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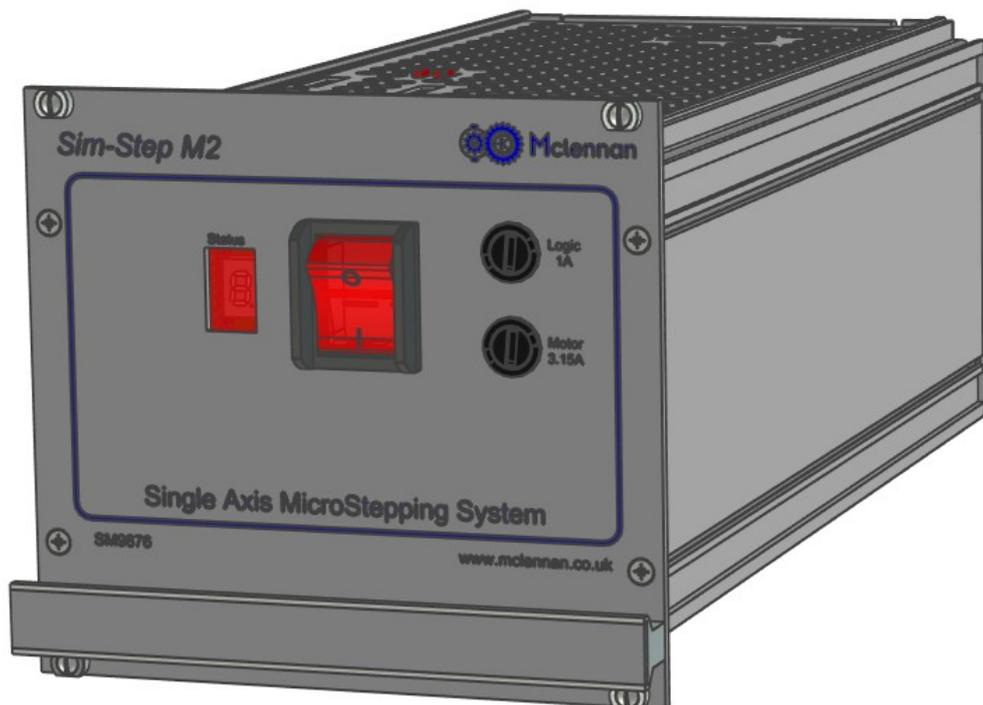
Mclennan

User Manual
for

Sim-Step M2

Microstepping Single Axis
Stepper Drive & Controller

User Manual for *Sim-Step M2*
Single Axis Stepper Motor Drive and Controller

Mclennan Drg. No. 5405 Issue B

Associated Documents:

MSE570M Data Sheet
PM1000 Manual

Software:
McTerminal Terminal and Monitor Program

The associated documents are available from the technical documents section of our web site www.mclennan.co.uk

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SAFETY NOTICE

Position control systems are inherently hazardous. Even a small motor, if coupled to a leadscrew, gearbox, or any other form of mechanism that provides a mechanical advantage, can generate considerable force and could cause serious injury. Incorrect operation can also lead to damage to the motor or associated machinery. It is essential that the purpose of the various fault detection features built into the *Sim-Step M2's* MSE1000 controller be fully understood and used correctly.

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1   Description

The system is a single axis stepper motor control and drive rack. Motor motion is commanded either from a computer or from a terminal via the RS232 (or RS485) serial data port or from a manual Jog Box or Joystick controller. The controller can drive stepper motors in open-loop (step counting) mode or encoded motors/mechanisms in closed-loop mode.

The controller consists of:

1	MSE570M 4.0A Microstepping Drive
1	MSE1000 Motor Controller
1	MSB867 Backplane
1	MSE779 Power Supply Board

These are mounted in a 3U high 28HP rack unit. The **Sim-Step M2** is supplied with a mains lead, an RS232 cable and an RS232 terminator. A range of standard motor, encoder, limits/datum and I/O cables are available.
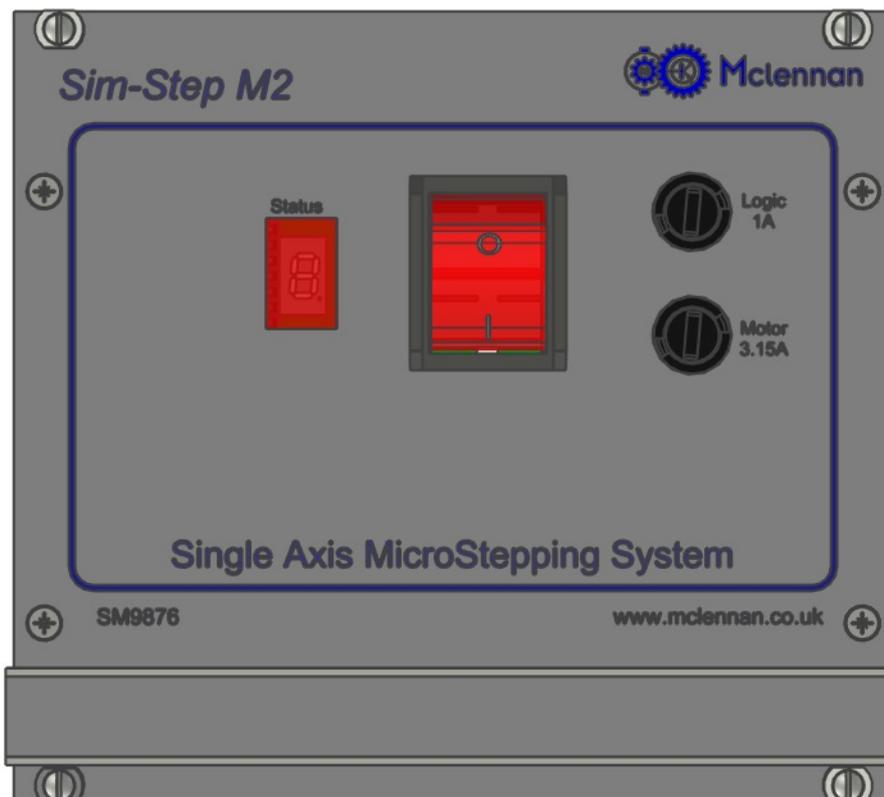

*Fig.1.1 **Sim-Step M2** Front View*

The system has a MSE1000 motion controller and a MSE570M microstepping drive powered by a power supply based on the MSE779 power supply board.

The MSE1000 controller and the MSE570M plug into the MSB867 backplane. *Step, clock* and *direction* signals from the MSE1000 are fed to the MSE570M microstepping drive. The bipolar stepper motor is connected to the MSB867 backplane via a rear panel connector.

The MSE1000 position controller generates the *clock* and *direction* signals for the MSE570M drive in response to move commands.

The MSE1000's *Enable* output is connected to the *enable* input of the MSE570M drive. If the MSE1000's *Enable* output is turned off (e.g. as a result of an error) the motor current will turned off. The *Enable* output may also be turned off by an **AB** *abort* command, or *reset* (turned on) by an **RS** command.

An incremental encoder can be fitted to the motor or mechanism to monitor the movement of the mechanism. The quadrature signals from the encoder are connected to the MSE1000 to allow passive closed-loop operation. The system is initially supplied with the MSE1000 configured for open-loop operation. The MSE1000 must be reconfigured for closed-loop operation.

Absolute (SSI or BiSS) encoders may be used in a similar manner.

The power supply provides +24V (nominal) to energise the supply rail on the MSE1000 controller, and +40V (nominal) to energise the supply rail on the MSE570M drive.

The PM1000 manual (applicable to MSE1000) referred to in this document can be found on www.mclennan.co.uk.
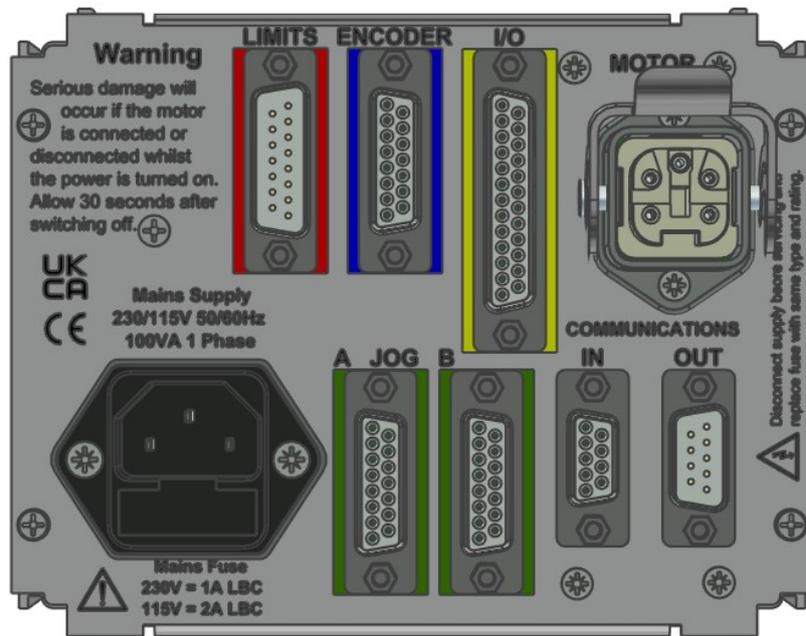
1.1   Rear View:

*Fig.1.2 **Sim-Step M2** Rear Panel*

Connections for motors, limits/datum, I/O, encoders, RS232 and mains are taken from the MSB867 backplane to connectors on the rear panel.

The **MAINS** input is a filtered IEC inlet.

The **MOTOR** connector has outputs from the MSE570M Micro stepper drive to connect to a bipolar stepper motor.

> **WARNING!   Serious damage will occur if the motor is connected or disconnected whilst the power is switched on. Allow 30 seconds after switching off.**

The **LIMITS/DATUM** connectors have inputs for the Upper and Lower Limit switches, a Datum Approach switch and a Datum Stop switch. The connections to the Limit switch inputs must be **made** for normal operation of the MSE1000 controllers.

> **Limit switches must not be used as a safety device or part of a safety system for ensuring the safety of persons**

The **ENCODER** connector is for the position encoder input. It has a +5V supply to energise the encoder, complementary *quadrature* inputs and complementary *index* inputs for incremental encoders or clock (output) and data (input) signals for absolute encoders.

The **JOG A** and **JOG B** connectors have inputs for Jog pushbuttons, a Joystick control and data connections for a JC809 Jog Box.

They have connections for Jog, Jog- and Jog Fast pushbuttons compatible with a JC100 Jog Box and +5V, 0V Joystick input and Joystick centre tap compatible with a JC400 Joystick. The JC100 and JC400 may be plugged into either connector.

If using a JC809 Multi axis jog box, the axis address that is assigned to Jog is set on the MSE1000 address select switch (previously set on MSB867 interface board using a rotary switch). The JC809 can be connected to other axes by using a 'Jog daisy-chain' cable plugged into the vacant **JOG A** or **JOG B** connector. The Jog Terminator supplied with the JC809 must be plugged into the vacant connector in the last axis in the daisy-chain.

The **I/O** connector has inputs and outputs from MSE1000's *Read* inputs and *Write* outputs.

There are also connectors for **RS232 IN** for connecting to the computer or terminal that supplies the control data and **RS232 OUT** for connecting either to a subsequent control rack (*daisy-chain*) or to an RS232 terminator. These connectors can also be configured for RS485 communications (see section 1.2/1.3).

Note: The RS232 Terminator supplied with the control system **MUST** be fitted to the last unit in the *daisy-chain* (when using RS232 communications). This allows both replies from, and commands sent to, the controller to be echoed back.

> **WARNING!   To avoid overheating, the vents in the top and bottom of the unit must be unobstructed at all times.**

1.2 Link Settings for legacy *Sim-Step M* (Skip to 1.3 for *Sim-Step M2*)

The control operation of the *Sim-Step M* can be configured by means of links fitted to the MSE867. The links can be accessed by removing the rear top cover of the unit.
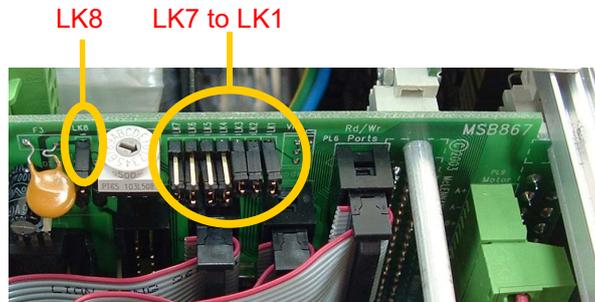
Fig. 1.3 Link Location

Link	Action	Default
LK1	Not applicable for *Sim-Step M*	On
LK2	Drive over-temperature activates MSE1000 *abort stop* input	On
LK3	Drive overload activates MSE1000 *abort stop* input	On
LK4 to LK7	1-2 selects RS485, 2-3 selects RS232	RS232
LK8	Select internal (on) or external (off) *abort stop*	Internal

LK1   Not applicable for *Sim-Step M*.

LK2   If LK2 is ON, an over-temperature fault detected on the drive output stage will cause the controller *abort stop* input to be activated.

LK3   Likewise if LK3 is ON, an overload fault detected on the drive output stage will cause the controller *abort stop* input to be activated.

LK4-7   These two position links select either the RS232 or RS485 communication interfaces. When the links LK4 to LK7 are all in the 1-2 position, RS485 is selected and when all in the 2-3 position, RS232 is selected (default).
If using RS485 communication, The last *Sim-Step M* in the line should have SW3–8 on the MSE1000 switched to the ON position (this selects a 100Ω terminating resistor) or an external line terminator fitted.

LK8   If LK8 is removed (OFF) the external 'Abort Stop' input selected. Pins 7 and 14 on the **Limits/Datum** connector must be linked (via a normally-closed contact or switch) to enable moves.

1.3   DIP switch settings for *Sim-Step M2*
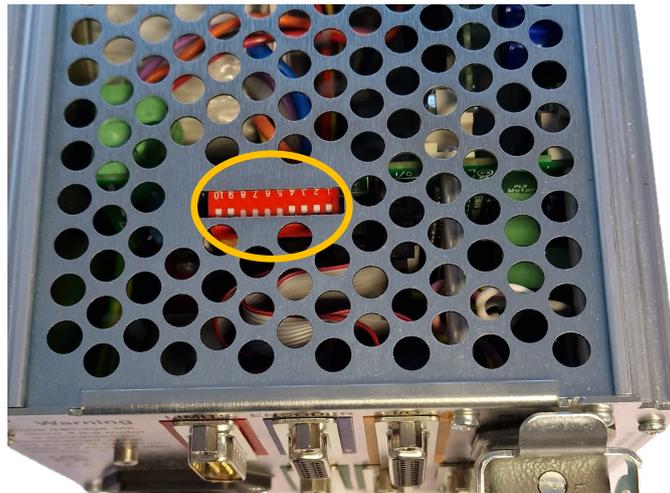
Fig. 1.4 Link Location

In the ***Sim-Step M2*** model, the links of the old the motherboard have been replaced by a DIP switch. The switch functions are:

Switch bit	Function	Switch ON for	Default
1	Idle current reduction	Automatic drive current reduction when idle	ON
2	Overtemperature abort	Force Input Abort when overtemperature fault detected by drive	ON
3	Overload abort	Force Input Abort when overload fault detected by drive	ON
4	Inhibit external abort	Suppress requirement for Abort Stop connection on Limits connector	ON
5	RS485 (In 1)	RS485 communication	OFF
6	RS485 (In 6)	RS485 communication	OFF
7	RS485 (Out 1)	RS485 communication	OFF
8	RS485 (Out 6)	RS485 communication	OFF
9	RS232 (In 1-4)	RS232 communication	ON
10	RS232 (In 6-4)	RS232 communication	ON

Switch bit 1 is only appropriate for the non-microstep version, as the Sim-Step M uses the DIP switches on the MSE570M drive to select the amount of current reduction at standstill.
Switch bits 2 & 3 make the MSE1000 controller go into an Abort state if there is a fault detected by the MSE570 drive, so the user can be aware of it. The only reason for switching these off would be for diagnosis.
For RS232 communication (default), **bits 9 & 10** should be **ON** and **bits 5, 6, 7 & 8** should be OFF (and SW3 bit 7 of the MSE1000 should be OFF).
For RS485 communication, **bits 5, 6, 7 & 8** should be **ON** and **bits 9 & 10** should be OFF (and SW3 bit 7 of the MSE1000 should be **ON**).

2   External Interface Connections

MAINS supply	
Connector type: IEC chassis plug	
Terminal	**Connection**
L	Live input 115/230V AC (Internally selectable)
N	Neutral input
E	Earth. **THIS UNIT MUST BE EARTHED**

MOTOR	
Connector type: HAN-4A socket	
Mating Cable: 507MOCxx892 (xx = length)	
Terminal	**Connection**
1	Motor Phase A+
2	Motor Phase A-
3	Motor Phase B+
4	Motor Phase B-
E	Screen

LIMITS/DATUM	**RED**
Connector type: 15 way 'D' Plug	
Mating Cable: 507LDCxx894 (xx = length)	
Terminal	**Connection**
1	
2	0V
3	Upper Limit Input -
4	Lower Limit Input -
5	Datum Approach Input -
6	Datum Stop Input -
7	Abort Stop – (selected by internal link LK8)
8	
9	
10	Upper Limit Input + (24V)
11	Lower Limit Input + (24V)
12	Datum Approach Input + (24V)
13	Datum Stop Input + (24V)
14	Abort Stop + (24V)
15	

Link pins 3 and 10 to enable positive moves
Link pins 4 and 11 to enable negative moves
Link pins 5 and 12 for fast datum search
If external 'Abort Stop' selected, link pins 7 and 14 to enable moves.

ENCODER		BLUE
Connector type: 15 way 'D' socket		
Mating Cable: 507ENCxx893 (xx = length)		
Terminal	Connection Incremental	Absolute SSI/BiSS
1		
2	0V	0V
3	Channel A-	CLK+ (MA+)
4	Channel B-	
5	Channel I-	Data+ (SLO+)
6		
7		
8		
9	+5V	+5V
10		
11	Channel A+	CLK- (MA-)
12	Channel B+	
13	Channel I+	Data- (SLO-)
14		
15		

I/O	YELLOW
Connector type: 25 way 'D' socket	
Mating Cable: 507IOCxx895 (xx = length)	
Terminal	Connection
1	Write Port 1
2	Write Port 2
3	Write Port 3
4	Write Port 4
5	Write Port 5
6	Write Port 6
7	Write Port 7
8	Write Port 8
9	Write Port Common (Isolated Supply)
10	+VLL (Controller Supply)
11	
12	
13	
14	Read Port 1
15	Read Port 2
16	Read Port 3
17	Read Port 4
18	Read Port 5
19	Read Port 6
20	Read Port 7
21	Read Port 8
22	Read Port Common (Isolated 0V)
23	0V (Controller 0V)
24	
25	

Refer to PM1000 Manual for typical connections.

JOG A and JOG B	GREEN
Connector type: 15 way 'D' socket	
Compatible with JC100, JC400 and JC809 manual controls	

Terminal	Connection
1	Jog Common (~+24V)
2	0V
3	Jog + Input
4	Jog – Input
5	Jog Fast Input
6	
7	
8	
9	Joystick Supply (+5V)
10	Joystick Input
11	
12	Joystick Centre Tap Input
13	
14	Data A
15	Data B

RS232 IN		
Connector type: 9 way 'D' type socket		
Terminal	RS232 Connection	RS485 Connection
1		RS485-A (+)
2	Transmit Data	
3	Receive Data	
4		
5	0V	
6		RS485-B (-)
7	CTS	
8	RTS	
9		

RS232 OUT			
Connector type: 9 way 'D' type plug			
Terminal	RS232 Connection		RS485 Connection
1			RS485-A (+)
2	Receive Data	Link to echo replies and commands	
3	Transmit Data		
4			
5	0V		
6			RS485-B (-)
7	RTS	Link to echo replies and commands	
8	CTS		
9			

3   Cables

3.1   Motor and Limit/Datum cables

Motor and limit / datum cables fitted with connectors to plug into the rear panel of the *Sim-Step M2* may be specified. The available lengths are shown below. The motor cables have a connector on both ends, which can be connected either to the connector fitted to the stepper motor or to the stepper motor wires via an MSA889 Junction Box.

Likewise, the *Limit* and *Datum* connections can be made either by connecting to the socket on the end of the cable or via an MSA889 junction box. The connections to the MSA889 junction box are shown in figures 4.2 and 4.3.

Limit/Datum Cables

Length	Type
1 m	507LDC**01**894
2 m	507LDC**02**894
3 m	507LDC**03**894
5 m	507LDC**05**894
10m	507LDC**10**894

Limit/Datum Cable

Junction Box Type MSA889

Motor Cable

- Limit   Datum   + Limit

Motor

Motor Cables

Length	Type
1 m	507MOC**01**892
2 m	507MOC**02**892
3 m	507MOC**03**892
5 m	507MOC**05**892
10m	507MOC**10**892

Fig. 3.1 Motor and Limit/Datum Cables

3.2   Electro-magnetic Compatibility (EMC)

The *Sim-Step M2* complies with EN-50081-1 and EN50082-1 when properly used with cables that use EMC connectors. The cable used to connect the motor to the drive should be a screened, twisted pair type. The screen should be connected at both ends of the cable. On the drive end, the screen should be connected to earthed metalwork of the case and on the motor end, the screen should be connected to the motor body.

The EMC profile may be improved by fitting ferrite sleeves to the motor cables. For cable diameters from 7mm to 8.5mm use RS part number 260-6492. For cable diameters from 8.5mm to 10mm use RS part number 309-7962.

3.3   Encoder Cables

The *Sim-Step M2* can be connected to the encoder via an encoder cable that is equipped with connectors at each end. One connector plugs into the controller, the other into the motor-encoder extension cable as shown in fig 3.2.
Alternatively, if the motor has a connector box, the cable can be plugged in directly.
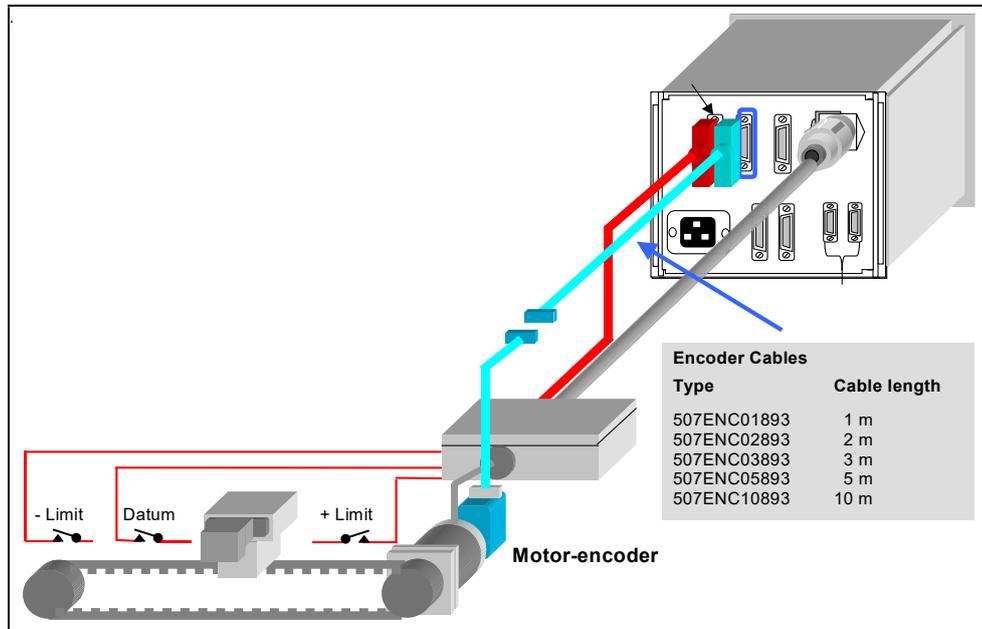

Encoder Cables

Type	Cable length
507ENC01893	1 m
507ENC02893	2 m
507ENC03893	3 m
507ENC05893	5 m
507ENC10893	10 m

Fig. 3.2 Encoder Cable

3.3.1   Typical Motor Encoders

Frame size	Motor Encoder	Order Code
Size 23	23HSX-206 CI 500L	301HSE00053
	23HSX-306 CI 500L	301HSE00054
Size 34	34HSX108E5-1000L	301HSE00094
	34HSX208E5-1000L	301HSE00093

4   Motor Connections

4.1   Colour Code for 8 lead motors:

The motor will have eight leads that can be identified as shown in figure 4.1.
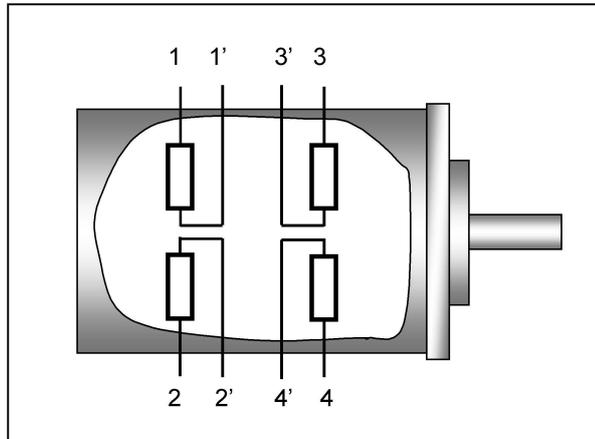
Fig. 4.1 Eight lead 23 & 34 frame size motors

Motor	Lead identification							
	1	1'	2'	2	3	3'	4'	4
HS Series	Red	White/ Red	White/ Yellow	Yellow	Black	White/ Black	White/ Orange	Orange
or	Red	Black	White	White/ Red	White/ Green	White/ Black	Orange	Green
23HSX	Red	White/ Red	White/ Yellow	Yellow	Orange	White/ Orange	White/ Brown	Brown
34HSX	Red	White/ Red	White/ Yellow	Yellow	Black	White/ Black	White/ Orange	Orange

The motor can be connected into the MSA889 junction box as shown in fig. 4.4. Internal links select parallel or series operation. This function is shown in figures 4.2 and 4.3.
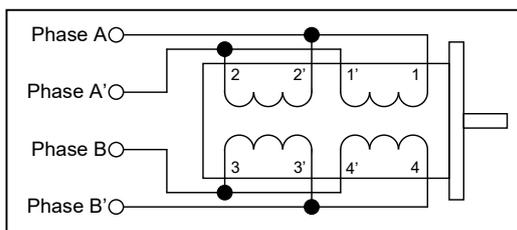
Fig. 4.2 Coils in Parallel
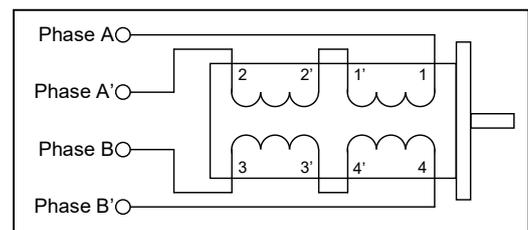
Fig. 4.3 Coils in Series

The maximum drive current for coils wired in parallel is the unipolar motor phase current rating x $\sqrt{2}$. The maximum drive current for coils wired in series is the unipolar motor phase current rating / $\sqrt{2}$.

To reverse motor direction, swap the connections to **one** phase. E.g., swap B with B'.

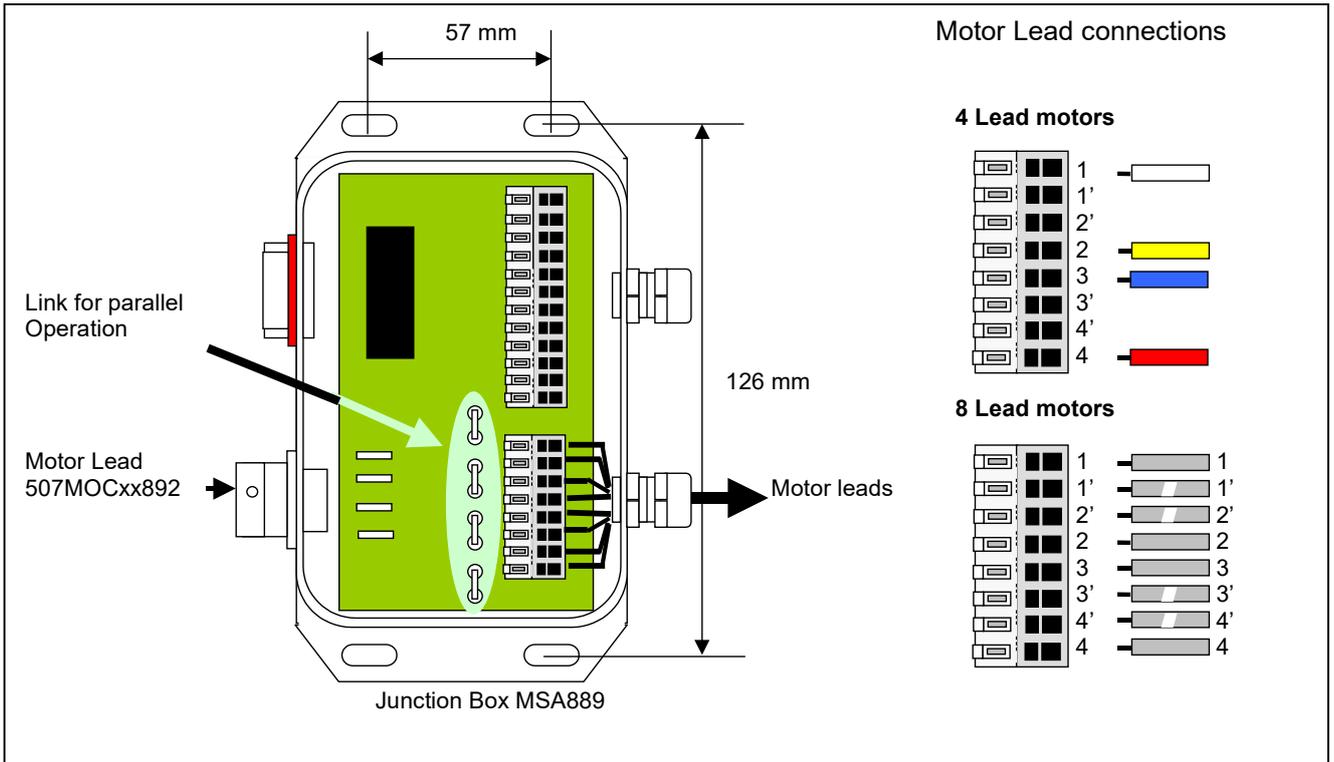## 4.2 Connecting To The MSA889 Junction Box
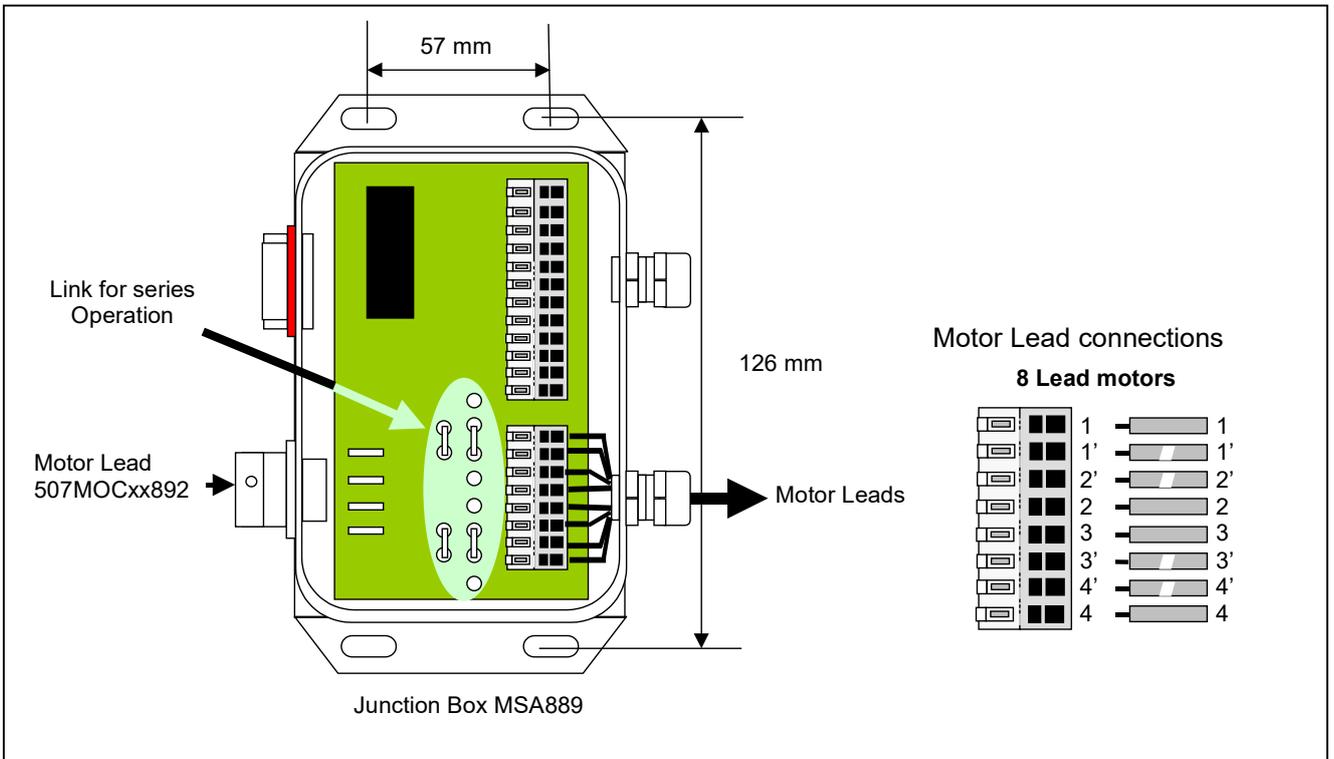

Fig. 4.4 Parallel Motor Coil Connections

Fig. 4.5 Series Motor Coil Connections
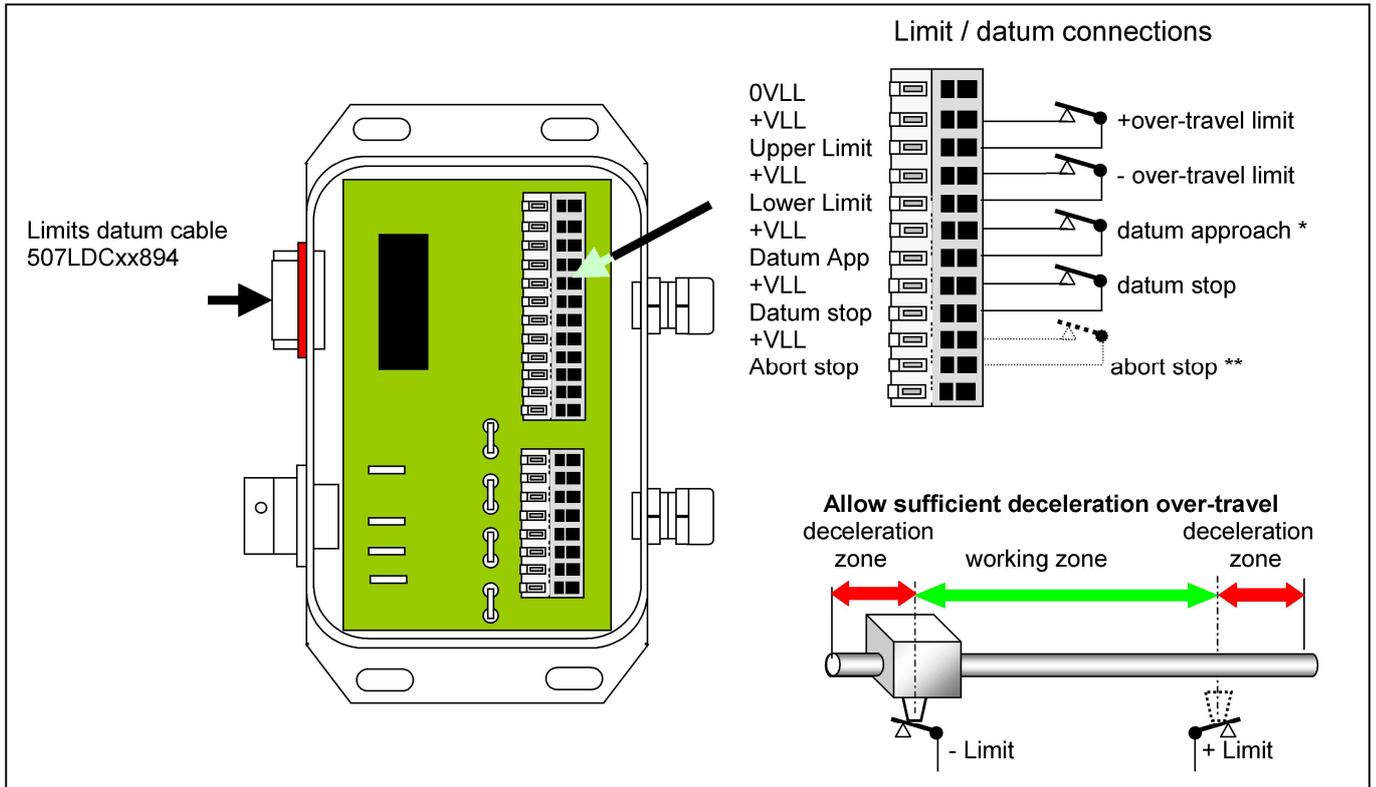
4.3   Connection of Limits And Datum

Fig. 4.5 Limit/Datum Connections

All limit and datum signal inputs should utilise normally closed contacts.

Note*   The datum approach signal is not always required. This is the case when:
   a)   The motor is operated at slow (creep speed) since it is not necessary to decelerate before stopping at the datum point. In this case the datum approach terminals should not be connected.

   b)   When the controller is configured to utilise the high-speed datum registration feature. In this case, the datum approach connections should be linked or a switch utilised to dictate the slow-down position.

Note **   This connection enables an external open contact to abort a move. However for this feature to be utilised it is necessary to remove an internal link LK8/Switch bit 4 within the controller.

It should be noted that the limit switches should be placed sufficiently within the total travel distance to allow the motor to decelerate from high speed.
They should also be mounted for sliding operation, so that they do not become crushed on first use. No mechanism can decelerate instantaneously.

4.3.1 Datum Position

The *datum* position is detected as the *datum stop* switch opens. It is also summed with the encoder *index* signal (if fitted). For further information, refer to the Datum Search Strategies section of the PM1000 manual.

4.3.2 Using Over-travel limits as datum inputs.

In applications where space is limited, the over-travel limit switches may also be used as the datum stop switch. In the example shown the lower limit switch is also connected to the datum stop input and the controller is configured to utilise the high-speed datum approach facility.
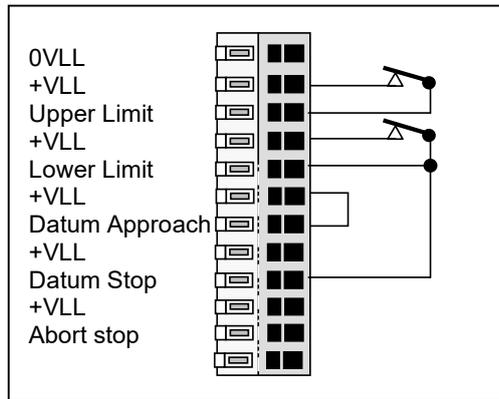

Fig. 4.6 Limit/Datum Connections

5   Power Supply Unit

The power supply unit used in this system has been designed to energise an MSE570M microstepping drive and a MSE1000 Position Controller.

It provides the unregulated logic supply of +24V (nominal) to the MSE1000, and an unregulated supply of +40V (nominal) to the MSE570M.

There is a mains fuse fitted in the mains inlet, its rating is 2A anti-surge. There are two front panel fuseholders that protect the DC outputs of the power supply. The rating of the fuses are 3.15A for the motor rail and 1A for the logic rail.

The mains voltage may be changed from 230V to 115V by changing the position of the links on the MSE779 PCB.
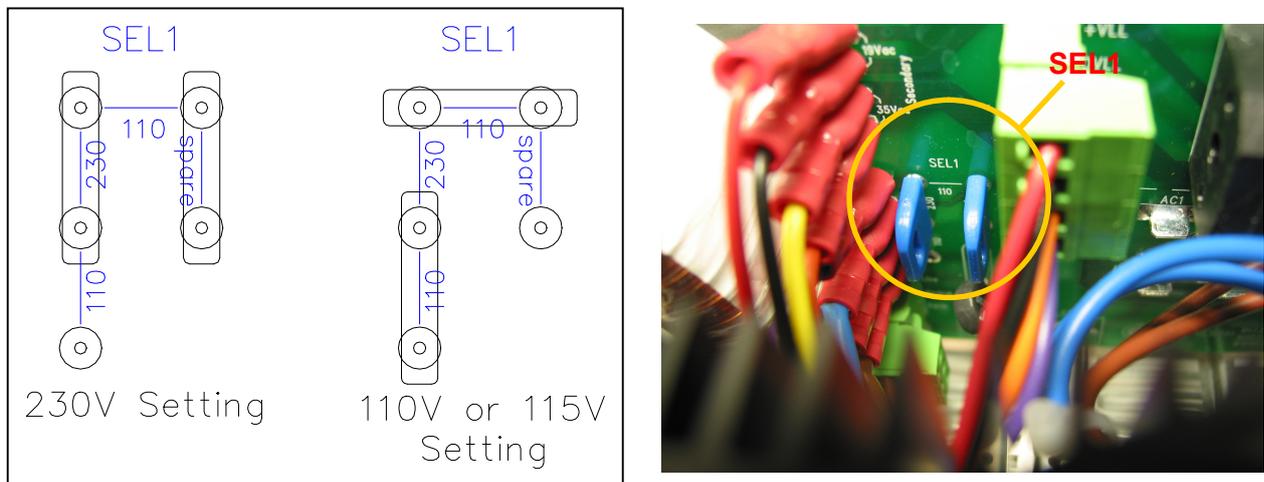

Fig. 5.1 Mains Voltage Selector

6   MSE570M   Microstepping Drive

The MSE570M is a microstepping motor drive with optional automatic current reduction at standstill.   Basic pin compatibility is retained with the MSE570 Classic (Mk 1) and EVO2 versions (without onboard oscillator).

The clock and direction signals from the MSE1000 controller are converted into bipolar chopped constant current with overload protected drive levels to energise a bipolar stepper motor. It is suitable for driving hybrid or permanent magnet stepper motors with 4, 6 or 8 leads.   Maximum output current 4.0A "peak of sine" per phase with optional automatic current reduction at standstill.

The output current, standstill current reduction, microstep size, direction, disable input, silent operation mode and input signal levels are all set by on-board DIP switches.

6.1   Configuration

The drive is configured using onboard DIP switches.

The switch is ON when pushed down towards the PCB and OFF when up, away from the PCB.
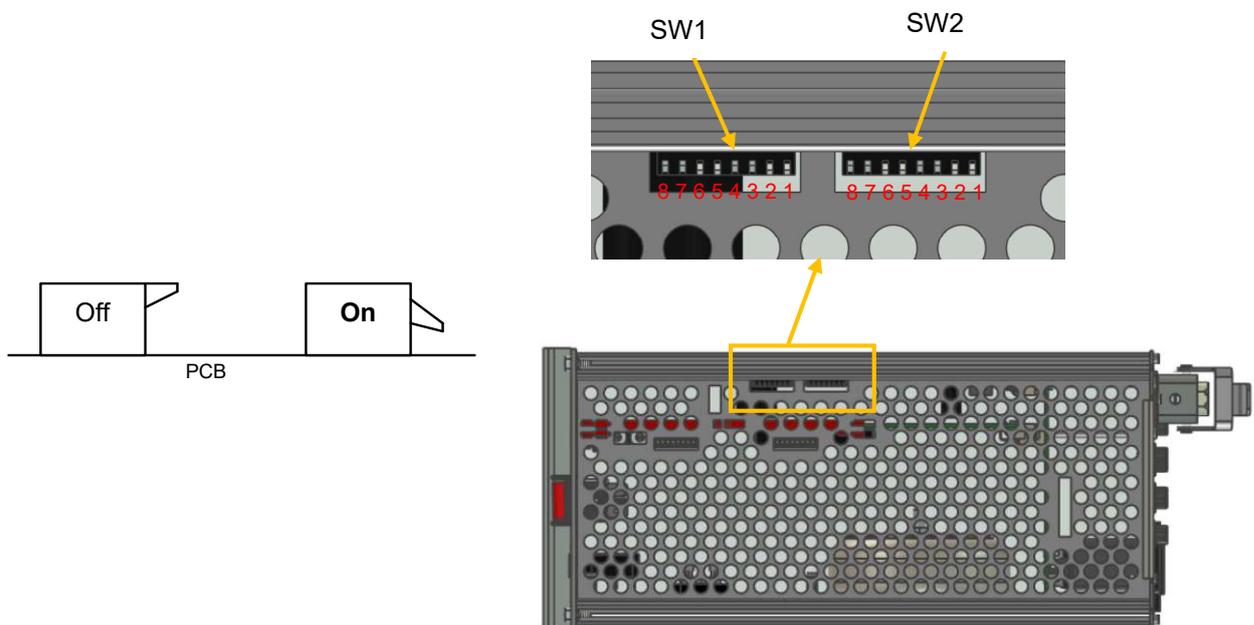

Fig 6.1 MSE570M Switch layout

Motor current setting - Running Current

The nominal output current per phase is set using a four segments of an 8 way DIP switch SW1 as follows:

Nominal peak of sine output current per phase:

	SW1-4	SW1-3	SW1-2	SW1-1
0.25	off	off	off	off
0.50	**ON**	off	off	off
0.75	off	**ON**	off	off
1.00	**ON**	**ON**	off	off
1.25	off	off	**ON**	off
1.50	**ON**	off	**ON**	off
1.75	off	**ON**	**ON**	off
2.00	**ON**	**ON**	**ON**	off
2.25	off	off	off	**ON**
2.50	**ON**	off	off	**ON**
2.75	off	**ON**	off	**ON**
3.00	**ON**	**ON**	off	**ON**
3.25	off	off	**ON**	**ON**
3.50	**ON**	off	**ON**	**ON**
3.75	off	**ON**	**ON**	**ON**
4.00	**ON**	**ON**	**ON**	**ON**

> **WARNING! Failure to make the correct current settings can damage the motor**

The above settings are approximate and may be influenced by the motors resistance and inductance. The output current should ideally be checked during commissioning, using an analogue meter.

Motor current setting - Standstill Current
The drive may be set to reduce the phase current when the motion has stopped to a standstill (no step pulses).

Relative current setting when at standstill:

	SW1-6	SW1-5
100%	off	off
50%	**ON**	off
20%	off	**ON**
0%	**ON**	**ON**

Caution must be used when using to 0% (current off) setting where the motor may lose position integrity.

Thermal protection
A thermal sensor is fitted to detect overheating of the drive.

This feature will give a warning on the over-temperature output, that the drive is too hot, and also on the OverTemp LED. This condition may be latched by setting switch SW1-8 on. The drive may be automatically disabled on over-temperature by setting switch SW1-7 on:

	SW1-8	SW1-7
Momentary monitoring only	off	off
Latched monitoring only	**ON**	off
Momentary with auto-disable	off	**ON**
Latched with auto-disable	**ON**	**ON**

We recommend the last option, so that the drive will automatically disable the output to prevent further heating and will not have the unexpected energisation once the temperature has fallen.

Microstep Size Selection
The step size, on each step pulse is set using a four segments of an 8 way DIP switch SW2 as follows:

	SW2-4	SW2-3	SW2-2	SW2-1
FULL	off	off	off	Off
HALF	**ON**	off	off	off
1/4	off	**ON**	off	off
1/8	**ON**	**ON**	off	off
1/16	off	off	**ON**	off
1/32	**ON**	off	**ON**	off
1/64	off	**ON**	**ON**	off
1/128	**ON**	**ON**	**ON**	off
1/256	off	off	off	**ON**

Direction Inversion

The sense of direction may be inverted, so that the motor will move in the reverse direction, without having to re-wire it.

	SW2-5
Direction normal	off
Direction inverted	**ON**

Disable Signal Inversion

The sense of operation of the external Disable signal may be inverted, so that in effect it becomes an ENABLE input.

	SW2-6
Disable Signal removes output current	off
Disable Signal enables output current	ON

*This switch must be set OFF for use in the Sim-Step

Silent Standstill

The current control algorithm may be changed to give less audible noise when at standstill. This can lead a slight loss in step accuracy when used at low current settings and automatic current reduction.

	SW2-7
Silent Standstill not used	off
Silent Standstill enabled	**ON**

6.2   Status LEDs

The unit is fitted with 4 surface-mount status indicators (LEDs).
Provision has also been made for the user to fit through-board versions of the five status light emitting diodes. These may be soldered into their locations at the front of the board.

LED1	green	power is on
LED2	yellow	output is disabled
LED3	red	over-temperature fault detected
LED4	red	overload fault detected

These may be used for diagnostics by viewing through the top cover as they are not presented to the front panel of the unit.

7   Manual Operation Using the Jog Box or Joystick

The *Sim-Step M2* controller can bᵉ operated in manual mode by means of either a jog box or joystick. These devices should be connected to the *Jog* connectors on the rear of the unit.

7.1   Jog Boxes - JC Series

JC Series Jog boxes provide a convenient way to manually control motor control systems. Three models, the JC100 single-axis, the JC200 dual axis and the JC809 multi-axis are available and provide the following manual control functions:

- Bi-directional single step (jog) function by momentary depression of '+' or '-' buttons.

- Slow speed continuous operation in desired direction by the depression and holding of the '+' or '-' buttons. The speed of movement can be programmed using **SJ** command into the *Sim-Step M2* during commissioning.

- Fast speed, continuous operation in desired direction by depressing & holding the 'F' button together with either the '+ or '- button. The fast positioning rates are can also be programmed using **SF** command into the *Sim-Step M2* during commissioning.

Figures 7.1 to 7.3 show the connections of the JC series Jog Boxes to the *Sim-Step M2.*

For single axis drives specify JC100 Jog box and connect it to the green 'D' connector on the *Sim-Step M2* as shown in fig 7.1.
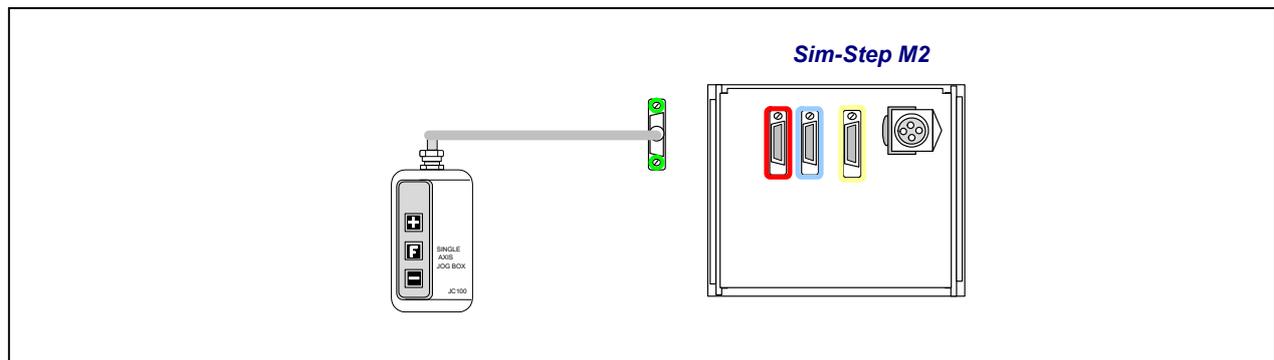

Fig. 7.1 Single axis installations

For dual axis drives specify JC200 Jog box and connect it to the green 'D' connector on the *Sim-Step M2* as shown in fig 7.2.
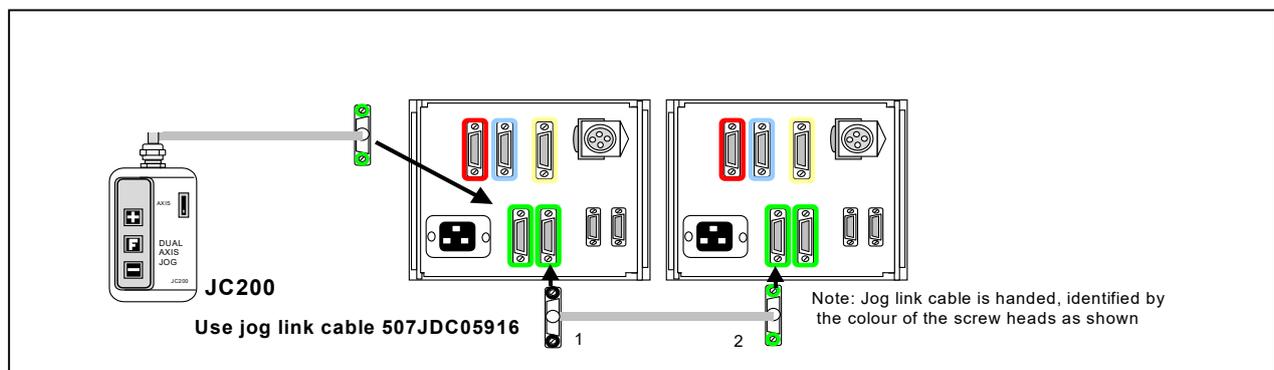

Fig. 7.2 Dual axis installations

For 3-15 axes drives specify JC809 Jog Box and connect it to the green 'D' connector on the *Sim-Step M2* as shown in fig. 7.3.
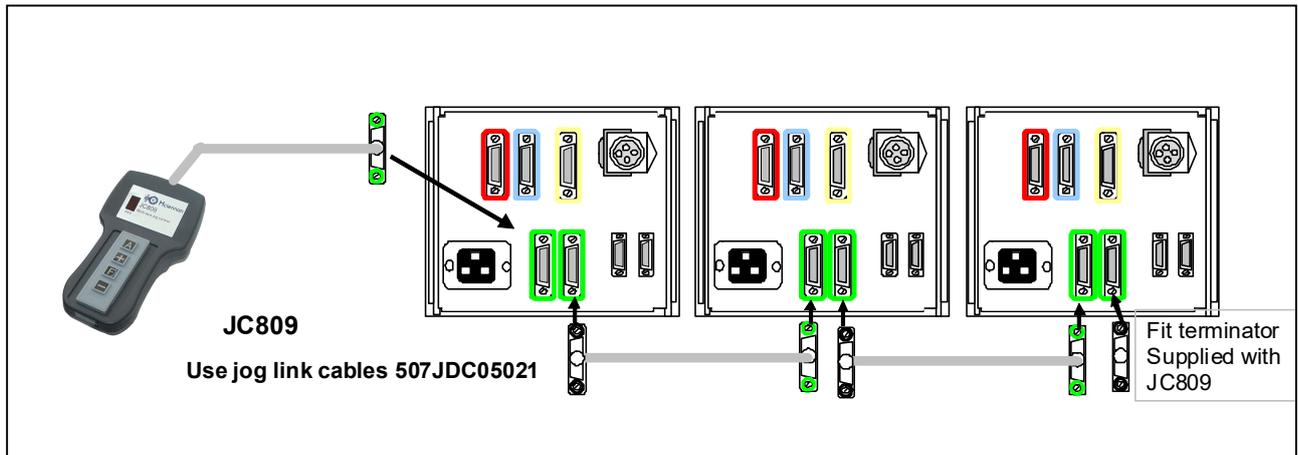

Fig. 7.3 3-15 axis installations

7.2   Single and Dual Axis Jog Box Operation

Jog box operation is very straightforward. Once connected, the jog box will control the motor as follows. Pressing either the **+** or **−** button causes the motor to move in the positive or negative rotation direction. The speed of rotation is determined by the **Slow Jog (SJ** command**)** speed that has been set in the MSE1000. Momentarily pressing the **+** or **−** buttons causes the motor to move in single steps.

Pressing the F button together with either the **+** or **−** buttons causes the motor to move at the Fast Jog (**SF** command) speed that has been programmed into the MSE1000 (see the PM1000 manual).

7.3   Multi-axis Jog Box Operation

The JC809 multi-axis jog box will communicate with the MSE1000 motion controller using a RS485 multidrop link. Connecting the 'Jog Daisy-Chain' lead between the **JOG B** connector on one system to the **JOG A** connector on the next system allows further systems to be connected to the JC809.

See section 8.1 for details on how to set the axis address number using the MSE1000.

For the legacy *Sim-Step M*, a rotary switch on the MSB867 sets the axis address that is shown on the JC809. This switch is accessible by removing the rear top cover of the unit. A setting of 0 will mean that the axis cannot be controlled by the JC809. The default axis is 1 but any axis between 1 and 15 can be selected. Note that axes 10, 11, 12, 13, 14 and 15 are represented by the letters A, B, C, D, E and F respectively.

Pressing the A button on the jog box will scan through all the available axes in ascending order, missing out those that are absent or not powered. (e.g. 1, 2, 3, 7, 8, 1, 2 etc.).

If the axis you have selected is switched off, the jog controller will revert to the power on state of no-axis selected; this is shown by a hyphen (-) on the job box display.

Once connected, the jog box will control the motor as follows. Pressing either the **+** or **–** button causes the motor to move in the positive or negative rotation direction. The speed of rotation is determined by the **Slow Jog (SJ** command**)** speed that has been set in the MSE1000. Momentarily pressing the **+** or **–** buttons causes the motor to move in single steps.

Pressing the F button together with either the **+** or **–** buttons causes the motor to move at the Fast Jog (**SF** command) speed that has been programmed into the MSE1000 (see the PM1000 manual).

7.4   Joystick - JC Series

The JC Series Joysticks provide an alternative way to manually control motor speed. The JC400 is a dual axis Joystick that can be used to control either one or two axes. The JC400 is connected in a similar way to the JC100 and JC200 Jog Boxes shown in figures 7.1 and 7.2.

7.5   Joystick Operation

In order to set the joystick parameters, the RS232 connection must be connected to a PC.

The joystick option gives variable control of the motor speed – the further the joystick is moved from the centre position, the faster the motor moves. Before the joystick option can be used, the joystick centre and minimum/maximum positions must be calibrated. Note that the *Sim-Step M2* is set up for *Jog Box* operation as standard.

The controller must then be told to accept the joystick input using the command **1JM01000000** (see PM1000 manual).

Assume that the controller is set as Axis 1 and that the joystick is in the "free" (i.e. mid range) position. The command **1AI3** will interrogate the joystick position; the controller will then display a value in the format **01:2126**, where 01: refers to Axis 1, and 2126 is the joystick centre position.

Now hold the joystick at one extreme of its range and repeat the 1AI3 command; note this number and then repeat at the other extreme of the joystick range. Let us assume that the following data are given from the 1AI3 command:

Low	1688
Centre	2126
High	2568

This means that the *range* either side of centre is ~440 units (note that the "centre position" may not be *exactly* in the middle of the upper and lower readings).

1JC2126   This sets the centre position. A value of JC=0 will use the value of a joystick centre tap signal, connected to Analogue input 5, to set the centre position.

1JR340   This sets the +/- range of the joystick (JR = *range* – 2 x JT)

1JT50   This sets the joystick threshold – this is the "deadband" around the centre position. If the joystick is moved by less than the deadband value, the motor will not move.

Note: You must use the **1BD** (backup digiloop) command in order to store these parameters otherwise they will be lost when power to the controller is switched off.

For further information, refer to the Joystick Calibration section of the PM1000 manual.

8   MSE1000 Intelligent Stepper Motor Controller
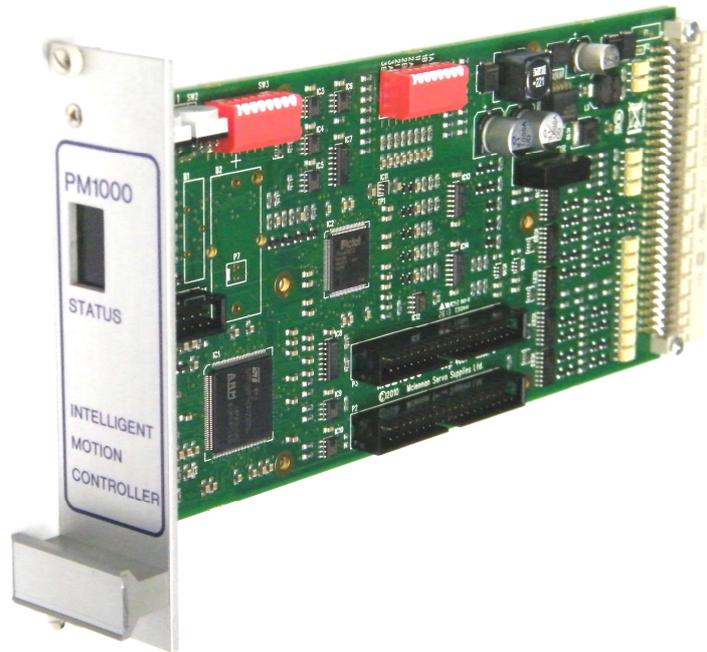
The MSE1000 is a microprocessor-based unit for controlling servo or stepper motors. When fitted with a front panel (as shown above) the controller is referred to as a PM1000. This panel is not used in the Sim-Step. The controller has a wide range of functions available and these are described in detail in the PM1000 manual included with this documentation.

The *Sim-Step M2* will operate under manual control with either a jog box or joystick, or can run under remote control through the RS232 (or RS485) interface.

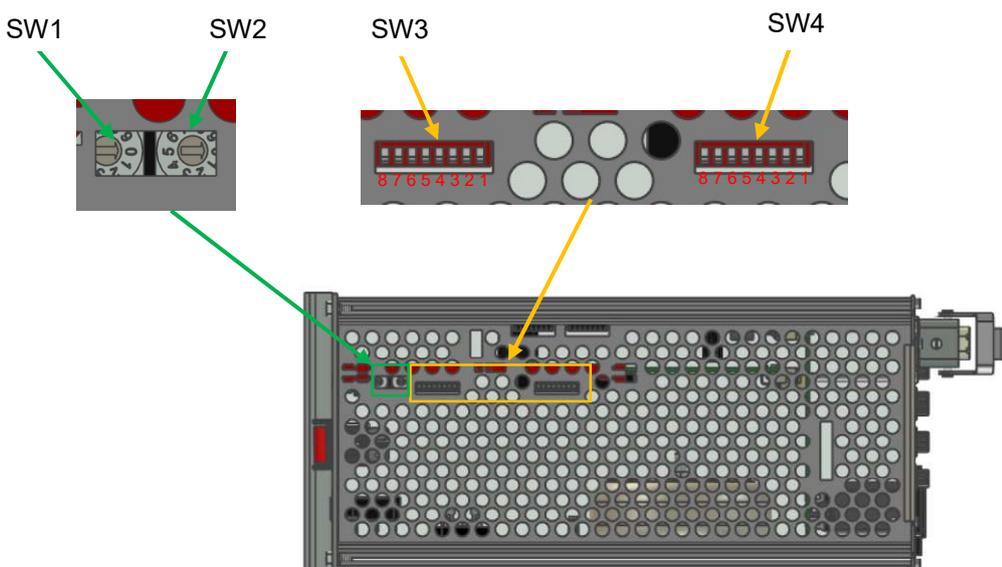The user should refer to the PM1000 manual for complete details.

Fig. 8.1 MSE1000 Switch layout

## 8.1   Axis address number SW1 & SW2

Rotary switches SW1 and SW2 are used to set the units axis address. This is the address of the serial commands that it will respond to. Typically, each controller in a system will be set to differing addresses.
These also dictate the jog axis number.
The left hand switch SW1 sets the decade value and SW2 sets the units. They can be set using a small screwdriver.
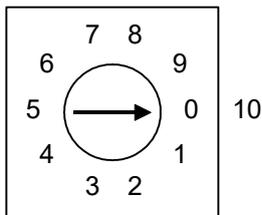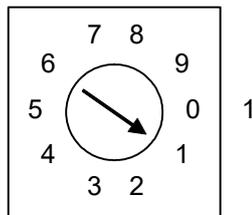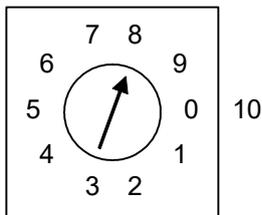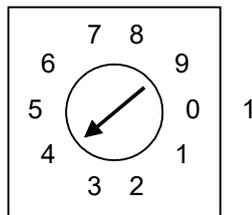

This example shows the address set to 1 (01).

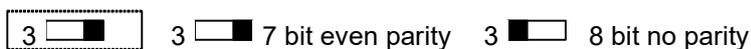This example shows the address set to 84.

8.2 Communication configuration Switch SW3

DIP Switch SW3 is used to set the serial communication parameters. These should be set to match those of your host terminal or PC, and all PM/MSE1000 units should be set the same. If the unit receives characters that do not match the set parameters it will cause a communication error abort.
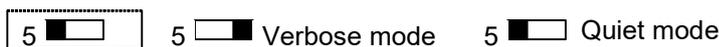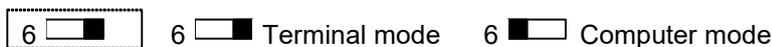
Baud rate

| O/N 1 2 | 1 2 4800 baud | 1 2 9600 baud | 1 2 19200 baud | 1 2 38400 baud |

Word format

| 3 | 3 7 bit even parity | 3 8 bit no parity |

Hardware handshake (RTS / CTS)

| 4 | 4 Disabled | 4 Enabled |

Reply format

| 5 | 5 Verbose mode | 5 Quiet mode |

Transmission format

| 6 | 6 Terminal mode | 6 Computer mode |

Interface type used

| 7 | 7 RS232 | 7 RS485 |

RS485 terminator select

| 8 | 8 No terminator | 8 100Ω terminator |

Reply format:

Verbose Mode - Responses are given in full (e.g. **1OS** gives 01:Status = 00000000). Unsolicited responses are allowed (e.g. **01:! STALL ABORT**).

Quiet Mode - Responses are given abridged (e.g. **1OS** gives 01:00000000). Unsolicited responses are NOT allowed (e.g. **01:! STALL ABORT**).

8.3   Encoder termination configuration switch SW4

Switch SW4 selects the termination for the encoder signals. These can be set to OFF for open ended, TTL or open collector type encoder outputs or ON for 5V differential, RS422 type encoder outputs
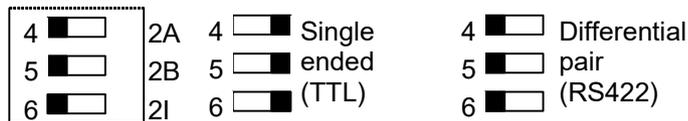
There are switches for Channel-A, Channel-B and Index point inputs. The A and B switches should be set as a group for each encoder input

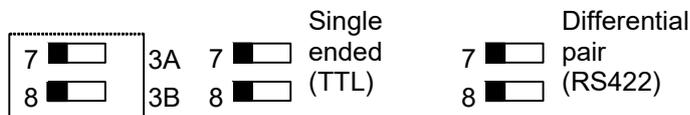The correct termination should be set. This gives maximum noise immunity.

Encoder 1
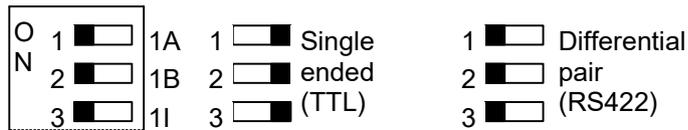
Encoder 2

Encoder 3 (has no index input)

9 I/O Cable and Breakout Box

Eight inputs (Read Ports) and eight outputs (Write Ports) can be used for external digital interfacing.

An I/O cable with the 'breakout' DIN rail mounting terminal box can be used to interface to the *Sim-Step M2* without needing to make a special cable.

The I/O breakout box features screw terminals to enable the 16 Digital I/O to be connected. The unit is DIN rail mounted so that it can be sited next to a typical PLC control unit

I O Breakout Box ordering details

I/O Breakout Box	506MSC00891
1m I/O Cable	507IOC01895
2m I/O Cable	507IOC02895
3m I/O Cable	507IOC03895
5m I/O Cable	507IOC05895
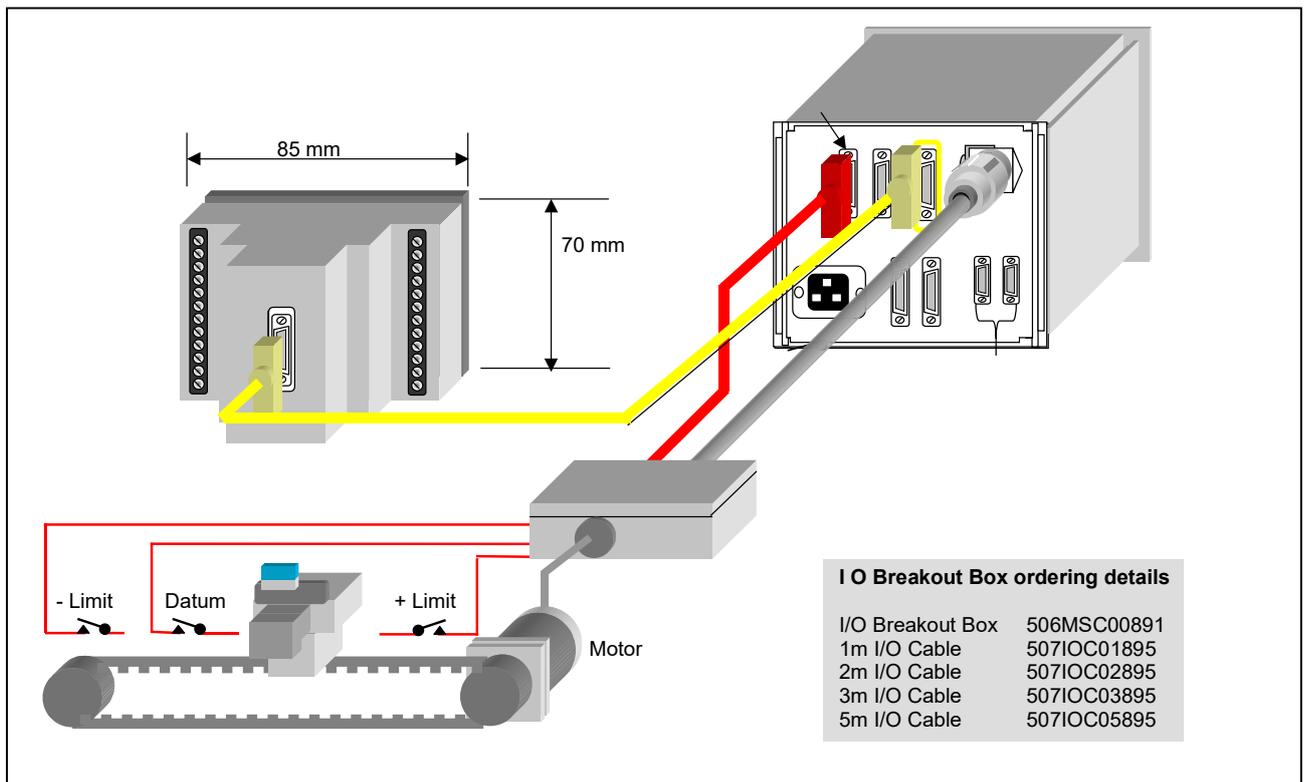
Fig. 9.1 I/O Breakout Box and I/O Cable

I / O Breakout box 506MSC00891 Connections:

Output Lines		Input Lines
WP1		RP1
WP2		RP2
WP3		RP3
WP4		RP4
WP5		RP5
WP6		RP6
WP7		RP7
WP8		RP8
WP com		RP-com
Diode-com		N/C
+VLL		+VLL
0V		0V

Screw Terminal connections
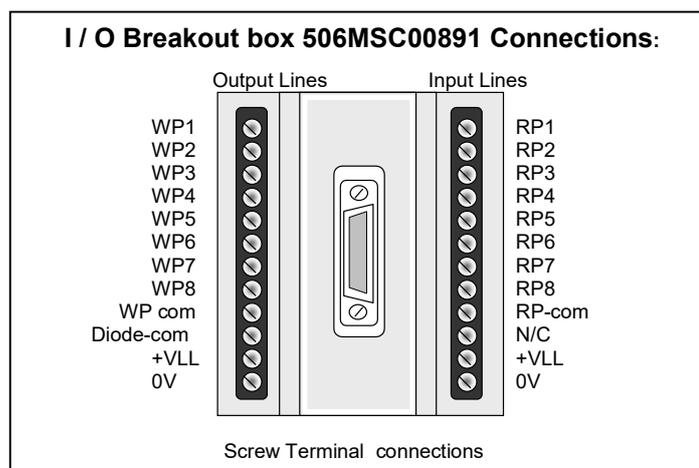
Fig. 9.2 I/O Breakout Box Connections

9.1 Isolation

The *Read Port* inputs and *Write Port* outputs are opto-isolated. A +24V nominal supply must be used as the common for these inputs. This supply can either be a separate external supply or the **Sim-Step M2's** internal +24V supply. If the internal supply is used, then the **WP-com** terminal must be connected the **+VLL** terminal on the Breakout box and the **RP-com** terminal must be connected the **0V** terminal on the Breakout box. If a separate supply is used then the **WP-Com** terminal must be connected to the +24V terminal of the external power supply and the **RP-Com** terminal must be connected to the 0V terminal of the external power supply. The +24V output from the external supply can be used for the common of the switches.
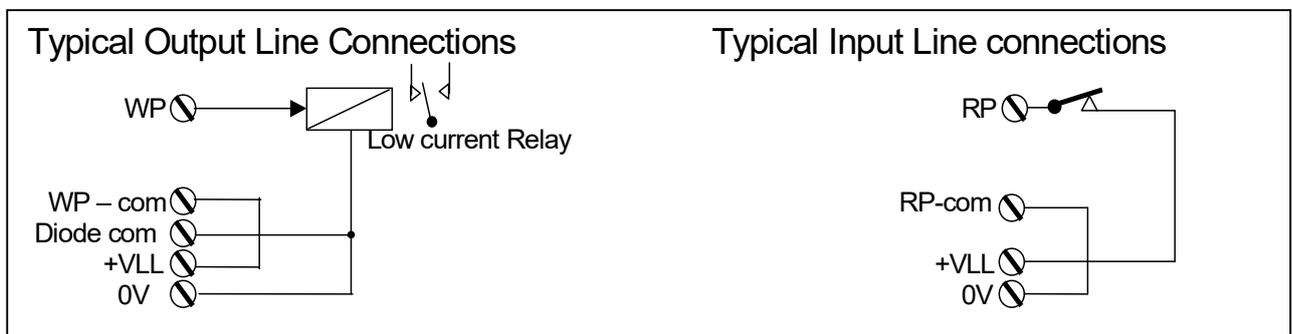
9.2 Typical Connections

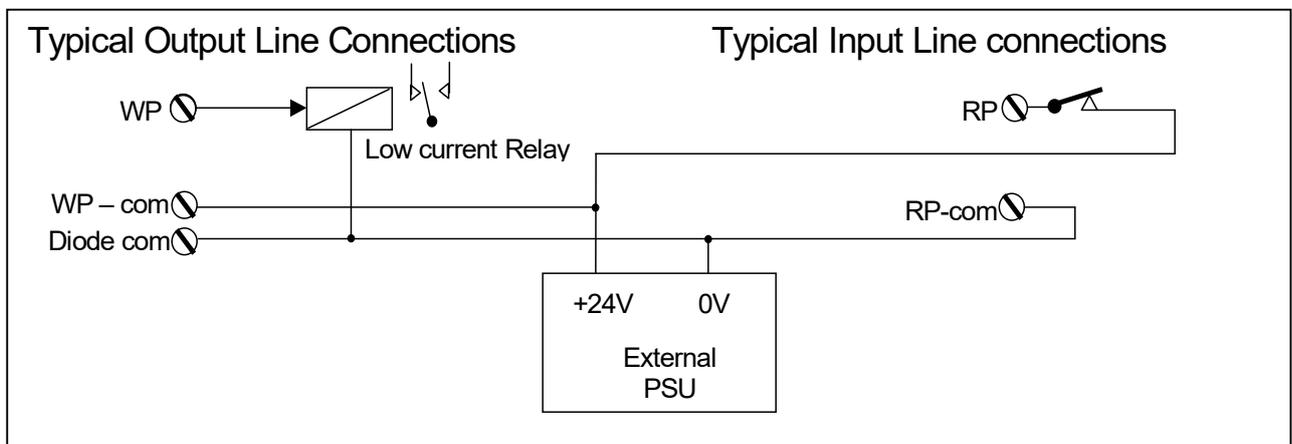*Fig. 9.3 Typical Connections to the I/O Breakout Box*

Fig. 9.4 Typical I/O Connections using an External Supply

Note: The above is only when using the I/O breakout box. If using your own discrete connections then a diode <u>MUST</u> be fitted across the relay coil.

9.3 Read Ports

The *read ports* can be connected to a PNP signal output, a switch, or another *Sim-Step M2's* write port.

The **RP** Read input Port command is used to check the operation of the *read ports*. This instruction returns an eight digit binary number of either **0** or **1** characters to represent the current state of the read port. These start with *read port* 8, through to 1. Referring to figures 9.3 and 9.4, a **1** represents a closed switch and a **0** represents an open switch.

The input voltage that is considered as a logic 1 signal is 10-35V and the input voltage that is considered as a logic 0 is 0-5V.

9.4 Write Ports

The *write ports* can be connected to an indicator (LED), an opto-isolator, a low-current relay or another *Sim-Step M2's* read port. The **WP(bit pattern)** command is used to write to the output port.

The bit pattern is specified as an eight digit binary number. The digits will be either characters **0, 1** or **2** starting with *write port* 8 through to 1. A **0** defines that the output will be **off**, a **1** defines that the output will be **on** and a **2** defines that the output will not change from its current state. The power-on states of the *write ports* are **00000000** - i.e. all **off**.

The outputs are rated at 50mA, 35V.

9.4.1 Inductive Loads

The *write ports* must not be reverse biased. If used to drive an inductive load such as a relay, then protection diodes must be used. If using an MSE891, this can be done by connecting **Diode-Com** to 0V (either **0V** on the Breakout box or the external supply 0V).

10 Example Sequence

An example sequence is shown below. Three switches are connected to the *Read Port* to control the action of the sequence and three outputs are used to monitor the action of the sequence. One switch executes a 'home to datum' move and two switches initiate moves. The 'home to datum' move must be done before the other moves can be selected.

The moves are controlled by the following inputs.
Read Port 1 = home to datum (datum search)
Read Port 2 = move to position 1
Read Port 3 = move to position 2

When the moves are completed, the following outputs turn on.
Write Port 1 = datum search complete
Write Port 2 = at position 1
Write Port 3 = at position 2

10.1 Sequence Definitions

Sequence 0 waits for the 'Home to Datum' input to be '1' and then executes a 'home to datum' (HD) move.

```
1ds0              Sequence 0 – Search for Datum
1wp22222000       Turn off outputs
1wa22222221       Wait for Home input to go on
1hd               Search for datum
1we               Wait for end of move
1wp22222001       Turn on axis 1 homed
1wa22222220       Wait for Home input to go off
1xs2              Goto input scanning sequence
1es
```

Sequence 2 scans the read port inputs and depending on the state of the inputs executes the moves in sequence 3 or 4. After the move is complete, the operation goes back to scanning the *read port* inputs.

```
1ds2              Sequence 2 - Scan for Move inputs
1it22222212       Is Move 1 input on
1xs3              Yes - do move
1it22222122       Is Move 2 input on
1xs4              Yes - do move
1xs2              No rescan inputs
1es
```

```
1ds3              Sequence 3 - Move 1
1wp22222002       Turn off 'At Position' outputs
1ma1000           Move to position 1000
1we               Wait for end of move
1wp22222012       Turn on 'At Position 1' output
1wa22222202       Wait for Move 1 input to go off
1xs2              Goto input scanning sequence
1es
```

```
1ds4              Sequence 4 - Move 2
1wp22222002       Turn off 'At Position' outputs
1ma5000           Move to position 5000
1we               Wait for end of move
1wp22222102       Turn on 'At Position 2' output
1wa22222022       Wait for Move 2 input to go off
1xs2              Goto input scanning sequence
1es
```

```
1bs               Save sequences
```

```
1ae0              Execute sequence 0 on power-up
```

10.2 Configuration

Configure the *Sim-Step M2* to set the position to zero when the datum position is found. This will mean that moves are relative to the datum position.

```
1dm00100000      Set datum position to home position (0)
1bd              Save settings
```

10.3 Run Sequence

Either the sequence can be run by sending a 1xs command or as sequence 0 has been set as an automatically executing sequence, by cycling the power to the *Sim-Step M2*.

11 Order Codes

11.1 System

Type	Order Code
Sim-Step M2	508SMS69876

11.2 Motor Encoders (typical)

Frame size	Type	Order Code
Size 23	23HSX-206 CI 500L	301HSE00053
	23HSX-306 CI 500L	301HSE00054
Size 34	34HSX108E5-1000L	301HSE00094
	34HSX208E5-1000L	301HSE00093

11.3 Cables (typical)

Type	Order Code
Motor – 1m	507MOC01892
Motor – 2m	507MOC02892
Motor – 3m	507MOC03892
Motor – 5m	507MOC05892
Motor – 10m	507MOC10892
Encoder – 1m	507ENC01893
Encoder – 2m	507ENC02893
Encoder – 3m	507ENC03893
Encoder – 5m	507ENC05893
Encoder – 10m	507ENC10893
Limits/Datum – 1m	507LDC01894
Limits/Datum – 2m	507LDC02894
Limits/Datum – 3m	507LDC03894
Limits/Datum – 5m	507LDC05894
Limits/Datum – 10m	507LDC10894
Jog Link – 0.5m	507JDC05916
I/O – 0.5m	507IOC05895
I/O – 1m	507IOC01895
I/O – 2m	507IOC02895
I/O – 3m	507IOC03895

11.4 Junction Boxes

Type	Order Code
MSA889 – Motor & Limits/Datum	506MSC00889
MSA891 – I/O Breakout	506MSC00891

11.5 Jog Boxes & Joystick

Type	Order Code
JC100 – Single Axis	506JCT00100
JC200 – Dual Axis	506JCT00200
JC809 – Multi-Axis	506JCT00809
JC400 – Dual Axis Joystick	506JCT00400

11.6 EMC Ferrites

Type	Order Code
Cable Dia. 7 – 8.5mm	114FER00003
Cable Dia. 8.5 – 10.5mm	114FER00004

12 Limitations of Use

This system has been designed to drive a hybrid type stepper motor. Any other use has not been considered, therefore could damage the drive and could be dangerous for the users.
Good engineering practices should be employed when using this product.

The operating temperature should be between 0ºC and 30ºC.

Users should take suitable precautions in the application of this product, to ensure that the overall system complies with EN50081-1 and EN50082-1 (EMC directive).

These products should not be put into service until the machinery in which they are incorporated has been declared in conformity with the provisions of The Supply of Machinery (Safety) Regulations 1992 and The Supply of Machinery (Safety) (Amendment) Regulations 1994 (Machinery Directive).

Motor control systems are inherently hazardous. Even a small motor, if coupled to a leadscrew, gearbox, or any other form of mechanism that provides a mechanical advantage, can generate considerable force and could cause serious injury. Incorrect operation can also lead to damage to the motor or associated machinery.

SAFETY NOTICE

Motor drive systems are inherently hazardous. Even a small motor, if coupled to a leadscrew, gearbox, or any other form of mechanism which provides a mechanical advantage, can generate considerable force and could cause serious injury Incorrect operation can also lead to damage to the motor or associated machinery

Static sensitive devices - This unit has static sensitive devices. Observe handling precautions: Hold card by edges only. Do not touch connector pins. Ship only in anti-static packaging.

Warning - Mains voltages can be present within a system, do not adjust, service, dis-assemble or otherwise work on this system whilst power is applied.

In accordance with European directive 2002/96/EC on Waste Electrical and Electronic Equipment (WEEE), disposal of this item must be through the correct channels for WEEE. It should not be disposed of by landfill.

This item can be returned to Mclennan for end of life disposal under the WEEE directive, contact Mclennan for further information.

UK CA CE