MSE570 EVO 2
Bipolar Stepper Motor Drive
Manual

Mclennan

Specifications

Bipolar stepper motor drive with optional on-board oscillator.
Pin compatible with Classic (Mk 1) version.

Electrical

Supply:
+15 to +42 (+52V max.) smoothed DC unregulated.

Auxiliary outputs (available for external circuitry):
+12V regulated 50mA maximum
+5V regulated 50mA maximum

Motor drive output:
Bipolar chopped constant current with overload protection. Suitable for driving hybrid or permanent magnet stepper motors with 4,6 or 8 leads.
Maximum output current 3.5A per phase.
Output current set by on-board DIP switches or external programming resistor.

Control inputs:
CMOS schmitt trigger inputs operating at +12V with 10KΩ pull-up resistors and diode isolation.
Logic 0 (low) - 0V to +2V or contact closure to 0V.
Logic 1 (high) - +9V to +30V maximum or open circuit.

Monitor outputs:
Open collector NPN transistor, referenced to 0V.
Low level - +1V maximum at 30mA maximum.
High level - open circuit +24V maximum.

Mechanical and physical

Card size:
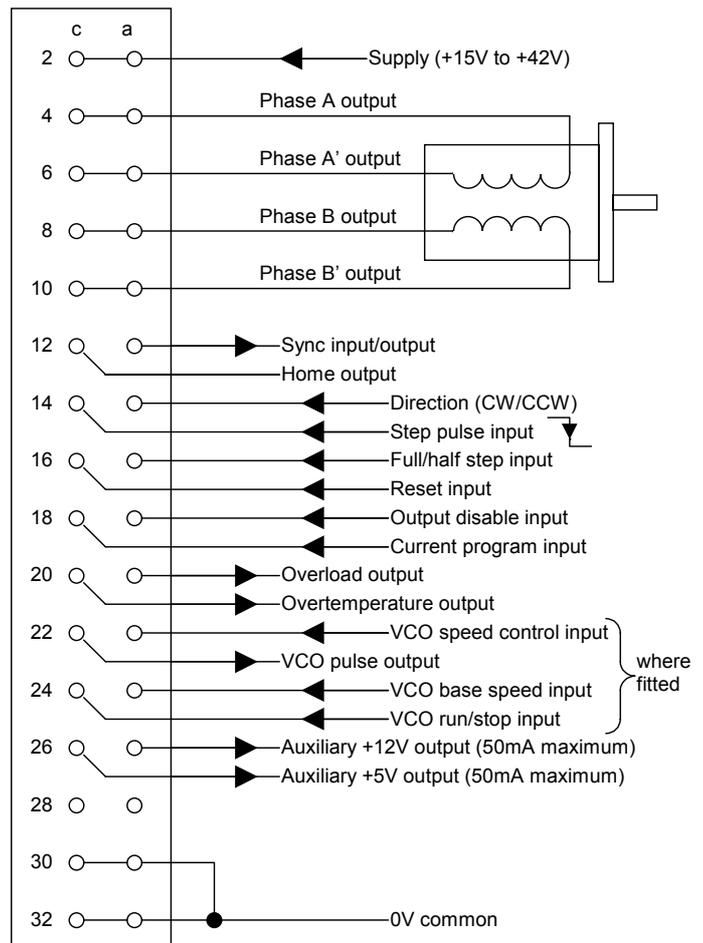Eurocard format 160 mm long x 100 mm high x 36 mm wide.

Weight:
120g approximately.

Connector:
32 way a & c DIN41612 type D.

Operating temperature range:
0°C to 40°C maximum ambient.

External connections

External connections are made via a 32 way a & c DIN41612 type D connector.

Supplies

Pins 2a & 2c
Motor supply input. Should be smoothed unregulated between +15V and +42V maximum.

Pins 28a & 28c
Not connected. (Was Logic supply input on Mk1 version).

Pins 30a & 30c, 32a & 32c
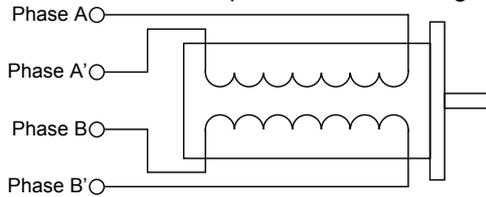0V common.

Motor

Pins 4a & 6c, 6a & 6c
Motor phase A should be connected between 4a & 4c and 6a & 6c.

Pins 8a & 8c, 10a & 10c
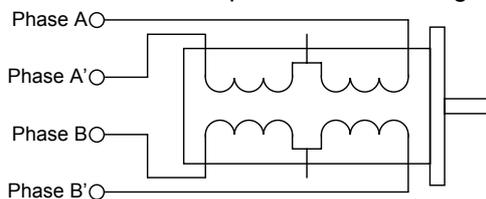Motor phase B should be connected between 8a & 8c and 10a & 10c.

4 lead motor
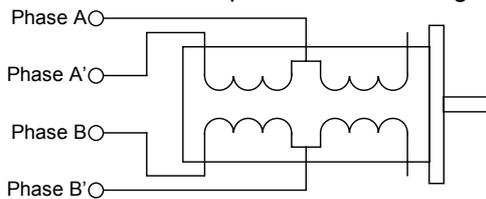max. drive current = motor phase current rating

Phase A
Phase A'
Phase B
Phase B'

6 lead motor - both coils
max. drive current = motor phase current rating / $\sqrt{2}$

Phase A
Phase A'
Phase B
Phase B'

6 lead motor - one coil
max. drive current = motor phase current rating

Phase A
Phase A'
Phase B
Phase B'

8 lead motor - coils in parallel
max. drive current = motor phase current rating x $\sqrt{2}$

Phase A
Phase A'
Phase B
Phase B'
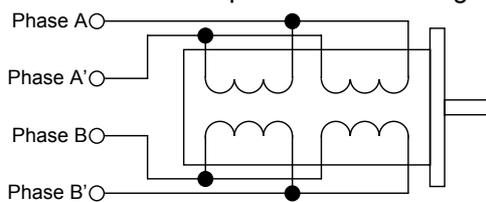
8 lead motor - coils in series.
Max. drive current = motor phase current rating / $\sqrt{2}$

Phase A
Phase A'
Phase B
Phase B'
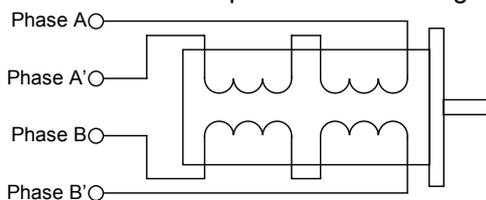
To reverse sense or direction swap the connections to **one** phase. E.g. swap phase B with phase B'.

Control inputs

Pin 14a
Direction control input. Pulling this input low will reverse the direction of rotation of the motor

Pin 14c
Step pulse input. The motor will increment one step on a high to low transition on this input. The pulse should be low for 10μS minimum. Maximum frequency 20KHz.

Pin 16a
Full/half step control input. If this input is high (or unconnected), full step drive will be generated giving 200 steps per revolution of a hybrid stepper motor. If it is pulled low, then half step drive will be generated giving 400 steps per revolution. This input would not normally be changed during use as the unit may enter a wave drive mode (full step with only one phase on).
The use of half step reduces problems with resonance.

Pin 16c
Reset input. Pulling this input low will set the internal logic to give the home phase output and therefore the home output will be on. This may also be used to reset an error condition such as overload or overtemperature.

Pin 18a
Output disable input. Pulling this input low will disable the motor output current. There will then be no motor torque and it may be rotated by hand.

These control inputs are CMOS schmitt trigger inputs operating at +12V with 10KΩ pull-up resistors and diode isolation. The control options are as follows:

CMOS output operating at +12V

Input
0V common
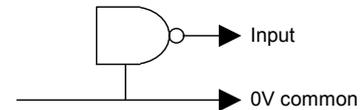
Open collector TTL output (e.g. 7406, 7407)

Input
0V common

Opto isolator

Input
0V common

Switch

Input
0V common
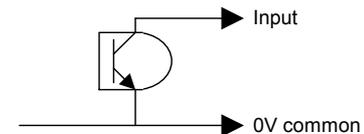
Monitor outputs

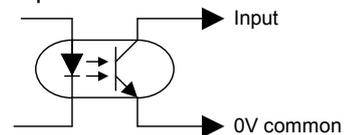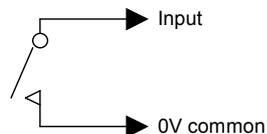Pin 12c
Home phase output. This output is low when the output phases are in their initial home state pattern. This state is repeated in four full steps or eight half steps.

Pin 20a
Overload output. This output will go low and remain latched low, if an overload or short circuit is detected. The motor output will also be disabled. This condition may be reset by either pulling the reset input low or removing the power

Pin 20c
Overtemperature output. This output will go low if the thermal sensor gets too hot. This condition may be latched by setting SW1-2 (LT) on so that the drive doesn't suddenly become active when it cools. This condition may be reset by either pulling the reset input low or removing the power. The motor output may also be disabled automatically by setting SW1-1 (DT) on.

Current programming

Pin 18c
Current program input. The motor current may be reduced from the value set on the DIP switch by connecting a resistor from this input to 0V. This may be used to set the phase current by the connector the unit is plugged into, or to reduce the motor current on application of an external signal such as at standstill.

Multi-axis synchronisation

Pin 12a
Sync input/output. This connection may be used to synchronise the chopping frequency between a number of drive cards by connecting them together. One drive is selected as the master; the others are slaves and should have their chopping oscillators disabled by setting SW1-4 on.

Auxiliary power outputs

Pin 26a
Auxiliary +12V output. 50mA maximum.

Pin 26c
Auxiliary +5V output. 50mA maximum.

On board oscillator (option)

Pin 22a
VCO speed control input. Applying a control voltage between 0V and +12V will proportionally vary the output frequency of the voltage controlled oscillator (if fitted).

Pin 22c
VCO output. This 12V CMOS output of the voltage controlled oscillator (if fitted) may be connected directly the step pulse input (14 c).

Pin 24a
VCO base speed control. A resistance to 0V sets the base speed of the voltage controlled oscillator (if fitted).

Pin 24c
VCO run/stop input. Pulling this input low enables the voltage controlled oscillator (if fitted).

Configuration
A four way DIP switch is provided for certain configuration options.

SW1-1 (DT)
Disable on overtemperature. If this switch is on and the thermal sensor gets too hot, then the motor output will be automatically disabled to prevent overheating.

SW1-2 (LT)
Latch overtemperature. If this switch is on and the thermal sensor gets too hot, then the overtemperature condition will be latched. This will prevent unexpected re-energisation of the drive when it cools back down. The latched condition may be reset by either pulling the reset input low or removing the power.

SW1-3 (CC)
Current control type. This switch determines whether the current control chopping is executed on the upper drive transistors or the lower drive transistors. This would normally be left off for more efficient use, but may have small advantages of current control on low current settings.

SW1-4 (SS)
Slave sync. If this switch is on, the chopping oscillator is inhibited. This should only be used on slave units in multi-axis synchronised systems, where another unit provides a master chopping signal.

Motor current setting

The output current per phase is normally set using a four way DIP switch as follows:

| Switch setting | | | | Nominal output |
SW2-1	SW2-2	SW2-3	SW2-4	current per phase
Off	off	off	off	0.0A
Off	off	off	**on**	0.5A
Off	off	**on**	off	0.9A
Off	off	**on**	**on**	1.2A
Off	**on**	off	off	1.3A
Off	**on**	off	**on**	1.6A
Off	**on**	**on**	off	1.85A
Off	**on**	**on**	**on**	2.1A
On	off	off	off	2.3A
On	off	off	**on**	2.5A
On	off	**on**	off	2.7A
On	off	**on**	**on**	2.9A
On	**on**	off	off	3.0A
On	**on**	off	**on**	3.1A
On	**on**	**on**	off	3.3A
On	**on**	**on**	**on**	3.5A

The above setting 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.

The motor current may be reduced from the value set on the DIP switch by connecting a resistor from the current program input to 0V. This may be used to set the phase current by the connector the unit is plugged into, or to reduce the motor current on application of an external signal such as at standstill.
The external resistor should be selected to give the required voltage on the current program input of approximately 0.47 x required current per phase.

Thermal protection

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

This feature will give a warning on the overtemperature output, that the drive is too hot. This condition may be latched by setting switch SW1-2 (LT) on. The drive may be automatically disabled on overtemperature by setting switch SW1-1 on

Status LEDs

The unit is fitted with 5 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	overtemperature fault detected
LED4	red	overload fault detected
LED5	yellow	home phase output

On board oscillator (user fit option)

A simple voltage controlled oscillator may be constructed on the drive board by the addition of a few components. These parts are located at the lower front of the board at the edge. The output of this oscillator may be connected directly to the step pulse input (pin 14c).
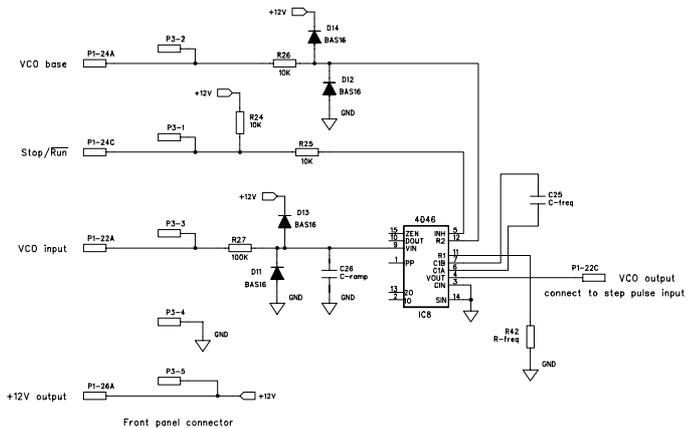


Oscillator external controls

The external controls for the oscillator may be connected via the 32 way DIN41612 connector or alternatively, if front panel controls are required, may be connected via a 5 pin MOLEX connector (P3).
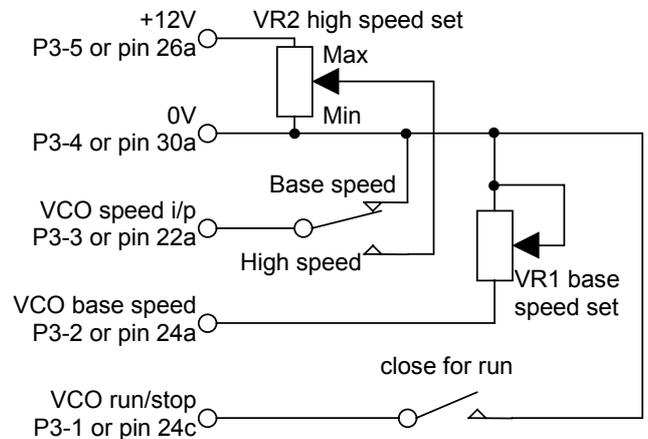
Oscillator operation

The normal method of oscillator operation is as follows:

1. The oscillator is started at the base speed by switching the run switch on with the base/high speed switch set to base. This base speed is a frequency offset and should be chosen to be safely within the pull-in capability of the motor/drive combination, and ideally above the resonant frequency range. This base speed is defined by C-freq and the setting of VR1.
2. The high speed may be selected by switching the base/high speed switch to high. The oscillator will then ramp up to the high speed. This high speed is set by VR2, whose range is defined by R-freq and C-freq. The ramp rate is determined by the time constant of R27 (100KΩ) and C-ramp.
3. The oscillator may then be slowed back down to the base speed by switching the base/high speed back to base.
4. When the speed has dropped down to the base setting the oscillator may be inhibited by switching the run switch off. The motor should only be started, stopped or have a direction change whilst at the base speed.
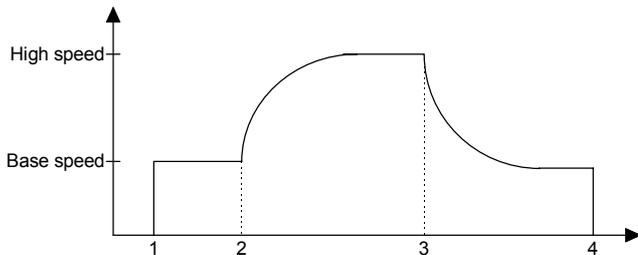
Component selection

The following components need to be soldered onto the PCB:

IC8	CD4046 CMOS PLL IC (used as VCO)		
R-freq	resistor	1KΩ-1MΩ	(typ 5.6KΩ)
C-freq	capacitor	>100pF	(typ 10nF)
C-ramp	capacitor		(typ 10μF)
P3	optional molex connector if using front panel controls		

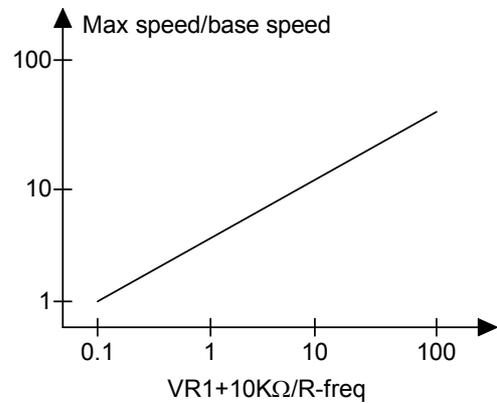The following external components are required to complete the oscillator:

VR1	pot	0 - 1MΩ	(typ 1 MΩ)
VR2	pot	1 KΩ	

First determine the base speed and the maximum high speed you wish to obtain.

Using the graph below select a value for C-freq for the chosen pot VR1
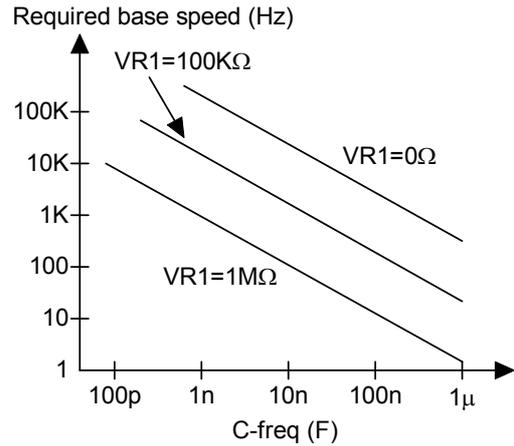
Then from the ratio of the maximum running speed to the base speed, use the following graph to select R-freq.

Electro-magnetic Compatibility (EMC)

The drive board complies to EN-50081-1 and EN50082-1 when properly fitted in an EMC compliant case with 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.

Caution!

1. SERIOUS DAMAGE WILL OCCUR if any motor lead is connected or becomes disconnected whilst the drive is energised.

2. The drive board should always be mounted such that it is vertical. Adequate clearance must be given top and bottom i.e. 25 mm minimum. When rack mounting the board there should be at least 15 mm clearance between the drive and an adjacent board. If the airflow around the unit is restricted, then force air cooling should be employed.

3. When using the drive at high ambient temperatures or at slow speeds or at standstill, whilst at high current settings, it will prove advantageous to employ forced air cooling.

4. Motor and power supply connections should be made with at least 32/0.2 mm wire due to the high peak currents flowing. All other control wiring may use 7/0.2 mm.

5. Good engineering practices should be employed in the commissioning of this product and should be made to adhere to all relevant regulations.