

# UCC daughtercards

© 2003 - 2006 Renishaw plc. All rights reserved.

This document may not be copied or reproduced in whole or in part, or transferred to any other media or language, by any means, without the prior written permission of Renishaw.

The publication of material within this document does not imply freedom from the patent rights of Renishaw plc.

### **Disclaimer**

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

### **Trademarks**

**RENISHAW®** and the probe emblem used in the RENISHAW logo are registered trademarks of Renishaw plc in the UK and other countries.

**apply innovation** is a trademark of Renishaw plc.

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

# **UCC daughtercard**

**installation guide**



## 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.

## 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.

## Trade marks

Windows 98, Windows XP, Windows 2000 and Windows NT are registered tradenames of the Microsoft Corporation.

All trademarks and tradenames are acknowledged

## References and associated documents

It is recommended that the following documentation is referenced to when installing the UCC.

## Renishaw documents

Relevant documentation supplied on Renishaw UCC software CD.

Document number	Title
H-1000-5056	UCC1 installation guide
H-1000-5057	UCC controller programmer's guide
H-1000-5058	UCC Renicis user's guide
H-1000-5227	UCC servo tuning user's guide
H-1000-5223	<b>UCC2</b> installation guide

---

# Contents

1	Introduction .....	6
2	Daughterboards .....	7
2.1	Installation in the UCC.....	8
2.2	Removal of a daughterboard .....	9
3	PHC1050 daughterboard .....	10
3.1	Introduction.....	10
3.2	Connector and pin outs .....	11
3.2.1	Head connector.....	11
3.2.2	HCU connector .....	11
3.3	Configuration options .....	12
3.3.1	Two wire probe configuration.....	12
3.3.2	Multiwire probe configuration .....	13
3.4	Operating overview .....	14
3.4.1	Communication with the PHC1050.....	14
3.4.2	Configuring the PHC1050 board.....	14
3.4.3	Power-up sequence .....	15
3.4.4	Probe head operation .....	15
4	PICS/RS232 daughterboard .....	16
4.1	Introduction.....	16
4.2	Connector and pin outs .....	16
4.2.1	PICS A connector .....	16
4.2.2	RS232 connectors (9-way D-type plug).....	17
4.3	Configuration options .....	18
4.3.1	Connecting an external PHC10 to the UCC.....	18
4.3.2	Connecting an ACC2-2 to the UCC .....	19
4.3.3	RS232 communication cable .....	20
4.4	Operating overview .....	20
4.4.1	PICS A port.....	20
4.4.2	RS232 channel 2 .....	20
4.4.3	RS232 channel 3 .....	21
5	Joystick interface daughterboard (JI card).....	22
5.1	Introduction.....	22
5.2	Connector and pin outs .....	22
5.2.1	Joystick connector .....	23
5.2.2	Emergency stop connector .....	24
5.3	Configuration options .....	25
5.3.1	Minimum recommended installation wiring.....	25
5.3.2	Emergency stop signal.....	26
5.3.3	Analogue input signal.....	27
5.3.4	input circuit.....	27
5.3.5	Binary output circuit .....	28

5.4	Operating overview.....	28
5.4.1	Method of operation .....	28
5.4.2	Initialising the JI card.....	29
5.4.3	Joystick modes.....	29
5.4.4	Joystick type selection .....	30
5.4.5	Enable joystick .....	30
5.4.6	Functionality in DCC mode .....	31
5.4.7	Functionality in joystick mode .....	32
5.4.8	Changing modes.....	32
5.4.9	Moving and touching.....	32
5.4.10	Recording points .....	33
5.4.11	Probe damping.....	33
5.4.12	Joystick orientation.....	34
6	MCU1 daughtercard .....	36
6.1	Introduction.....	36
6.2	Connector and pin outs .....	36
6.2.1	MCU connector .....	37
6.2.2	Emergency stop connector .....	37
6.3	Configuration options.....	38
6.3.1	Emergency stop signal.....	38
6.4	Operating overview.....	38
6.4.1	Method of operation .....	38
7	SP25M daughtercard.....	39
7.1	Introduction.....	39
7.2	Connectors and pin outs.....	39
7.2.1	Analogue probe connector.....	39
7.3	Operating overview.....	40
7.3.1	Method of operation .....	40
8	SP80 daughtercard.....	41
8.1	Introduction.....	41
8.2	Connector and pin outs .....	41
8.2.1	SP80 connector.....	41
8.3	Operating overview.....	42
9	Additional I/O daughtercard .....	43
9.1	Introduction.....	43
9.2	Connector and pin outs .....	43
9.2.1	Additional I/O connector.....	43
9.3	Operating overview.....	44
9.3.1	Software integration .....	44
9.3.2	Electrical integration.....	45
10	Temperature sensor daughtercard .....	46
10.1	Introduction.....	46
10.2	Connector and pin outs .....	46

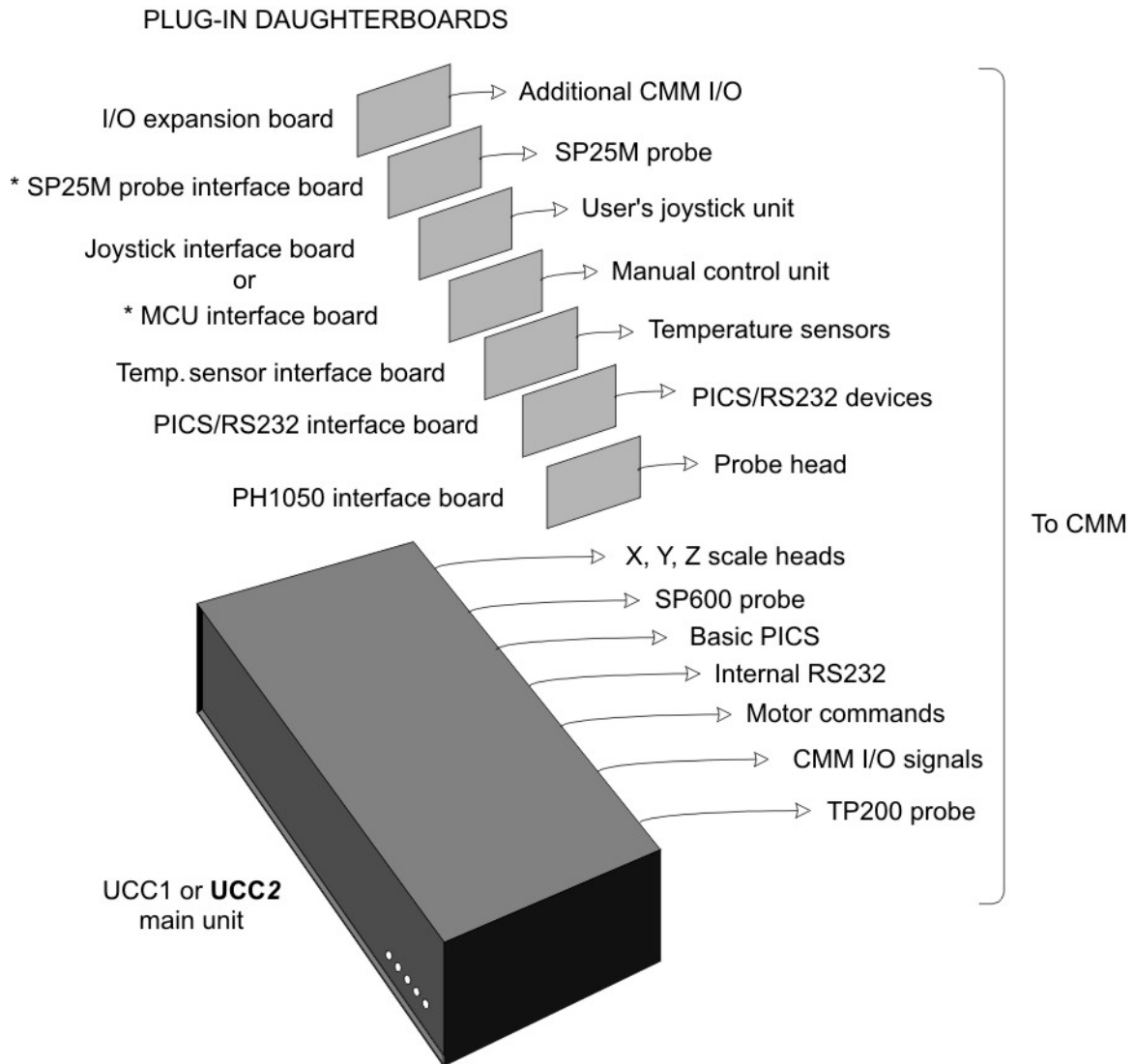
---

10.2.1	44-way connector.....	47
10.3	Operating overview .....	47
10.3.1	Software integration .....	48
10.3.2	Electrical integration.....	49
11	Additional axis daughtercard .....	50
11.1	Introduction.....	50
11.2	Connector and pin outs .....	50
11.2.1	Scale connector .....	51
11.2.2	Table / axis connector.....	52
11.2.3	Emergency stop connector .....	54
11.3	Configuration options .....	55
11.3.1	Daughtercard channel setting .....	55
11.3.2	Emergency stop signal.....	56
12	PHS daughtercard .....	57
12.1	Introduction.....	57
12.2	Connector and pin outs .....	57
12.2.1	PHS connector.....	57
12.3	Configuration options .....	58
12.3.1	PHS power PCB settings.....	58
12.4	PHS card installation .....	58
12.4.1	Power connection .....	58
12.4.2	PHS control PCB settings.....	60
13	Revision history .....	61
13.1	What's new in release 01-A.....	61
13.2	What's new in release 02-A.....	61
13.3	What's new in release 02-B.....	61

# 1 Introduction

The purpose of this chapter is to outline the capabilities of the various UCC daughtercards and the generic installation instructions to fit these cards into the UCC1 or **UCC2** units.

There are a range of UCC daughtercards available, each offering additional capabilities to the standard UCC1 or **UCC2** product. For specific details on each card please refer to the respective section within this installation guide.



\* Not compatible with **UCC2** system as these cards have been integrated into the **UCC2** design



## 2 Daughterboards

Listed below are the range of UCC1 daughterboards available with a brief explanation of their capabilities:

Daughterboard	Description	Refer to section
PHC1050	Permits connection of a PH10 motorised probe head to the UCC controller.	3
PICS/RS232	Adds two RS232 communication ports to the UCC, and includes a PICS compliant connector.	4
J1	Permits the connection of a third party analogue joystick to the UCC controller.	5
MCU1	Permits the connection of the Renishaw MCU1 joystick to the UCC controller.	6
SP25M	Permits the UCC controller to accept the SP25M probe signals.	7
SP80	Permits the UCC controller to accept the SP80 probe signals.	8
Additional input/output	Increases the number of uncommitted input and output signals available to the UCC controller.	9
Temperature sensor	Permits the UCC to accept and interface up to 24 temperature sensors.	10
Additional axis	Permits the UCC to control an additional machine axis or a rotary table. Multiple cards can be installed within a UCC system.	11
PHS	Permits the PHS probe head to be integrated into the <b>UCC2</b> controller.	12

## 2.1 Installation in the UCC



**CAUTION:** It is essential that full anti-static precautions are taken before working within the UCC1 or **UCC2** controllers enclosure or handling individual boards.



**CAUTION:** Removing the top panel of the UCC enclosure will give access to the mains driver power supply (PSU). The PSU is further protected by a metal cover. This protective cover **MUST NOT BE REMOVED** as it would expose hazardous voltages.

The following procedure is recommended for installing a daughtercard:

1. Remove the ac power supply from the UCC1 or **UCC2** and move the unit so you have clear access to the top and rear of the enclosure, it may be necessary to disconnect some of the other cables to achieve this.
2. Remove the top panel of the UCC1 or **UCC2** enclosure by removing the screws at the top of the rear panel and the screw located at the top of each side panel, near the front. Retain the fixing screws.
3. Select a socket on the motherboard to house the daughtercard (all sockets are compatible).

**NOTE:** Install long daughtercards and daughtercards with appreciable heat dissipation towards the power supply end of the UCC1 or **UCC2**.

If the PHS daughtercard is to be installed into the **UCC2** it must be fitted into the fourth socket from the power supply.

4. Remove (and store for possible re-use) the appropriate blanking plate from the rear panel of the enclosure.
5. Carefully position the daughtercard so that the rear connectors pass through the hole in the controller rear panel, but without engaging the motherboard connector.
6. Align the daughtercard plug with the socket on the motherboard.
7. Check that the rear panel hook of the daughtercard is located above the slot in the rear panel.
8. Press the daughtercard firmly into the socket on the motherboard until it is seen to be fully engaged.
9. Confirm that the top hook is engaged in the rear panel, if it is not then repeat steps 7 and 8.

10. If a PHS daughtercard is being installed please refer to section 12.4 at this stage of the process.
11. Refit the top panel of the enclosure and secure using the fixing screws.
12. Reconnect all disconnected cables between the UCC1 or **UCC2** and the CMM and then the mains cable. Switch on the ac supply.

## 2.2 Removal of a daughtercard

The following procedure is recommended for removal of a daughtercard from the UCC1 or **UCC2**.



**CAUTION:** It is essential that full anti-static precautions are taken before working within the UCC1 or **UCC2** controller enclosure or handling individual boards.

---

1. Remove the ac power supply from the UCC1 or **UCC2** and move the unit so you have clear access to the top and rear of the enclosure, it may be necessary to disconnect some of the other cables to achieve this.
2. Remove the top panel of the enclosure by removing the five screws at the top of the rear panel and the screw located at the top of each side panel, near the front. Retain the fixing screws.
3. Carefully remove the daughtercard from the socket on the motherboard, taking care to disengage the top hook from the rear panel.
4. Refit the blanking plate in the rear panel of the enclosure
5. Refit the top panel of the enclosure and secure using the fixing screws.
6. Reconnect all disconnected cables between the UCC1 or **UCC2** and the CMM and then the mains cable. Switch on the ac supply.

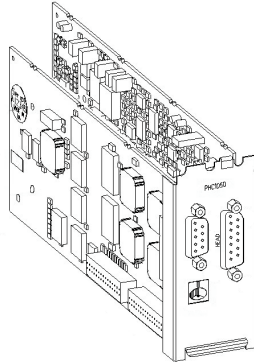
## 3 PHC1050 daughtercard

---

**NOTE:** This daughtercard is suitable for use in both UCC1 and **UCC2** controllers.

---

### 3.1 Introduction



The PHC1050 interface board is one of a range of plug-in daughtercards for Renishaw CMM controllers. It provides a simple interface between the PH10 probe head and the metrology front-end software using no external hardware and with minimal cabling and connectors.

Provision is made for a probe head hand controller (HCU1), although this is not necessary if an MCU1 joystick is fitted to the system.

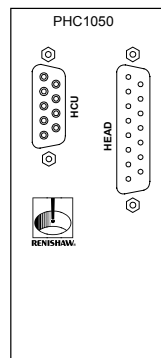
The PHC1050 is an internal option which enables the UCC1 or **UCC2** to offer all the functions of the Renishaw PHC10-2 probe head controller.

The PHC1050 supports the basic and extended command set from the front-end software in their original format, ensuring interchangeability and an easy upgrade path. The commands are transmitted via the link from the host PC to the UCC controller. Probe signals are handled directly by the UCC1 or **UCC2**.

## 3.2 Connector and pin outs

On the rear panel of the PHC1050 are two connectors:

- The connection to the PH10 head, via the 15-way D-type plug labelled HEAD
- The optional connection to the HCU1, via the 9-way D-type socket labelled HCU



### 3.2.1 Head connector

The head connector is a 15-way D-type socket with the signals as detailed in the table below, for further details on these signals please refer to the PH10 installation guide (Renishaw part number H-1000-5071).

Pin number	Function
1	Ground sense
2	Head present
3	A axis feedback
4	0 V
5	Motor probe switch
6	12 V reference
7	B axis motor / probe contact
8	LED and datum
9	Not connected
10	Locking motor drive
11	A axis motor
12	A axis motor
13	Not connected
14	B axis feedback
15	B axis motor / probe contact
Shell	Screen

### 3.2.2 HCU connector

The HCU connector is a 9-way D-type socket with the necessary signals to connect directly to the HCU1 handbox, for further information please refer to the HCU1 user's guide (Renishaw part number H-1000-5016).

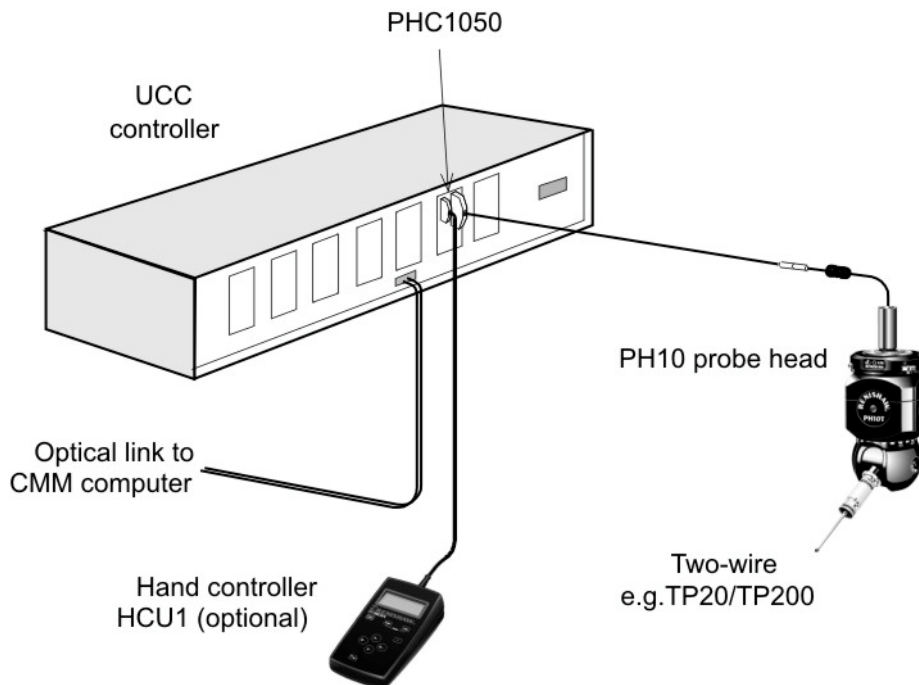
### 3.3 Configuration options

#### 3.3.1 Two wire probe configuration

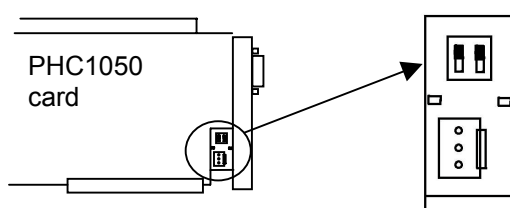
The diagram below shows a typical wiring arrangement for a two-wire touch trigger probe system incorporating a PH10 motorised probe head.

The PHC1050 daughtercard may be fitted into any of the available slots in the UCC.

- The cable from the probe head should be connected to the 15-way D-type plug marked 'HEAD' on the PHC1050 rear panel. The probe signals within this cable are connected automatically to the UCC motherboard for interfacing.
- The cable from the hand control unit (if fitted) should be connected to the 9-way D-type socket.



**NOTE:** Ensure that the configuration switches on the PHC1050 card are both set to 'ON' UP position as shown in diagram below (factory default). This routes the probe signal through the card to the internal interface.



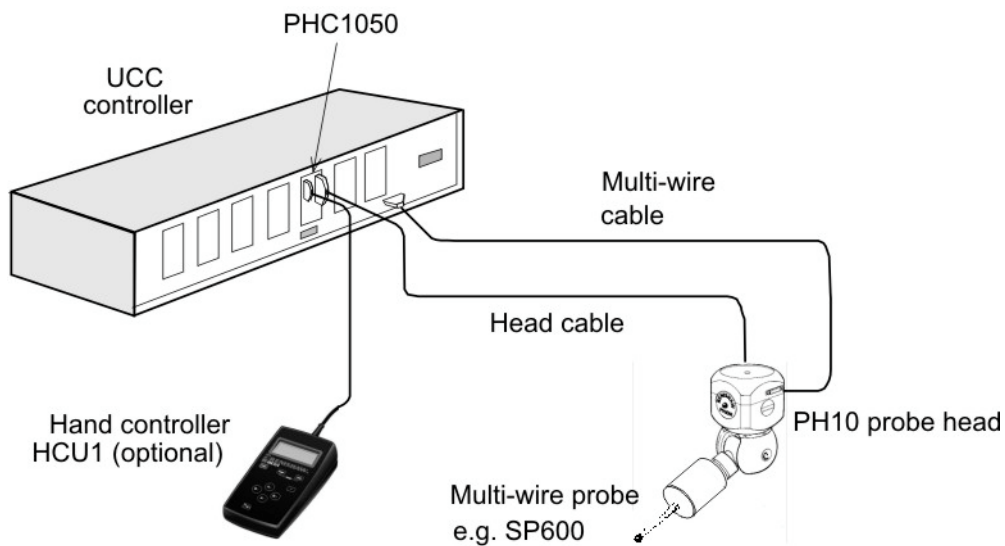
### 3.3.2 Multiwire probe configuration

The diagram below shows a typical wiring arrangement for a system incorporating an analogue scanning probe (SP600) and two-wire touch trigger probe incorporating a PH10 motorised probe head.

The head cable links the probe head to the PH1050 daughtercard and the multiwire cable connects directly to the analogue probe socket on the rear panel of the controller, to permit interfacing of TP2/6/20, TP200 and SP600 probes (and SP25 on UCC2).

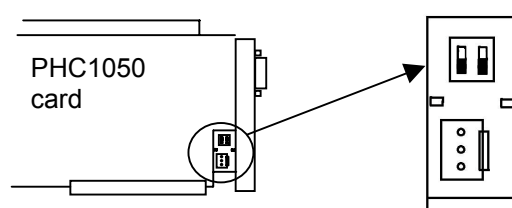
The PHC1050 daughtercard may be fitted into any of the available slots in the UCC.

- The cable from the probe head should be connected to the 15-way D-type plug marked 'HEAD' on the PHC1050 rear panel. The probe signals within this cable are connected automatically to the UCC motherboard for interfacing.
- The cable from the hand control unit (if fitted) should be connected to the 9-way D-type socket marked 'HCU' on the PHC1050 rear panel.



**NOTE:** Ensure that the configuration switches on the PHC1050 Card are both set to 'OFF' DOWN position as shown in diagram below. This routes only the head signals through the PHC1050 card.

Failure to configure the switches as detailed can result in illegal triggers when using the system.



### 3.4 Operating overview

The PHC1050 must be installed within the UCC and connected to the PH10 motorised probe head before the controller is powered up.

When the UCC software is downloaded, it searches the internal bus for daughtercards and will detect the presence of the PHC1050 daughtercard.

---

**NOTE:** If no PHC1050 card is found and a PICS/RS232 daughtercard is identified on the UCC internal bus, all PHC commands will be routed to the PICS/RS232 daughtercard for use by an external motorised head controller.

However, if no PHC1050 or PICS/RS232 daughtercards are found then the system will return an error if any motorised probe head commands are sent to the UCC1 controller.

---

The metrology front-end software may then configure the PHC1050 using UCC command 340 (PHC1050 initialise), refer to following section and the UCC command set (Renishaw part number H-1000-5222) for more information.

#### 3.4.1 Communication with the PHC1050

The CMM metrology front-end program can communicate with the probe head in a similar manner to that used in the RS232C link with an external PHC system.

- The application selects commands from either the basic command set or the RECS (Renishaw extended command set).
- The command is sent to the controller using UCC command number 336 (Write to PHC10), to transfer the data.
- The UCC will automatically direct the command to the PHC1050 daughtercard. (If this is not fitted refer to note above)
- Any reply is read by using the UCC command number 337 (Read from PHC10), referring to the status flags as described in the UCC command set document.

#### 3.4.2 Configuring the PHC1050 board

The only hardware configuration on the PHC1050 board is that for probe type selection, please refer to section 3.3 for details.

Other configuration options for the PHC1050 daughtercard are software configurable using UCC1 command 340 (PHC1050 initialise). Refer to the UCC command set (Renishaw part number H-1000-5222) for further details.

Following receipt of command 340 (PHC1050 initialise) the UCC system will enable/disable the applicable options.



---

**NOTE:** As part of this process the servo motors, if engaged, will be disengaged and the PHC1050 will be reset to its default manual or automatic mode.

---

The default configuration mode of the PHC1050 depends on whether a hand control unit is fitted (manual mode) or not fitted (automatic mode). This mode can be changed by the use of command 336 (Write to PHC10).

### 3.4.3 Power-up sequence

The PHC1050 (or PICS/RS232) daughtercard is powered from the internal UCC power supply, provided that all components are connected before power-up, they will initialise correctly.

Plugging or unplugging a motorised probe head with the system live is described in the basic command set programming manual (H-1000-5075). The same process should be used with a PHC1050.

### 3.4.4 Probe head operation

For programming probe head operation, refer to the basic command set programming manual (Renishaw part number H-1000-5075), the same flow charts and programming techniques apply.

Any references in the basic command set programming manual with regards to RS232 communications should be replaced by the UCC commands 336 (Write to PHC10) and 337 (Read from PHC10) to send data over the link to the PHC1050 or PICS/RS232 daughtercard via the UCC controller.

---

**NOTE:** None of the IEEE488 communications protocols are supported by the UCC system.

---

## 4 PICS/RS232 daughtercard

**NOTE:** This daughtercard is suitable for use in both UCC1 and **UCC2** controllers.

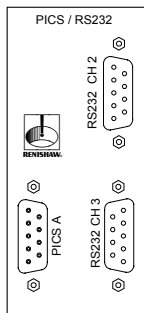
### 4.1 Introduction

The UCC supports a PICS B (IN) and an RS232 port (channel 1) for use by Renishaw probes and peripherals. By including this option card into the UCC system two additional RS232 ports and a PICS A (OUT) port are incorporated, allowing the basic measuring system to be enhanced with alternative probes and/or added peripherals.

### 4.2 Connector and pin outs

On the rear panel of the PICS/RS232 daughtercard there are three connectors these are:

- PICS A
- RS232 channel 2
- RS232 channel 3



#### 4.2.1 PICS A connector

The PICS A connector is a 9-way D-type socket with the signals as detailed in the table below. This connection conforms to the Renishaw PICS standard and all signals are active low. Refer to PICS installation guide (Renishaw part number H-1000-5000) for further information.

Pin number	Function
1	STOP
2	PPOFF
3	0V
4	Reserved
5	SYNC
6	HALT
7	PDAMP
8	LED OFF (out)
9	
Shell	Screen

---

### 4.2.2 RS232 connectors (9-way D-type plug)

RS232 CH2 (RS232 channel 2) and RS232 CH3 (RS232 channel 3) connectors have the same pin-outs as detailed in the table below.

Pin number	Function
1	Not connected
2	RX data
3	TX data
4	DTR
5	Signal ground
6	Not connected
7	RTS
8	CTS
9	Not connected
Shell	Screen

---

**NOTE:** The communication protocols for these connectors are fixed and can not be changed. Refer to section 4.4.2 and 4.4.3 for details.

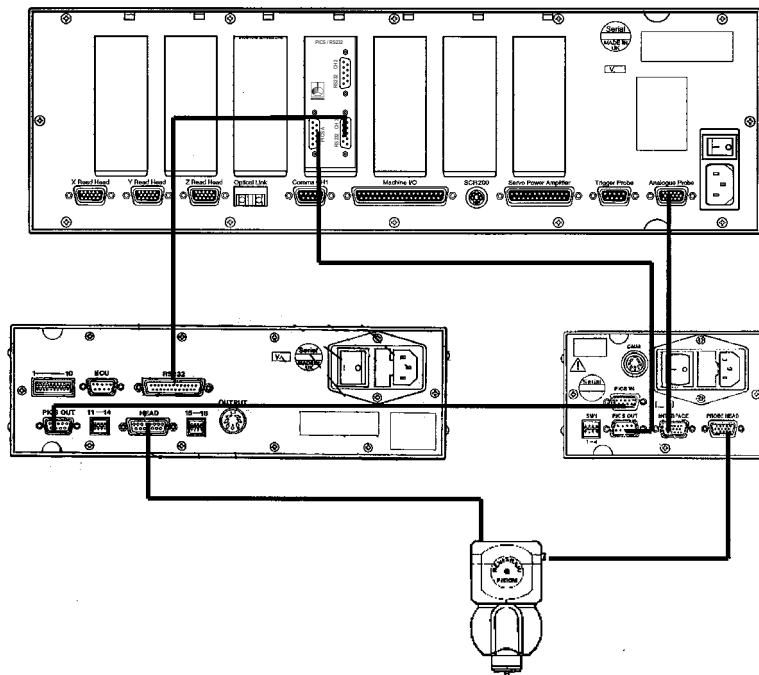
---

### 4.3 Configuration options

#### 4.3.1 Connecting an external PHC10 to the UCC

The figure below shows a UCC system fitted with the PICS/RS22 daughtercard, an external PHC10-2 and an external Renishaw interface (OPI6).

In this case it is necessary to use both the PICS A and the RS232 channel 3 connectors on the PICS/RS232 daughtercard.



The recommended dip switch settings for the PHC10-2 unit shown in this configuration are given in the table below

**NOTE:** If the RECS command set is being used then dip switch should be in the up position.

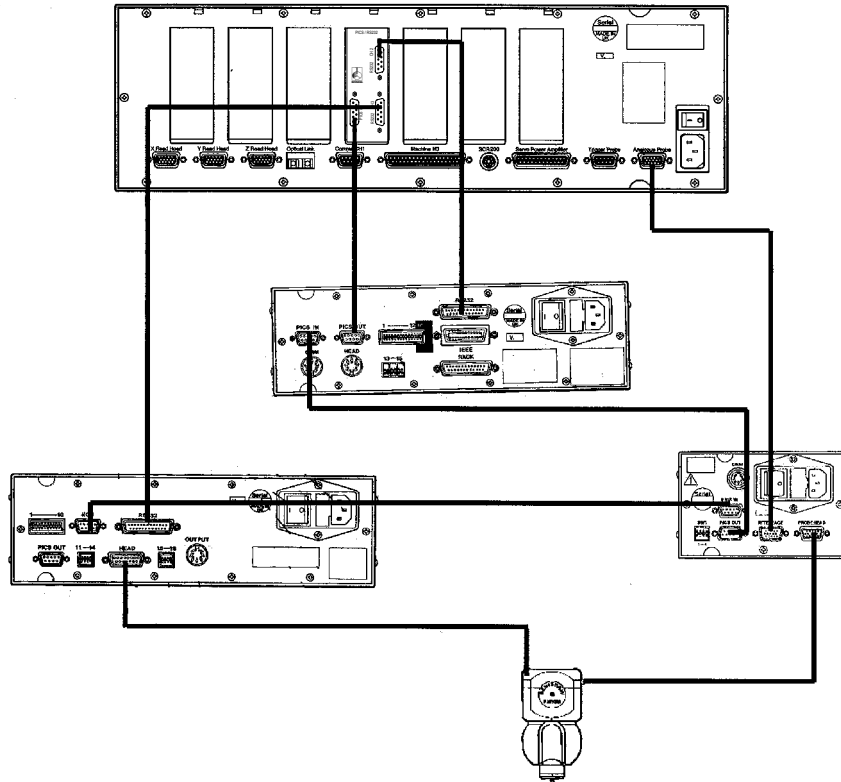
	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18
UP	X		X												X	X	X	X
DOWN		X		X	X	X	X	X	X	X	X	X	X	X				

The RS232 communication cable between the PICS RS232 daughtercard and the PHC10-2 shown in this configuration is not available from Renishaw, the connections details for this cable are as detailed in section 0.

### 4.3.2 Connecting an ACC2-2 to the UCC

The figure below shows a UCC system fitted with the PICS/RS22 daughtercard, an external PHC10-2, an ACC2-2 and an external Renishaw interface (OPI6).

In this case it is necessary to use all three of the connectors on the PICS/RS232 daughtercard.



In this connection scheme it is necessary to configure the PHC10-2 as detailed in section 4.3.1, it is also necessary to manufacture two RS232 cables as detailed in section 4.3.3 to connect the ACC2-2 and the PHC10-2 to the PICS/RS232 daughtercard.

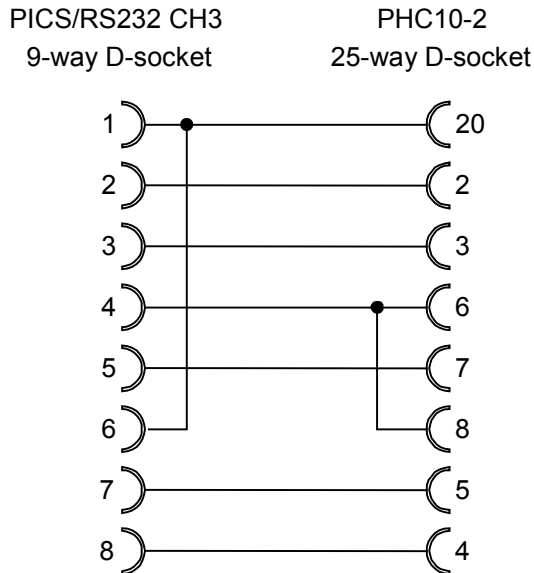
**NOTE:** If only an external ACC2-2 is to be used without the external interface and PHC10-2 controller then it is necessary to terminate the PICs signals used by the ACC2-2 controller. This is done by placing a 100K resistor between pins 1 & 6 and 1 & 5 on the PIC IN connector of the ACC2-2 unit.

The recommended dip switch settings for the ACC2-2 unit shown in this configuration are given in the table below:

	1	2	3	4	5	6	7	8	9	10	11	12	A	B
UP	X		X						X			X		
DOWN		X		X	X	X	X	X		X	X		X	X

### 4.3.3 RS232 communication cable

The RS232 communication cable between the PICS/RS232 daughtercard and either the ACC2-2 or the PHC10-2 product is a standard null modem cable, the connection details are shown below:



## 4.4 Operating overview

### 4.4.1 PICS A port

This port will be used for the control of external Renishaw interface products (e.g. PI 7-2, OPI6, etc.) as described in the appropriate UCC installation manual (Renishaw part number H-1000-5056 for UCC1, H-1000-5223 for UCC2) and the installation guide for the peripherals concerned.

The signals produced by the PICS interface circuits in the board are used internally by the UCC controller but may be examined or modified by using the appropriate UCC commands 280 (Read from PICS port) and command 325 (Write to PICS port).

---

**NOTE:** Installing the PICS/RS232 daughtercard will disable the PICS "B" (IN) port on the UCC. This is no longer required, since the interface board connects internally to the controller.

---

### 4.4.2 RS232 channel 2

This connector handles the serial data link to such Renishaw products as the ACC2-2 or any other compatible external equipment connected to this communication port.

More detailed information about the ACC2-2 software routines is available in the installation and programmers guide (Renishaw part number H-1000-6010).

To read or write to this communication port command 338 (write to ACC), and command 339 (read from ACC), please refer to the UCC command set document (Renishaw part number H-1000-5222) for further information.

The serial communications parameters used by this port are not configurable and set as detailed below:

Baud rate	9600
Data	7 bits
Parity	even
Stop	1 bit

The user should ensure that the device connected to this port uses the same settings.

### 4.4.3 RS232 channel 3

This connector handles the serial data link to Renishaw products such as the PHC10-2 or any other compatible external equipment connected to the communication port.

More detailed information about the PHC10-2 software routines is available in the programmers guide (H-1000-5075).

To read or write to this communication port command 336 (Write to PHC), and command 337 (read from PHC), please refer to the UCC command set document (Renishaw part number H-1000-5222) for further information.

The serial communications parameters used by this port are not configurable and set as detailed below:

Baud rate	9600
Data	8 bits
Parity	none
Stop	2 bit

The user should ensure that the device connected to this port uses the same settings.

## 5 Joystick interface daughtercard (JI card)

---

**NOTE:** This daughtercard is suitable for use in both UCC1 and **UCC2** controllers.

---

### 5.1 Introduction

The joystick interface daughtercard (referred to in this document as the 'JI card') is one in a range of plug-in daughtercards for the Renishaw UCC universal CMM controllers.

For the UCC1 kit (A-1333-0003) a JI card is provided as part of the kit. UCC1 kit (A-1333-0006) provides an MCU1 (Renishaw joystick) interface.

The **UCC2** controller has the MCU1 interface integrated into the motherboard and no other interfaces are fitted. If a JI card is required then it must be ordered as a separate item (A-1333-0020).

The JI card provides a flexible interface between the UCC controller and many different types of OEM joystick control units. It has provision for analogue signals from the joystick unit. Multiple switch and indicator signals can be accepted or provided.

The JI card is configured by commands from the metrology front-end software, via the UCC controller, to select the required functions from the available range.

Physically, the device consists of a single printed circuit board with a connector to suit the controller's internal bus sockets. The board has a metal end plate for fixing to the rear panel of a UCC1 or **UCC2** controller. Attached to the metal panel is a 37-way D-type plug, to connect to the user's joystick unit, and a 2-way socket dedicated to the wiring from any emergency stop switch on the joystick unit.

Electrically, the interface board carries an embedded processor and the required circuits to process analogue joystick signals and to handle the two-way communications with the controller.

The JI board is powered by the UCC controller and will provide d.c. power to the joystick unit if required.

### 5.2 Connector and pin outs

On the rear panel of the JI daughtercard are two connectors:

- the connection to the joystick unit, via a 37-way D-type connector, labelled joystick
- the connection to the CMMs emergency stop system, via a dedicated 2-way connector, labelled EMERGENCY STOP



### 5.2.1 Joystick connector

The joystick connector is a 37-way D-type plug with the signals as detailed in the table below:

Pin number	Function (primary)	Signal direction	Signal effect	Schematic
1	+5 V supply	from JI	-	-
2	Digital ground	-	-	-
3	+12 Vdc supply	from JI	-	-
4	-12 Vdc supply	from JI	-	-
5	Analogue ground	-	-	-
6	+24 Vdc supply	from JI	-	-
7	24V return	to JI	-	-
8	Emergency stop A	to JI	-	5.3.2
9	Emergency stop B	to JI	-	5.3.2
10	Analogue axis, X	to JI	+ signal gives + move*	5.3.3
11	Analogue axis, Y	to JI	+ signal gives + move*	5.3.3
12	Analogue axis, Z	to JI	+ signal gives + move*	5.3.3
13	Analogue axis, W	to JI	-	5.3.3
14	Analogue speed override	to JI	+12V = FS, -12v = stop	5.3.3
15	Dead man's handle	to JI	<1V = JI operational	5.3.4
16	X axis lock	to JI	<1V = axis locked	5.3.4
17	Y axis lock	to JI	<1V = axis locked	5.3.4
18	Z axis lock	to JI	<1V = axis locked	5.3.4
19**	W axis lock	to JI	-	5.3.4
20	Probe enable	to JI	<1V = probe disabled	5.3.4
21	Fast/slow	to JI	<1V = Fast	5.3.4
22	Record point	to JI	<1V = record point	5.3.4
23	Cancel last point	to JI	<1V = cancel last point	5.3.4
24	Reset TP200 probe	to JI	<1V = reset TP200	5.3.4
25	Reserved		-	
26	Reserved		-	
27	Axis swap	to JI	-	
28	Axis swap	to JI	-	
29	Joystick/DCC	to JI	<1V = DCC mode	5.3.4
30	X axis lock indicator	from JI	<1V = axis not locked	5.3.5
31	Y axis lock indicator	from JI	<1V = axis not locked	5.3.5
32	Z axis lock indicator	from JI	<1V = axis not locked	5.3.5
33**	W axis lock indicator	from JI	-	5.3.5
34	Probe enabled indicator	from JI	<1V = probe is enabled	5.3.5
35	Beep control	from JI	<1V = beep sounding	5.3.5
36	Near max. speed	from JI	<1V = near max speed	5.3.5
37	Servo engaged indicator	from JI	<1V = servo disengaged	5.3.5
Shell	Shell and screen	-	-	-

\* Assuming an ISO 841 right-handed co-ordinate system

\*\* See also secondary built-in functions

### 5.2.2 Emergency stop connector

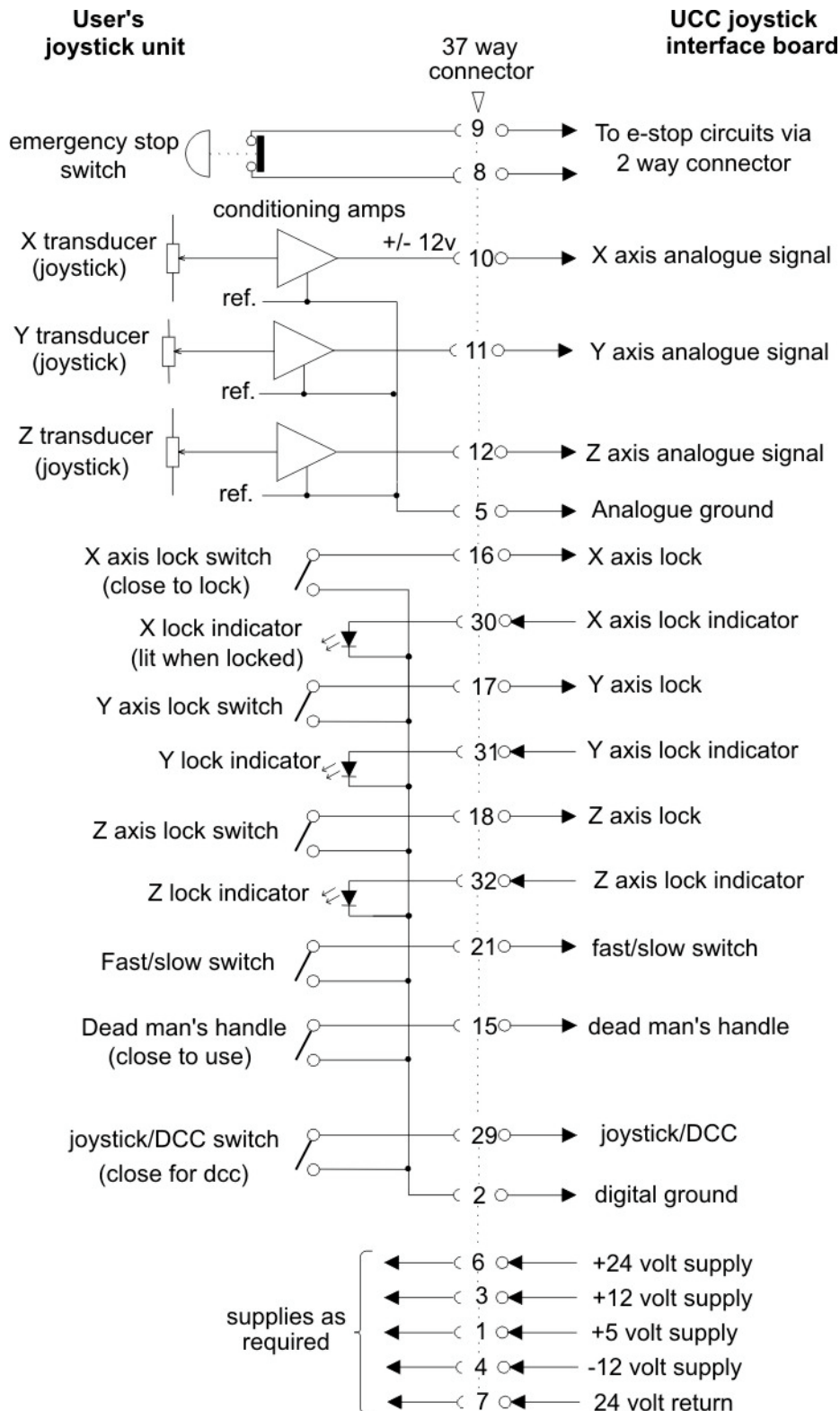
The emergency stop connector is a two pin Lemo connector that is connected directly to pins 8 and 9 of the 37-way D-type plug. These pins should be connected into the CMM's emergency stop system if an emergency stop button is mounted on the joystick.

Pin number	Function
1	ESTOP A
2	ESTOP B
Shell	Screen

### 5.3 Configuration options

#### 5.3.1 Minimum recommended installation wiring

The figure below shows the recommended minimum installation wiring scheme for connecting a joystick to the JI card.



### 5.3.2 Emergency stop signal

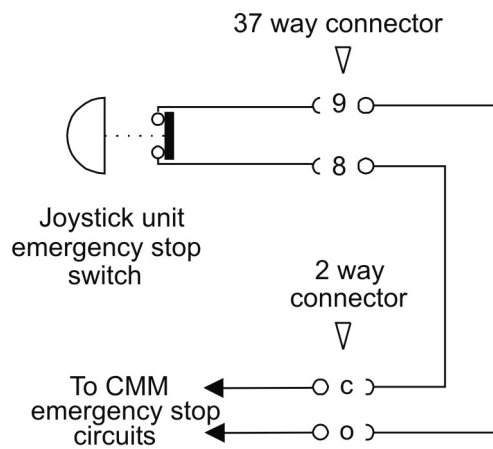
The figure below shows the EMERGENCY STOP signal routing through the JI card.

---

**NOTE:** The emergency stop signal is not connected to any internal circuits within the UCC1 or **UCC2**, the emergency stop signal is routed directly from the 37-way D-type connector to the emergency stop connector on the rear of the card.

For recommended installation wiring please refer to the UCC1 or **UCC2** installation guides (Renishaw part numbers H-1000-5056 or H-1000-5223 respectively).

---

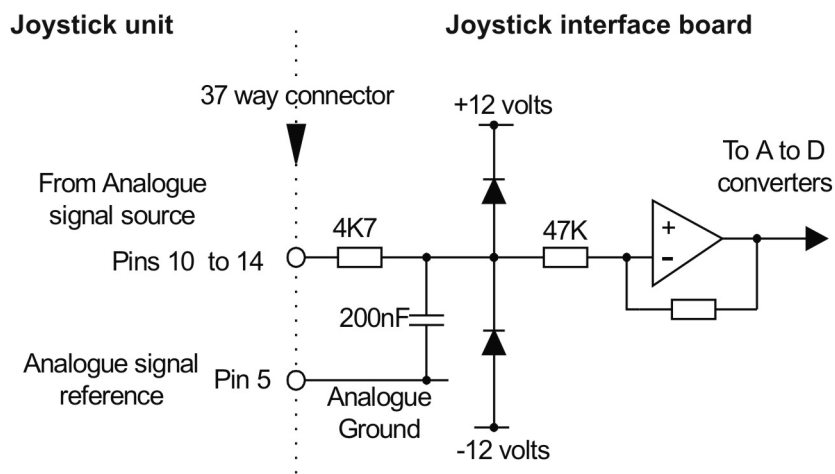


### 5.3.3 Analogue input signal

The figure below gives the analogue input circuit that is incorporated into the JI card. These are all transient-protected and standardised.

There are connections for four analogue axis signals and one analogue speed signal from the joystick unit to the UCC JI card.

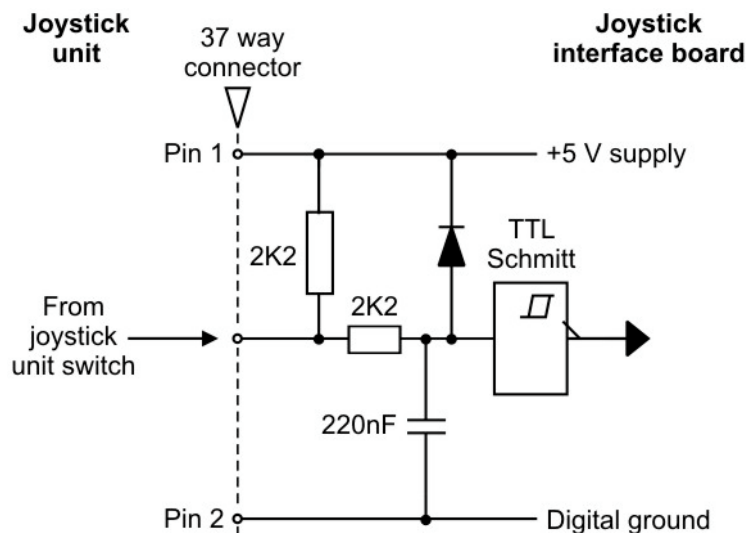
The input voltage range is  $\pm 12$  V nominal,  $\pm 15$  V maximum. Positive inputs should produce machine movements in a positive direction.



### 5.3.4 Binary input circuit

The figure below gives the binary input circuit that is incorporated into the JI card, which are all transient-protected and standardised.

The input voltage range is  $\pm 12$  V nominal,  $\pm 15$  V maximum. The active state for this connection is with the input connected to pin 2.



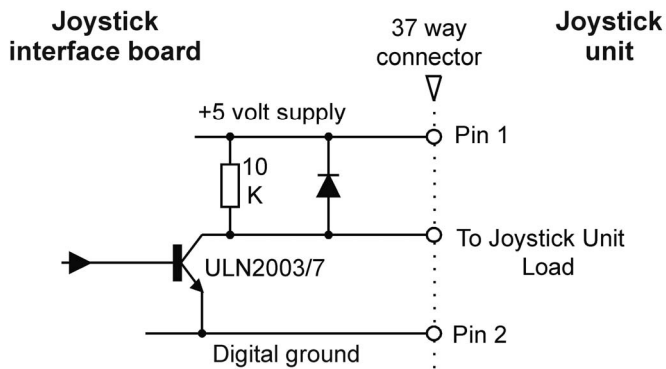
### 5.3.5 Binary output circuit

The figure below gives the binary output circuit that is incorporated into the JI card. These are all standardised.

The active state for this connection is with the transistor conducting and the limits for this connection are listed below.

Maximum output current = 100 mA

Output voltage @ 100 mA = 1.1 volts max.



## 5.4 Operating overview

### 5.4.1 Method of operation

The JI board CPU scans all inputs from the joystick unit, the analogue signals are processed to give suitable velocity commands for the servo system and when information is requested by the controller, these velocity commands and other input signals are returned to it.

The controller can also send instructions to the JI board to change the states of the outputs going to the joystick unit, e.g. to turn indicators on or off.

There is provision for up to 19 user inputs or outputs from the joystick unit which can be configured as simple I/O to and from the user's PC, or as controls for many built-in functions.

---

### 5.4.2 Initialising the JI card

After powering up the UCC1 or **UCC2** controller, the JI card must be brought into operation by the following three actions:

- The JI card must be selected by setting *Joystick type* = 1 in the command 256 (Machine configuration).

---

**NOTE:** This action will prevent the PC command 320 (Enter velocity demand) from working, since the joystick will now provide this function.

---

- The JI card should also be configured to provide the characteristics required for the front-end software application. Like most other parts of the UCC1 or **UCC2** system, the JI board can be used with all its parameters as their default settings, in which case no configuration is required. Otherwise command 396 (Joystick configuration) should be sent to the controller. The board can be configured before or after it has been selected.
- Finally, the JI card should be enabled using the command 397 (Joystick enable) command.

### 5.4.3 Joystick modes

When a CMM system is fitted with a joystick unit and a joystick daughtercard, these must be suitably commissioned as described above. This will then permit the system to operate in one of two modes: DCC mode or joystick mode.

In DCC mode the majority of the functions offered by the JI card are not active, moves can only be initiated and controlled by commands from the front-end software.

---

**NOTE:** The emergency stop will always be available, if integrated, and the speed override functions will be available if configured

---

In joystick mode the joystick(s) can be used to move the machine and all other JI card functions are available, but no metrology front-end software controlled moves can be made.

The required mode can be selected either by a metrology front-end software command or by a switch on the joystick unit.

---

**NOTE:** The default JI card characteristics can be changed using command 396.

This command may be used to remove the need for the dead man's handle and joystick/DCC switch signals. In this state the joystick must be enabled as required by command 397 and disabled again by the same command when a computer controlled move is required.

---

#### 5.4.4 Joystick type selection

Command 256 (Machine configuration) sets a parameter called joystick type to 0 or 1.

If joystick type is set to 0:

- No joystick functions will be available (even beeps or uncommitted I/O)
- Command 320 (Enter velocity demand) from the PC will operate to give mouse-like movements controlled by the PC

If Joystick type is set to 1:

- JI functions may be available, depending on the other factors (see below)
- A command 320 (Enter velocity demand) from the PC will be ignored

#### 5.4.5 Enable joystick

To move the machine under joystick control requires the following conditions to have been met:

- The JI must be *selected* using command 256 as type 1, see *Joystick type selection* section below
- The JI must be *enabled* using command 397 with *enable* set to 1
- The dead man's handle switch signal to the JI from the joystick unit must be active (contacts closed)
- The joystick/DCC switch signal to the JI from the joystick unit must be active (contacts open or pulled high)

Even when the JI is selected and enabled, the signal from the joystick/DCC switch on the JI affects the joystick availability.



Since both the joystick/DCC switch and command 397 (Joystick enable) command from the PC control the same things and both may be present, the truth table governing the system mode is:

	Joystick/DCC switch set to DCC	Joystick/DCC switch set to joystick
Joystick disabled by front end software	<b>DCC mode</b>	<b>DCC mode</b>
Joystick enabled by front end software	<b>DCC mode</b>	<b>joystick mode</b>

**NOTE:** If the joystick/DCC switch is not fitted to the JI card, the default state of the signal must be wired to the joystick, on the JI connector, to allow the PC to control the mode.

Alternatively, the switch signal pin may be reconfigured (by command 396) for a secondary built-in pin or as an uncommitted I/O pin: the PC command alone will then select the mode.

#### 5.4.6 Functionality in DCC mode

Active CMM functions when the system is in DCC mode:

Function	Machine state			
	<i>Disengaged or hold</i>	<i>Joystick move</i>	<i>Point-to-point move</i>	<i>Scanning or pencil*</i>
<i>Jl commands</i>	All JI commands	Unavailable	None	None
<i>Speed override</i>	Yes	-	Yes	No
<i>Joystick controlled movements</i>	No	-	No	No
<i>Built-in JI functions</i>	Beep only	-	Beep only	None
<i>Probe enabled or disabled</i>	PC controlled	-	PC controlled	PC controlled
<i>Probe enable/disable indicator (on JI)</i>	PC controlled	-	PC controlled	PC controlled
<i>Jl uncommitted I/O</i>	Yes	-	Yes	None

### 5.4.7 Functionality in joystick mode

Active CMM functions when the system is in joystick mode:

Function	Machine state			
	<i>Disengaged or hold</i>	<i>Joystick move</i>	<i>Point-to-point move</i>	<i>Scanning or pencil*</i>
<i>Jl commands</i>	All JI commands	All except <i>Read JI Version</i> and <i>Configure</i>	Point-to-point move not available	No scanning or pencil moves available.
<i>Speed override</i>	No	No	-	-
<i>Joystick-controlled movements</i>	Can be started if in hold state	Yes	-	-
<i>Built-in JI functions</i>	All functions	All functions	-	-
<i>Probe enabled or disabled</i>	Controlled by JI switch	Controlled by JI switch	-	-
<i>Probe enable/disable indicator (on JI)</i>	JI controlled	JI controlled	-	-
<i>Jl uncommitted I/O</i>	Yes	Yes	-	-

\* Pencil mode applies to Cyclone class machines only.

### 5.4.8 Changing modes

If a change occurs due to the *Enable* command or the joystick/DCC switch which would move the system from DCC mode to joystick mode, it will not take effect until the system is in a disengaged or hold state.

If a change occurs which would move the system from joystick mode to DCC mode, it will take effect as soon as any joystick activity has been terminated by the user and the system is in a disengaged or hold state.

### 5.4.9 Moving and touching

When joystick mode is selected, the CMM can be moved by deflecting the joystick levers. The system behaviour can be modified by the optional primary I/O functions.

In the event of a trigger, the CMM will be stopped and back away from the surface. The back-off speeds and distances are defined as the maximum values for normal moves and touches in command 257 (Move configuration).

After backing-off and finally stopping, the joysticks cannot move the machine until all three joystick signals have been at 0 speed for the null wait time defined in command 396 (Joystick configuration). The default value is 0.05 seconds.

The back-off direction is the reverse of the direction in which the stylus approached the surface.

### 5.4.10 Recording points

It is often necessary to construct a program of moves and touches on the host for a repetitive measuring procedure. Two of the primary built-in functions are designed to allow the user to log chosen machine positions on the host as part of that construction.

When the user sends a *Record point* signal to the JI board, usually by pressing a momentary switch on the joystick unit, the controller will store the current machine position and set a status flag to alert the host. The flag is status byte B7, bit 1.

When next requesting position and status, the host should respond to this flag by recording the position as a 'way-point' in the measuring program. Once the point has been read by the host, the flag is set to zero.

If the user sends a *Cancel last point* signal to the JI board, usually by pressing a momentary switch on the joystick unit, the controller will check that the last recorded point has been read by the host. If it has not yet been read, the point data will be discarded and the *Store as recorded point* flag cleared to zero. If the point has been read by the host, the controller will set a flag in status byte B7, bit 2 to inform the host that the last recorded point it received should be cancelled. The flag is cleared after it has been read by the host by the next request for position and status.

The cancelling process could be repeated many times and the host main program will use it to delete multiple stored points.

### 5.4.11 Probe damping

Probe damping is not initialized by the joystick box, but if damping is asserted through the UCC, and the system is in joystick mode, then probe damping will be controlled by the joystick fast/slow switch:

If the joystick fast/slow switch is set for 'slow' speed then probe damping, if applied, is overridden and the probe operates at full sensitivity.

If the joystick fast/slow switch is set for 'fast' speed then probe damping, if applied, is still valid and the probe operates at reduced sensitivity.

If damping is asserted by an external device, such as an HCU1 unit or a connection to the 'PDAMP' line of the probe or PICS connector, then probe damping will not be overridden by the fast/slow switch.

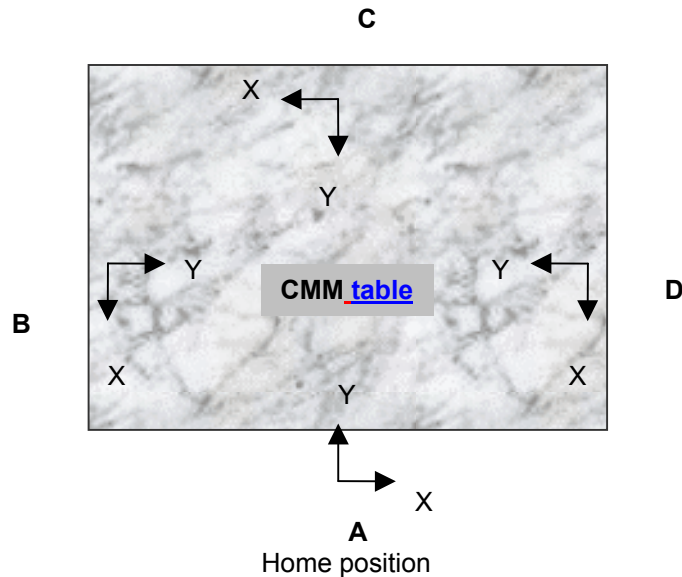
### 5.4.12 Joystick orientation

It is assumed that the joystick unit will normally be used in one position relative to the CMM's table (the home position) but during use, the joystick user will move freely around the table to control the CMM.

By operating a switch mounted on the joystick unit, the X and Y joystick deflection signals can be transposed as required to give instinctive user response for all four sides of the CMM table. The Z axis is always in the same orientation.

**NOTE:** Any axis labelling on the joysticks themselves may no longer be correct.

This function is not controlled by command 396 (Joystick configuration), but is a hard-wired option to the JI connector. The two signal pins which define the required orientation are pins 27 and 28.



Position	Pin 27	Pin 28
A	<i>o/c</i> or high	<i>o/c</i> or high
B	pulled low	<i>o/c</i> or high
C	pulled low	pulled low
D	<i>o/c</i> or high	pulled low

**NOTE:** If both pins are left unconnected, the joystick unit will operate normally at the default home position.

Should the operator switch the joystick unit orientation during use, then it will not change the active orientation until the UCC is in state 0 (disengaged) or state 2 hold). Therefore the machine should be left to reach one of these states (i.e. release joystick demand) to allow the change to occur.

Axis locks are also affected by the joystick axis reorientation. If the user moves to position B or D, the X and Y joystick axes will be interchanged on the joystick unit. Any existing or new axis locks applied will also be interchanged when in either of these positions. Moving to a new position will alter whichever axes are locked as required to maintain consistency with the joystick deflection directions.

Joystick reorientation will only take effect if *Joystick type* is equal to analogue and the axis locks and indicators are set as primary functions.

## 6 MCU1 daughtercard

---

**NOTE:** This daughtercard is only suitable for use in the UCC1 controller. The **UCC2** has this functionality integrated as standard on its motherboard.

---

### 6.1 Introduction

The MCU1 daughtercard is one of two joystick interface options offered by the UCC1 and is normally supplied as part of the UCC1 kit when purchased.

The MCU1 daughtercard provides all the necessary interfacing between the MCU1 joystick and the UCC1 controller.

---

**NOTE:** The **UCC2** controller has an integrated MCU interface that removes the requirement for a separate MCU daughtercard to be fitted.

---

The MCU1 daughtercard is configured by commands from the front-end software, via the UCC1 controller, to select and respond to functions available from the MCU1 joystick.

Physically, the device comprises a single printed circuit board with a connector to suit the controller's internal bus sockets. The board has a metal end plate for fixing to the UCC1 controller. Attached to this metal plate is a 9-way D-type connector, to connect to the MCU1 joystick, and a 2-way socket dedicated to the wiring from the emergency stop button located on the MCU1 joystick.

The MCU1 daughtercard and MCU1 joystick are powered by the UCC1 controller.

### 6.2 Connector and pin outs

On the rear panel of the MCU daughtercard are two connectors:

- the connection to the Renishaw MCU joystick unit, via a 9-way D-type connector, labelled MCU
- the connection to the CMMs emergency stop system, via a dedicated 2-way connector, labelled EMERGENCY STOP

### 6.2.1 MCU connector

The MCU1 joystick connector is a 9-way D-type socket with the signals as detailed in the table below:

Pin number	Function
1	Not connected
2	TX_A
3	RX_A
4	RX_B
5	0v
6	ESTOP_A
7	ESTOP_B
8	TX_B
9	+15v
Shell	Screen

### 6.2.2 Emergency stop connector

The emergency stop connector is a two pin Lemo connector that is connected directly to pins 6 and 7 of the MCU1 9-way D-type socket connector, these pins should be connected into the CMMs emergency stop system.

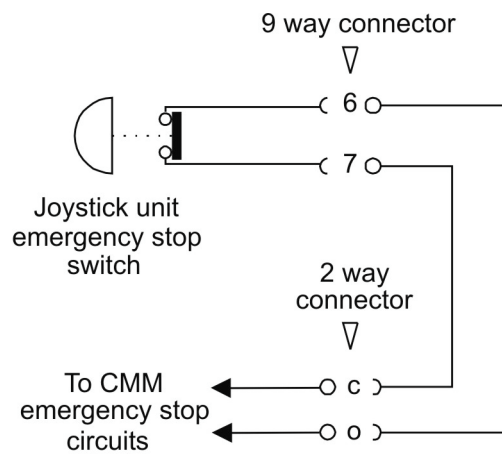
Pin number	Function
1	ESTOP_A
2	ESTOP_B
Shell	Screen

## 6.3 Configuration options

### 6.3.1 Emergency stop signal

The diagram below shows the EMERGENCY STOP signal routing through the MCU1 daughtercard.

**NOTE:** The emergency stop signal is not connected to any internal circuits within the daughtercard, the emergency stop signal is routed directly from the 9-way D-type connector to the emergency stop connector on the rear of the card.



## 6.4 Operating overview

### 6.4.1 Method of operation

The MCU daughtercard decodes the input from the MCU1 joystick unit, to give the information required by the controller.

The MCU daughtercard is software configurable. Please refer to either the COM class programmers guide (Renishaw part number H-1000-5230) or the UCC command set (Renishaw part number H-1000-5222) for further details.



## 7 SP25M daughtercard

**NOTE:** This daughtercard is only suitable for use in the UCC1 controller. The **UCC2** has this functionality integrated as standard on its motherboard.

### 7.1 Introduction

The UCC1 main unit has an analogue probe port for use with the SP600, TP200 and TP20 range of probes. This daughtercard adds a further capability to that of the analogue connector permitting the use of the SP25M probe, whilst still accommodating SP600, TP200 and other standard touch trigger probes, without the need to change cable connections.

**NOTE:** The **UCC2** controller has an integrated SP25 interface that removes the requirement for a SP25 daughtercard to be fitted.

### 7.2 Connectors and pin outs

On the rear panel of the SP25M daughtercard there is a single connector:

- the connection to the multiwire probe cable, via a 15-way HDD connector, labelled analogue probe

#### 7.2.1 Analogue probe connector

This enables connection of the SP25M, SP600 family, TP20 or TP200 probes to the UCC1.

The connections for the analogue probe connector are shown in the table below.

Jacking posts are fitted to the connector on the rear panel to secure the mating plug.

Pin number	Signal description	Pin number	Signal description
1	+5v probe supply	9	Reserved
2	Reserved	10	Probe overtravel
3	TTP signal / 0v	11	Channel A
4	Channel B	12	0 V ref
5	Channel C	13	TTP signal
6	+12V	14	Head LED anode
7	-12V	15	Head LED cathode
8	Probe identification	Shell	Screen

## 7.3 Operating overview

### 7.3.1 Method of operation

The SP25M daughtercard is used to interface any SP600, TP200, TP20 or SP25M probe into the UCC1 system. This card replaces the need to interface some of these probes via the analogue probe connector on the main UCC1 motherboard.

---

**NOTE:** When the SP25M daughtercard is installed into the UCC1 system it will disable the function offered by the analogue probe connector on the UCC1 main unit. This is no longer required, since the interface board connects internally to the controller.

---

---

## 8 SP80 daughtercard

---

**NOTE:** This daughtercard is suitable for use in both UCC1 and **UCC2** controllers.

---

### 8.1 Introduction

This daughtercard permits the use of the SP80 probe system with the UCC1 or **UCC2** controller.

---

**NOTE:** This daughtercard is only compatible with the production version of the SP80 probe, which can be identified by:

Probe status LED = production version (compatible)

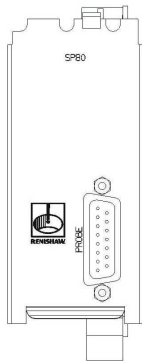
No probe status LED = prototype version (not compatible).

---

### 8.2 Connector and pin outs

On the rear panel of the SP80 daughtercard there is a single connector:

- Connection to the machine cable, via a 15-way D-type connector, labelled PROBE.



#### 8.2.1 SP80 connector

This 15-way D-type connector permits the connection of the SP80 probe to the UCC1 system.

---

**NOTE:** This connection is designed to only accept the production version of the SP80 probe, fitment of a PH10 system or an early SP80 system to this connector may cause damage to the daughtercard.

---

Jacking posts are fitted to the connector on the rear panel to secure the mating plug.

Pin number	Signal description	Pin number	Signal description
1	Cos Y	9	Not connected
2	Not connected	10	Red LED drive
3	Cos Z	11	Cos X
4	0 V	12	Sin X
5	Probe identification	13	Not connected
6	Green LED drive	14	in Y
7	Sin Z	15	Probe power
8	Reference voltage	Shell	Screen

### 8.3 Operating overview

The SP80 daughtercard is used to interface the SP80 probe with the UCC1 or **UCC2** system. When the SP80 probe is detected, all enabled scanning options will be available to the system user.

## 9 Additional I/O daughtercard

**NOTE:** This daughtercard is suitable for use in both UCC1 and **UCC2** controllers.

### 9.1 Introduction

The additional input / output daughtercard is one of a range of plug-in daughtercards available for the Renishaw universal CMM controllers.

This card provides sixteen additional uncommitted inputs and sixteen additional uncommitted outputs.

### 9.2 Connector and pin outs

On the rear panel of the additional input / output daughtercard there is one connector which is:

- a 37-way D-type connector, labelled additional I/O

#### 9.2.1 Additional I/O connector

This connector permits the connection of input or output signals to or from the UCC1 or **UCC2**.

Jacking posts are fitted to the connector on the rear panel to secure the mating plug.

Pin number	Function	Description	See section
1	+24 V dc	Provided for use on CMM switches	9.3.2.2
2	Additional output 10	General purpose output signal	9.3.2.2
3	Additional output 9	General purpose output signal	9.3.2.2
4	Additional output 6	General purpose output signal	9.3.2.2
5	Additional output 7	General purpose output signal	9.3.2.2
6	Additional output 0	General purpose output signal	9.3.2.2
7	Additional output 1	General purpose output signal	9.3.2.2
8	Additional output 2	General purpose output signal	9.3.2.2
9	Additional output 3	General purpose output signal	9.3.2.2
10	Additional output 4	General purpose output signal	9.3.2.2
11	Additional output 5	General purpose output signal	9.3.2.2
12	Additional output 6	General purpose output signal	9.3.2.2
13	Additional output 11	General purpose output signal	9.3.2.2
14	Additional output 12	General purpose output signal	9.3.2.2
15	Additional output 13	General purpose output signal	9.3.2.2
16	Additional output 14	General purpose output signal	9.3.2.2
17	Additional output 15	General purpose output signal	9.3.2.2
18	0 V		
19	0 V		
20	+24 V dc	Provided for use on CMM switches	9.3.2.1
21	Additional input 12	General purpose input signal	9.3.2.1
22	Additional input 13	General purpose input signal	9.3.2.1

23	Additional input 14	General purpose input signal	9.3.2.1
24	Additional input 15	General purpose input signal	9.3.2.1
25	Additional input 0	General purpose input signal	9.3.2.1
26	Additional input 1	General purpose input signal	9.3.2.1
27	Additional input 2	General purpose input signal	9.3.2.1
28	Additional input 3	General purpose input signal	9.3.2.1
29	Additional input 4	General purpose input signal	9.3.2.1
30	Additional input 5	General purpose input signal	9.3.2.1
31	Additional input 6	General purpose input signal	9.3.2.1
32	Additional input 7	General purpose input signal	9.3.2.1
33	Additional input 8	General purpose input signal	9.3.2.1
34	Additional input 9	General purpose input signal	9.3.2.1
35	Additional input 10	General purpose input signal	9.3.2.1
36	Additional input 11	General purpose input signal	9.3.2.1
37	0 V		
Shell	Shell and screen		

## 9.3 Operating overview

The additional input / output daughtercard complements the current 6 input and 6 output uncommitted connections on the UCC1 or **UCC2** motherboard. Both the motherboard and the additional input / output daughtercard takes its power directly from the controller.

### 9.3.1 Software integration

Software integration details are specified in the UCC command set document (Renishaw part number H-1000-5222), please refer to this document for full integration details.

#### 9.3.1.1 Read from additional I/O card

Command 343 (refer to UCC command set, Renishaw part number H-1000-5222) is used to read from the connections on the additional I/O card.

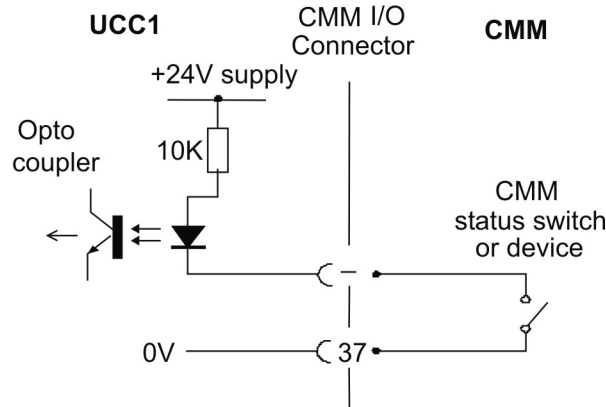
#### 9.3.1.2 Write to additional I/O card

Command 344 (refer to UCC command set, Renishaw part number H-1000-5222) is used to activate the output connections on the additional I/O card.

## 9.3.2 Electrical integration

### 9.3.2.1 Machine opto-isolated input

The circuit used for the input to the UCC is as outlined below with the electrical characteristics as detailed:



Machine I/O inputs ratings	
Maximum current	2.5 mA
Open circuit voltage	24 V
Switching values	
Max. OFF current	10 $\mu$ A
Min. ON current	1 mA

**NOTE:** The CMM status switches must be isolated from all other circuits.

**Polarity:** In the safe operating condition the input should be pulled down to the 0 V return line (i.e. switch closed).

### 9.3.2.2 Machine output

The circuit used for the output from the UCC is as outlined below with the electrical characteristics as detailed:

Machine I/O output ratings	
Maximum current	500 mA (pulse)
Maximum rated current	100 mA
Open circuit voltage	24 V

**Polarity:** The transistor will be conducting for the active state of the output.

## 10 Temperature sensor daughtercard

---

**NOTE:** This daughtercard is suitable for use in both UCC1 and UCC2 controllers.

---

### 10.1 Introduction

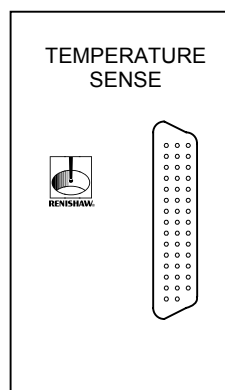
Up to 24 sensors can be monitored, with the information being used to compensate for measurement errors introduced by thermal expansion. 23 permanently fixed sensors measure the temperature of the desired parts of the CMM, and an additional sensor can monitor the temperature of the part under inspection.

The daughtercard is designed for use with Beta Therm NTC 10K3A1 thermistors. These sensors have an accuracy of up to  $\pm 0.1$  °C (There are several manufacturers who make equivalent devices). Other types of sensor can be used, however interface card hardware and software will not be optimised for such devices.

### 10.2 Connector and pin outs

On the rear panel of the temperature sensor daughtercard there is a single connector:

- a 44-way D-type connector is used for connection of temperature sensors to the UCC system





### 10.2.1 44-way connector

This connector permits the connection of the thermistors to the UCC.

The connections for the 44-way D-type connector are shown in the table below.

Jacking posts are fitted to the connector on the rear panel to secure the mating plug.

Pin no.	Channel	Description	Pin no.	Channel	Description
1	2	Sensor 2	24		Sensor common
2	3	Sensor 3	25		Sensor common
3	4	Sensor 4	26		Sensor common
4	5	Sensor 5	27		Sensor common
5	6	Sensor 6	28		Sensor common
6	7	Sensor 7	29		Sensor common
7	8	Sensor 8	30		Sensor common
8	9	Sensor 9	31		Sensor common
9	11	Sensor 10	32		Part attached
10	13	Sensor 11	33		Sensor common
11	15	Sensor 15	34		Sensor common
12	17	Sensor 17	35	1	Sensor 1
13	19	Sensor 19	36		Sensor common
14	21	Sensor 21	37	10	Sensor 10
15	23	Sensor 23	38	12	Sensor 12
16		Sensor common	39	14	Sensor 14
17		Sensor common	40	16	Sensor 16
18		Sensor common	41	18	Sensor 18
19		Sensor common	42	20	Sensor 20
20		Sensor common	43	22	Sensor 22
21		Sensor common	44	24	Sensor 24
22		Sensor common	Shell		Screen
23		Sensor common			

## 10.3 Operating overview

The temperature sensor daughtercard has no user selectable settings.

Unused channels will be specified in the software that is downloaded to the UCC. Similarly, whether the output from channels is to be used to make direct or differential temperature measurements will also be specified in the downloaded software. This information affects the way that the UCC1 processes the data from the interface card, but it is not required by the card itself.

The temperature sensor daughtercard measures each input in rotation and digitises the result in a 12-bit word. Each measurement is then processed to reduce errors introduced by the electronic circuit and interference signals before being stored in memory on the card. The resistance of each sensor is then stored in a unique memory location, where it can be directly accessed by the UCC.

In addition to the sensor's resistance, the interface provides the controller with the following status information about each sensor and the card:

- The sensor's resistance measurement is consistent and can be used by the UCC
- No sensor is connected/ the channel is open circuit
- The channel is faulty/ short circuit
- The temperature sensor interface card is OK
- The sensor is within the defined limits

### **10.3.1 Software integration**

Software integration details are specified in the UCC command set document (Renishaw part number H-1000-5222), please refer to this document for full integration details.

#### **10.3.1.1 Configure the temperature sensor daughtercard**

Command 436 (refer to UCC command set document, Renishaw part number H-1000-5222) is used to configure the temperature sensor card.

#### **10.3.1.2 Latch the temperature sensor daughtercard**

Command 437 (refer to UCC command set document, Renishaw part number H-1000-5222) is used to start the temperature reading process for the temperature sensor card.

#### **10.3.1.3 Read data and status of temperature sensor daughtercard**

Command 438 (refer to UCC command set document, Renishaw part number H-1000-5222) is used to read the latched temperature and status of the temperature sensor daughtercard.

## 10.3.2 Electrical integration

### 10.3.2.1 Thermistor connections to daughtercard

The 44-pin high-density D-type connector on the daughtercard has the following connections:

FUNCTION	CONNECTION
Part under inspection sensor attached switch	1 pin
Part under inspection's sensor signal	1 pin
CMM sensors' signal (23 Channels)	23 pins
Sensors' common connection (0 V)	19 pins *
Cable screen ground	Via connector shell

#### NOTES:

\* Common required for all sensors and part under inspection sensor attached switch common

Unused pins should be left open circuit inside the D type connector.

Each temperature sensor will have two terminals that are connected to the temperature sensor daughtercard in the UCC.

It is recommended that to avoid having to re-wire the machine if a sensor has to be changed after installation, the sensor should have connectors attached locally. These should plug into screened cables that run through the CMM to where the UCC is located. At the UCC, all the cables from the different temperature sensors should be brought together and wired into a 44-pin high-density D-type socket connector.

## 11 Additional axis daughtercard

**NOTE:** This daughtercard is suitable for use in both UCC1 and **UCC2** controllers.

### 11.1 Introduction

The additional axis daughtercard is one of a range of plug-in daughtercards for the Renishaw CMM controller products (UCC1 and **UCC2**).

This daughtercard has been created to enable the following capabilities to be added to the UCC1 system. It is also valid for the **UCC2** controller but because the **UCC2** is already a four axis controller it is only needed when a fifth axis is required.

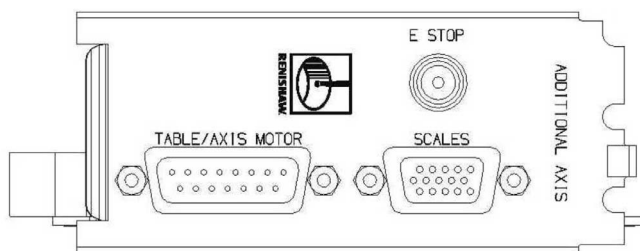
- Rotary table
- Additional axis (scale only)
- Additional axis (scale and drive)

The additional axis daughtercard offers the ability to change its internal reference address permitting up to four of these cards to be fitted to a UCC.

### 11.2 Connector and pin outs

On the rear panel of the additional axis card are three connectors these are:

- The connection to the scale system, via a 15-way HDD connector, labelled scales.
- The connection to the rotary table or axis motor system, via a 15-way D-type connector, labelled table/axis motor.
- The connection from the CMM's emergency stop system, via a dedicated 1-way connector, labelled E STOP. This connection is only required for a UCC1 system, it routes the CMM emergency stop signal through to the table/axis motor connector and on to the servo power amplifier. On **UCC2** systems, the emergency stop signal is available on the motherboard connector so the external connection is not required.



### 11.2.1 Scale connector

The additional axis scale input connector is a high density 15-way D-type socket.

The socket is wired to the same pin-out as that of the UCC scale connector, suitable for Renishaw RGH22 and RGH24 series head wiring. They will also accept the standard Renishaw digital output scale reading heads or interpolators.

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

For further details refer to the scale input connector specification within the respective UCC installation guide.



**CAUTION:** The connection of the cabling should be such that the CMM's movements as reported by the UCC system 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 UCC system. Adjust this, if required, by reversing the inputs of the scale reading head signal.

**Suggestion:** label all read head connectors to avoid cross connection if removed and replaced in the future.

Pin number	Signal description
1	External set up
2	0 V supply from UCC
3	- Error
4	- Ref. mark
5	- B signal
6	- A signal
7	+5V supply from UCC
8	+5 V supply sensing

Pin number	Signal description
9	0 V supply sensing
10	Limit switch Q
11	Limit switch P
12	+ Ref Mark
13	+ B signal
14	+ A signal
15	Inner screen
Shell	Screen

## 11.2.2 Table / axis connector

The table / axis connector is a 15-way D-type socket.

The socket is wired as detailed below, further details on the pin functions are also detailed below.

Pin number	Signal description configured for table operation	Signal description configured for axis operation
1	Reference position	Outer limit positive direction
2	-ve differential output to motor drive	-ve differential output to motor drive
3	amplifier ok	amplifier ok
4	0 V	0 V
5	Contactator feedback	Contactator feedback
6	Contactator	Contactator
7	ESTOP_B	ESTOP_B
8	Emergency stop tripped	Emergency stop tripped
9	not connected	Inner limit positive direction
10	Amplifier enable	Amplifier enable
11	not connected	Inner limit negative direction
12	reserved for future use	ESTOP_RESET
13	+ve differential output to motor drive	+ve differential output to motor drive
14	not connected	Outer limit negative direction
15	not connected	not connected
Shell	screen	screen

### 11.2.2.1 Reference position

This pin accepts an input from the rotary table to indicate a reference position (switch).

### 11.2.2.2 Differential output to motor drive

These connections (pins 2 and 13) output the industry standard  $\pm 10$  V differential output for a servo power amplifier system.

### 11.2.2.3 Amplifier OK

This signal (pin 3) is used to inform the UCC controller that the servo power amplifier connected to the additional axis card is not in a fault condition. The pin should be pulled down to the 0 V (24 V return line) by the SPA control electronics to signal that the CMM servo power amplifiers are functioning correctly.

### 11.2.2.4 0 V

Reference line for all signals.

### 11.2.2.5 Contactor feedback

This input signal (pin 5) is used by the UCC1 to monitor the operation of the axes drive motor control contactor. When the contactor is energised this input pin should be pulled down to 0v line to signal that motor power is available.

If the UCC1 has turned on the contactor output (pin 6) and the signal on this pin indicates that the contactor has not operated after a short delay, the UCC1 will disable the drive motors and inform the CMM host computer of this.

### 11.2.2.6 Contactor

The additional axis card provides a NFET output.

The transistor drain is available on pin 6 to be connected to the load and the source is connected to the 0 V line (pin 4). This output is not optically isolated from the supply lines.

A collector pull-up resistor and a reverse spike protection diode connected between the drain (pin 6) and the source is provided within the IC.

**Ratings:** Maximum current 1 A.

**Polarity:** The output transistor conducts when the motors are intended to be energised.

### 11.2.2.7 ESTOP B

This is an output from the UCC1 emergency stop system designed to be monitored by the servo power amplifier connected to the additional axis.

For further details on the emergency stop system please refer to section 11.3.2.

### 11.2.2.8 Emergency stop tripped

This is the feedback signal from the servo power amplifier connected to the additional scales card indicating that it has received an emergency stop signal and reacted upon it.

### 11.2.2.9 Amplifier enable

The additional axis card provides a NFET output.

The transistor drain is available on pin 6 to be connected to the load, and the source is connected to the 0 V line (pin 4). This output is not optically isolated from the supply lines.

A collector pull-up resistor and a reverse spike protection diode connected between the drain (pin 6) and the source is provided within the IC.

**Ratings:** Maximum current 1 A.

**Polarity:** The output transistor conducts when the motors are intended to be energised.

### 11.2.2.10 Limit switches

The UCC1 will use these input signals (axis operation pins 1,9,11 and 14) to stop the CMM as programmed by the host computer. Refer to UCC1 programmer's guide (Renishaw part number H-1000-5057), command number 311.

Both outer limit switches have to be closed before the CMM drives can be engaged.

When a CMM actuates an inner limit switch all CMM axes are decelerated, stopped and held stationary under servo control. Refer to UCC programmers guide (Renishaw part number H-1000-5057), command number 311 for further details).

If the CMM actuates either of the outer limit switches, all CMM axes servo drive motors are disengaged.

## 11.2.3 Emergency stop connector

The emergency stop connector is a one pin lemo connector that should be connected into the emergency stop system, refer to section 11.3.2 for further details.

Pin number	Function
1	ESTOP B
Shell	Screen

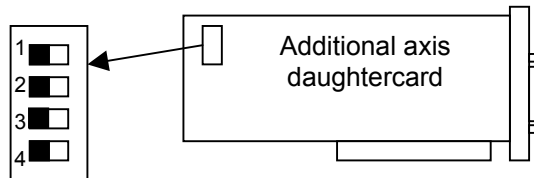


## 11.3 Configuration options

### 11.3.1 Daughtercard channel setting

The additional axis daughtercard has the ability to be configured to four different channel settings this is to permit multiple cards to be used within the UCC1 / **UCC2** controller.

There are four configuration switches located as shown in the drawing below:



These switches have the following address settings

#### 11.3.1.1 Configuration switch 1

Configuration switch 1 sets the function of the additional axis card

Switch in the left position (off) = Rotary table

Switch in the right position (on) = Additional axis

#### 11.3.1.2 Configuration switches 2 and 3

Configuration switches two and three configure the channel for the additional axis daughtercard.

Base address	Switch 2	Switch 3
Channel 1 (default)	Left (Off)	Left (Off)
Channel 2	Right (On)	Left (Off)
Channel 3	Left (Off)	Right (On)
Channel 4	Right (On)	Right (On)

#### 11.3.1.3 Configuration switch 4

This configuration switch is reserved for future use and must be located in the off position.

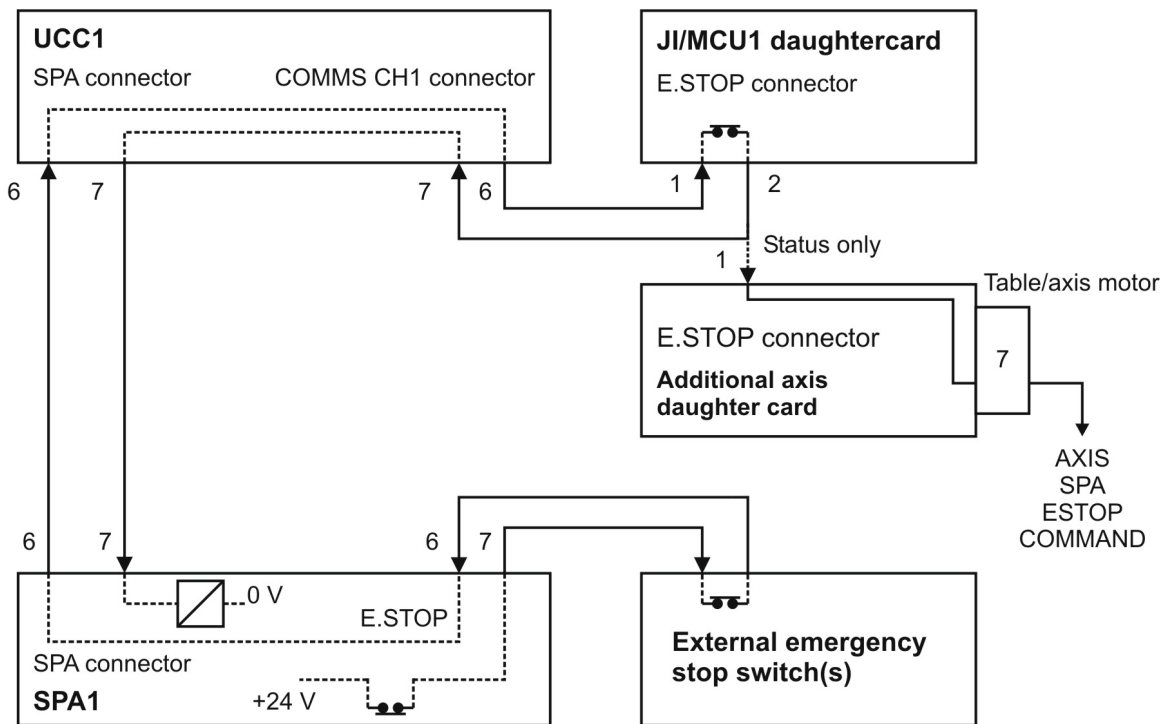
### 11.3.2 Emergency stop signal

The figure below shows the EMERGENCY STOP signal routing through the additional axis daughtercard.

**NOTE:** The emergency stop signal is not connected to any internal circuits within the UCC1, the emergency stop signal is routed directly from the 9-way D-type connector to the emergency stop connector on the rear of the card.

#### 11.3.2.1 Recommended emergency stop system routing

The figure below shows a recommended installation for the UCC1 system incorporating an additional axis daughtercard and a joystick card.



## 12 PHS daughtercard

**NOTE:** This daughtercard is only suitable for use in the **UCC2** controller. UCC1 will not support this functionality.

### 12.1 Introduction

The PHS daughtercard is one of a range of plug-in daughtercards for the Renishaw CMM controller products.

This daughtercard has been created to enable the PHS probe head to be integrated with the **UCC2** controller.

### 12.2 Connector and pin outs

On the rear panel of the PHS daughtercard there are two connectors these are:

- the connection to the PHS head, via a 15-way HDD connector, labelled PHS
- a reserved connector – this is used for commissioning

#### 12.2.1 PHS connector

The PHS connector is a high density 15-way D-type socket.

Pin number	Signal description	Pin number	Signal description
1	Not connected	9	Not connected
2	Not connected	10	Data output
3	Data return	11	+24 V supply
4	Not connected	12	0 V
5	Data return	13	Not connected
6	+24 V supply	14	+12 V supply
7	0 V	15	Ground
8	Data output	Shell	Screen

## 12.3 Configuration options

The PHS daughtercard is constructed from two PCBs mounted together, these are the control PCB and the power PCB.

The power PCB has the necessary circuits to permit the PHS to have a CAT2 emergency stop system applied to it, if configured by the installer. All power supplied by the **UCC2** to the PHS system is controlled by this PCB. The card can be clearly identified by four large relays located on the one side of the PCB.

The control PCB has the necessary circuits to control the movement of the PHS and interface to the **UCC2** control signals, it also has the external connectors mounted upon it.

### 12.3.1 PHS power PCB settings

The PHS power PCB has two configuration switches which are located on the upper edge of the daughtercard between the power and control PCBs.

#### 12.3.1.1 Configuration switch 1

This switch sets the PHS card emergency stop reset function.

When the switch is in the ON position (up) following an emergency stop, the card will automatically reset itself into an operational state when the emergency stop has been removed.

When the switch is in the OFF position (down) following an emergency stop, the card will maintain the emergency stop status when the emergency stop is removed from the system until a manual reset has been applied.

#### 12.3.1.2 Configuration switch 2

This switch sets the PHS card overtravel detection system.

When the switch is in the ON position (up) the PHS card will monitor the PHS head overtravel mechanism and report on its status.

When the switch is in the OFF position (down) the PHS card will not monitor the PHS head overtravel mechanism.

## 12.4 PHS card installation

The PHS card is generally installed into the **UCC2** controller as specified in section 2.1 of this handbook.

---

**NOTE:** The PHS card must be fitted into the fourth slot away from the power supply within the controller

---

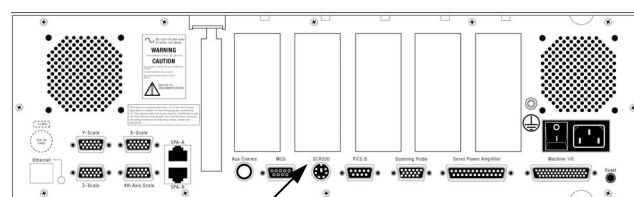
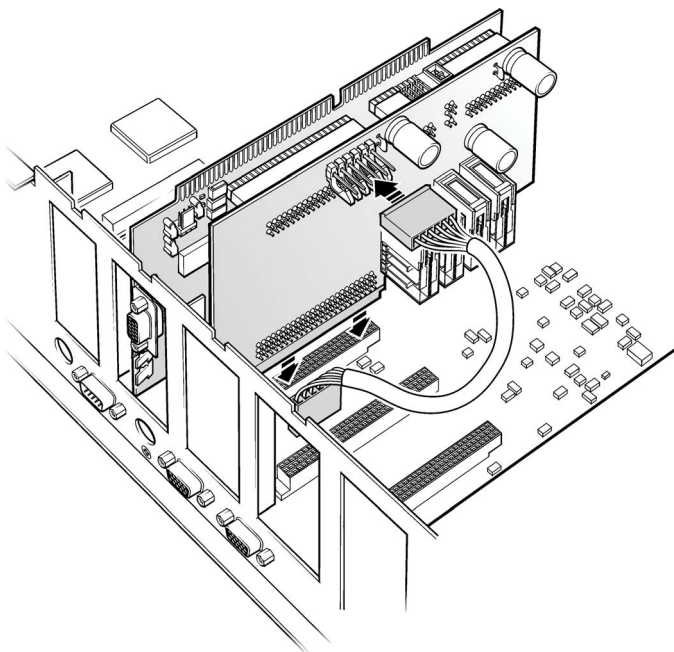
### 12.4.1 Power connection

The additional power supply required by the PHS to operate is supplied from a connector located on the **UCC2** motherboard.

It is necessary to connect this supply to the PHS daughtercard using the loom supplied with the kit.

The following procedure is recommended for installing the power supply loom to the PHS daughtercard within the **UCC2** controller.

1. The process of daughtercard installation as specified in section 2.1 must have been completed to step 9.
2. Align the connector from one end of the power supply loom with the power connector pins on the **UCC2** motherboard and press firmly into position.
3. Align the connector from the other end of the power supply loom onto the power pins on the daughtercard. Place a finger behind the connector on the daughtercard, then using another finger, pinch the connector on the loom into place (see diagram below).



**NOTE:** The PHS daughtercard must be fitted in slot 4.

## 12.4.2 PHS control PCB settings

The PHS control PCB has four banks of three configuration switches located on the rear edge of the card (nearest to the front panel of the UCC2). These switches configure the communication protocol between the daughtercard and the PHS.

### 12.4.2.1 Configuration switch settings

The configuration switches must be configured as detailed below:

Switch bank	Configuration switch	Position	
		Off	On
1 Closest to the <b>UCC2</b> motherboard when daughtercard fitted	1	X	
	2	X	
	3	X	
2	1	X	
	2	X	
	3	X	
3	1		X
	2	X	
	3	X	
4 Furthest from the <b>UCC2</b> motherboard when daughtercard fitted	1	X	
	2		X
	3	X	

## 13 Revision history

### 13.1 What's new in release 01-A

- First issue.
- Superseding all documents listed below:
  - H-1000-5226-03-A PHC1050 daughtercard
  - H-1000-5225-03-A PICS/RS232 daughtercard
  - H-1000-5221-04-A joystick interface daughtercard

### 13.2 What's new in release 02-A

- Inclusion of **UCC2** controller references throughout the text.
- Inclusion of additional axis daughtercard (section 11).
- Inclusion of PHS daughtercard (section 12).

### 13.3 What's new in release 02-B

- No technical information has been changed in this issue.
- Various description improvements for signals and connectors made throughout the document.
- Specific references to UCC1 have either been made non-controller specific (i.e. changed to UCC) or reference to **UCC2** has been added.

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

**T** +44 (0)1453 524524  
**F** +44 (0)1453 524901  
**E** uk@renishaw.com  
[www.renishaw.com](http://www.renishaw.com)

**RENISHAW**   
**apply innovation™**

**For worldwide contact details,  
please visit our main website at  
[www.renishaw.com/contact](http://www.renishaw.com/contact)**



H - 1000 - 5220 - 02