MCUlite-2 and MCU5-2 installation and user's guide

Documentation part number H-1000-5280-07-A

MCU general information

ORIGINAL LANGUAGE VERSION

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Company registration details

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Packaging

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

Packaging component	Material	94/62/EC code	94/62/EC number
Outer box	Corrugated fibreboard	PAP	20
Packaging insert	Corrugated fibreboard	PAP	20
Packing foam	Low density polyethylene	LDPE	4
Bag	Low density polyethylene	LDPE	4

MCU product compliance

EU declaration of conformity

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

UK declaration of conformity

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

EMC conformity

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

FCC (USA only)

Information to user (47 CFR 15.105)

This equipment has been tested and found to comply with the limits for a Class A digital device, pursuant to Part 15 of the FCC rules. These limits are designed to provide reasonable protection against harmful interference when the equipment is operated in a commercial environment. This equipment generates, uses, and can radiate radio frequency energy and, if not installed and used in accordance with the instruction manual, may cause harmful interference to radio communications. Operation of this equipment in a residential area is likely to cause harmful interference, in which case you will be required to correct the interference at your own expense.

Information to user (47 CFR 15.21)

The user is cautioned that any changes or modifications not expressly approved by Renishaw plc or authorised representative could void the user's authority to operate the equipment.

Equipment label (47 CFR 15.19)

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

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

Supplier's declaration of conformity (47 CFR Section 2.1077 Compliance information)

Unique identifier: MCUlite-2, MCU5-2

Responsible party - US contact information

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ICES-003 (Canada only)

Class A Equipment Statement (non-residential)

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

REACH regulation

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

www.renishaw.com/REACH

China RoHS

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

MCU safety

CAUTION: Before unpacking and installing the MCU system, the user should carefully read the safety instructions below and ensure that they are followed at all times by all operators. Operators must be trained in the use and application of the MCU system and accompanying products, in the context of the machine it is fitted to, before being allowed to operate that machine.

Please ensure that you understand all safety instructions. Familiarisation with the MCU system components is recommended.

- The CMM should only be controlled from pre-determined zones or locations
- For safety reasons it is recommended that the joystick docking station is mounted outside the CMM working area

Operation and maintenance

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

- These products are only to be used with the appropriate Renishaw controller
- Installation of the MCU must be performed by trained personnel
- Do not edit any of the system files directly, only trained personnel may use the appropriate commissioning software package
- Remove the power before performing any maintenance operations
- Maintenance is restricted to procedures described in the maintenance section

STOP buttons

The MCU system offers three STOP buttons:

- Emergency STOP switch - RED
- STOP switch - YELLOW or GREY
- Keypad STOP button (MCU5-2)

MCU warnings

Beware of unexpected movement of the CMM or probe system. The user should remain outside of the full working envelope of probe head and stylus. The machine supplier should ensure the user is aware of the full working envelope of the system.

In all applications involving the use of machine tools or CMMs, eye protection is recommended.

It is the machine supplier's responsibility to ensure that the user is made aware of any hazards involved in operation, including those mentioned in Renishaw product documentation, and to ensure that adequate guards and safety interlocks are provided.

The product and the system components contain no user serviceable parts. No attempt should be made to disassemble any part of the product. In the event of a problem please contact your supplier for assistance.

The cables must meet Renishaw specifications. Incorrect cabling could cause damage to the equipment.

Probe disable will prevent machine backing off in the event of a probe collision.

The MCUlite-2 / MCU5-2 must be transported in Renishaw supplied packaging.

This equipment is not suitable for use in a potentially explosive atmosphere.

MCU environmental conditions

Indoor use	IP40
Altitude	Up to 2000 m
Operating temperature	+5 °C to +40 °C
Storage temperature	-25 °C to +70 °C
Relative humidity	Relative humidity 80% maximum (non-condensing) for temperatures up to +31 °C Linear decrease to 50% at +40 °C

MCU references and associated documents

It is recommended that the following documentation be referred to when installing an MCU.

Renishaw documents

Installation guide: SPA3-2 (H-1000-5364)
Installation guide: UCC T5 (H-1000-7573)
Installation guide: UCC T3-2 (H-1000-5254)
Installation guide: UCC T3 PLUS and UCC S3 CMM controller (H-1000-2118)
Installation guide: UCC S5 REVO-2 CMM controller (H-1000-7598)

External documents

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

BS EN ISO 12100:2010 (Safety of machinery - General principles for design - Risk assessment and risk reduction)

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

EN (IEC) 60204-1:2019 (Safety of machinery - Electrical equipment of machines - Part 1: General requirements).

Manual control systems description

NOTE: Only to be used with Renishaw UCC controllers and UCC software.

MCUlite-2

The MCUlite-2 is a basic entry level joystick . It has the controls necessary to control a 3-axis touch-trigger CMM and Renishaw head but without the sophistication of an LCD display screen.

NOTE: The MCUlite-2 is not compatible with UCC1.
The MCUlite-2 and HCU are not supported on the same installation.

MCU5-2

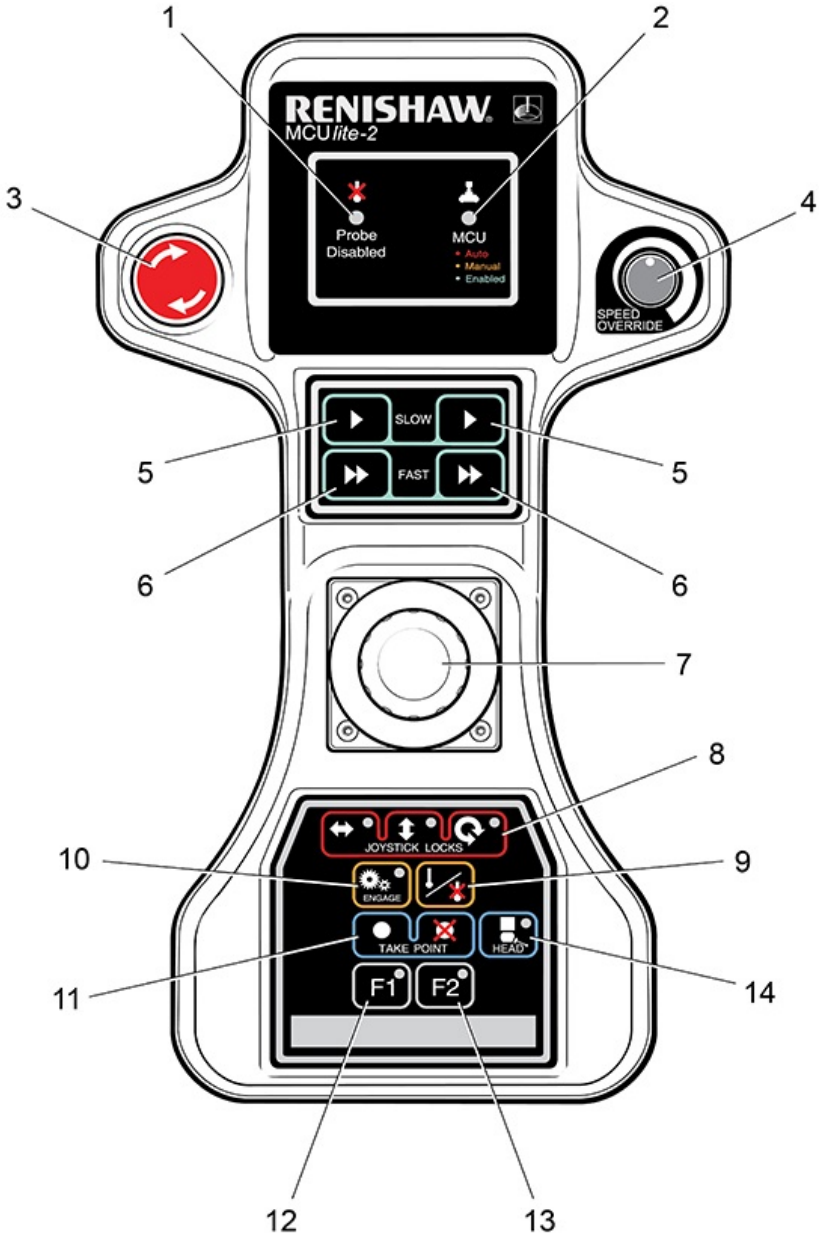
The MCU5-2 has been developed for use with Renishaw's REVO and PH20 systems, providing the ability to move the CMM in the probe and stylus axis and has an LCD display.

NOTE: The MCU5-2 is not compatible with UCC1 and requires UCCsuite 4.9 or later.

Configuration

All MCU units can be configured to match the customer's requirements using Renishaw UCCassist software. Contact Renishaw CMM support for details.

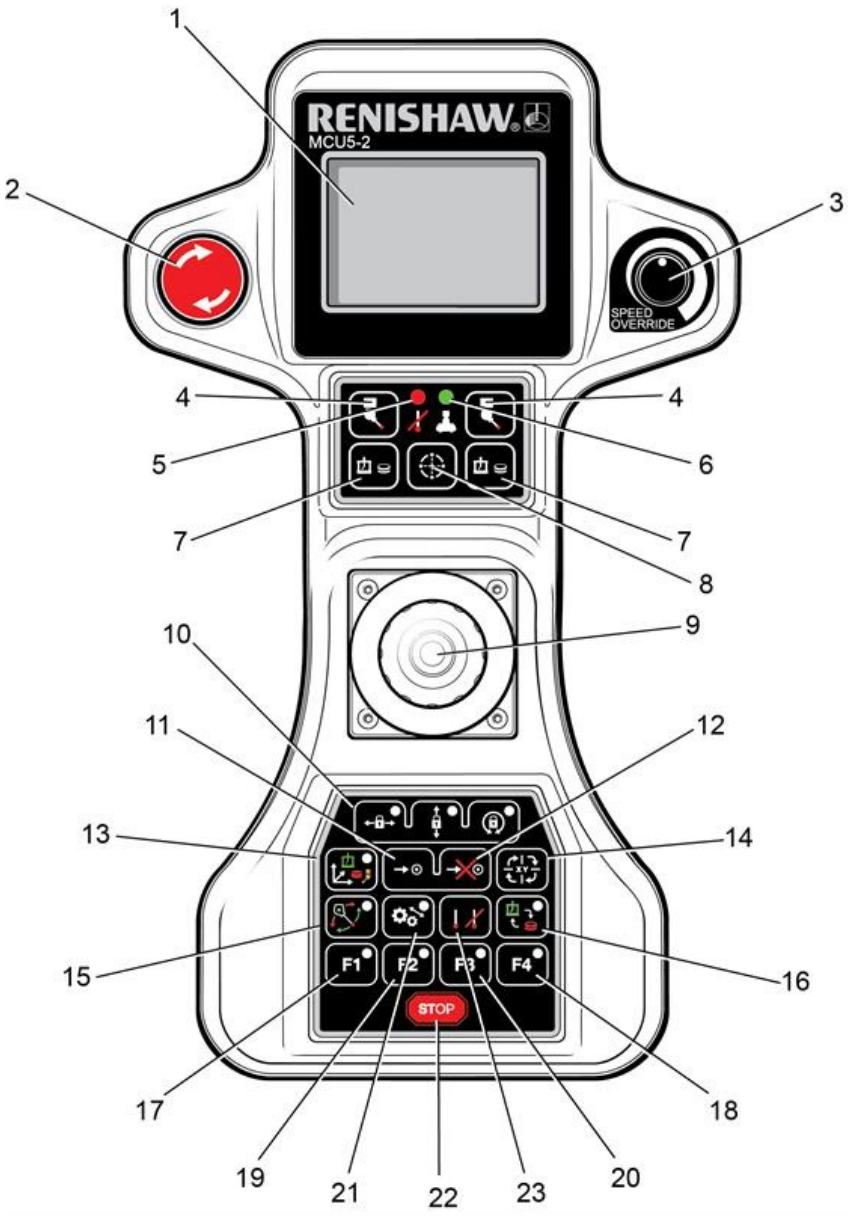
MCUlite-2 features



NOTE: 3 - red or grey

Key	Description	Key	Description
1	Probe disabled LED (red)	8	Joystick locks (three separate buttons)
2	MCU status LED (tri-colour)	9	Probe disable button
3	Emergency stop switch / stop switch	10	Servo engage button
4	Speed override	11	Take point / cancel last point button
5	Slow speed enable buttons	12	F1 function button
6	Fast speed enable buttons	13	F2 function button
7	3-axis joystick	14	Head enable

MCU5-2 features



NOTE: 2 - red or grey

Key	Description	Key	Description
1	LCD screen	13	Joystick co-ordinate system (axis select)
2	Emergency stop switch / stop switch	14	Joystick orientation
3	Speed override	15	Switch between orbital mode and head mode
4	Joystick enabled head mode (see '6' and '15')	16	CMM movement or rotary table
5	Probe disabled LED	17	F1 function
6	Joystick enabled LED	18	F4 function
7	Joystick control of CMM or rotary table (see '6' and '16')	19	F2 function
8	Bore teach	20	F3 function
9	3-axis joystick with push button	21	Engage servos
10	Joystick locks (three separate buttons)	22	Stop
11	Take point	23	Probe disabled (see '5')
12	Cancel point		

System operation

All three axis movements are controlled from the one joystick. Moving the joystick left, right, backwards and forwards controls the CMM X and Y movements. The Z-axis is controlled by twisting the joystick clockwise and anti-clockwise (configurable)*.

If a trigger event occurs during joystick operation, the CMM will stop and back away from the surface along the vector that it was travelling. After the back off operation, it is necessary for the joystick to return to its null position for a set period of time before the joystick will permit movement of the CMM. The default value is 0.05 seconds*. The back-off speeds and distances are defined by the UCC configuration settings*.

* These values and configuration settings will have been set by your CMM service provider.

Head mode

Holding one of these buttons enables movement of the head. Pushing the joystick forwards and backwards will operate the A-axis and twisting the joystick will operate the B-axis.

When in orbital mode (LED lit) the head and machine move relative to the stylus ball.

Indicator LEDs

MCUlite-2:

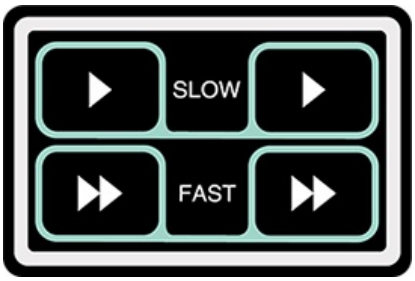
MCU5-2:

The left LED indicates that the probe is disabled. In this mode, if the stylus is driven into a surface the CMM will NOT stop.

The right LED indicates that the joystick is enabled i.e. the joystick will move the CMM or head when deflected.

Joystick enable

MCUlite-2:



MCU5-2:

The joystick enable button(s) are intended to be used to prevent the accidental movement of the machine. Two actions are required to initiate CMM motion: press joystick enable button and operate the joystick.

Holding this button down enables movement of the CMM or rotary table (dependent upon the status of the CMM / rotary table button) :

With CMM selected

- Twisting the joystick moves the Z-axis
- Left, right, backwards and forwards moves the X and Y-axes

Bore teach

Place the stylus into a bore and press the 'joystick enable' and 'bore teach' buttons simultaneously:

The machine will take ×4 points (0,90,180 and 270) perpendicular to the stylus axis.

If the 'head mode' and 'bore teach' buttons are pressed simultaneously the bore is measured with head touches (PH20 and REVO / RSP2 only):

Joystick axis locks

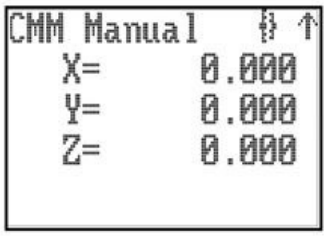
MCUlite-2:

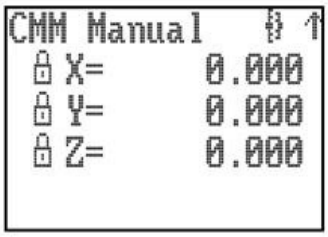
MCU5-2:

These permit the locking of one or more axes of the CMM, ignoring any joystick deflections for that axis. On each of the axis lock buttons there is an LED indicator that will light red when the respective axis is locked. On the MCU display there will also be a padlock symbol next to the respective axis (see below). These buttons toggle the lock on / off.

NOTE: If an axis lock is released when the joystick is deflected, that axis is immediately free to move.

NOTE: When the CMM joystick orientation function is operated, the axis locks will be transposed on the MCU.





When the MCU is in head mode, the axis locks are applied to the relevant head axes. When the joystick is in head mode and a REVO / REVO-2 / PH20 head is fitted, the left / right axis lock button is used to initialise and cancel 'SNAP ON'. 'SNAP ON' is the ability to move the head to the nearest multiple of a defined head angle. In UCCassist-2 the variable can be set to define the resolution of manual head moves (e.g. 5°). These axis locks will only be active during manual (MCU) controlled CMM movements. When the CMM is under DCC (direct computer control) operation, all axis locks will be released and re-latched when returning to manual operation.

Take point / cancel point

MCUlite-2:

MCU5-2:

This button is designed to allow the user to record or cancel chosen machine positions. When a program is being generated by the teach and learn method, the take point button is used to permit the CMM to record a waypoint and use it in the program. Use of the cancel point button will indicate to the application software that the point just taken (either a touch point or a position generated by the take point button) should be removed from the program. The cancelling process can be repeated many times and the front-end program will use it to delete multiple stored points.

NOTE: When the take point button is pressed, the machine's XYZ position will be recorded and a waypoint created.

Axis select button

The axis select button changes the CMM motion in any one of three different axis systems - machine, part or stylus:

Machine axis (green LED)

In this axis system, the joystick directly controls the machine axes, i.e. a forward deflection of the joystick produces a pure Y+ movement of the CMM. This is the default machine setting when the machine is initialised.

Part axis (red LED)

In this axis system, the joystick controls the machine within the current part axis system. i.e. a forward deflection of the joystick produces a movement in the part Y+ direction. This could be a compound of two or three machine axes.

Stylus axis (amber LED)

In this axis system, the joystick controls the machine axes in the axis system of the selected stylus. i.e. a twist (Z) deflection of the joystick produces a movement along the axis of the probe stylus. This could be a compound of two or three machine axes. The stylus axis is a secondary part co-ordinate system, applicable only to the MCU joystick, and this needs to be updated by the application software to reflect the active stylus axis.

The axis system in which the MCU is moving the CMM (machine, part co-ordinate or stylus) is indicated on the LCD by an M, P or S and by a tri-colour LED mounted below the axis select button. Pressing the axis select button will enable the user to scroll through the three axis systems.

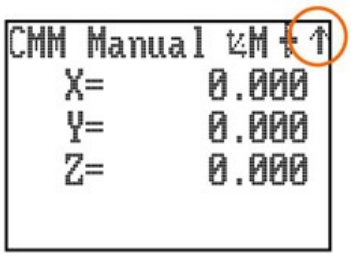
To change to the required axis system the axis select button must be pressed and held on the desired axis system. This selection is confirmed by simultaneously pressing the joystick enable switch. Both switches can then be released. This change procedure prevents unintentional changing of the axis system which could give unexpected machine movement.

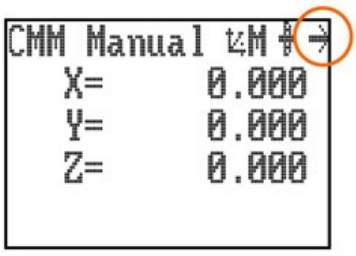
Joystick orientation button - MCU5-2

The joystick orientation button changes the mapping of joystick deflection direction to CMM axis. This allows the user to move freely around any side of the CMM and transpose the joystick orientation such that the machine's X-axis and Y-axis correspond to joystick direction of deflection. If any axis lock is asserted and the joystick orientation is changed then the relative axis lock will also be transposed.

An arrow in the top right of the LCD indicates the orientation of the MCU. Pressing the joystick orientation button will enable the user to scroll through the four operational positions. The direction of the arrow indicates the +Y axis direction of the machine when the machine co-ordinate system is in force.

NOTE: When switching the system to CMM auto mode, the joystick orientation feature will drop out and then be reasserted when the system is placed into CMM manual mode.





Orbital mode

When head mode is active and this button is pressed, joystick deflection rotates the CMM around the stylus tip.

CMM / rotary table

This button switches between CMM and rotary table operation.

If there is no rotary table this button has no effect. The rotary table is set up during commissioning in UCCassist-2.

Function buttons

MCUlite-2:

MCU5-2:

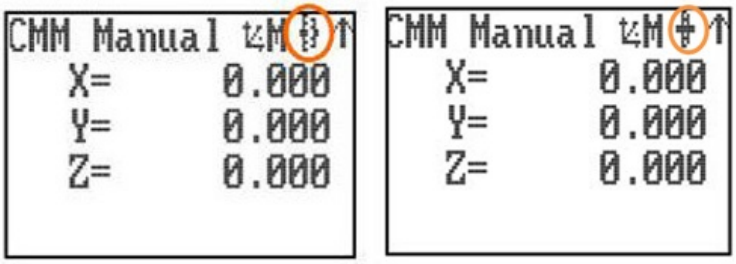
The application software can define the function buttons. Their status can be read at any time and in any mode. These buttons have no effect on the UCC controller as they are solely for the use of the front-end software. The associated keypad LEDs can also be switched on and off at any time. For example, one of the buttons may be used to initiate a circle measurement command when the system is in a manual mode and is being used for teach and learn programming.

Engage button

MCUlite-2:

MCU5-2:

The engage button gives the CMM user the ability to engage or disengage the servos whilst the CMM is in manual mode. This button is configured as a toggle switch and has an associated LED to indicate the servo status. The LED identifies the various operational states as listed below. A symbol at the top of the LCD screen (shown below) also indicates whether the servos are engaged.



LED off - The CMM servos are disengaged.

LED amber - The servos are in the process of engaging.

LED red - The servos are engaged but the joystick is not enabled.

LED green - The servos are engaged and the joystick is enabled and ready.

Operating the disengage switch disengages only the CMM axes, it does not disengage the REVO or PH20.

Keypad STOP button - MCU5-2

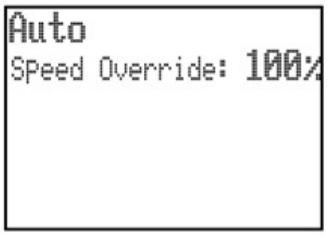
The STOP button gives the operator the ability to rapidly stop the CMM, REVO head and PH20 without disengaging. When the CMM has stopped, the system stays in hold state with both the CMM and head engaged.

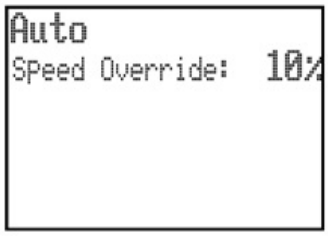
Emergency STOP switch

A red or grey emergency STOP switch is mounted on the MCUlite-2 and MCU5-2 which is hard wired to the UCC controller. It complies with EN13850 and when connected to a UCC / SPA the system can comply as either a category 2 or category B E-STOP system as defined in EN954-1:1996 (ISO13849-1:1999). When this switch is operated power to all the CMM axes is removed.

Speed override

Speed override controls the machine speed when the CMM is running a program under DCC mode. It will also control the speed of the REVO head or PH20 if fitted. The LCD screen displays a percentage value of the programmed move speed when in DCC operation as shown below. If the speed override is set to less than 10%, the speed percentage shown on the LCD display will flash.





Probe disable button

MCUlite-2:

MCU5-2:

The probe disable button gives the CMM user the ability to move the CMM while the probe is triggered or disconnected by disabling the probe trigger signal.

WARNING: When operating in this mode the probe is disabled and therefore probe contact with a surface will NOT stop the CMM. No measured data will be returned to the CMM host computer.

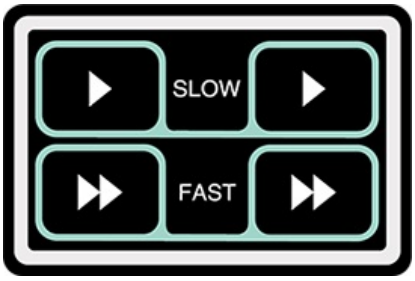
The probe disable function will only work while in manual mode and cannot be applied while in automatic / DCC mode. To disable the probe, press and hold the joystick enable button and then press the probe disable button. The CMM can now be moved irrespective of the probe trigger status. Releasing the joystick enable button cancels the probe disable function. In all modes the application of probe disable is confirmed by the red probe disabled LED being illuminated.

Power-saving screen back light

If the joystick has not been used for 60 seconds, the back light turns off.

To activate the screen back light press the joystick enable button:

MCUlite-2



MCU5-2

MCU installation

Part numbers

There are several MCU joysticks available:

- A-5331-0015 - MCUlite-2 kit
- A-5734-0100 - MCU5-2 kit

Grey button version

- A-5504-0258 - EQ300 kit
- A-6078-0258 - EQ500 kit
- A-5734-0900 - MCU5-2 kit

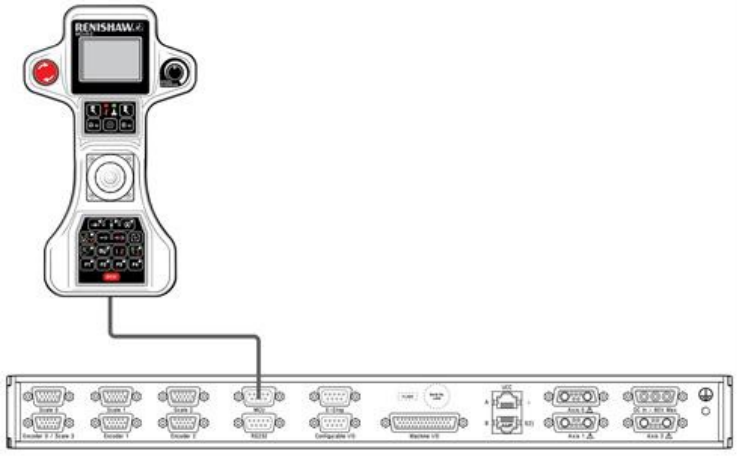
Each of these kits are provided with a 5 m flexible joystick cable. Replacement cables are available from your machine supplier or directly from Renishaw.

- A-1016-8098 - 5 m cable
- A-1016-8099 - 10 m cable

Connecting the MCU to the UCC system

The MCU joystick kits include a 5 m flexible cable provided as standard. The cable is fitted from 9-pin D connector on the rear of MCU to a 9-pin D connector on the rear of the SPA3-2.

Connecting to the SPA3-2



The emergency stop button on the MCU5-2 has a dedicated circuit that is fed directly into the rear of the SPA3-2 servo power amplifier or UCC controller.

MCU fault finding

Many operating problems can be solved by checking the MCU status LEDs, the system configuration and current operating conditions.

NOTE: As with most cable connected ancillary equipment, the actual cable is the most vulnerable part, particularly with a joystick where it can be trapped by the part under inspection, pulled if caught by machine motion, trodden on, run over, etc. If any malfunction with the MCU occurs, the first step should be to examine the cable.

Suspect operation of joystick or buttons

There is a comprehensive test program for the MCU joystick operation and button function within UCCassist-2. Plese refer to the UCCassist-2 user's guide (Renishaw part number H-1000-5224) for details.

The joystick will not move the CMM

Several conditions have to be satisfied before joystick controlled moves can be made:

- The joystick must be connected to the UCC and have been set up in the configuration file
- The joystick must be 'enabled'
- The MCU 'joystick enable' button must be pressed down
- The axis locks must not be applied
- The CMM application software must be in manual (joystick) mode
- The probe must not be 'deflected', unless probe disable is on
- No limit switches should be open, unless disabled
- The CMM position must be inside all 'soft limits' if these are enabled

The speeds are too low or too high

- Check the correctness of the joystick speeds and accelerations that are set in the UCC configuration file
- Check the operation of the fast / slow switch - higher speeds will be obtained when this switch is active

The motors disengage during joystick operation

- If the joystick maximum speed is set to a high value, the machine may be able to exceed the maximum move speed and may cause an overspeed error
- If the joystick maximum acceleration is set too high, the motor signals may attempt to exceed the overdrive limits and cause an overdrive fault
- If the system proportional gains are set too high, or the velocity gains are too low, an overdrive fault may occur

Speed override does not work correctly

- This feature must be enabled separately from the general joystick enabling function. It is an entry in the UCC configuration file

NOTE: Speed override ONLY works on DCC moves and scanning. It is not operational when the MCU is in manual (joystick) mode.

Servos will not engage

- E-STOP not connected correctly
- E-STOP still asserted
- An outer limit switch is activated

No screen display

- Check cable connection

MCU maintenance

The MCUlite-2 and MCU5-2 have no user serviceable parts. There is an E-STOP repair leaflet (Renishaw part number H-1000-7601) available for these joysticks. Should a unit become defective for any other reason then it should be returned to the nearest Renishaw service centre.

The MCU may be kept clean by wiping with a clean, damp, lint-free cloth.

CAUTION: Do not use solvents.

Replacement connection cables can be purchased through the CMM provider or direct from Renishaw:

CAUTION: Always follow the safety instructions given in this guide. Failure to do so could adversely affect the performance of the MCU system and / or lead to personal injury.

NOTE: The external surfaces of all system components can be cleaned with a water damped cloth but all parts should be kept dry. Keep MCU contacts clean and free from dirt using non-abrasive material.

Requirements

Software requirements for installation

The required version of UCCsuite:

- MCUlite-2 - UCCsuite 4.9 and later
- MCU5-2 - UCCsuite 4.9 and later

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