Installation guide
H-1000-5068-05-A

RENISHAW
apply innovation™

SPA1 servo power amplifier

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Renishaw part no: H-1000-5068-05-A

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SPA1

Installation guide

CE

FCC

Information to user (FCC section 15.105)

This equipment has been tested and found to comply with the limits for a class A digital device, pursuant to part 15 of the FCC rules. These limits are designed to provide reasonable protection against harmful interference when the equipment is operated in a commercial environment. This equipment generates, uses and can radiate radio frequency energy and, if not installed and used in accordance with the installation 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 expense.

Information to user (FCC section 15.21)

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

EC declaration of conformity

The SPA1 has been manufactured in conformity with the following standards:

BS EN 61326:1998	Electrical equipment for measurement, control and laboratory use – EMC requirements. Immunity to Annex A - industrial locations. Emissions to class A (non-domestic) limits.
BS EN 60204-1:1998	Safety of machinery – Electrical equipment of machines. Part 1: General requirements.

and that it complies with the requirements of the following EC Directives (as amended):

89/336/EEC – Electromagnetic compatibility (EMC).

73/23/EEC – Low voltage.

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.

References and associated documents

It is recommended that the following documentation is referred to when installing the SPA1.

Renishaw documents

Documentation supplied on Renishaw UCC software CD.

Document number	Title
H-1000-5056	UCC1 installation guide
H-1000-5057	UCC programmer's guide
H-1000-5058	RENICIS user's guide
H-1000-5067	MCU1 installation and user's guide
H-1000-5223	UCC2 installation guide
H-1000-5227	UCC1 and UCC2 servo tuning user's guide

External documents

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

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

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

Document number	Title
0470-0005	User's guide, 'Mini Maestro™' drive

Safety

Electrical requirements

The SPA1 is powered from the a.c. mains supply via an IEC 320 connector. The operating voltages of the unit are as follows:

90 – 264 V ac 47 – 63 Hz 600 W maximum

This equipment must be connected to a protective earth conductor via a three core mains (line) cable. The mains plug shall be inserted only into a socket outlet provided with a protective earth contact. The protective earth contact shall not be negated by the use of an extension cable without protective conductor.

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

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

Environmental requirements

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

Indoor use	IP30 (no protection against water)
Altitude	up to 2000 m
Operating temperature	0 °C to +50 °C (local to SPA2)
Storage temperature	-10°C to +70°C
Relative humidity	80% maximum (non-condensing) for temperatures up to +31 °C.
	Linear decrease to 50% at +40 °C
Transient overvoltages	Installation category II
Pollution degree	2

NOTE: If a higher IP rating is required, following a risk assessment by the installer of the equipment, an additional external enclosure will be required to house the SPA1.

Contents

1 System description

The servo power amplifier (SPA1) unit is a 3-axis variable speed drive for permanent magnet DC servo motors, designed for use with Renishaw universal CMM controllers (UCC1 or UCC2).

The unit contains three proprietary servo power amplifiers, contactor circuitry and a power supply.

1.1 SPA1 kit components

Two SPA1 kits are available, the contents of these kits being dependent on whether a UCC1 or UCC2 controller is incorporated into the system. These kits contain the following components:

SPA1 kit for UCC1 control A-1333-0008

SPA1 kit for UCC2 control A-5121-0008

All the necessary interconnection connection cables are supplied as components of the appropriate SPA1 kit.

1.1.1 SPA1 kit for UCC1 control (A-1333-0008)

This kit contains three connection cables as listed below:

- MCU (joystick) daughtercard ESTOP connector to UCC1 comms CH1 connector for emergency stop signal.
- SPA1 ‘SPA’ connector to UCC1 ‘servo power amplifier’ connector.
- SPA1 ‘machine I/O’ connector to UCC1 ‘machine I/O connector’, incorporating an additional connector for interconnection of other system signals.

1.1.2 SPA1 kit for UCC2 and UCClite control (A-5121-0008)

This kit contains a signal connection cable whose function is to connect the SPA1 ‘SPA’ connector to UCC2 ‘servo power amplifier’ connector.

NOTE: The cable included in this kit is not compatible with the UCC1 system, connection of this cable to a UCC1 will cause damage to the UCC1.

1.2 SPA1 accessories

1.2.1 Service kits

Two SPA1 service kits are available, the contents of these kits being dependant on whether a UCC1 or UCC2 controller is incorporated into the system. These kits contain the following components:

SPA1 service kit for UCC1 control A-1333-0017

SPA1 service kit for UCC2 control A-5121-0029

1.2.1.1 SPA1 service kit for UCC1 control (A-1333-0017)

This SPA1 service kit contains the following components that will assist in the connection of the SPA1 to a UCC1 controlled system:

- 3 off motor connectors including backshells
- 6 off power pins for motor connectors (7W2)
- 4 off DIL headers
- 4 off 20 KΩ multi-turn potentiometers
- 300 mm length of wire
- 1 off 37-way D connector including backshell for machine I/O connection *****
- 1 off 9-way D connector including backshell for emergency stop connection

1.2.1.2 SPA1 service kit for UCC2 control (A-5121-0029)

This SPA1 service kit contains the following components that will assist in the connection of the SPA1 to a UCC2 controlled system:

- 3 off motor connectors including backshells
- 6 off power pins for motor connectors (7W2)
- 4 off DIL headers
- 4 off 20 KΩ multi-turn potentiometers
- 300 mm length of wire
- 1 off 44 way D connector including backshell for machine I/O connection
- 1 off 9-way D connector including backshell for emergency stop connection

1.2.2 Replacement SPA drives

If required, for support purposes, replacement SPA drives (part number P-MC10-0001) can be ordered from Renishaw.

1.3 SPA1 system layout

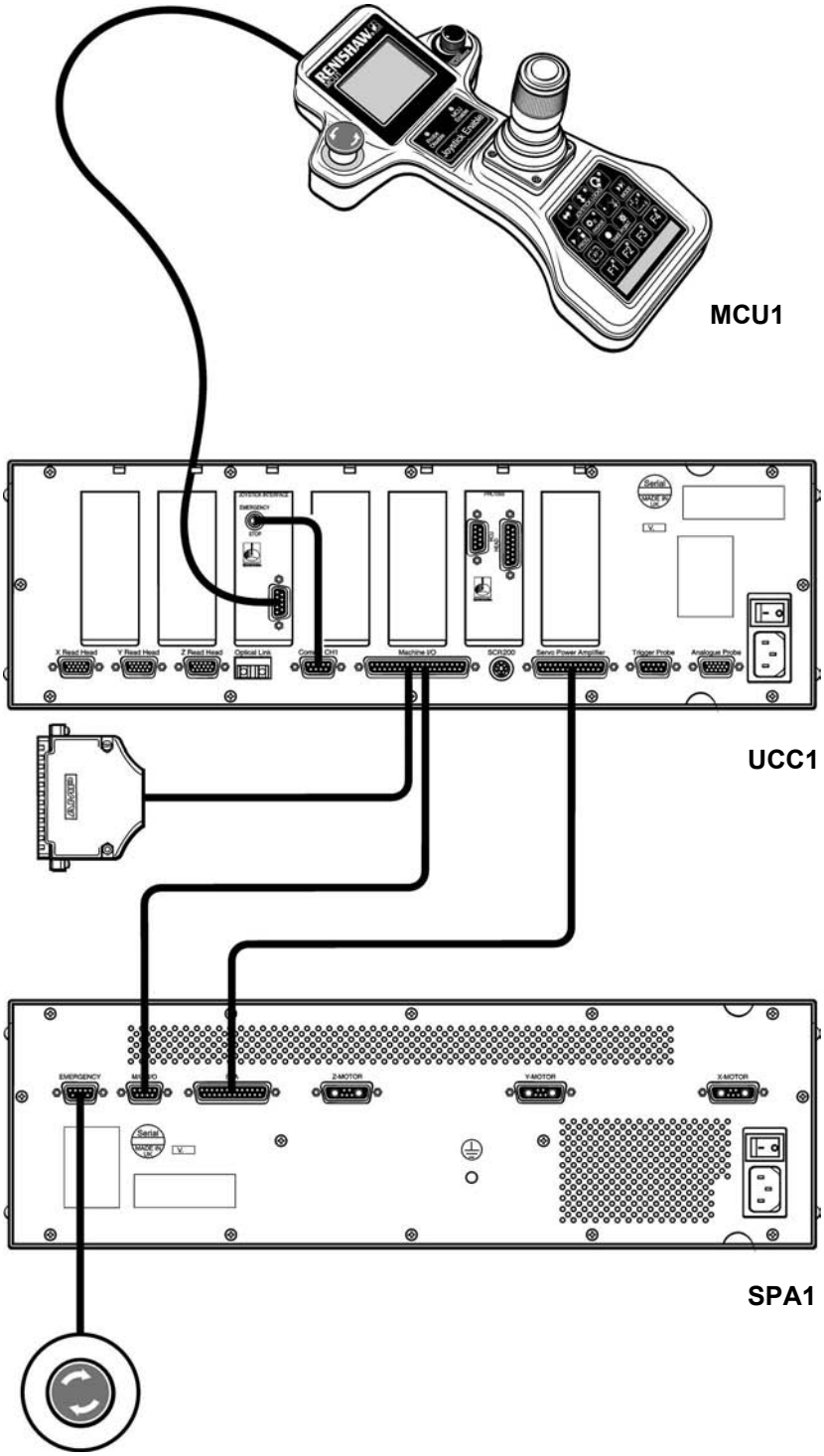


Figure 1 – Simplified SPA1 and UCC1 system layout

1.4 Simplified SPA1 and UCC2 layout

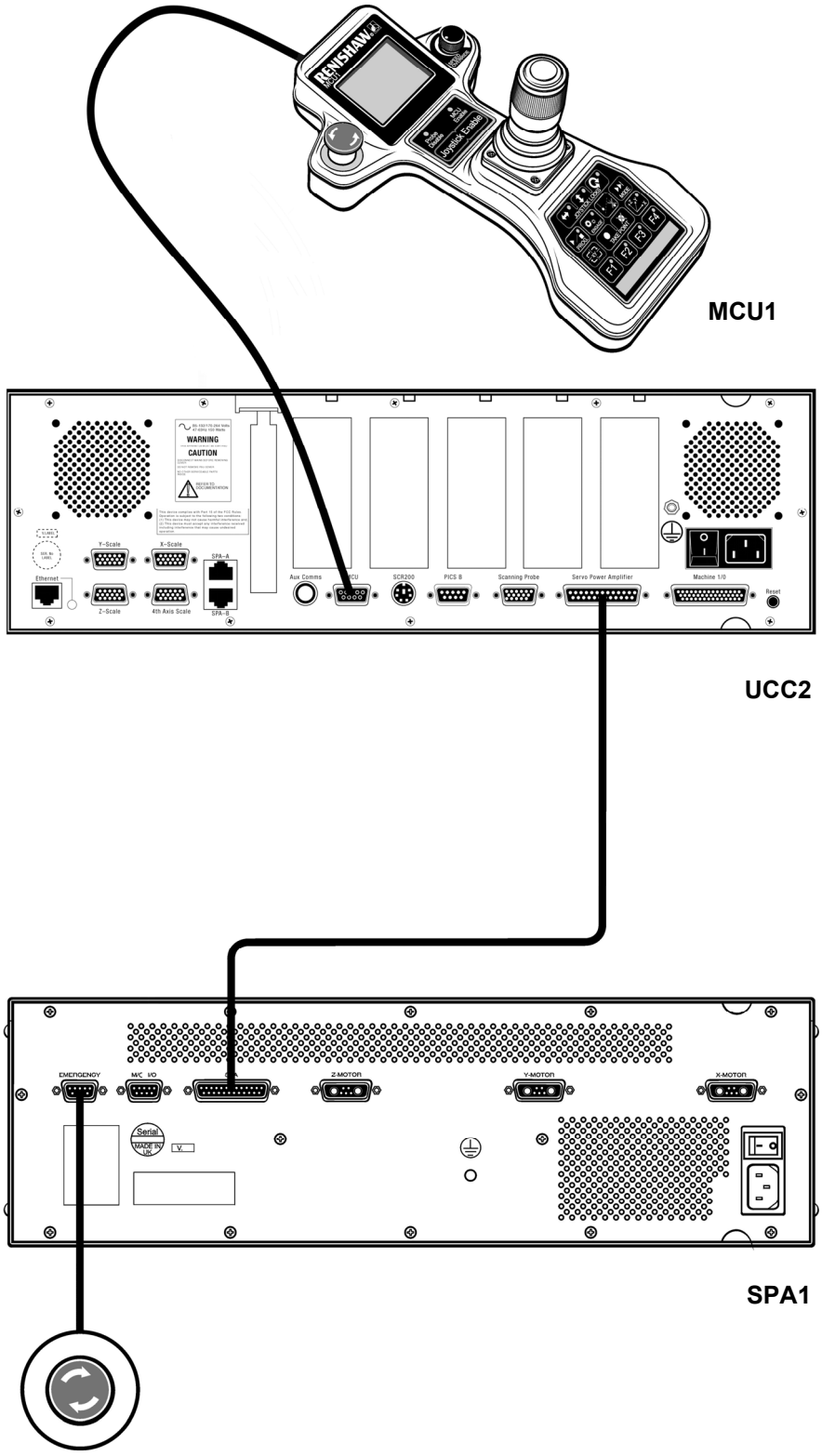


Figure 2 – Simplified SPA1 and UCC2 system layout

1.5 Simplified SPA1 and UCC*lite* layout

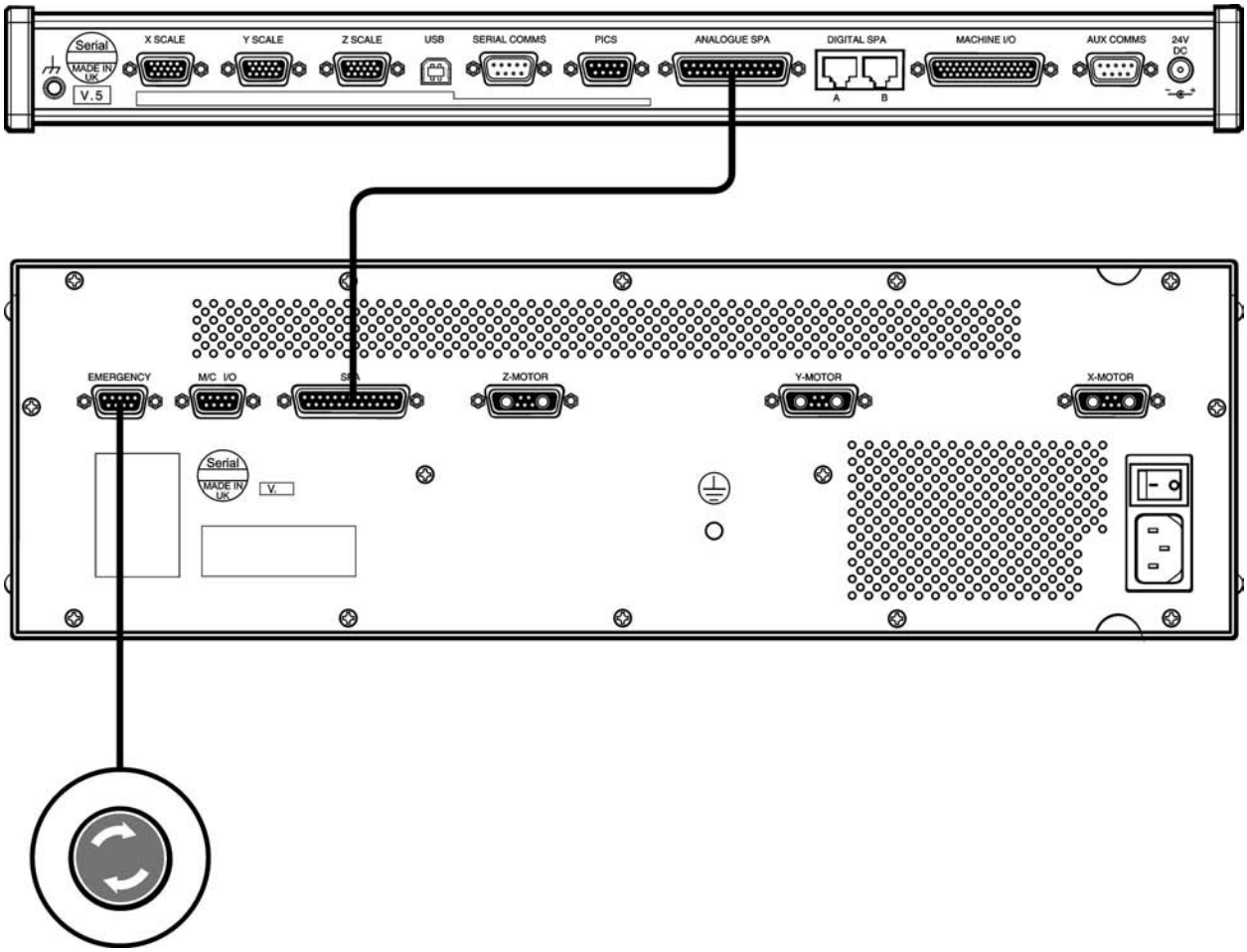
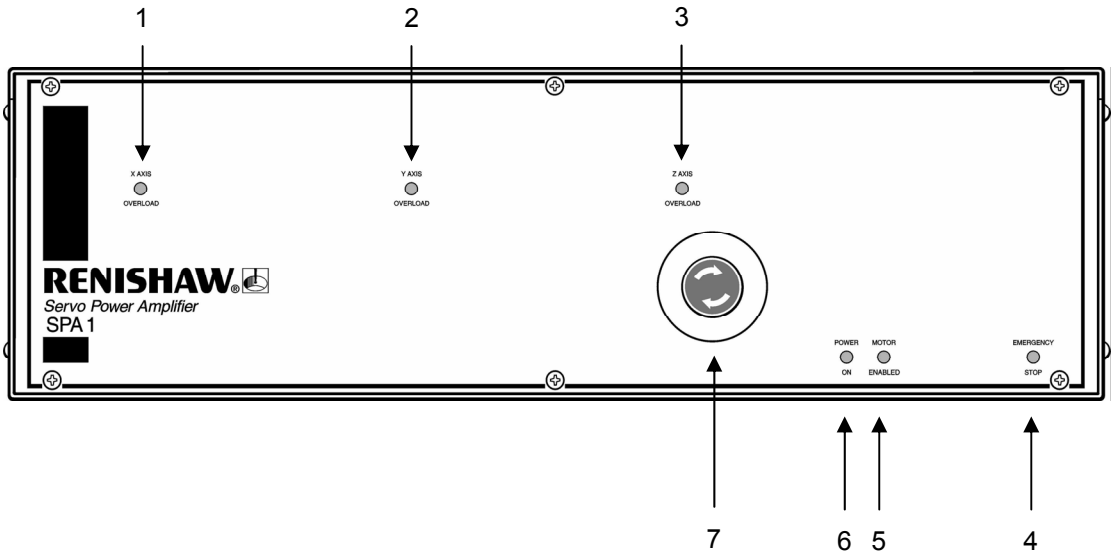


Figure 3 – Simplified SPA1 and UCC2 system layout

2 Front panel description



Key

1. X axis overload indicator (refer to section 2.1)
2. Y axis overload indicator (refer to section 2.1)
3. Z axis overload indicator (refer to section 2.1)
4. Emergency stop indicator (refer to section 2.2)
5. Motor enabled indicator (refer to section 2.3)
6. Power indicator (refer to section 2.4)
7. Emergency stop button (refer to section 2.5)

Figure 3 - Front panel of the SPA1

2.1 Axis overload

There are a number of possible causes for this LED being lit, please refer to the Control Techniques™, 'Mini Maestro™' user guide supplied with the product.

2.2 Emergency stop LED

This LED is lit when the SPA1 is aware of an emergency stop being applied to the system. During normal operation this LED is not illuminated.

2.3 Motor enabled

This LED is lit when the SPA1 servo amps are engaged.

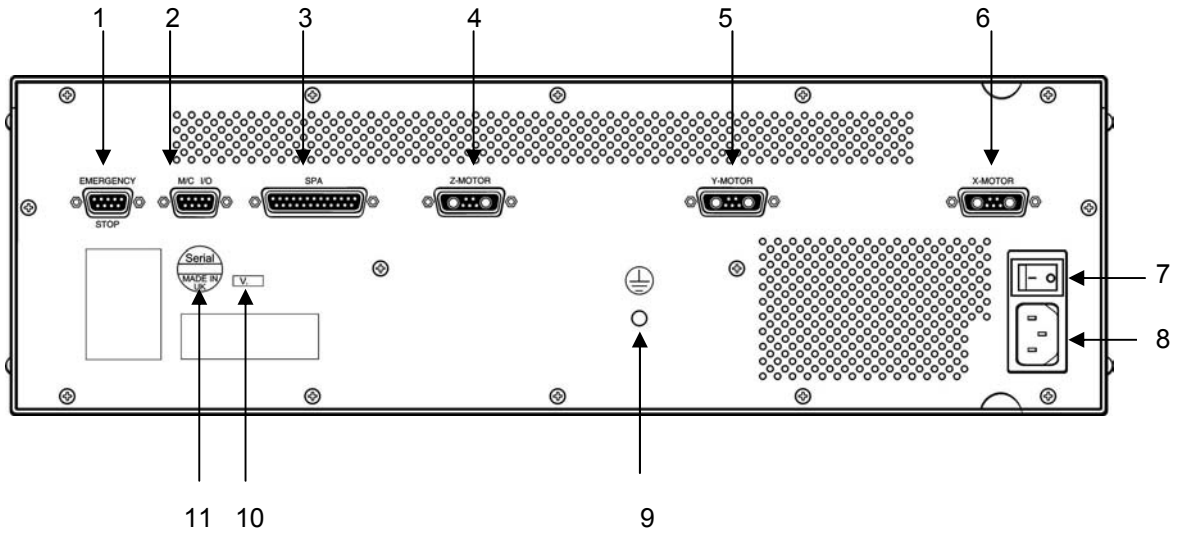
2.4 Power

This LED is lit when there is a mains supply attached to the SPA1 unit.

2.5 Emergency stop button

A normal category ‘B’ emergency stop function is provided within this unit. It is the machine installer's responsibility to add any additional emergency stop switches that the system requires.

3 Rear panel description



Key

1. Emergency stop connector (refer to section 3.1)
2. Machine I/O connector (refer to section 3.2)
3. SPA connector (refer to section 3.3)
4. Z motor connector (refer to section 3.4)
5. Y motor connector (refer to section 3.4)
6. X motor connector (refer to section 3.4)
7. Mains power ON/OFF switch
8. Main power input via an IEC320 connector
9. Earth stud
10. Version number label
11. Serial number label

Figure 4 - Rear panel of the SPA1.

3.1 Emergency stop connector

3.1.1 Connector

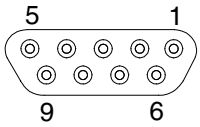


Figure 5 - ESTOP connector (view on face of socket or rear of plug)

3.1.2 Pin-outs

Pin number	Description
1	Not connected
2	Not connected
3	Not connected
4	Not connected
5	Not connected
6	ESTOP A
7	ESTOP B
8	Not connected
9	Not connected
Shell	Gnd

3.2 Machine I/O connector

3.2.1 Connector

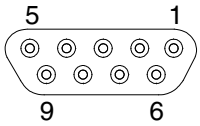


Figure 6 - Machine I/O connector (view on face of socket or rear of plug)

3.2.2 Pin-outs

Pin number	Description
1	Amplifier OK output
2	Not connected
3	Emergency stop output
4	Not connected
5	Motor contactor feedback output
6	Not connected
7	Not connected
8	Not connected
9	Not connected
Shell	Shell and screen

3.3 Servo power amplifier connector

3.3.1 Connector

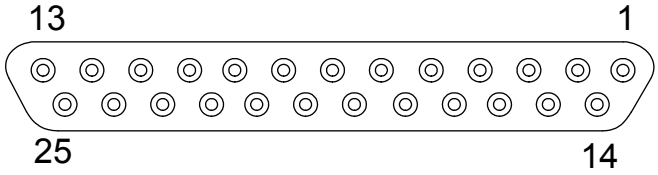


Figure 7 – Servo power amplifier connector (View on face of socket / rear of plug)

3.3.2 Pin-outs

Pin number	Function	Description
1	+24 Vdc	Provided for use on CMM status switches.
2	Contactor	Input signal to control motor contactor
3	Not connected	
4	Amp Control C	Floating collector (amplifier enabling)
5	Amp Control E	Floating emitter (amplifier enabling)
6	ESTOP A	
7	ESTOP B	
8	- Z command	Differential input to CMM Z drive motor
9	+ Z command	Differential input to CMM Z drive motor
10	- Y command	Differential input to CMM Y drive motor
11	+ Y command	Differential input to CMM Y drive motor
12	- X command	Differential input to CMM X drive motor
13	+ X command	Differential input to CMM X drive motor
14	Not connected	
15	Not connected	
16	Command common	Ref. line for power amplifier commands
17	Not connected	
18	Not connected	
19	Not connected	
20	Not connected	
21	Not connected	
22	Mot cont F/B	Motor contactor feedback output
23	Servo amps OK	Amplifier OK output
24	ESTOP tripped	
25	24 V return	Common for dc supply and contactor signal
Shell		Shell and screen

NOTE: Pin functions that are listed as not connected must not be connected.

3.4 Motor connector

3.4.1 Connector

On the rear of the SPA1 unit there are three motor connection channels (X,Y and Z), the function of which are given below:

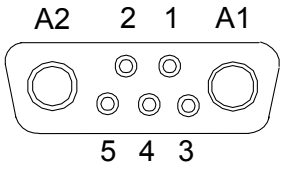


Figure 8 – Motor connection (view on face of socket or rear of plug)

3.4.2 Pin-outs

Pin number	Description
A1	+ Motor output
A2	- Motor output
1	+ Tachogenerator input
2	- Tachogenerator input
3	Not connected
4 (linked to pin 2)	- Tachogenerator input
5	Not connected
Shell	Shell and screen

4 Installing the SPA1

CAUTIONS:

1. Connection to the protective bonding circuit: provision for connecting the complete machine to the protective ground (earthing) is the responsibility of the manufacturer or equipment installer.

2. Isolation: the SPA1 is isolated by removing the mains connector. It is the responsibility of the equipment installer or user to fit additional means of isolation if indicated by risk assessment.

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

NOTE: All of the 'Mini Maestro™' drives must be securely connected to the SPA1 otherwise the emergency stop will be activated.

4.1 Preparation of SPA1 service pack

The SPA1 service pack contains all the components required to construct the following items, which will assist in the connection and set-up of the SPA1 unit.

4.1.1 Motor connectors

The service pack contains three motor connectors that fit the motor output from the SPA1.

Each of the three connector assemblies consist of the following:

- 1 off metal backshell
- 1 off power and signal D-type connector
- 2 off power pins

The power and signal D-type and power pins are of the solder bucket variety and should be fitted to the CMM's wiring by a competent technician or engineer.

4.1.2 20 KΩ potentiometer on DIL header

The 20 KΩ potentiometer on DIL header must be constructed for use (if required) as detailed in section 4.5.1 step 12.

To fit a 20 KΩ potentiometer on DIL header the following procedure is recommended:

1. Place the DIL header on a firm surface.

2. Solder two of the potentiometer legs (centre and one side) to one side of the DIL header, and the other leg to the other side, refer to figure 9 below.

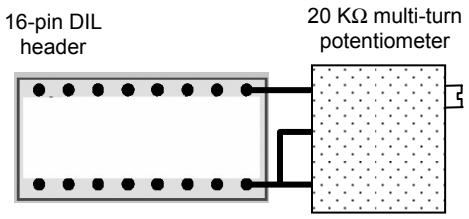


Figure 9 - 20 KΩ potentiometer on DIL header

4.1.3 20 KΩ potentiometer on 150 mm wire

The 20 KΩ potentiometer on 150 mm wire must be constructed for use (if required) as detailed in section 4.5.1 step 3 onwards.

To construct the 20 KΩ potentiometer on 150 mm wire the following procedure is recommended.

1. Take the wire supplied in the SPA1 service pack and cut it in half.

2. Solder one of the wires to two of the potentiometers legs (centre and one side).

3. Solder the second wire to the other potentiometers leg.

4. Solder either of the wires, with the potentiometer fitted to the other end, to pin 1 on the DIL header, refer to figure 10 below.

5. Solder the other wire, with the potentiometer fitted to the other end, to pin 16 on the DIL header, refer to figure 10 below.

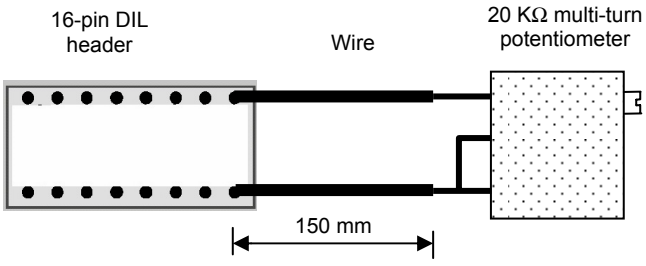


Figure 10 – 20 KΩ potentiometer on 150 mm wire

4.1.4 Emergency stop

WARNINGS:

1. The emergency stop system incorporated in the SPA1 does not comply with standard EN 954-1:1997 (equivalent to ISO 13849-1) - Safety of machinery - Safety related parts of control systems.

2. The installer or the manufacturer of the machine incorporating the SPA1 must ensure (by risk assessment) that an emergency stop system, compliant with the above standards, is not required. Where an emergency stop system compliant with standard EN 954-1:1997 (equivalent to ISO 13849-1) is required, the installer or manufacturer must fit external safety relays to achieve compliance.

NOTE: Emergency stop switches (where required by the manufacturer or installer's risk assessment) must comply with the requirements of standards UL1054/EN60947.

The service pack contains a 9-way D connector and backshell which fits the emergency stop connector from the SPA1.

This connector is of the solder bucket variety and should be fitted to the CMM's wiring by a competent technician or engineer.

4.1.5 Machine I/O connector

Depending on the type of SPA1 service kit that is purchased, the connector for the machine I/O is altered within the service kit.

- For the SPA1 service kit of UCC1 the connector is a 37-way D plug
- For the SPA1 service kit of UCC2 the connector is a 44-way D plug

The connector is of the solder bucket variety and should be fitted to the CMM's wiring by a competent technician or engineer.

4.2 Setting of the motor voltage

The SPA1 has the ability to drive either 24 V or 48 V motors, the factory setting for the unit is the 48 V configuration.

WARNINGS:

1. Before the SPA1 is opened up, mains power to the SPA1 must be switched off.

2. The heat sink on the SPA drives could be warm to touch.

The SPA1 unit contains components that store energy. After power has been removed, the installation engineer should wait a minimum of 30 seconds prior to working within the SPA1's enclosure.

CAUTION: It is essential that full anti-static precautions be taken before working within the SPA1's enclosure.

The following procedure gives instructions to change the configuration of the SPA1 to permit a 24 V motor voltage:

1. Remove AC supply from the SPA1 and disconnect other system cables to CMM.

2. Remove top panel of the SPA1 enclosure ensuring that all fixing screws are retained for future re-assembly. This is completed by removal of a screw from each side of the SPA1 unit towards the front of the enclosure, and removal of the 5 screws across the top of the rear panel of the SPA1. The top of the SPA1 can then be removed by pulling upward on the lid of the unit.

3. Locate the motor voltage configuration as shown in figure 11.

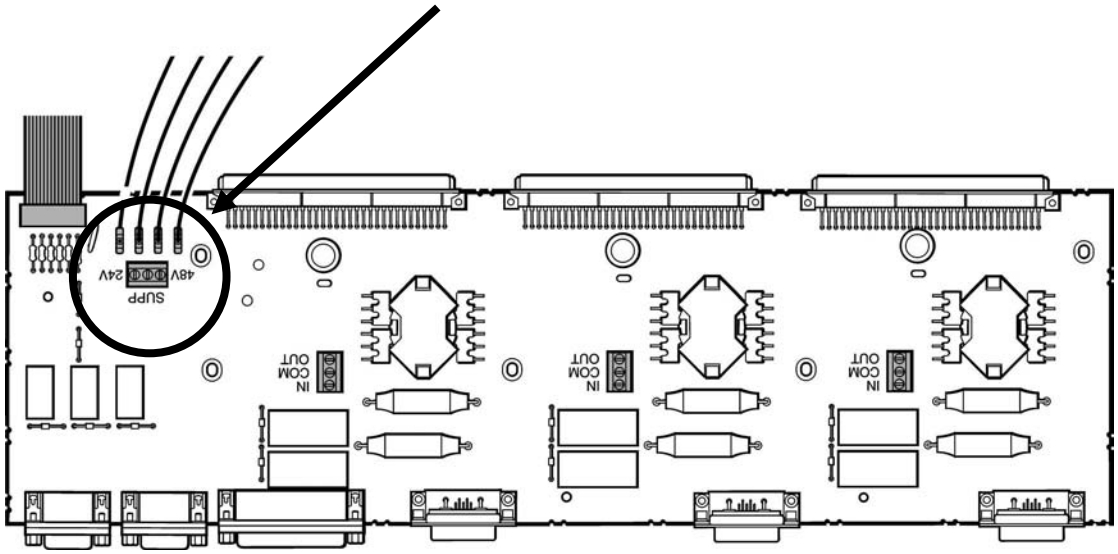


Figure 11 – Motor voltage configuration

4. Changing the motor voltage is achieved by positioning the link wire that is joining the ‘SUPP’ terminal (supply to PCB) to the ‘48 V’ terminal, such that the link wire now joins the ‘SUPP’ and the ‘24V’ terminals. Refer to figure 12.

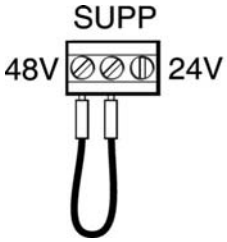


Figure 12 – Identification of the motor voltage configuration terminal

NOTES: Do not overtighten the connector when changing the wire connection within the SPA1 unit. Ensure the screw within the third terminal is tightened.

5. When the motor voltage has been altered then the top panel of the unit must be re-fitted. This is completed by reversal of the method used in step 2.

4.3 Accessing SPA drives

The recommended procedure for accessing the SPA drives located within the SPA1 unit is as detailed below.

1. Remove the front panel of the SPA1 by releasing the 6 fixing screws that restrain the front panel as shown in figure 13.

WARNING: Sharp edges will be exposed when removing the front panel of the SPA1 as the EMC connection strip behind the panel has a serrated edge.

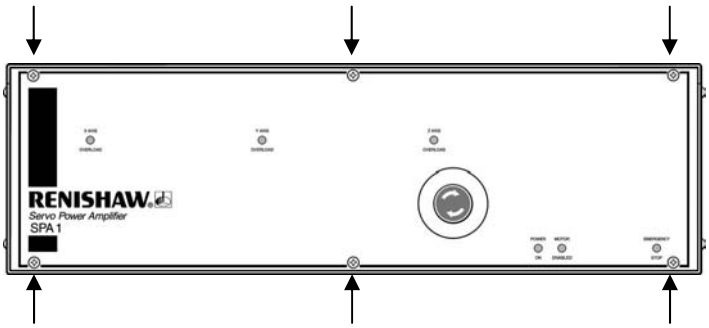


Figure 13 – Front of SPA unit showing screws

CAUTION: Anti-static precautions should be used when handling the SPA drives.

2. Adjust the drives in accordance to section 4.4.

3. Re-fit the SPA1 front panel and secure it using the six fixing screws.

4.4 Functions of the SPA drive potentiometers

The SPA drives have 5 potentiometers located at the front of the SPA1 when fitted. Their functions are detailed below – please refer to figure 14.

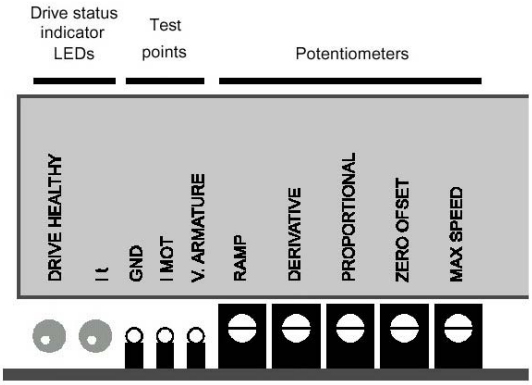


Figure 14 - Locations of potentiometers on the drive

NOTE: For further explanation concerning each potentiometer function listed in this section, please refer to the 'Mini Maestro™' drive user's guide incorporated with the SPA1 kit.

4.4.1 Ramp

Adjust the potentiometer to increase or decrease the time from 0 second to 2 seconds for the motor to reach maximum speed (with a 10 V speed reference signal). To disable ramps, set the potentiometer at the fully anti-clockwise position (this should be the initial starting point position).

4.4.2 Derivative

Turn the potentiometer clockwise to reduce the amount of overshoot in the system response by increasing the derivative gain of the PID amplifier.

4.4.3 Proportional

Turn the potentiometer clockwise to increase the proportional gain of the PID amplifier.

4.4.4 Zero offset

Adjust this potentiometer to cancel any offset in the external speed reference signal.

4.4.5 Max speed

Turn the potentiometer anti-clockwise to reduce the maximum motor speed to 50%. Turn the potentiometer clockwise to increase the maximum motor speed to 120%.

4.5 Adjusting the SPA drives

Please refer to the RENICIS user's guide (H-1000-5058), chapter 6 for the procedure on how to set up the SPA drives.

The 'Mini Maestro™' drive enables the adjustment of various parameters such as peak current, motor internal resistance compensation and armature voltage speed feedback.

Most applications do not require these parameters to be adjusted. However, if adjustment is required please refer to the 'Mini Maestro™' user guide (0470-0005, included with each SPA drive) for guidance.

4.5.1 Max speed adjustment

When using the 'Mini Maestro™' SPA drives and the SPA1, it has been experienced that it is not always possible to achieve the desired maximum move speed by adjustment of the 'MAX SPEED' potentiometer on the drive. If this is the case, the 'RT' resistor on SK1 on the SPA drive will require adjustment (default value = 10KΩ). This resistor normalises the tachogenerator input signal and adapts the drive to the voltage constant of the tachogenerator.

If adjustment to the 'RT' resistor is required then the following procedure is recommended.

WARNINGS:

1. Before the drive is removed from its guide way, mains power to the SPA1 must be switched off.

2. The heat sink on the drive could be warm to touch.

3. Anti-static precautions should be used when handling the SPA drives.

NOTES: This procedure assumes that you have prepared and will be using the SPA1 service pack. (refer to section 4.1).

If more than one axis requires adjustment then this procedure should be repeated for each axis in turn.

1. Remove the SPA drive requiring adjustment from the SPA1 by sliding out the drive from the front of the enclosure.

2. Remove the DIL header fitted to SK1 of the SPA drive that has the 10 KΩ resistor fitted.

3. Set the value of the 20KΩ multiturn potentiometer on 150 mm wire connected to a DIL header (contained in the service pack refer to section 4.1) to 10 KΩ.

4. Fit the 20 KΩ multiturn potentiometer on 150 mm wire connected to a DIL header into SK1.

5. Refit the SPA drive into the SPA1. Be sure to feed the wire with the 20 KΩ multiturn potentiometer so that the potentiometer is at the front of the SPA drive when fitted.

6. Adjust the ‘MAX SPEED’ potentiometer fully anti-clockwise until the end stop click is heard and then adjust the potentiometer 9 turns clockwise (centre position).

7. Follow the ‘Setting the power amplifier velocity gain’ step of the RENICIS UCC1 controller installation program (user’s guide H-1000-5058, chapter 6) and adjust the target speed to 25 mm/s using the tachogenerator potentiometer.

8. Disengage the servos in RENICIS and switch off the mains power to SPA1.

9. Remove the SPA drive from the SPA1 by sliding out the drive from the front of the enclosure.

10. Remove the DIL header fitted to SK1.

11. Measure the value of the potentiometer fitted to the DIL header with a resistance meter. This now determines the required value of the RT resistor.

12. Set the value of one of the 20 KΩ multiturn potentiometer fitted directly to a DIL header (contained in the service pack refer to section 4.4) to the measured value of ‘RT’ (from step 11) and fit into SK1 of the SPA drive, refer to figure 15.

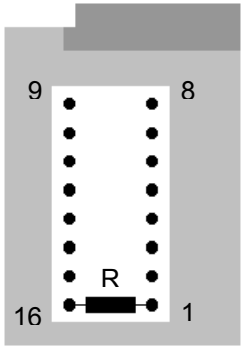


Figure 15 - Location of RT on the drive

13. Re-fit the SPA drive into the SPA1.

NOTES: It is recommended that a fixed resistor of the nearest preferred value should be fitted to a DIL header and used as ‘RT’ if possible.

It is not recommended to retain the potentiometer extended on the wire as this is likely to introduce electrical interference into the tachogenerator circuitry.

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14. The ‘Calc Velocity Gain’ step can be run though again in RENICIS and any adjustment required made using the ‘MAX SPEED’ potentiometer.

4.6 Adjustment of the inductance of the motor drive system

When using the 'Mini Maestro™' drives, where a motor has an inductance of less than 1 mH, it is necessary to have an inductor connected between the motor and the drive. The SPA1 has a 10 mH inductor fitted to the system as default and can be removed if not required.

If the inductance of the SPA1 and motor combination is too high, the CMM will tend to overshoot when positioning. If this happens, remove the inductance by following steps 1 to 6 below.

If the inductance of the SPA1 and motor combination is too low the drive will oscillate and an audible whistle will be heard. If this happens, reinstate the inductance by following steps 1 to 6 below but connect the link between IN and COM in step 4.

WARNINGS:

1. It is essential that full anti-static precautions be taken before working within the SPA1 enclosure.

2. The SPA1 unit contains components that store energy. After power has been removed the installation engineer should wait a minimum of 30 seconds prior to working within the SPA1 enclosure.

1. Remove AC supply from SPA1 and disconnect other system cables to the CMM.

2. Remove top panel of the SPA1 enclosure ensuring that all fixing screws are retained for future re-assembly. This is completed by the removal of a screw from each side of the SPA1 unit towards the front of the enclosure, and removal of the 5 screws across the top of the rear panel of the SPA1. Then the top of the SPA1 can be removed by pulling upward on the lid of the unit.

3. Identify the axis channel that requires the inductor to be removed from the drive system, these are shown in figure 16.

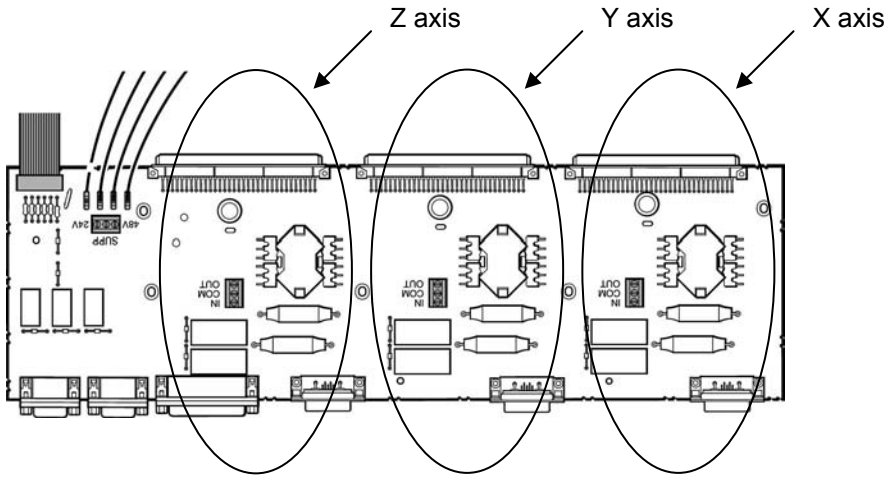
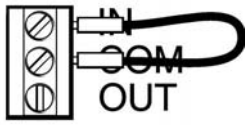


Figure 16 - SPA1 with top of enclosure removed

4. Removal of the inductor from the drive system is achieved by changing the link wire that is joining the ‘COM’ (common) to the ‘IN’ (inductor in circuit) terminals, such that the link wire now joins the ‘COM’ and the ‘OUT’ (inductor out of circuit) terminal. Refer to figure 17.



Key

IN = Inductor in circuit

COM = Common connection

OUT = Inductor out of circuit

Figure 17 – Identification of the inductor configuration terminal

5. The inductor configuration terminal is located towards the rear panel on the SPA1 in the respective axis area as shown in figure 17.

NOTES: Do not overtighten the connector when changing the wire connection within the SPA1 unit. Ensure the screw within the third terminal is tightened.

6. When the respective axis channel has been modified then the top panel of the unit must be re-fitted. This is completed by reversal of the method used in step 2.

7. Re-connect the system cables that were removed from the CMM, then reapply the AC supply to the SPA1.

5 System interconnection diagrams

Many problems can be solved by examining the system's configuration and current conditions. In addition, the RENICIS program provides several functions to assist in SPA1 problem solving and commissioning.

5.1 Cable connections

5.1.1 Emergency stop cable

This cable is designed to connect the E.STOP circuit between the joystick daughter card emergency stop connector and the UCC1 comms channel 1 connector.

The cable configuration for this cable is as specified below.

UCC1 comms 9-way D connector	Function	Joystick daughter card mini lemo connector
6	ESTOP A	C
7	ESTOP B	NOT C
Shell	Screen	Shell

NOTE: This cable is not used when an MCU1 joystick is connected to the UCC2.

5.1.2 SPA cable

This cable is designed to connect all the necessary signals from the SPA1 to the UCC1 units.

The cable configuration for this cable is as specified below:

SPA1 pin number	Function	UCC1 pin number	UCC2 pin number
1	+24 Vdc	1	1
2	Contactor	2	2
3	Reserved	3	Not connected
4	Amp Control C	4	Not connected
5	Amp Control E	5	Not connected
6	ESTOP A	6	6
7	ESTOP B	7	7
8	- Z command	12	12
9	+ Z command	13	13
10	- Y command	10	10
11	+ Y command	11	11
12	- X command	8	8
13	+ X command	9	9
14	Reserved	Not connected	Not connected
15	Reserved	Not connected	Not connected
16	Command common	16	Not connected
17	Reserved	Not connected	Not connected
18	Reserved	Not connected	Not connected
19	Reserved	Not connected	Not connected
20	Reserved	Not connected	Not connected
21	Reserved	Not connected	Not connected
22	Mot cont F/B	Not connected	22
23	Servo amps OK	Not connected	23
24	ESTOP tripped	Not connected	24
25	24 V return	25	25
Shell	Shell and screen		

5.1.3 Machine I/O cable

This cable is designed to connect some functions from the machine I/O connector from the UCC1 to the machine I/O connector on the SPA1, also giving the ability to attach external connections to the system through the additional connector.

The cable configuration is as specified below:

UCC1 machine I/O connector pin number	Function	SPA1 machine I/O connector pin number	Additional machine I/O connector pin number
1	+24 Vdc	-	1
2	Reserved	-	2
3	Reserved	-	3
4	Reserved	-	4
5	Reserved	-	5
6	Output 0	-	6
7	Output 1	-	7
8	Output 2	-	8
9	Output 3	-	9
10	Output 4	-	10
11	Output 5	-	11
12	Output 6	-	12
13	Input 0	-	13
14	Input 1	-	14
15	Input 2	-	15
16	Input 3	-	16
17	Input 4	-	17
18	Input 5	-	18
19	Input 6	1	-
20	Input 7	-	20
21	Emergency stop	3	21
22	Air pressure	-	22
23	Crash	-	-
24	Contactor feedback	5	-
25	X+ outer limit	-	25
26	X- outer limit	-	26
27	Y+ outer limit	-	27
28	Y- outer limit	-	28
29	Z+ outer limit	-	29
30	Z- outer limit	-	30
31	X+ inner limit	-	31
32	X- inner limit	-	32
33	Y+ inner limit	-	33
34	Y- inner limit	-	34
35	Z+ inner limit	-	35
36	Z- inner limit	-	36
37	24V return	-	37
Shell	Shell and screen	Shell	Shell

NOTE: A 44 way to 37 way adaptor cable (part number A-5121-0060) is required to connect this cable to the UCC2 controller.

6 Maintenance

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

Periodically check the security of the mounting screws and electrical connectors.

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

Periodical safety checks should include the function of the emergency stop system and must also include operation of all switches integrated into the system. After operation of the emergency stop system the SPA1 should be checked to ensure servo power can again be engaged.

Remove dust from the external surfaces with a clean, dry cloth as the unit is not sealed against fluids/water.

7 Testing and verification

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

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

8 Revision history

Issue 01-A

- First issue – Beta release.

Issue 02-A

- Production release of unit.
- Inclusion of 24 V motor supply option.

Issue 03-A

- AC voltage limits and frequency range revised.
- Additional warnings, cautions and notes added.
- New 'Testing and verification' section added.

Issue 04-A

- Clarification of SPA connector pin outs in section 3.3.
- Inclusion of UCC2 kit options in secion 1.
- New interconnect diagrams in section 1.4.
- UCC2 cabling variations in section 5.1.

Issue 04-B

- Error corrected in table in section 5.1.3. SPA1 machine I/O connector pin number 3 to ‘emergency stop’ not ‘crash’.

Issue 05-A

- Addition of UCClite product.

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