method of ensuring that the controller is earthed is to use the protective earth wiring in the AC supply cable and connector:

Earthing provisions for the complete machine are the responsibility of the manufacturer or installer.

**Isolation:** UCC2 and UCC2-2 is isolated by removing the mains connector. It is the responsibility of the installer or user to fit additional means of isolation if indicated by risk assessment.

**Earth fault / residual current protection:** It is the responsibility of the machine manufacturer or product installer to ensure an adequate level of protection for the complete machine installation.



- Scale readhead signals, reference marks and error signals should comply with EIA RS-422A. It is recommended that each readhead had its own screened cable and that these cables are kept well away from electrically noisy wiring such as motor supplies, etc.
- All opto-isolated inputs and outputs should be separate from other connections to the UCC2 and UCC2-2 controller, so that the CMM's electrical system is kept isolated from the circuitry within the controller, with the exception of the 0 V reference and protective grounding.
- The analogue ground ( if daughtercard fitted) for a 3rd party joystick compatibility should be dedicated only to that function.
- The analogue ground for the analogue probe connections should be dedicated only to that function.
- All signal cables **MUST** be screened and all cable screens should be connected electrically to the cable connector's metal shells. It is recommended that cable screens should only be connected to the protective earth (via the connector shell) at the UCC2, UCC2-2 ,SPA2-2 and SPA3 end, and not directly connected to the CMM's protective earth. This is to avoid earth loops. However, the protective grounding must be continuous between the controller and all other equipment in the installation.
- All cable connectors should be secured to the UCC2 and UCC2-2 by the connector jack screws.
- See also the installation instructions supplied with other Renishaw components in the system, i.e. probes or probe heads etc. Particular attention should be paid to the screening and earthing methods of the cables carrying low level signals from either analogue or touch-trigger probes.



**NOTE:** The UCC2 an UCC2-2 electronics 0 V rail is connected to the overall ground plane at a star point within the UCC2 and UCC2-2 and also to the protective ground of the ac supply.

## Preparations

Before beginning the installation of the UCC2 and UCC2-2 ensure that:


- All connecting cables, Ethernet link, daughtercards, test equipment and software are available
- The CMM's measuring scales / readheads are correctly installed and are functioning
- All the CMM status and limit switches etc. are correctly installed and have been function checked
- All mains power has been removed from the CMM, CMM's host computer, CMM servo power amplifiers and CMM's axis drive motors etc.
- The CMM and the UCC2 and UCC2-2 are in their final positions and that all connecting cables are of the required length

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# Installation of the UCC2 and UCC2-2 components

## Installation of daughtercards

 **WARNING:** It is essential that full anti-static precautions are taken before working within the UCC2 controller enclosure.

To install a daughtercard please refer to the daughtercard installation guide (Renishaw part number [H-1000-5220](#)).

## Connecting UCC2 cables to and from CMM

- Attach all CMM cable connectors to the mating sockets on the UCC2
- Secure all cable connectors with the connector jacking screws to ensure physical and electrical connection
- Secure all cables for strain relief without reducing access for servicing

## Connecting the UCC2 mains supply

This installation must be undertaken by suitably experienced and / or qualified personnel.

The UCC2 contains no user serviceable fuses. It is protected internally from inadvertent current overload by self resetting fuses.

There is no internal fuse on the mains supply of the UCC2. The installer must provide suitable protection. The recommended fuse is a 5 A type T (anti-surge) to IEC60127/UL248-14, rated to at least 250 V with a high breaking capacity. Its installation must meet the requirements of IEC61010 and any applicable national wiring regulations for the country of installation.

The UCC2 is isolated from ac power by disconnection of the IEC mains connector on the rear panel. If any additional means of isolation is required, it must be specified and fitted by the machine manufacturer or the installer of the product. The isolator must comply with IEC61010 and any applicable national wiring regulations for the country of installation.

The use of suitable RCD (residual current device), for automatic disconnection in the event of insulation failure is recommended. This should be sited within easy reach of the CMM operator and must meet the requirements of IEC61010 and any applicable national wiring regulations for the country of installation.

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### Mounting in a 19 inch rack

For the UCC2 to be fitted into a 19 inch enclosure the rack mounting kit (Renishaw part number A-5121-0006) is required.



**NOTE:** The screws supplied with this kit are M5 × 6 mm countersink type. DO NOT replace with longer screws as damage could occur.

The following procedure is recommended to fit the rack mounting brackets to the UCC2:

1. Position the UCC2 on a firm flat surface, with either the left or right hand side of the unit placed on the surface and the front of the unit facing towards you.
2. Remove the blanking plugs from the side of the unit, there are two of these located about 15 mm from the front lip on the enclosure and about 15 mm from the top and bottom of the enclosure.
3. Remove the rack mounting kit from its packaging and place one of the countersunk screws supplied in the kit through one of the rack mounting brackets supplied.
4. Align this screw and mounting bracket assembly to the fixing holes in the side of the UCC2 enclosure, so that the rack mounting flange is flush with the front of the unit, and engage the screw into the mating thread. Do not tighten at this point.
5. Align the other fixing location in the rack mounting bracket with the fixing hole in the side of the UCC2, and engage the other countersunk screw into the mating thread.
6. Tighten both countersunk screws to ensure a secure fixing.
7. Rotate the UCC2 such that the other side of the enclosure can be accessed and then repeat steps 2 to 6.

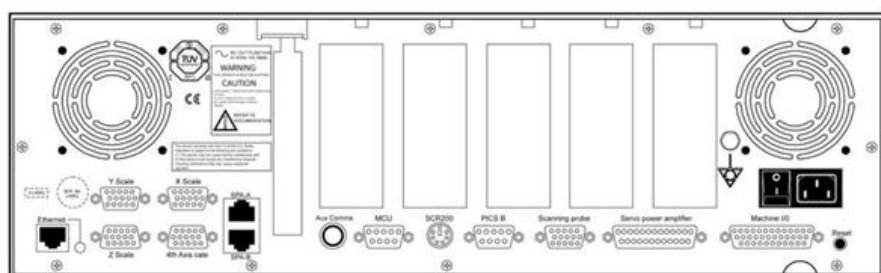
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# Connectors and signals

The purpose of this chapter is to describe in detail the pin-outs of the connectors mounted at the rear of the UCC2 controller and to show examples of relevant circuit diagrams for the input and output circuits.

The connectors on the rear panel of the UCC2 controller enclosure are shown below:



The pin-out of each connector, and its purpose, is described in the following sections.

## CMM readhead input connections

The X, Y, Z and "4th axis" measuring scale readhead input connectors are high density 15-way 'D' sockets.

The X, Y and Z axis scale readheads of the CMM must be connected to the relevant socket on the rear panel of the UCC2 enclosure.

Similarly the 4th axis scale readhead (dual axis or rotary table capability), if required, must be connected to the socket (marked 4th axis) on the rear panel of the UCC2 enclosure.

**Suggestion:** Label all readhead connectors to avoid cross connection, if removed and replaced in the future.

The four CMM readhead sockets are wired to the same pin-out, suitable for direct connection to Renishaw RGH22 and RGH24 scale readhead wiring.

**NOTE:** Other manufacturers' readheads and interpolators may require an external adapter to enable them to use the Renishaw standard readhead connector wiring. They may also not produce an error signal to the RS-422 specification.

The UCC2 supplies a servoed 5 Vdc power supply for the readheads. See "[Electrical power requirements](#)" for details.

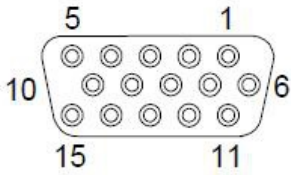
If standard Renishaw cables are used, the recommended cable sizes are 3 m of head cable and 15 m of extension cable, or an equivalent combination. That the head cable is 5 times the resistance of the extension cable, e.g. 4 m of head cable and 10 m of extension cable.

Even with the servoed 5 V supply it is still important that the cable resistance is kept to less than 2 ohms.

**CAUTION:** The connection of the cabling should be such that the CMM's movements, as reported by the UCC2, are of the correct polarity i.e. machine movement in a positive direction along any axis should give positive change of position as reported to the host computer by the UCC2 controller. Adjust this, if required, by reversing the inputs of the scale readhead signal (change over +A with +B and -A with -B).

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Pin number	Function	Pin number	Function
1	External set up	9	0 V sensing
2	0 V supply from UCC2	10	Limit switch Q*
3	- Error	11	+ Error / limit switch P
4	- Reference mark	12	+ Reference mark
5	- B signal	13	+ B signal
6	- A signal	14	+ A signal
7	+5 V supply from UCC2	15	Inner screen
8	+5 V sensing	Shell	Screen

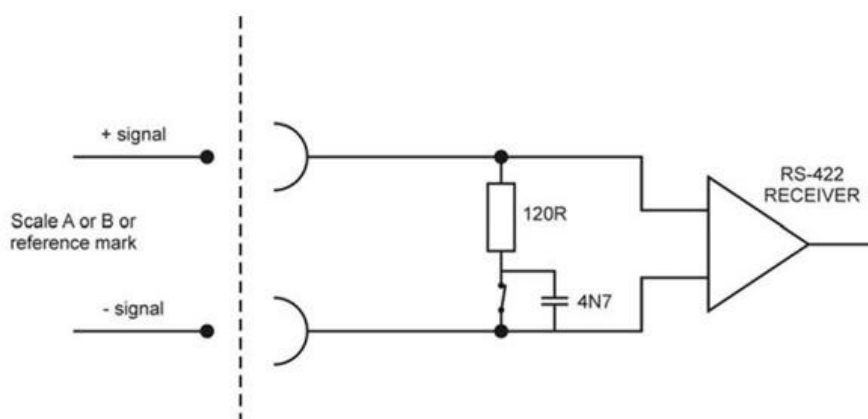
\* The UCC2 is capable of supporting both single and dual limit-switch RG22 readheads. The electronic circuits can interface either type without any intervention but the correct type must be set in the machine "ini" file. If dual limit types are fitted pin 11 functions as the second limit switch.



**NOTE:** The 0 V supply and the 0 V sensing leads are connected together at the readhead. The +5 V supply and +5 V sensing leads are similarly connected at the readhead. It is important that all the cable cores are connected to ensure the voltage drop is compensated for.

## CMM readhead interface circuit

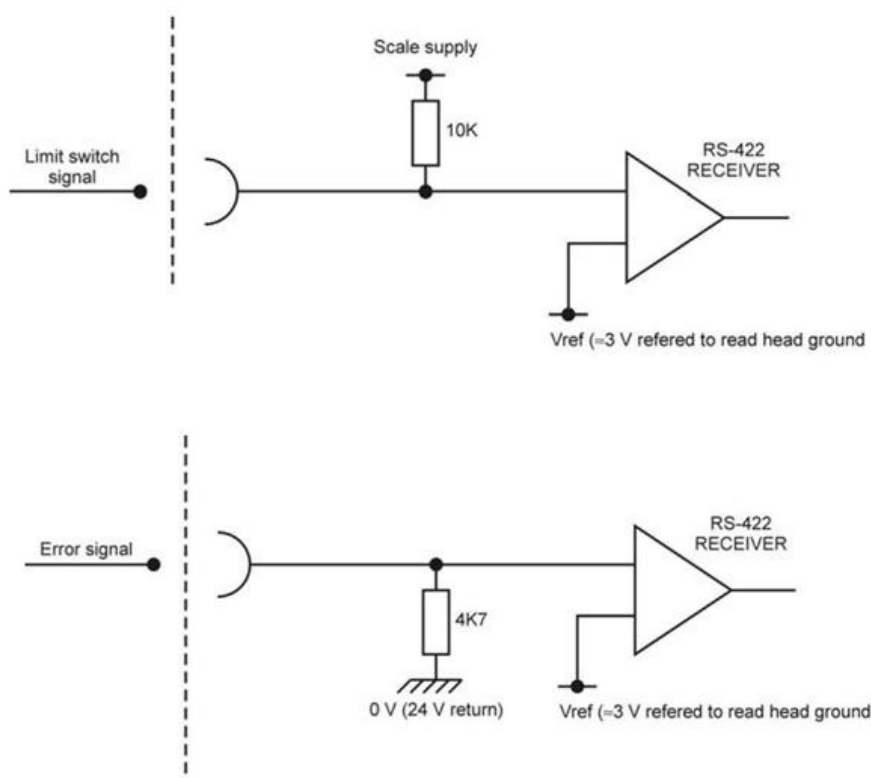
The signals from a readhead or interpolator should be to EIA specification RS-422.



**NOTE:** If error inputs are not used or the readhead type is RGH24, connect the -Error input to +5 V.

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## Adjusting readhead supply voltage

It is strongly recommended that the sense lines are connected to the readhead so that the adjustment of the supply voltage, to compensate for cable drop, is automatic. However, there are some circumstances where this is not practical and we have provided a manual method of boosting the supply voltage.

In the .ini file there is a section called ReadHeadPSU which contains three parameters per axis.

These parameters are termination type, enable and voltage.

Termination type - controls the controller readhead circuits to provide either ac termination (0) or dc termination (1) [recommended].

Enable - This is set to 0 as a default which allows the normal automatic voltage servo to operate. If it is set to 1, then the readhead supply voltage can be manually set.

Voltage - This is the manual readhead voltage setting. It is only read when the enable is set to 1 and the allowable range is 5 V to 7.5 V.

**i** **NOTE:** You must ensure that the voltage at the readhead is within the range  $5\text{ V} \pm 5\%$  (i.e. must not exceed 5.25 V).



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### SPA2 connector A and B

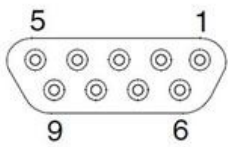
This is a pair of standard RJ45 connectors that support the high speed communication links to and from the SPA2-2 servo power amplifier. See [SPA2-2 installation guide](#) (Renishaw part number H-1000-5234) for details.

### UCC2 aux comms

This connector is reserved for future use, no connections should be made to it.

### MCU connector

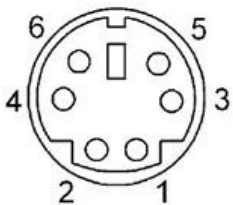
This is a 9-pin 'D' plug suitable for direct connection to the MCU1 / MCU5 or *MCUlite* joystick unit.



Pin number	Function	Pin number	Function
1	Ground	6	+15 V
2	RX_B	7	TX_B
3	RX_A	8	E-STOP_B
4	TX_A	9	E-STOP_A
5	Reserved	Shell	Screen

### SCR200 connector

This is a 6-pin miniature DIN socket suitable for direct connection to the SCR200 stylus change rack.



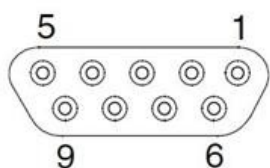
Pin number	Function	Pin number	Function
1	Remote reset	5	0 V
2	Error	6	Not connected
3	Inhibit	Shell	Screen
4	Rack power		

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### PICS connector

This socket is intended for use with any of the range of Renishaw touch-trigger probes, including the TP200. The connector is a 9-pin miniature 'D' socket, pinout as follows:



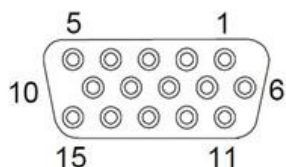
Pin number	Function	Pin number	Function
1	PICS STOP	6	Reserved
2	PICS probe power off (PPOFF)	7	PICS probe damping (PDAMP)
3	0 V	8	PICS LED off (LEDOFF)
4	PICS LED anode	9	Probe common
5	Probe signal	Shell	Screen

### Scanning probe connector

The plug on the cable from the analogue probe connects to the 15-way high-density 'D' socket on the rear panel of the UCC2.

This socket is intended for use with the Renishaw TP2, TP6, TP20 and TP200 touch-trigger probes and the SP25 and SP600 series of analogue scanning probes.

The pin-out of the socket is as follows:



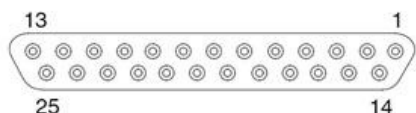
Pin number	Function	Pin number	Function
1	+5 V supply	9	Not connected
2	Not connected	10	Overtravel
3	Probe common	11	A signal
4	B signal	12	0 V reference
5	C signal	13	Touch-trigger probe signal
6	+12 V supply	14	Fixed probe head LED cathode
7	-12 V supply	15	Fixed probe head LED anode
8	Probe identification	Shell	Screen

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### Servo power amplifier connector

The UCC2 has the ability to connect a 3rd party servo power amplifier system through this 25-way 'D' socket on its rear panel. A 24 Vdc supply is also provided by the UCC2 through this connector to energise the CMM status switch.



Pin number	Function	Description	Refer to section
1	+24 Vdc	Supply provided for use with CMM status switches	" +24 V dc"
2	Contactor (active low)	Output signal to control motor contactor (active low)	"Contactor"
3	E-STOP_C	E-STOP system - reset signal	"ESTOP_C"
4	Enable amps (active low)	Command to SPA to enable amplifiers (active low)	"Enable amps"
5	Contactor (active high)	Output signal to control motor contactor (active high)	"Contactor"
6	E-STOP_A	E-STOP signal from MCU1 / joystick	"E-STOP_A and E-STOP_B"
7	E-STOP_B	E-STOP signal from MCU1 / joystick	"E-STOP_A and E-STOP_B"
8	-X command	Differential output to CMM X drive motor	"Axis command signals"
9	X command	Differential output to CMM X drive motor	"Axis command signals"
10	-Y command	Differential output to CMM Y drive motor	"Axis command signals"
11	Y command	Differential output to CMM Y drive motor	"Axis command signals"
12	-Z command	Differential output to CMM Z drive motor	"Axis command signals"
13	Z command	Differential output to CMM Z drive motor	"Axis command signals"
14	-4th axis command	Differential output to CMM 4th axis drive motor	"Axis command signals"
15	4th axis command	Differential output to CMM 4th axis drive motor	"Axis command signals"
16	Command common	Reference line for power amplifiers	"Command common"

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17	Reserved		"Reserved"
18	Reserved		"Reserved"
19	Reserved		"Reserved"
20	Reserved		"Reserved"
21	Enable amps (active high)	Command to SPA to enable amplifiers (active high)	"Enable amps"
22	Contactator feedback	Confirmation of contactor operation	"Contactor feedback"
23	Amps OK	Confirmation from the servo amplifiers that they are ready	"AMPs OK"
24	E-STOP tripped	Indication from the SPA that the E-STOP signal is asserted	"E-STOP tripped"
25	24 V return	Common reference line for supply and contactor signals	"0 V (24 V return)"
Shell	Screen		

### +24 Vdc

+24 Vdc supply provided for the use of contactors, relays and other motor control circuits. Current limit 1 A.

### Contactator

This command is issued by the UCC2, to the SPA, to engage the motor contactor. This output signal can drive the contactor directly providing its current consumption is within the output specification. This output signal is available in both an active low on pin 2 and an active high on pin 5.

### E-STOP\_C

This is the E-STOP reset line from the servo power amplifier. It is made available to the UCC2 plug in daughter-card slots for incorporation by products that need to be aware or pass on this signal's status. It is part of the "category 2" E-STOP system supported by the UCC2 and SPA2 controller system.

### Enable amps

This is a command from the UCC2 to the SPA requesting it to enable its amplifiers. This output signal is provided as both an active low signal on pin 4 and as an active high signal on pin 21.

### E-STOP\_A and E-STOP\_B

These are the connections from the SPA E-STOP system to the joystick / MCU mounted emergency stop switch. E-STOP\_A is the high end and E-STOP\_B is the return. The E-STOP\_B signal is also made available to the UCC2 plug in daughter-card slots for incorporation by products that need to be aware or pass on this signal's status. A rotary table is a good example of where it needs to be incorporated as part of the E-STOP system.

### Axis command signals

These outputs (pins 8 to 15) are the velocity demand signals for each axis from the UCC2 to the servo power amplifiers. They vary over the range +10 V to -10 V.

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### Command common

An analogue reference zero is available to the servo power amplifiers but this signal is not used by our SPA1 and SPA2 amplifiers although some third party units do require this reference. It is important that this is not used as a 0 V return for digital signals because this will inject noise into the velocity demands. This pin (16) should be left open circuit if not required.

### Reserved

These pins (17 to 20) have high-speed serial communication driver / receivers connected to them, they are intended for future development. It is important that these pins should be left open circuit.

### Contact feedback

This is a confirmation signal from the motor contactor to the UCC2 that it has successfully operated and the motors are now engaged. This signal was on the I/O connector (pin 24) for the UCC1 and is still available on that connector on the UCC2 for backwards compatibility reasons.

### AMPs OK

This is a confirmation signal (pin 23) from the servo amplifiers that they are on and ready. It is produced as a response to the Enable Amps command. This signal was on the I/O connector (pin 19) for the UCC1 and is still available on that connector on the UCC2 for backwards compatibility reasons.

### E-STOP tripped

This input (pin 24) is used to inform the UCC2 of the CMM 'Emergency Stop' condition (E-STOP). If the input pin is pulled down to 0 V (24 V return) the UCC2 will assume that there is no emergency stop active and allow the servo motors to be energised. This input is also on the I/O connector pin 21.

If the input pin is open-circuit or near +24 V the UCC2 will assume that the emergency stop is active and will disable all motors and inform the host computer of the event.



**NOTE:** No motor can be enabled while this input is high or open-circuit.

### 0 V (24 V return)

This is the 0 V reference connection for all the digital and switching signals, unless otherwise stated the 0 V connections from all external devices should be connected to this line. This signal line is available on pin 25 on the SPA connector and pins 37 and 44 of the I/O connector. It is taken to a star point within the UCC2 controller where it is connected to protective ground, cable screens and all the internal supply 0 V lines. The star point must be the only point that these different 0 V and ground connections are made.

## UCC2 and UCC2-2 installation guide

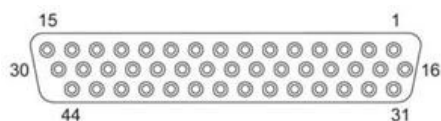
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### Machine I/O connector

The plug on the cable from the CMM connects to the 44 way miniature (high density) socket on the rear of the panel of the UCC2.

The input/output (I/O) signals to/from the UCC2 controller are:

- Air solenoid output
- X, Y and Z brake outputs
- Emergency stop switch
- Machine air pressure switch
- Crash switch
- Contactor feedback
- X+ and X-, Y+ and Y-, 4th axis- and 4th axis+, Z+ and Z- inner and outer limit switches of the CMM
- General purpose outputs and inputs
- 24 Vdc supply and return



Pin number	Function	Description	Refer to section
1	+24 Vdc	Supply provided for use on CMM switches	" +24 Vdc"
2	Air solenoid	CMM air solenoid output signal	"Air solenoid"
3	X brake	CMM X brake output signal	"X, Y, Z brake"
4	Y brake	CMM Y brake output signal	"X, Y, Z brake"
5	Z brake	CMM Z brake output signal	"X, Y, Z brake"
6	Output 0	General purpose output signal	"UCC2 general purpose outputs"
7	Output 1	General purpose output signal	"UCC2 general purpose outputs"
8	Output 2	General purpose output signal	"UCC2 general purpose outputs"
9	Output 3	General purpose output signal	"UCC2 general purpose outputs"
10	Output 4	General purpose output signal	"UCC2 general purpose outputs"
11	Output 5	General purpose output signal	"UCC2 general purpose outputs"
12	Output 6	General purpose output signal	"UCC2 general purpose outputs"
13	Input 0	General purpose input signal	"UCC2 general purpose inputs"
14	Input 1	General purpose input signal	"UCC2 general purpose inputs"
15	Input 2	General purpose input signal	"UCC2 general purpose inputs"
16	Input 3	General purpose input signal	"UCC2 general purpose inputs"
17	Input 4	General purpose input signal	"UCC2 general purpose inputs"
18	Input 5	General purpose input signal	"UCC2 general purpose inputs"
19	Amplifier OK		"Amplifier OK input"

## UCC2 and UCC2-2 installation guide

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20	CMM declutch		"CMM declutch"
21	E-STOP tripped		"ESTOP tripped"
22	Air pressure	Machine air pressure switch input	"Air pressure switch"
23	Crash	Crash detector switch input	"Crash switch"
24	Contactator feedback	Contactator input signal	"Contactator feedback"
25	X axis outer limit	CMM X axis limit switch input	"Limit switches"
26	-X axis outer limit	CMM X axis limit switch input	"Limit switches"
27	Y axis outer limit	CMM Y axis limit switch input	"Limit switches"
28	-Y axis outer limit	CMM Y axis limit switch input	"Limit switches"
29	Z axis outer limit	CMM Z axis limit switch input	"Limit switches"
30	-Z axis outer limit	CMM Z axis limit switch input	"Limit switches"
31	X axis inner limit	CMM X axis limit switch input	"Limit switches"
32	-X axis inner limit	CMM X axis limit switch input	"Limit switches"
33	Y axis inner limit	CMM Y axis limit switch input	"Limit switches"
34	-Y axis inner limit	CMM Y axis limit switch input	"Limit switches"
35	Z axis inner limit	CMM Z axis limit switch input	"Limit switches"
36	-Z axis inner limit	CMM Z axis limit switch input	"Limit switches"
37	24 V return (0 V)	Common reference line for input and output signals	
38	4th axis brake	Reserved for future use	
39	+4th axis outer limit	CMM 4th axis limit switch input	"Limit switches"
40	-4th axis outer limit	CMM 4th axis limit switch input	"Limit switches"
41	+4th axis inner limit	CMM 4th axis limit switch input	"Limit switches"
42	-4th axis inner limit	CMM 4th axis limit switch input	"Limit switches"
43	Reserved	Reserved for future use	"Air pressure switch"
44	24 V return (0 V)	Common reference line for input and output signals	"24 V return"
Shell	Screen		

### +24 Vdc

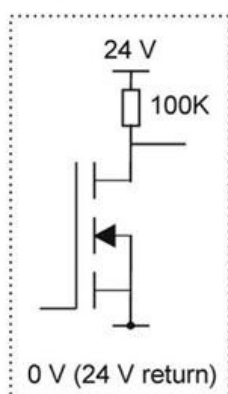
+24 Vdc supply provided for the use of contactors, relays and other motor control circuits. Current limit 1 A.

## UCC2 and UCC2-2 installation guide

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### UCC2 general purpose outputs

These 7 transistor output signals (pins 6 to 12) are switched on and off by commands from the host computer (See the UCC programmers guide, command number 318). The outputs are active low.

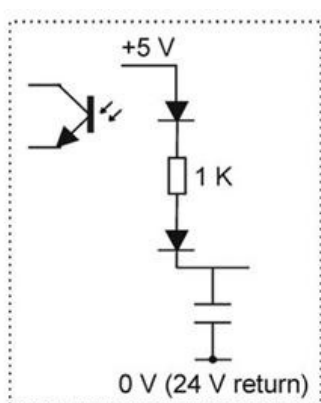


- Absolute maximum voltage rating 55 V dc
- Recommended maximum voltage 48 V dc
- Recommended maximum current 1.0 A
- The output is protected against higher currents but the output state may change due to thermal shutdown.

When the output is not activated the transistor is not switched on and the output pin is lightly pulled high (+24 V) via a 100K resistor. When the output is activated, by sending a '1' to the relevant control bit the transistor will turn on, pulling the output pin down to the 0 V (24 V return) line.

### UCC2 general purpose inputs

These 6 opto-isolated LED inputs (pins 13 to 18) to the UCC2 can be used to send signals from the CMM to the CMM host computer via the UCC2 (see the UCC programmers guide, command number 279). Pulling an input pin low, towards the 0 V (24 V return line) will cause the controller to return a '0' in reply to the read command.



- Absolute maximum voltage rating 55 V dc
- Recommended maximum voltage 48 V dc

### Air solenoid

This output signal (pin 2) is used to activate the CMM main air supply solenoid (if fitted). The output becomes active as soon as a downloadable is sent to the UCC2 controller. The output is active low.

### X, Y and Z brakes

These outputs (pins 3,4 and 5) are used to disengage the CMM axis brakes (if fitted). The outputs become active as soon as the CMM servos are engaged. During the commissioning process it is possible to invert the output from the brake connections from active low to an active high.



## UCC2 and UCC2-2 installation guide

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### Amplifier OK input

This signal (pin 19) is produced by the servo power amplifier to inform the connected UCC2 controller that ALL the servo power amplifiers have been successfully enabled, it is an active low signal i.e. pulled to 0 V (+24 return) to indicate success. This signal is a response to an active 'amp control' signal from the controller. This signal is also available on the SPA connector pin 23.

### CMM declutch

This input on pin 20 should normally be pulled down to the 0 V return line, to signal to the controller that the CMM's drives are mechanically connected to the moving elements of the machine, i.e. in their normal condition. The input should be open circuit, or held high, when a CMM has been temporarily 'de-clutched' from its drive motors to allow manual positioning. The servo system will not drive the motors in this condition and will resume control at the machine's position when the signal again goes low.

### E-STOP tripped

This input (pin 21) is used to inform the UCC2 of the CMM 'emergency stop' condition (E-STOP). This signal is also available on the SPA connector pin 24. If the input pin is pulled down to the 24 V return line, the UCC2 will assume that there is no emergency stop active and will allow the servo motors to be energised. If the input pin is open-circuit or near +24 V the UCC2 will assume that the emergency stop is active and will disable all motors, and inform the host computer of the event.



**NOTE:** No motor can be enabled while this input is high or open-circuit.

## UCC2 and UCC2-2 installation guide

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### Air pressure switch

The low air pressure signal should be connected to a suitable air pressure switch. This input is monitored by the controller and when activated will remove power from the motors causing a system fatal fault. During commissioning process it is possible to invert this signal from an active low to an active high. If this capability is not required for integration to the system then it should be connected to the 0 V.

### Crash switch

This input signal (pin 23) is used to stop the CMM movement if there is a collision involving parts of the CMM and probe system, as detected by a switching mechanism.

The crash switch should pull the input down to 0V return line. If the input is not pulled down, the UCC2 will disable all motors, and inform the CMM's host computer of this state. During commissioning process it is possible to invert this signal from an active low to an active high.

### Contactors feedback

This input signal (pin 24) is used by the UCC2 to monitor the operation of the axes drive motors control contactor. This signal is also available on the SPA connector pin 5.

When the contactor is energised (drive motors enabled), this signal should be pulled down to the 24 V return line to indicate that motor power is available.

If the UCC2 has turned on the 'contactor' output (servo power amplifier socket, pin 2) and the signal on pin 24 indicates that the contactor has not operated, after a short delay the UCC2 will disable the drive motors and inform the CMM host computer of this fault.

### Limit switches

The UCC2 will use these input signals (pins 25 to 36 and 39 to 42) to stop the CMM as programmed by the host computer (See the UCC programmers guide, command number 311).

All outer limit switches have to be closed before the CMM's drives can be engaged. Operation of these switches is interpreted as a fatal fault. If any of them is operated, all the CMM's axes servo drive motors are automatically disengaged. These signals cannot be overridden by a software command. Recovery from an outer limit operation is either by manually pushing the machine "off" the limit switch or by a separate override switch provided by the CMM's manufacturer / retrofitter.

When a CMM actuates an inner limit switch on any of its axes, all CMM axes are decelerated, stopped and backed off in the opposite direction as if it were a touch-trigger event. The inner limit switches can be overridden by a software command for error mapping or collision recovery purposes, see command number 311, control limit switch override, in the programmer's guide.

### 24 V return (0 V)

This is the 0 V reference for all of the I / O signals and is available on pins 37 and 44.

### Reset button

The rear panel reset button has two different functions. Its function depends on what operational state the controller is in.

a) If the unit has just been switched on and is in the stage before it is ready for download i.e. approximately a 15 second window from switch-on, pressing and releasing this button will force the controller into the IP configuration state. See section "[Configuration of IP addresses](#)" for details.

b) If the controller is ready for download, or if the control software has been downloaded (in the operational state), operation of this button will force a reset, i.e. the software will restart as if the unit had been switched "off" then "on" again.

If you wish to enter the IP configuration state when the controller is ready for download, or is running the control software, then two presses of this button, with a momentary pause between them, will achieve this state.

## UCC2 and UCC2-2 installation guide

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### Daughtercard slots

Inside the UCC2 controller is a Renishaw proprietary bus system for connecting additional interfaces in the form of plug-in cards. There is a wide range of additional interfaces available such as a PH10 controller, a SP80 interface, an additional axis (rotary table or dual drive), a temperature interface, etc. This allows the UCC2 to be correctly configured for the application for which it is being used, and also allows for the integration future products.

PH10 / 50 card	A-1333-0011
PICS RS232 card	A-1333-0012
SP80 card	A-1333-0021
Additional axis / rotary table card	A-1333-0020
REVO card	A-5121-0020
Temperature compensation card	A-1333-0195

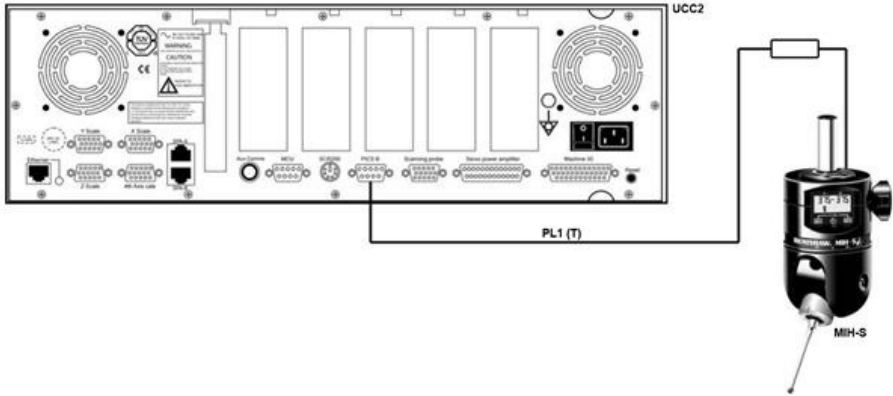
# UCC2 and UCC2-2 installation guide

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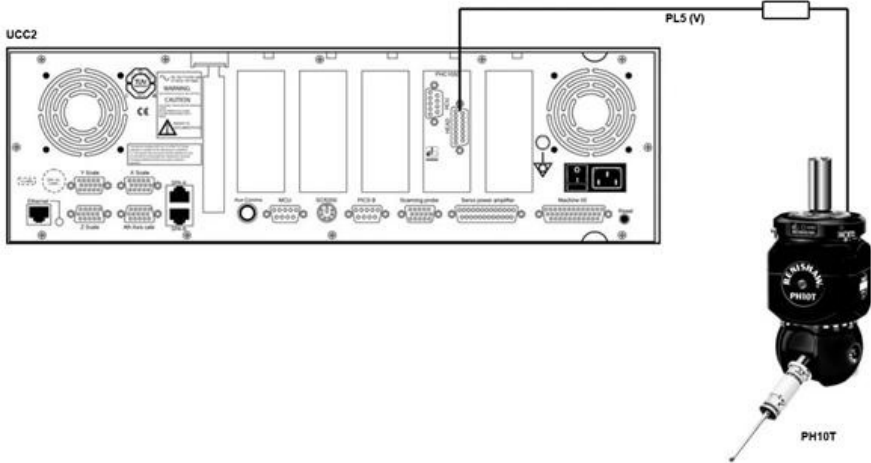
## System interconnection

The UCC2 provides a simple means of interconnecting many of the sub-systems (e.g. a probe head) in a measuring system. The purpose of this chapter is to illustrate some system configurations.

### 2-wire touch-trigger probe system



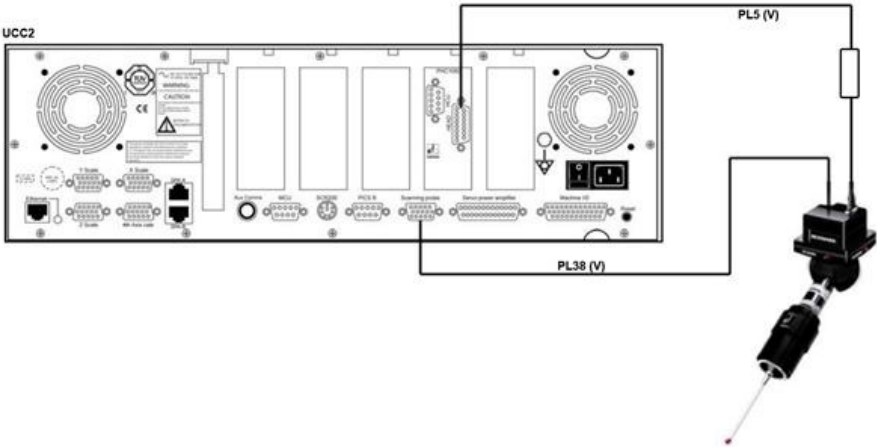
### PH10 probe head and 2-wire touch-trigger probe system



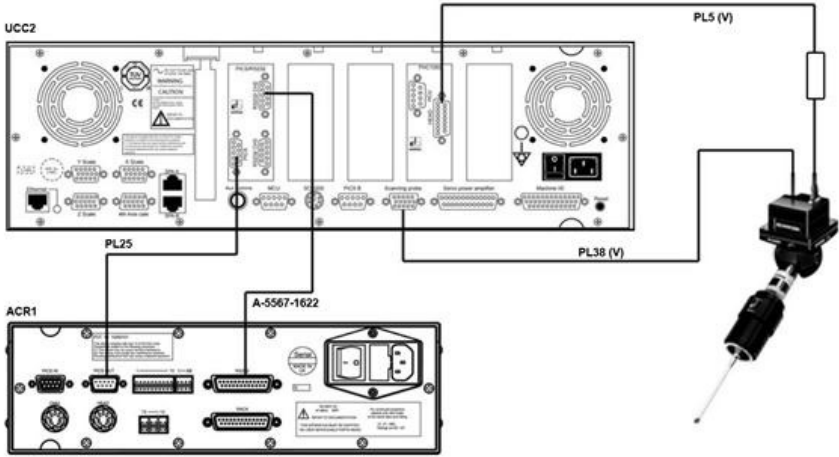
# UCC2 and UCC2-2 installation guide

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## PH10 probe head and multiwire probe system



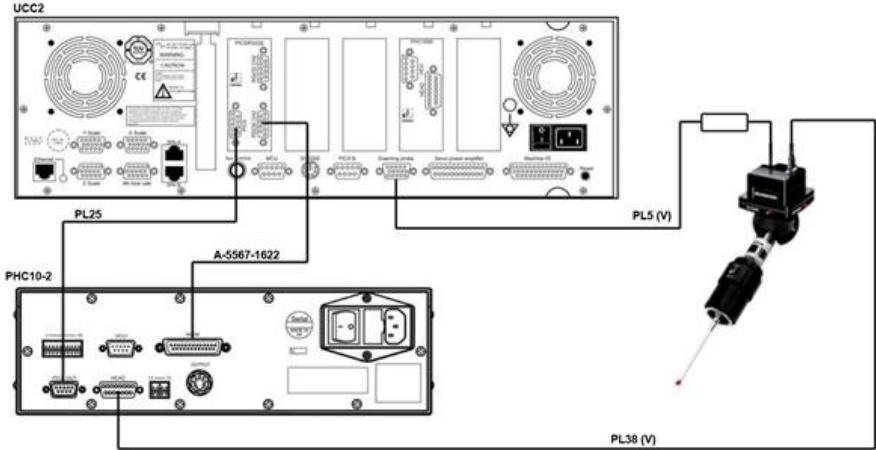
## PH10 probe head, multiwire probe system and ACR1



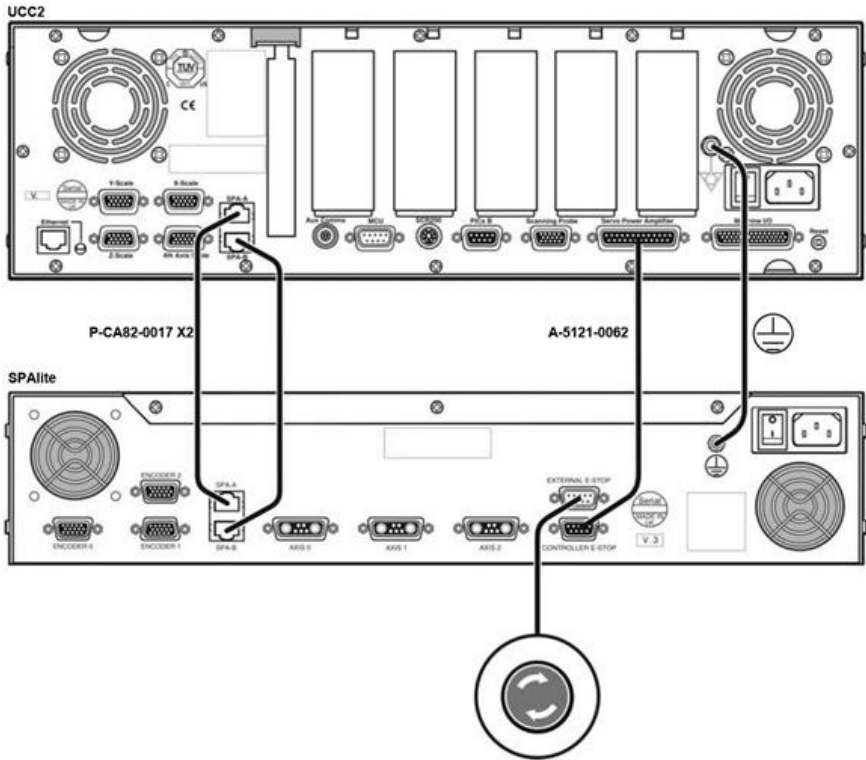
# UCC2 and UCC2-2 installation guide

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## PH10 probe head and multiwire probe system using external PHC10-2



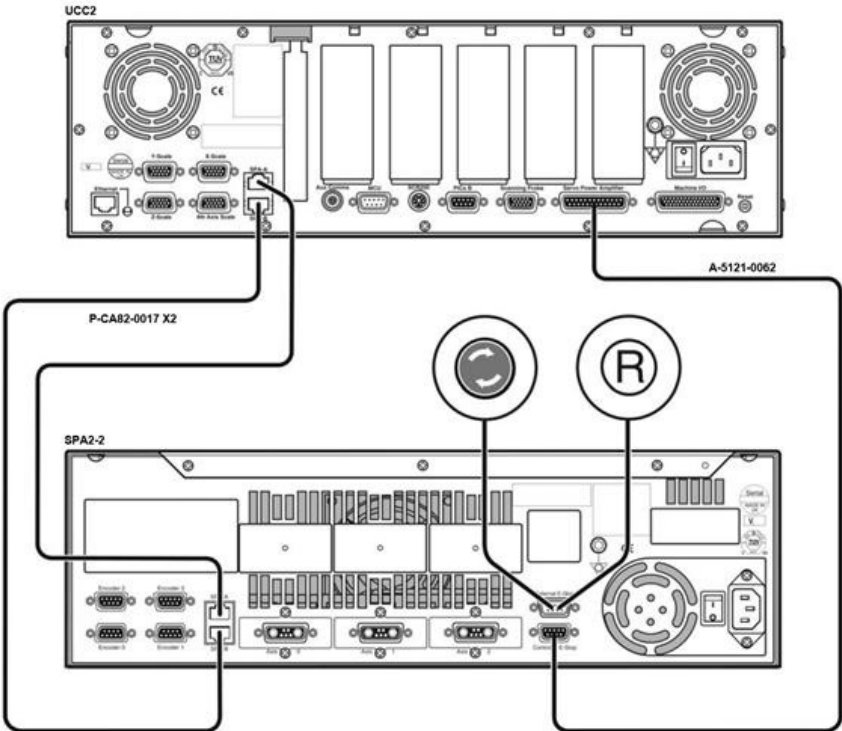
## UCC2 and SPAlite



# UCC2 and UCC2-2 installation guide

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## UCC2 and SPA2-2



## UCC2 and UCC2-2 installation guide

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# Connecting the UCC2 and UCC2-2 to the host PC

For the installation of a UCC2 controller, the CMM's host computer must use Windows NT (service pack 6 or later), Windows 2000, Windows XP Pro, Windows Vista or Windows 7 as an operating system; a CD-ROM drive, and a hard disc drive. The storage requirements of the UCC system are less than 500 Mbytes. The processor speed and RAM requirements are not excessive, if the PC is supporting the operating system and application software, it will almost certainly support the UCC controller operation.

The PC must have one free dedicated network (Ethernet) connection port available for the UCC2 communication. It is recommended that this NOT a USB plug-in adapter because of the reduction in speed of operation these devices normally produce.

The following sections detail how to connect and configure the communication link between the UCC2 and the host PC that is running either the UCC utilities or metrology application software.

## Hardware connection

The host PC must have a dedicated Ethernet connection to the UCC2. It is recommended that this 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 UCC2 communication. For details on how to install additional hardware into the host PC, please refer to the PC's installation / users guide.

The UCC2 is capable of using both 10 Mbps and 100 Mbps Ethernet, the selection being determined by the capability of the network adapter to which it is connected. We recommend that you use a 100 Mbps network adaptor.

A 5 m Ethernet cable is provided for this link as part of the UCC2 kit and is a Cat 5e, cross-over type. Other lengths may be used, the maximum being is governed by the generic specification for Ethernet connections (i.e. a hundred metres), which is sufficient for any CMM installation. It must be a cross-over type for a single installation.

If you are concerned about EMC disruption due to your environment, or the routing of the cable, then the use a shielded cross-over cable is recommended.

We suggest that you label your cross-over cable as a cross-over cable as it looks identical to a normal, not-crossed-over, cable.

## Software installation

The UCC software must be installed on the host PC, prior to connection of the UCC2.

The UCC software suite can be downloaded from the [Renishaw website](#).

After the software has been installed, one of the utility programs available is "IP Configurer"; which is used to give the UCC2 an IP address, and establishes the pairing of the PC and the UCC2.

Included in the UCCSuite is UCCassist-2 which is the installation and diagnostics software for UCC2 installations.



## UCC2 and UCC2-2 installation guide

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# Configuration of IP addresses

This section describes the steps needed to connect your UCC2 and UCC2-2 to the host PC and configure the ethernet communication link.

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

## IP addresses

Choose an IP address for the UCC2 or UCC2-2 and an IP address for the PC's network adaptor that are of the same network.

class A 1.0.0.1 – 126.255.255.254

class B 128.0.0.1 – 191.255.255.254

class C 192.0.0.1 – 223.255.255.254

For class A networks, a network is defined by the first number.

For class B networks, a network is defined by the first two numbers.


For class C networks, a network is defined by the first three numbers.

IP addresses that belong to the class A network class, then you must be sure that the first numbers are identical, e.g. 10.0.0.1 and 10.123.4.17.

IP addresses that belong to the class B network class, then you must be sure that the first two numbers are identical, e.g. 155.23.0.1 and 155.23.86.207.

IP addresses that belong to the class C network class, then you must be sure that the first three numbers are identical, e.g. 192.168.32.1 and 192.168.32.2.

e.g. 172.16.40.1 and 172.16.40.2.

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

## UCC2 and UCC2-2 installation guide

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### IP addresses

Choose an IP address for the UCC2 or UCC2-2 and an IP address for the PC's network adaptor that are of the same network.

class A 1.0.0.1 – 126.255.255.254

class B 128.0.0.1 – 191.255.255.254

class C 192.0.0.1 – 223.255.255.254

For class A networks, a network is defined by the first number.

For class B networks, a network is defined by the first two numbers.

For class C networks, a network is defined by the first three numbers.

IP addresses that belong to the class A network class, then you must be sure that the first numbers are identical, e.g. 10.0.0.1 and 10.123.4.17.

IP addresses that belong to the class B network class, then you must be sure that the first two numbers are identical, e.g. 155.23.0.1 and 155.23.86.207.

IP addresses that belong to the class C network class, then you must be sure that the first three numbers are identical, e.g. 192.168.32.1 and 192.168.32.2.

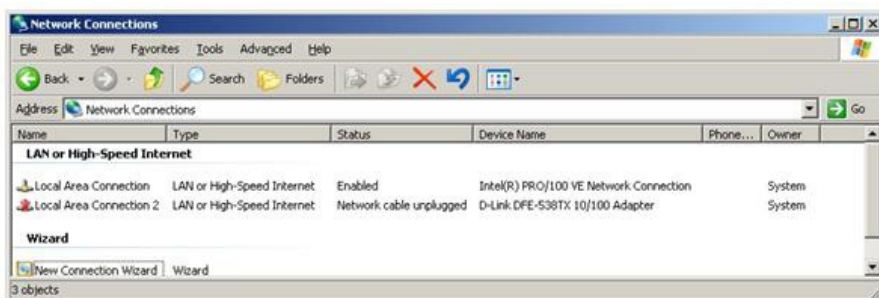
e.g. 172.16.40.1 and 172.16.40.2.

### Setting the IP address of the PC

The network adapter in the PC which the UCC2 or UCC2-2 is connected needs an IP address. See the paragraph "IP addressing".

You need administrator rights in order to perform this operation.

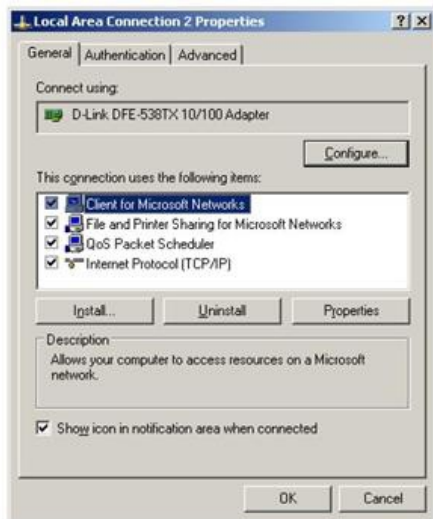
a) Select Start → Settings → Control Panel → Network Connections to give:



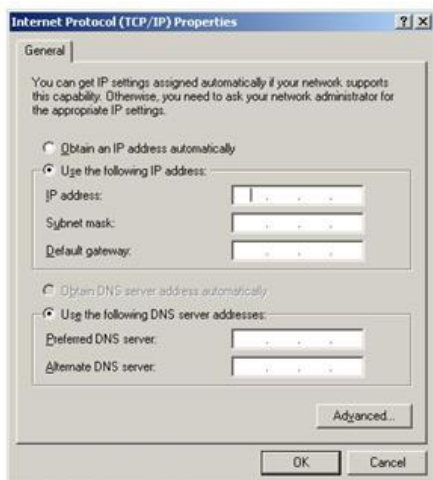
b) Right-click the appropriate Local Area Connection and select Properties from the resultant popup menu box to give:

## UCC2 and UCC2-2 installation guide

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c) Select 'Internet Protocol (TCP/IP)' and click Properties to give:



d) If not already selected select 'Use the following IP address' and type in the IP address that you want to use for the PC end of the comms link. Now click in the Subnet mask field. On Windows XP the Subnet mask will be filled in for you. If you have to fill it in for yourself, here are the values:

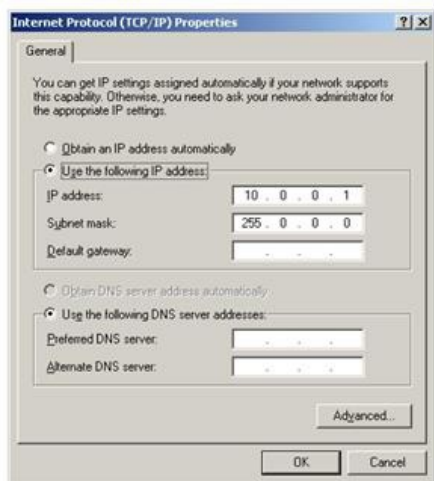
Class of network IP address belongs to	Subnet mask to use
A	255.0.0.0
B	255.255.0.0
C	255.255.255.0

Leave the Default gateway field blank.

## UCC2 and UCC2-2 installation guide

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Example:



e) Click OK and then OK again. Whether or not this setting has taken effect depends on the version of Windows that you are running. On earlier versions you will need to reboot the PC. To be absolutely sure, reboot your PC anyway.

## Setting the IP address of the UCC2 or UCC2-2

The UCC2 or UCC2-2 is not intended to be used on a corporate network. It is extremely important that this setting of the IP address of the UCC2 or UCC2-2 is on a dedicated connection. It is also important that the connection is not “firewalled” at the PC end. You need administrator rights in order to perform this operation.

When it is first installed the UCC2 or UCC2-2 does not have any IP address. Turn the UCC2 or UCC2-2 on and wait for it to boot up. It will enter its IP configuration state, shown by the Error LED flashing rapidly. (Please be patient; this will take about 15 seconds.)

Now start the UCC IP configuration software on the PC.

a) Start → UCC Software → IP Configurer



b) Click on the drop-down icon and select the IP address of the network adapter into which the UCC2 or UCC2-2 is plugged. (This should be the one on which you set the IP address of in 'Setting the IP address of the PC'.)

## UCC2 and UCC2-2 installation guide

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c) You are now told that the UCC2 or UCC2-2 does not have an IP address:



d) 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 you have selected. (See “IP addressing” for a discussion of the choice and of IP addresses in general.)



e) Click on 'Configure PC and UCC pair'. If all is well this will result in a confirmatory dialogue box:



The UCC2 or UCC2-2 will now have moved into its 'waiting for download' state – shown by the error LED flashing slowly.

You have established the UCC2 or UCC2-2 PC system using the IP addresses of "Setting the IP address of the PC" and this section.

**NOTE:** Whenever you change one of the items in this pairing, e.g. by connecting a different UCC2 or UCC2-2 to the PC, you must re-run the UCC2 or UCC2-2 IP configuration software to establish the new UCC2 or UCC2-2 PC system.

## UCC2 and UCC2-2 installation guide

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### Changing the IP address of the UCC2 or UCC2-2

If the UCC2 or UCC2-2 has an IP address, after booting up it skips its IP configuration state and proceeds into waiting for a download, shown by the error LED flashing slowly. There are two ways to force the UCC2 or UCC2-2 into its IP configuration state:-

- a) During the 15 second power up phase, before the error LED comes on, press and release the Reset button on the rear of the UCC2 or UCC2-2. At the end of the power up phase the error LED will flash rapidly indicating it is in the IP configuration state.
- b) If the UCC2 or UCC2-2 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 UCC2 or UCC2-2 is now in its IP configuration state, and the UCC2 or UCC2-2 IP configuration software can be run on the PC, selecting the appropriate network adapter required. The current IP address of the UCC2 or UCC2-2 will be displayed. Type in the new one and click on 'Configure PC and UCC pair'.

### Establishing a new UCC2 or UCC2-2 PC pairing

If you connect a different UCC2 or UCC2-2 to your PC, or a different PC to your UCC2 or UCC2-2, or even if you modify the network settings on the PC, you must ensure that they are a matched pair. To do this, go through the procedure in 'Setting the IP address of the PC', even if you do not wish to change the IP address of the UCC2 or UCC2-2. (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.

## UCC2 and UCC2-2 installation guide

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# Downloading

The name of the downloadable file is `contrler.uca`. *UCClite* and *UCClite-2* controller downloadables will not work on a UCC2 or UCC2-2. Remember to change the name in any configuration settings appropriate for your application software if required.

Your UCC2 or UCC2-2 system is now established.

## UCC2 and UCC2-2 installation guide

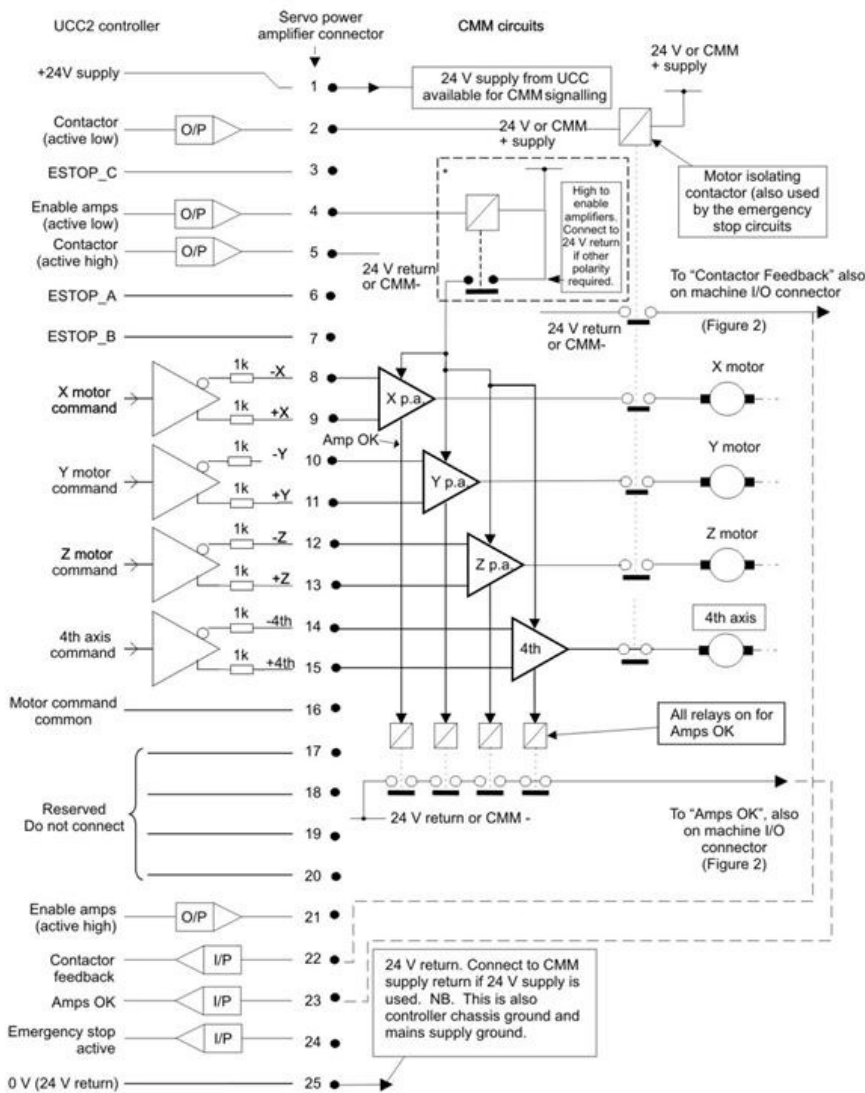
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# Connecting the UCC2 or UCC2-2 to a CMM

The purpose of this chapter is to describe the various connections available within the UCC2 or UCC2-2 design to enable connection to a CMM.

This section reviews each UCC2 or UCC2-2 connection and gives comments on the preferred methods and available alternatives.

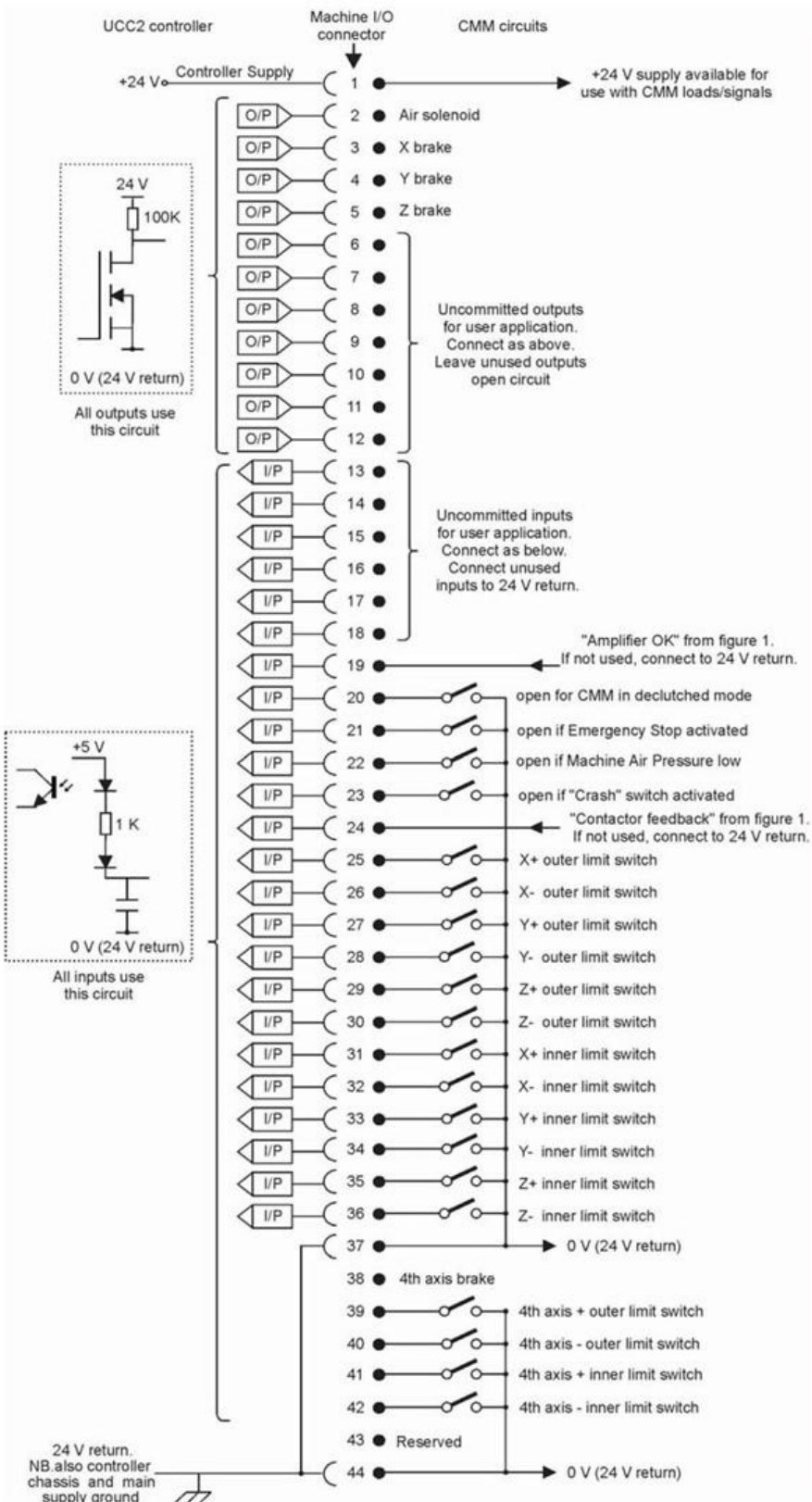
### Suggested wiring to the servo power amplifier connection





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### The controller's 24 V supply

This supply is available at both the servo power amplifier connector and the machine's I/O connector for use by the CMM signalling circuits. It has low current rating, see "[Machine I/O connector](#)", and is thus not suitable for heavy loads.

Please use semiconductors or relays to interface with high power loads or to those which need electrical isolation.

All inputs and outputs (excepting the optically isolated amp control signals) are referenced to this supply.

It is not a floating supply, the 24 V return line is connected to the controller's chassis and to the mains supply protective ground at a star point within the controller.

If there are any interconnections between this supply and any of the CMM's supplies, there is a possibility that an additional path to ground may be created.

A separate supply of similar voltage may be used for signalling purposes in place of the controller's 24 V supply but its negative rail must be connected to the controller's 24 V return line.

### Motor engagement via SPA connector

The controller will begin to engage the servo motors when instructed to do so by the host computer, if all the operating functions are in a safe or acceptable condition.

Listed below are possible causes for the motor engagement to fail:

- The system has not yet been configured for motion (i.e. the machine, servo and move parameters have not been sent to the controller)
- A fatal fault has been detected
- The emergency stop system has been activated
- A PICS 'stop' signal is detected within the system
- The amplifier OK signal not asserted
- An open limit switch
- A present or previously present scale reading fault

The process is in two stages, amplifier enabling and contactor energising, with protective delays between each stage.

### Amplifier enabling

The 'amps OK' signal produced by the amplifier control circuits is an indication to the UCC2 controller that the servo power amplifiers are not faulty.

The controller will first ensure that all its motor demand signals are zero and will then try to enable the power amplifiers by asserting the 'enable amps' signal (servo power amplifier connector pin 4 or 5, [figure 1](#)). See [chapter 6](#) for its electrical ratings.

This "enable amps" signal will be held on for 0.1 second to allow the 'amps OK' signal, from the servo power amplifier, to become valid. If this signal does not become valid (i.e. pin 19 of the machine I/O connector is not pulled low) the controller will abandon the engagement process. If no error is detected then the controller will wait for a further period of 1 second before beginning the next stage, to allow the amplifiers to settle after any initial transients.


[Figure 1](#) is an example of the recommended circuits that can be used to drive the power amplifier enable inputs and to generate the amps OK signal shown. The circuits that are used in the installation will vary depending on the amplifiers' requirements but must pull the 'amps OK' input (pin 19) down if all amplifiers are operating correctly.

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If the user wishes to signal amplifier failures individually to the main computer, it is recommended that the uncommitted user inputs (machine I/O connector, [figure 2](#)) are used for this purpose.

If the installer of the CMM makes the decision that the amplifier enabling function is not needed, the 'Enable amps (active low)' signal could be connected directly to the 'amps OK' input signal. This will provide immediate feedback to the controller during the amplifier enabling process and permit the next stage to begin.

 **NOTE:** This method is not recommended.


### Contactor energising

After establishing that the amplifiers are working correctly, the controller will take the "contactor" signal (pin 2 of the servo power amplifier connector) low, this should be used to signal the servo power amplifier to apply power to the motors. The controller will keep this output signal low for 0.2 of a second during which it expects the 'contactor feedback' input (machine I/O connector pin 24) to be pulled low to indicate that the motors are now powered.

If the 'contactor feedback' signal is not received in time, the contactor (pin 2) and the amp control signals (pins 4+5) are turned off and the motor engagement process is stopped.

If the 'contactor feedback' signal is received within this 0.2 second window, the controller keeps all motor commands at zero for another 1.0 second before allowing the servo system to begin operating. This is intended to give further protection against sudden machine movements when engaging the motors

If the installer of the CMM makes the decision that the contactor energising function is not needed, the 'contactor' signal (pin 2) can be joined to the 'contactor feedback' input signal (pin 22). This will provide immediate feedback to the controller during the contactor energising process and permit the next stage to begin.

 **NOTE:** This method is not recommended.

### Motor command signals

The UCC2 controller generates complementary motor velocity command signals for each axis (X axis = pins 8+9, Y axis = pins 10+11, Z axis = pins 12+13, 4th axis = pins 14+15).

Each motor velocity signal is capable of a swing of +/-10 V centred on a zero velocity command of 0 V. A motor "command common" connection is provided to define this 0 V level (servo power amplifier connector, pin 16, [figure 1](#)).

The motor command common signal is also connected to the 24 V supply return, the controller chassis and the mains supply protective ground at a star point within the controller. Care may be required in its application.

If complementary signals are not required, either of the motor command signals may be used as a single ended input, referred to the motor "command common" line.

Each motor command signal has a series resistor of 1k ohm to protect the controller from inadvertent damage and this will reduce the drive signal to the power amplifiers if their inputs are of low impedance. The UCCassist-2 will compensate for this automatically.

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### Motor command polarity

For each axis, the motor command +ve pin will go negative with respect to the command common line to produce a positive change of position.

The motor command -ve pin will go positive at the same time.

### Brakes

The brake on a CMM is a mechanism to prevent that axis from moving when it is already stationary, it is not there to slow an axis down.

These outputs are used to disengage the CMM axis brakes (if fitted). The output becomes active as soon as the CMM servos are engaged.

It is possible to set delays for the release and application of the brakes. These delays are applied equally to all of the brake outputs.

- Release delay is the time between de-activating the brake outputs and allowing motion requests occurring during engagement.
- Apply delay is the time between servo disengagement and activating the brake outputs.

### Air solenoid

This output signal is used to activate the CMM main air supply solenoid (if fitted). The output becomes active as soon as a downloadable is sent to the UCC2 controller. If the controller is reset or switched off the air solenoid will be de-energised disconnecting the CMM air supply .

### Switched outputs

The UCC2 has the following uncommitted switched outputs, please refer to [outputs section](#) for details.

There are seven uncommitted outputs available on the UCC2 I/O connector, pins 6 to 12 are allocated to be outputs 0 to 6 consecutively. The UCC does not directly control these outputs, it merely acts as a post-box. These outputs are controlled from the application software package via command 318 "Write to controller port".

These switched outputs are pulled up to the 24 V rail by a 20 k ohm resistor when inactive, and will be pulled down to the 24 V return line via an NPN transistor when activated. There is an excess voltage protective diode fitted internally to the controller.

The outputs can be activated by a command from the main computer to the controller. If not being used they should be left open circuit.

### Switched inputs

The UCC2 has the following controller switch inputs, please refer to "[Machine I/O connector](#)" for details:

There are six uncommitted inputs available on the UCC2 I/O connector, pins 13 to 18 are allocated to be inputs 0 to 5 consecutively. The UCC does not directly read these inputs, it merely acts as a post-box. These inputs are read by the application software package via command 279 "Read from controller ports".

The controller provides 29 inputs of this type. See "[Connectors and signals](#)" for their electrical ratings.

Each input is connected to an LED fed from the +24 V rail, and is activated by being pulled down to the 24 V return line. The LED is part of an opto-coupler which is used to give the controller some isolation from unwanted electrical signals on the input wiring.

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### Limit switches

Sixteen inputs are allocated to limit switch signals, 8 inner and 8 outer. When a limit switch is not activated (i.e. the machine is within its working range) these inputs should be connected to the 24 V return line by the limit switch contacts. If the machine installation does not require the connection of the limit switches the signals must be connected to the 24 V return line.



**NOTE:** Limit switches should be installed such that they will not be damaged in the event of overtravel. Where necessary for safety related functions, they should be of the direct (or positive) operating type to IEC 60947-5-1).

### Amplifier OK and contactor feedback

The 'amplifier OK' and the 'contactor feedback' inputs have been discussed in "[Motor engagement via SPA connector](#)".

### Fatal fault

Three 'Fatal Fault' inputs are provided: emergency stop, machine air pressure low and a 'Crash Switch' input. This last is intended for use with a sensing mechanism which detects an unintended contact between the machine's moving and fixed components. The controller monitors these inputs and will stop the motors if one or more input goes open circuit or high. If not required these inputs should be connected to the 24 V return line.



**NOTE:** The 'emergency stop' input is not a primary safety device, although the controller will stop the motors as far as it can. Its main use is to allow the controller to inform the main computer, and hence the operator, of the 'emergency stop' switch actuation. In addition it will prevent motor re-engagement if the 'emergency stop' switch is still activated. Where an electromechanical controlled emergency stop is required, to IEC/ EN60204-1 category 0, it must be separately provided and external to the UCC2.

### Declutched mode

The 'CMM in declutched mode' input is intended to tell the controller that the driving motors are mechanically disconnected from the machine, and that the machine may be moved by some other means, e.g. by hand. In this state, the motor commands will be kept at zero velocity until the machine clutches are re-engaged, at which time the controller will resume servo control at the new machine position. For normal servo operation, this input should be pulled down to the 24 V return line. If this function is not required, the input should be connected to the 24 V return line.

### Uncommitted inputs

The remaining six inputs are uncommitted and may be used as required. These signals are not used by the controller and are simply passed to the main computer, on request. If not required these inputs should be connected to the 24 V return line.

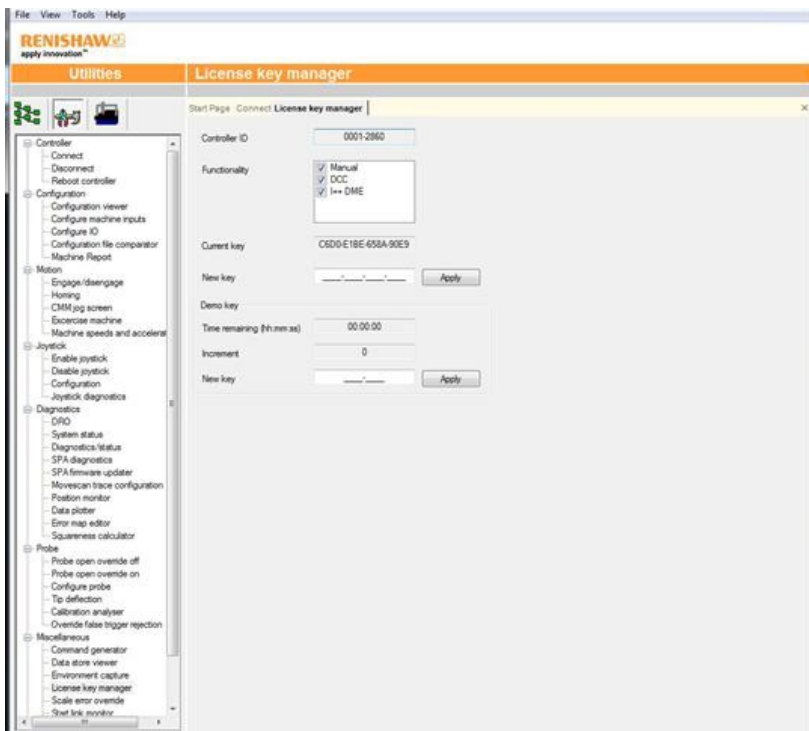
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# Renishaw license key manager system

The license key system has been designed to allow the OEM and retrofitters to easily upgrade UCC2 systems by simply entering in a licence key into the controller via the host PC. The upgrades can be done in the OEM factory, or in the field, without the need for hardware dongles or additional extra inventory (extra units configured for different functionality).

The license key system is based on a controller ID that is embedded into the UCC2 hardware. For each UCC2 system there is a unique 'key' that is required to unlock the required functionality.



## Using the Renishaw license key manager

When the UCC2 is received from Renishaw, it will be configured in the touch-trigger state and have the I++DME active. If only the touch-trigger system was purchased then no further action is required. However, if additional functionality was purchased (or has been purchased since), the process of upgrading the system must be conducted.

## Obtaining the key

This 'key' is provided by Renishaw. To obtain the 'key', the above information needs to be supplied to Renishaw. This can be done by e-mail, fax or even by telephone.

They will have the capability to generate the unique key required for the unit in question, which will be supplied in a 16 digit hexadecimal number of the form xxxx-xxxx-xxxx-xxxx.

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### Applying the key

Using the Renishaw license key manager software, the 'new key' button is clicked. The software then prompts the user to enter the 16 digit key. Once entered, the 'key' is stored in the unit and will enable the purchased upgrade. This can be checked by looking at the 'enabled functionality' table. The unit will remember these settings even after it has been powered down.

Once this 'key' is entered into the UCC2, using the Renishaw license key manager software, it is stored in non-volatile memory. The UCC2 will remember the 'key' and so once a function is enabled it will remain enabled until a new function is applied.

### Ordering extra functionality / upgrading

Additional functionality can be enabled by the application of a new 'key'. Before the 'key' can be issued by Renishaw, an order for the upgrade must be placed.

Two pieces of information are required in this process.

1. The controller's ID or serial number.
2. A valid order number for the required upgrade.

To read the enabled functions on a controller the connection must be made between the UCC2 and the PC via the Ethernet link. No other connection to the UCC2, other than power, is required at this stage.

Using the Renishaw license key manager software, the controller ID number will be read from the system. The format of the ID is an 8 digit number, hyphenated (e.g. xxxx-xxxx).

This number will be needed to request a new 'key' which will then enable the required function upgrade.

### Demonstration mode

A demonstration mode can be enabled giving 40 run time hours of all available functions.

The purpose of this is for sales demonstrations and short term evaluation. The 'demo key' is obtained from Renishaw using the controller ID number. The key is generated in much the same way as the main key, but is only 8 digits.

The 'demo key' is applied by clicking the 'demo key' button and entering the code.

Once the 40 hours have been used up, this 'demo key' becomes invalid. To use this function again a new 'demo key' must be obtained. It is intended that the 'demo key' is only used a limited number of times. After this number Renishaw will be unable to issue further 'demo keys'.

### Repairing upgraded systems

If a unit is returned for repair and it is necessary to send a replacement / exchange unit back, then it will arrive in the touch-trigger functionality state.

At this point, a new 'key' must be obtained. In this case the controller ID will be required and instead of an order number, the repair number, GRA number or the serial number of the original unit returned is required.

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# Testing and verification

The manufacturer of the finished machine, or the installer of the UCC2, is responsible for ensuring that the following testing and verification, to the appropriate standards, is performed as a minimum on the complete installation.

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



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# Troubleshooting

To aid troubleshooting of the UCC2 system, five status LEDs are visible through the front panel of the UCC2.

LED					System status	Refer to section
<b>Power on</b>	<b>System ready</b>	<b>Servo active</b>	<b>Probe seated</b>	<b>Error</b>		
off	off	off	off	off	Power off	UCC2 power not switched ON
on	off	off	off	off	Default start up condition	UCC2 power switched ON

## UCC2 power not switched ON

All LEDs OFF.

## UCC2 power switched ON

Power on LED is lit.

If switch-on is successful the UCC2 proceeds to the initialisation/test sequence.

## Initialisation / test

If the initialisation tests fail, then after about 15 seconds three LED configurations are possible, each indicating a different form of failure:

Power on	System ready	Servo active	Probe seated	Error
On	Off	Off	Flashing slowly	Flashing fast
On	Off	Off	Off	On
On	Off	Off	Off	Off



**NOTE:** These failures are not fixable at the customer's site - if any of these forms of failure are indicated the unit must be returned to your local Renishaw office.



**NOTE:** The state of all LEDs being off except 'power on' is the normal switch-on state (as per "UCC2 power switched ON"); it only indicates failure if it remains like this beyond about 15 seconds.

Try switching the controller off, waiting about 10 seconds, then turning it on again. If the problem persists, the unit needs attention.

If initialisation tests are successful, the power on LED will remain lit and the error LED will start flashing. A slow flash (approximately 0.5 second period) indicates the system is ready for a download. A fast flash (approximately 0.2 second period) indicates the UCC2 is in its IP configured state (see "[Configuration of IP addresses](#)").

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### System file downloading

During system file downloading, the power on LED is lit and the error LED is slowly flashing.

If the system file download fails then the power on, error and system ready (flashing) LEDs will be lit. In this condition, the UCC2 waits for a system restart. Switch the controller off and after approximately 10 seconds switch it on again.

After a successful download the system is ready for use; the power on and system ready LEDs will be lit.

### Servo active LED

When the servo drives are not active, the servo LED is off.

When the servo drives are active, the servo LED is on.

### Probe seated LED

When the probe is not deflected (in the case of analogue contact probes, not deflected beyond the trigger threshold zone): probe seated LED is on.

When the probe is deflected: probe seated LED is off

### Fatal faults

Some conditions can arise which mean that it is inadvisable or even dangerous to continue using the CMM servo system. These are known in this document, and in UCCassist-2, as 'fatal' faults, and are as follows.

- 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:** That other faults (not classed as fatal) can prevent the CMMs operation. Refer to following sections.

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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 switch on, 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).
- 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 outer limit switch being operated, or a soft limit exceeded.
- An active PICS STOP signal.
- Specifying the wrong probe type in the machine configuration, since open-circuit analogue probe inputs may eventually drift to an apparently 'deflected' value.

#### Tests / cures

Check each of the above signals using the status flags returned to the host PC, and / or by confirming the values of the actual signals reaching the controller.

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

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

A PICS STOP signal may originate from an external accessory such as a probe head controller. If the external device is a Renishaw interface it will indicate it is asserting the PICS STOP by illuminating its own stop led but it may be necessary to remove the PICS connections to peripherals one by one to establish which one is responsible.

Remember, a PICS accessory may produce a STOP signal. Renicis can be used to find the condition causing this, which should then be removed.

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### Poor positioning accuracy

#### Symptoms

The CMM will not finish a move at the correct position. This may occur even if it had reported having reached the target position near the end of the move.

#### Possible causes, tests and cures

##### Power amplifier offset:

Check this by engaging the servo drives with the position loop open and a zero speed demand and check that the machine does drift slowly. Use the power amplifier's offset adjustment to reduce the drift to a minimum. See the following paragraph on forces applied by the machine since it may be difficult to distinguish between these effects.

##### Forces applied by the machine:

Forces such as those caused by elastic deformation of a cable chain attached to an axis, or by gravity if the machine is imperfectly levelled or counter-balanced, will produce a position error which may vary with the machine's position. Correct the mechanical problem as necessary. Do not compensate by introducing a power amplifier offset to cancel the error.

##### High axis bearing friction:

Move the machine (manually) with the servo drives not energised to search for general or localised high friction. Alternatively, use UCCassist-2 to show the following error as the CMM is moved slowly. High friction will cause a larger following error. Adjust or repair the machine as necessary.

##### Too large a positioning tolerance:

This parameter, set by the 'enter positional tolerance' command, defines the maximum allowed position error at the end of a move. Adjust if necessary, but note that if this is made too small for the CMM's servo capabilities, it will cause time-out failures during moves. See below!

##### Insufficient position loop gain:

If the machine has previously performed adequately this is unlikely to be the cause but during the tuning process, this problem could occur. If the position loop gain (defined as the axis proportional gain in the 'servo configuration' command) is set too low, the machine may not be able to hold position accurately enough.

##### Insufficient position loop integration term:

The integration term in the servo position loop is set when the machine is commissioned to give the best compromise between long-term positioning accuracy and machine stability. If the machine has previously performed adequately, the cause is more probably due to some mechanical degradation.

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### Controller will not respond to host PC

#### Symptoms

All or some commands from the user's PC are not executed by the controller. See also the 'Cannot start a move/scan' sections below.

#### Possible causes, tests, cures

##### If only some commands are ignored:

- Check that the UCC2 is enabled for the type of commands you are sending. If you are sending scanning commands and the controller has not been licensed for scanning, then the commands will not be accepted.
- Some commands are not executed by the controller if it is preoccupied with a previous command. See the programmer's guide for information on individual commands and their handling. The controller state number (from the status bytes in the reply to the 'position and status' command) will indicate whether it is able to execute that command at that time.
- Other commands are ignored if inappropriate for the current circumstances, e.g. asking for a peripheral's data when none is available.

##### If all commands are ignored:

- Send the 'resync controller' command (#351). If this restores normal operation, the controller was in a locked state due to some internal malfunction. A possible cause is an incorrectly constructed command from the host PC to the controller. If the system is fully commissioned and is being controlled by proven user front-end software, consult the Renishaw support services. If the front-end software is not fully proven in service, the faulty command must be found.
- Send the reboot controller command (#335). If the front panel LEDs are now extinguished, except the 'power on' and flashing error, download the controller program and reinitialise the controller.
- Power down the controller, wait at least 10 seconds and then power up again. Download the controller program and re-initialise the controller. If this restores normal operation the controller was in a locked state due to some internal malfunction. Proceed as described above.
- Check that the Ethernet cable between the host PC and the controller is in place and undamaged. Reconnect or replace as necessary.

If none of the above tests succeed in solving the problem then it is possible that there is a problem with the communication link between the host PC and the controller. Section 3 describes the IP configuration in detail but in the following sections there some additional checks outlined that you can make.

### Seeing the IP address of a UCC2

Follow the procedure in "[Configuration of IP addresses](#)", but once you have seen the IP address of the device click on the 'Exit' button.

### Checking the IP address of the UCC2 with ping

You can check the IP address of a UCC2 either by running the IP configuration software, as described in "[Configuration of IP addresses](#)", or you can use the command-line utility ping. Ping tests connectivity, so as long as your UCC2 has an IP address and is either waiting for a download or the downloadable is running, you can check that you have a connection to it by pinging it. This is done as follows:

1. Use ipconfig to ensure that your network adapter is not in the "Media disconnected" state:

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```
C:\Windows\System32\cmd.exe
Microsoft Windows XP [Version 5.1.2600]
(C) Copyright 1985-2001 Microsoft Corp.

Z:\>ipconfig

Windows IP Configuration

Ethernet adapter Local Area Connection:

    Connection-specific DNS Suffix  . : renishaw.com
    IP Address. . . . .               : 172.16.141.183
    Subnet Mask . . . . .            : 255.255.0.0
    Default Gateway . . . . .        : 172.16.21.1

Ethernet adapter Local Area Connection 2:

    Connection-specific DNS Suffix  . : 
    IP Address. . . . .               : 10.0.0.1
    Subnet Mask . . . . .            : 255.0.0.0
    Default Gateway . . . . .        : 

Z:\>_
```

 NOTE: The IP addresses displayed here are those on the PC.

2. Now ping the UCC2 using its IP address, e.g. if you think that the UCC2s IP address is 10.0.0.2, then a successful ping of it would look like this:

```
C:\Windows\System32\cmd.exe
Microsoft Windows XP [Version 5.1.2600]
(C) Copyright 1985-2001 Microsoft Corp.

Z:\>ping 10.0.0.2

Pinging 10.0.0.2 with 32 bytes of data:

Reply from 10.0.0.2: bytes=32 time<1ms TTL=255
Reply from 10.0.0.2: bytes=32 time<1ms TTL=255
Reply from 10.0.0.2: bytes=32 time<1ms TTL=255
Reply from 10.0.0.2: bytes=32 time<1ms TTL=255

Ping statistics for 10.0.0.2:
    Packets: Sent = 4, Received = 4, Lost = 0 (0% loss),
    Approximate round trip times in milli-seconds:
        Minimum = 0ms, Maximum = 0ms, Average = 0ms

Z:\>
```

The parts which matter in the output are the replies and “0% loss”. If the UCC2 had a different address then the ping would have looked like the following:

```
C:\Windows\System32\cmd.exe
Microsoft Windows XP [Version 5.1.2600]
(C) Copyright 1985-2001 Microsoft Corp.

Z:\>ping 10.0.0.2

Pinging 10.0.0.2 with 32 bytes of data:

Request timed out.
Request timed out.
Request timed out.
Request timed out.

Ping statistics for 10.0.0.2:
    Packets: Sent = 4, Received = 0, Lost = 4 (100% loss),

Z:\>_
```

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Notice the lack of replies and the “100% loss”.

You have to be slightly careful with ping because you can successfully ping yourself! The output of ipconfig (step 1) tells you which IP addresses are associated with your network adapters. Use this information to make sure that you are not pinging yourself and thinking that you have just confirmed your connection with a UCC2.

### “IP configure” software fails to run

If the PC is using a VPN (virtual private network) software such as “check point”, it will be necessary to disable the use of this software for the network card dedicated for UCC use. This is carried out in ‘control panel’ / ‘network connections set-up page’.



**NOTE:** A reboot of the PC will be required before this change is implemented.

## Motor stalling

### Symptoms

The machine stops unexpectedly. The event should be reported as a fault by the user’s program and may be identified as a stall on a specified axis. (The condition is reported to the application software by the controller’s setting of one of the three ‘axis overdriven’ flags in a status report).

### Possible causes, tests, cures

- The problem may be due to unintentional contact between a moving part of the machine (not the probe’s stylus) and some object. Correct as required, checking for correct CMM calibration if a serious impact occurred.
- Contact between cables or cable-chains and the machine structure may also be the cause, similarly lock-up may be due to cable creepage through clamps and limiting travel.
- Excessive friction can cause the problem due to a mechanical problem (low air pressure, contaminated bearings/ways, etc.). Drive the machine slowly past the suspect region to localise the problem area. Correct as required.
- Other factors may stop the machine such as the operation of limit switches, crash switches, air pressure switches, etc. These should be reported as such by the application software. If not, confirm the effect using Renicis and request more detailed error reporting from the application software.

## Machine overspeed report

### Symptoms

The event should be reported by the application software as an ‘overspeed’ or similar wording. (The condition is reported to the application software by the controller’s setting of the ‘overspeed’ flag in a status report.) The servo drives, if engaged, will be disengaged automatically by the controller.

### Possible causes, tests, cures

- Machine movement by hand (with motors disengaged) at speeds higher than the limit set by ‘max move speed’ times the ‘overspeed factor’. See the ‘move configuration’ command. Avoid moving the machine too quickly by hand, or ensure that the application software suppresses this warning if the motors are disengaged, provided that it is unlikely that the machine can be moved so quickly that the controller counter circuit bandwidth limit is exceeded, see the ‘Specification’ chapter of this manual.
- Very high apparent speed due to initialisation with improper values of maximum speed or scale increment, or incorrect velocity or position feedback signal polarities causing instability (normally only occurring if a machine configuration parameter is altered). See the sections in

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this manual on read-head connections and motor command signals. Correct the values/polarities as required.

- A scale reading failure can cause an apparent large change of position. This fault may also be reported as a 'scale reading' failure, or an 'overdriven' failure. Correct the scale reading problem, see below.

### Scale reading ('grating') failures

#### Symptoms

The machine will stop and disengage the servo drives. The event should be reported by the application software as a 'scale reading fault' or similar wording. (The condition is reported to the application software by the controller's setting of the 'scale reading failure' flag in a status report.) The readhead hardware may have reported an error condition, or the fault may be elsewhere.

Any errors detected on the readheads by the UCC are treated as fatal faults which cause the system to disengage. If this happens after the system has been homed it is possible that the scale error will have affected metrology. For this reason if the UCC detects a readhead error on any axis that has its absolute datum set (i.e. after the CMM has been homed), the UCC will enter "permanent scale error" mode.

When the UCC enters a "permanent scale error" mode the following will happen:

- Any measuring datums will be lost, the UCC will revert to machine coordinates.
- On the front of the UCC the error LED will be on and the "system ready" LED will flash.
- If an MCU joystick is fitted the screen display will be locked to the following message:

SCALE ERROR(S)

Axis: X Y Z W Y2 \*

UCC reboot required

\* Actual readout will denote the axis / axes on which the scale error was detected.

- The system will be put into the disengaged state.
- It will not be possible to engage the system until the UCC has rebooted and no scale error is detected.

If a scale error occurs prior to absolute datum being set the system will still disengage with a fatal fault, but, it will be possible to recover by moving the axis so it is not in error and then reengaging. This allows the CMM system to be commissioned or fault found without the need to continually reboot.

#### Possible causes

On a new machine, the readhead cables may introduce too large a voltage drop. Check specification for heads and cable, see "[CMM readhead input connections](#)".

On a machine which has previously been operating correctly, the fault may be due to:


- Connector displacement or cable damage. Visually examine and then check by temporarily exchanging readheads with drives disabled, since the machine will be violently unstable if drives are engaged in that condition.
- Mechanical disturbance of the readhead; use the readhead LEDs to diagnose. Realign the head if necessary or replace the head if damaged.
- Damage or contamination of the scale. Clean or replace scale as required.
- Machine bearing damage causing head misalignment. Repair or adjust as needed.
- The supply voltage to the readheads may be below specification. Check applied voltage and calculate the voltage at the heads, comparing with manufacturers specification. See chapter "[CMM readhead input connections](#)" and "[Electrical power requirements](#)", Description of connector signals, CMM readhead input connections, for the electrical details of the cables and heads.
- The readhead could have detected an overspeed. Check the readheads are capable of supporting the maximum move speed setting.

**NOTE:** A scale error will cause the UCC2 to enter an error state. This is not recoverable within a metrology application



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 environment. If a scale error occurs, it is now necessary to re-initialise the installation. This is because of the possibility of lost scale counts and therefore metrology being effected.

### Timing out during moves or scans

#### Symptom

The CMM takes a long time to complete a commanded move. The event should be reported by the application software as a 'move timeout fault' or similar wording. (The condition is reported to the application software by the controller's setting of the 'time-out during move or scan' flag in a status report).

#### Possible causes, tests, cures

This is similar to the 'poor positioning accuracy' fault described earlier in this chapter. In particular, the drive friction level and the positional tolerance setting are important factors.

Check that the friction levels have not deteriorated since the machine was commissioned.

The positioning tolerance defines the maximum allowed position error at the end of a move. If this is made too small for the CMMs servo capabilities, it will cause time-out failures during moves. Adjust it using the 'Enter positional tolerance' command 308.

### Cannot start a move

#### Symptom

The machine does not respond when given a move command. The controller returns either the 'cannot start move' or the 'illegal parameter' status flag with the normal 'action complete' flag.

#### Possible causes, tests, cures

- The 'illegal parameter' flag indicates that the move command may contain a parameter which is outside its acceptable range or is not logical. See the definition of the move command.
- The servo motors are not engaged, engage the motors, see above.
- Physical restraint of the CMM causing an immediate stall condition (e.g. unreported failure of the air supply to air bearings). Check CMM mobility, rectify as required.
- If a joystick unit is attached, the controller must be in DCC mode, not the manual joystick mode.
- The controller is not in 'HOLD' state, e.g. it may be completing a previous command, or it may be in joystick mode and responding to a joystick deflection. Wait for the action complete flag from the previous command, or send an Abort command to ensure termination.
- The probe is open/deflected. Use the joystick "probe disable" switch or the 'probe open override' (command number 310) to escape from the deflecting surface - remember to turn the override off afterwards.
- The probe is reported as 'deflected' even when not in contact with a surface. Test/cure: check probe calibration – has the configuration changed since last qualification, if so correct and null the scanning probe with command number 288.
- All inner limit switches must be closed and the machine must be inside all soft limits, if these are enabled. limit switch operation can be over-ridden by use of command number 311.
- The analogue probe signal converter within the UCC2 reports an error. To resolve this problem the system must be rebooted.

### Cannot start a scan

#### Symptom

When a scan command is sent to the controller, it does not begin the search for the part surface. If this process does not start it returns either

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the 'cannot start move' or the 'illegal parameter' status flag with the normal 'action complete' flag.

### Possible causes, tests, cures

- The 'illegal parameter' flag indicates that the scan command may contain a parameter which is outside its acceptable range or is not logical. See the definition of the scan command.
- Check that none of the faults which would stop a move are present, see above, except that a scan CAN be started with the probe deflected.
- The absolute datum and master datum have not been set.
- The analogue probe has not been qualified
- In the case of 2D or 3D scans, the actual position at the point that the scan command is issued, is different from the specified position by more than the "positional tolerance" (see command 308). To resolve this problem, either ensure that the parameters are the same, or move to the correct start position.
- If the search for a surface starts but then stops the search distance is smaller than the gap between the starting point and the surface. To resolve this set a larger search distance for the scan.
- The UCC2 licence has not been upgraded to permit scanning

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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 the security of mounting screws and electrical connectors.

Periodical electrical safety checks should include inspecting the mains cable for damage and safe connections. An earth continuity (ground bonding) test may be applied between the protective earth pin of the mains connector and the metal case at a test current of no greater than 25 A.

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 fluids/water.

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