Parker
Automation

CE

XL25/XL50/XL80
Stepper Drives
User Guide

Part No: 1600.286.02 March, 2002

IMPORTANT INFORMATION FOR USERS

Installation and Operation of Motion Control Equipment

It is important that motion control equipment is installed and operated in such a way that all applicable safety requirements are met. It is your responsibility as an installer to ensure that you identify the relevant safety standards and comply with them; failure to do so may result in damage to equipment and personal injury. In particular, you should study the contents of this user guide carefully before installing or operating the equipment.

The installation, set-up, test and maintenance procedures given in this User Guide should only be carried out by competent personnel trained in the installation of electronic equipment. Such personnel should be aware of the potential electrical and mechanical hazards associated with mains-powered motion control equipment - please see the safety warning below. The individual or group having overall responsibility for this equipment must ensure that operators are adequately trained.

Under no circumstances will the suppliers of the equipment be liable for any incidental, consequential or special damages of any kind whatsoever, including but not limited to lost profits arising from or in any way connected with the use of the equipment or this user guide.

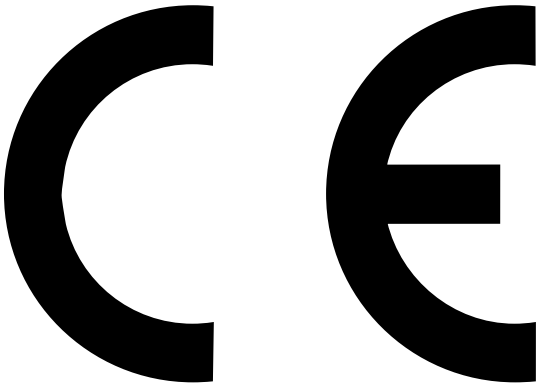
⚠ SAFETY WARNING

High-performance motion control equipment is capable of producing rapid movement and very high forces. Unexpected motion may occur especially during the development of controller programs. ***KEEP WELL CLEAR*** of any machinery driven by stepper or servo motors. Never touch any part of the equipment while it is in operation.

This product is sold as a motion control component to be installed in a complete system using good engineering practice. Care must be taken to ensure that the product is installed and used in a safe manner according to local safety laws and regulations. In particular, the product must be enclosed such that no part is accessible while power may be applied.

This and other information from Parker-Hannifin Corporation, its subsidiaries and authorised distributors provides product or system options for further investigation by users having technical expertise. Before you select or use any product or system, it is important that you analyse all aspects of your application and review the information concerning the product in the current product catalogue. The user, through its own analysis and testing, is solely responsible for making the final selection of the system and components and assuring that all performance, safety and warning requirements of the application are met.

If the equipment is used in any manner that does not conform to the instructions given in this user guide, then the protection provided by the equipment may be impaired.



Product Type: **XL25, XL50 & XL80**

The above product is in compliance with the requirements of directives

- **73/23/EEC** **Low Voltage Directive**
- **93/68/EEC** **CE Marking Directive**
- **89/336/EEC** **Electromagnetic Compatibility Directive**

Provided the installation requirements described in this user guide are met, and there are no special requirements of the installation and operating environment so that the application may be considered typical, the XL drive series installation will conform to the protection requirements of Council Directive 89/336/EEC as amended by Directive 92/31/EEC on the approximation of the laws of the Member States relating to Electromagnetic Compatibility when operated and maintained as intended.

In assessing the overall compliance of an installation consideration must also be given to the effects of mains harmonics and flicker when interfacing the total supply system to the public low voltage supply system.

In accordance with IEC 61800-3:1997 (Adjustable speed electrical power drive systems) this product is of the restricted sales distribution class which meets the needs of an industrial environment when installed as directed. However, further measures may need to be taken for use of the product in a domestic environment.

WARNING – Risk of damage and/or personal injury

The XL drives and XL_PSU power supply described in this user guide contain no user-serviceable parts. Attempting to open the case of any unit, or to replace any internal component, may result in damage to the unit and/or personal injury.

Contact Addresses

For engineering assistance in Europe:
Parker Hannifin plc
Electromechanical
Division - Digiplan
21 Balena Close
Poole, Dorset
England, BH17 7DX
Tel: +44 (0)1202-699000
Fax: +44 (0)1202-695750
e-mail: sales.digiplan@parker.com
e-mail: support.digiplan@parker.com
Website: www.parker-emd.com

For engineering assistance in Germany
Parker Hannifin GmbH
Electromechanical
Division - Hauser
P. O. Box: 77607-1720
Robert-Bosch-Str. 22
D-77656 Offenburg, Germany
Tel: +49 (0)781 509-0
Fax: +49 (0)781 509-176
e-mail: sales.hauser@parker.com

Website: www.parker-emd.com

For engineering assistance in Italy
Parker Hannifin SpA
Divisione SBC
20092 Cinisello Balsamo
Milan,
Italy Via Gounod, 1

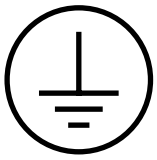
Tel: +39 02 6601 2478
Fax: +39 02 6601 2808

e-mail: sales.sbc@parker.com
Website: www.parker-emd.com

For engineering assistance in the U.S.:
Parker Hannifin Corporation
Compumotor Division
5500 Business Park Drive, Suite D
Rohnert Park
CA 94928
USA
Tel: (800) 358-9070
Fax: (707) 584-3793
FaxBack System: (800) 936-6939
e-mail: tech_help@cmotor.com
Website: www.compumotor.com

Symbols used, have the following meanings:

Caution -
Refer to the
accompanying documentation



Protective conductor terminal

Contents

User Guide Change Summary

This user guide, version 1600.286.02, is the second version of the XL25/XL50/XL80 Stepper Drives User Guide.

When a user guide is updated, the new or changed text is differentiated with a change bar in the outside margin (this paragraph is an example). If an entire section is changed, the change bar is located on the outside margin of the section title.

Major changes in revision 02 include:

Addition of XL80 information
SY motor range
XL PSU information
Correction of input supply voltage range

Latest Changes Sheet

Known changes required to be made to this issue of user guide are listed below:

Note: This sheet is intended for documenting any changes or corrections necessary in this issue of user guide. Any necessary changes we become aware of will be added to this sheet and will be incorporated into the main part of the user guide when it is next issued.

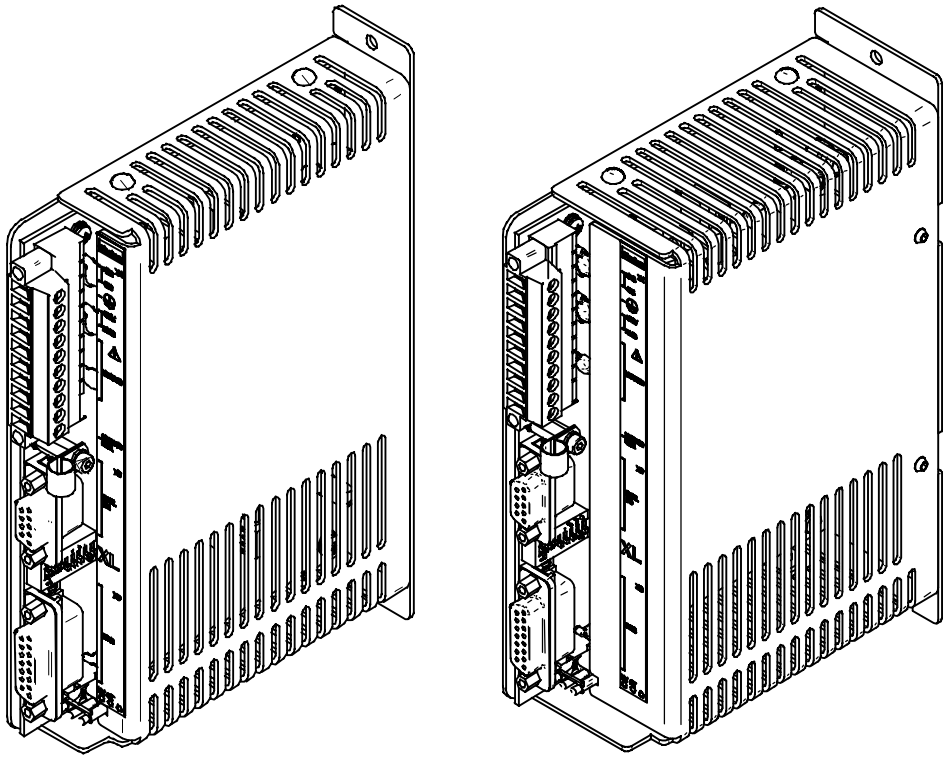
1. Introduction

XL25/XL50/XL80 Product Description

XL25, XL50 and XL80 are low powered stepper drives offering a cost-effective solution for applications involving single or multiple axis solutions. Designed to be used with existing general purpose stepper motors, the drives can be powered from a 20-84V (XL25) 40-84V (XL50) or 40-84V (XL80) DC supply and are fully LVD compliant. EMC compliance is achieved using an external line filter and following the wiring and layout recommendations described in the section ***Electrical Installation***. Three models provide an output current range of 1.25 to 8.0A:

XL80 providing a motor voltage of 80V at 8.0A peak
XL50 providing a motor voltage of 80V at 5.0A peak
XL25 providing a motor voltage of 80V at 2.5A peak

The XL25 and XL50 share a similar case size, while the XL80 is slightly wider. Figure 1-1 illustrates the two case styles. See ***Mechanical Installation*** for dimension information.



XL25/50 XL80

Figure 1-1. XL25/XL50 and XL80

Product Features

Protection Circuits
- Motor short circuits
- Overvoltage
- Overtemperature
- +24V reverse polarity

Function Indicators
- Drive Status (HV)/zero phase
- Fault Status (ST)

Adjustments
(Bit switch)
- Step/direction or Step+/Step-
- Standby 50% or 70%
- Resolution
- Current level in 10% increments

(External)
- SLOW & FAST ADJUST
- Acceleration rate

Outputs and Inputs
- Fault
- Zero phase
- Oscillator monitor
- Clock
- Direction
- Shutdown
- SLOW & FAST
- Analogue input (Fast)

Further Information

This user guide contains all the necessary information for the effective use of this drive. However, to gain a more in-depth understanding of drive applications and motion control, consider attending one of our English Customer Specific Technical Workshops, details of which can be found on our web site (www.parker-emd.com) under Sales & Services, Training.

Examples of previous courses that have proved to be of benefit include:

- Use and programming of DIN rail H & L series drives
- PDFX training
- Using the 6K controller
- EASI Tools programming
- Mechanical product training for ET/ER, XR and HPLA

2. Mechanical Installation

Environment

XL25/XL50/XL80 drives have an operating temperature range of 0° to 50°C Max, and can be used within humidity limits of 5-95% non-condensing. The drives should only be used, guarded from operator contact in an atmosphere of Pollution Degree 2, which means only dry, non conductive pollution is acceptable. The storage temperature limits are -20 to 70°C.

It is recommended the drives are powered from the XL_PSU, which provides all the necessary power supplies and eliminates the need for an EMC filter. One XL_PSU can supply up to six drives, alternatively, drives can be powered from a DC supply, fed from an isolated transformer. The insulation of the transformer must be suitably rated for the Installation Category and working voltage on the primary.

Drive Cooling

XL25 and XL50 drives are cooled by natural convection, whilst the XL80 is fitted with an integral fan. To aid cooling, drives should be installed vertically in an area where there is at least a 50mm air gap above and below the package and a 10mm gap either side. Avoid mounting heat producing equipment directly below a drive.

In the final installation, check that the ambient temperature specification of 50°C Max (without forced air cooling) is not exceeded directly below the top-most drives and that any circulating air flow is not being blocked from reaching the drives. For cabinet cooling calculations a drive dissipation figure of 15W can be assumed for the XL25/XL50 and 25W for the XL80.

Drive Dimensions

XL25 and XL50 drives share the same dimensions which are shown in Figure 2-1.

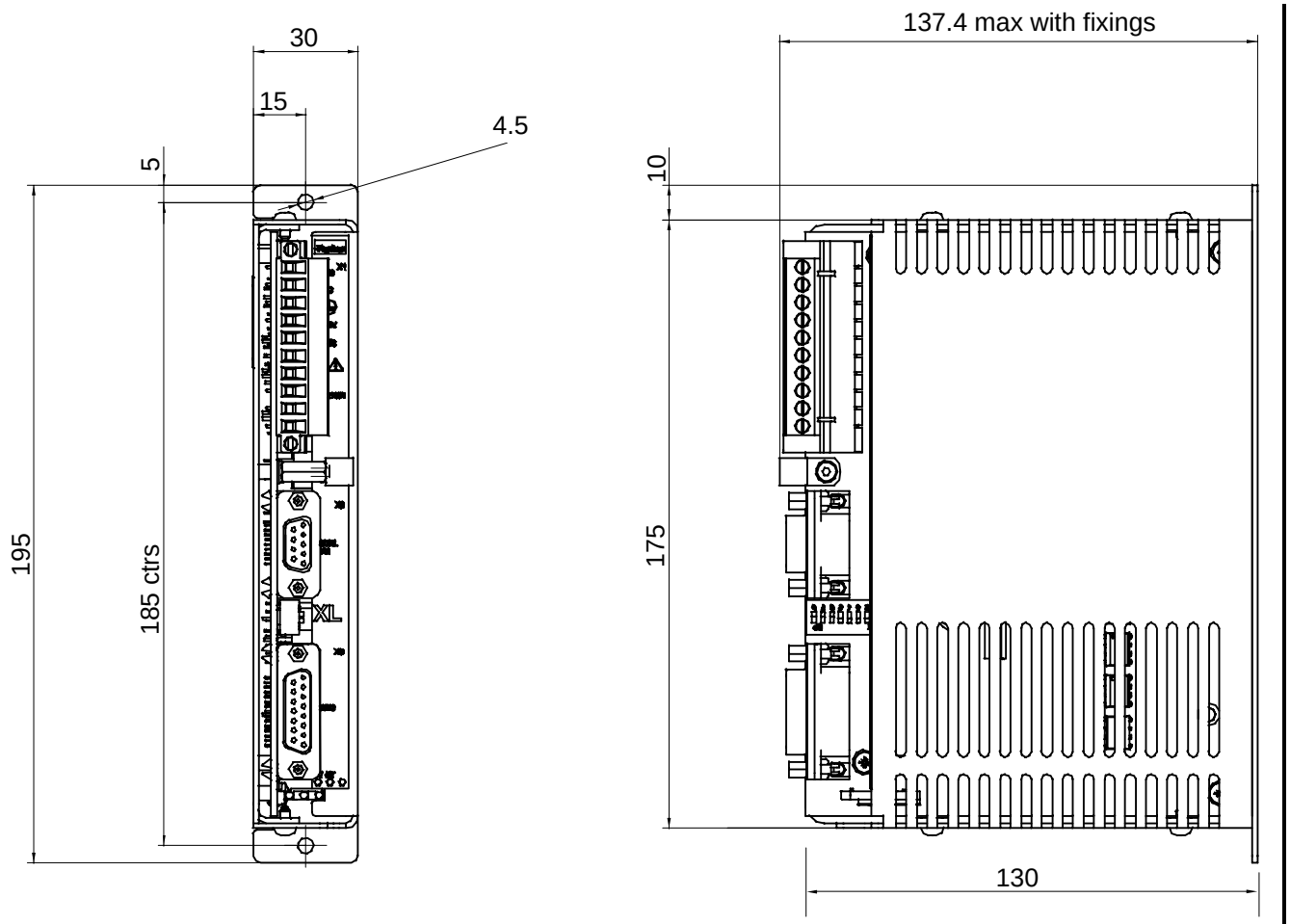


Figure 2-1. XL25/XL50 Dimensions

XL80 has the dimensions shown in Figure 2-2. Note the double slot fixing used on the base of this wider drive. The XL80 has the same fixing positions as the XL_PSU, but the drive is slightly wider (51mm) than the XL_PSU.

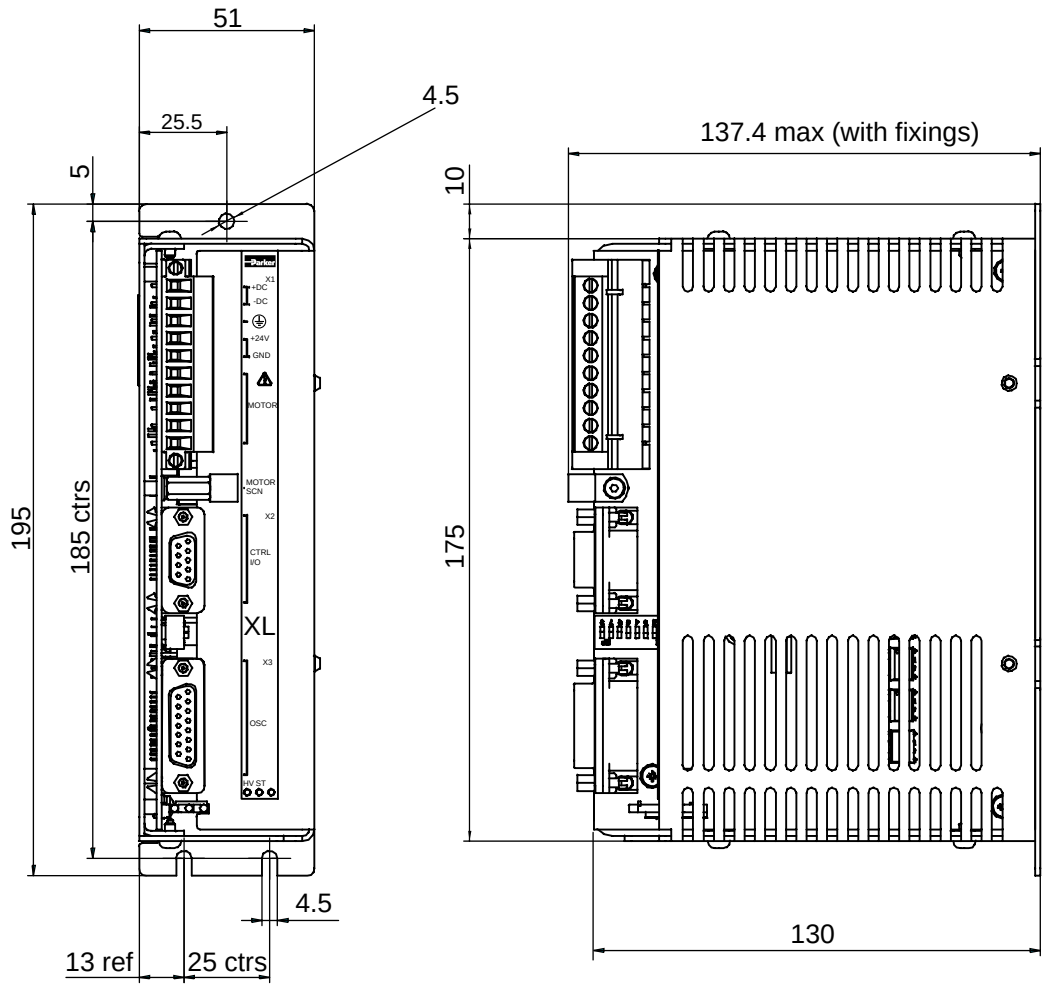


Figure 2-2. XL80 Dimensions

Mechanical Installation of Drives

It is recommended the drive is mounted vertically on a metal backplane, using M4 screws.

XL_PSU Dimensions

The XL_PSU dimensions are shown in Figure 2-3.

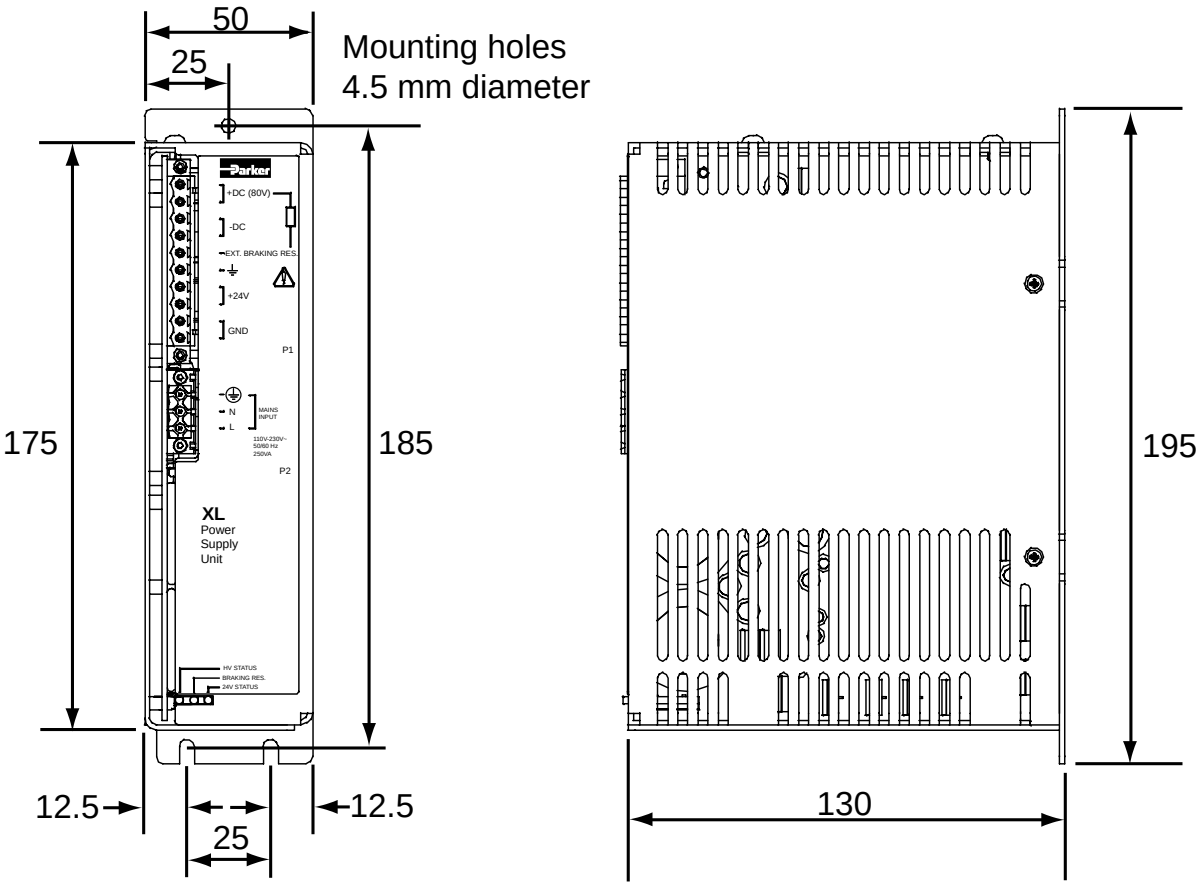


Figure 2-3. XL_PSU Dimensions

XL_PSU Mounting Information

The supply should be mounted vertically, near the drives it will supply. Both the top 4.5mm diameter fixing hole and the bottom two 4.5mm width fixing slots should be used.

The supply should be mounted with a minimum free space of 50mm both below and above its case. A side clearance of 10mm free space on both sides should be allowed.

Note, the supply must not be mounted above or close to other products which generate a significant amount of heat by radiation or convection.

Motor Mounting Mechanical Considerations

Motors should be securely fixed in position at all times. Do not test a motor/drive combination without first securing the motor – see the Safety Warning at the front of this user guide.

CAUTION – risk of equipment damage

Do not back drive the motor, that is use the motor in an application that may cause the motor shaft to be mechanically rotated in a manner uncontrolled by the drive.

Back driving the motor at high speed may damage the drive.

Back driving the motor at low to medium speeds may establish sufficient voltage on the drive's capacitors to energise the drive.

3. Electrical Installation

Installation Safety Requirements

XL stepper drives meet the requirements of both the EU Low Voltage Directive and EMC directive when installed according to the instructions given within this section. The drive must be installed in an enclosure to protect it from atmospheric contaminants and no operator access should be allowed to the drive while it has DC power applied. Metal equipment cabinets are ideally suited for housing the equipment since they can provide operator protection, EMC screening, and can be fitted with interlocks arranged to remove all power when the cabinet door is open.

Precautions

During installation, take the normal precautions against damage caused by electrostatic discharges. Earthed wrist straps should always be worn.
All user I/O connections should be screened, using 360° braided screen - do not use a foil screen.
A switch or circuit breaker must be included in the installation, which must be clearly marked as the disconnecting device and should be within easy reach of the machine operator.

Cabinet Installation

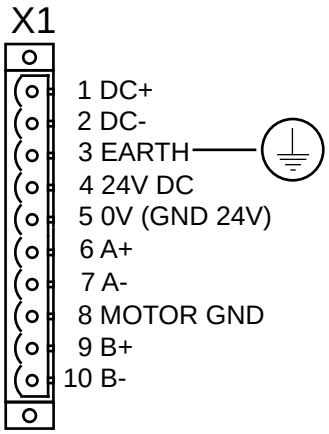
To produce an EMC and LVD compliant installation it is recommended that drives are mounted within a steel equipment cabinet. This form of enclosure is not essential to achieving EMC compliance, but does offer the benefits of operator protection and reduces the contamination of the equipment from industrial processes.

A steel equipment cabinet will screen radiated emissions provided all panels are bonded to a central earth point. Separate earth circuits are commonly used within equipment cabinets to minimise the interaction between independent circuits. A circuit switching large currents and sharing a common earth return with another low level signal circuit could conduct electrical noise into the low level circuit, thereby possibly interfering with its operation. For this reason so called ‘dirty earth’ and ‘clean earth’ circuits may be formed within the same cabinet, but all such circuits will eventually need to be returned to the cabinet’s main star earth point.

Individual drives are designed to be mounted on a metal earth plane to which the EMC filter’s earth connection is also attached. The earth plane will have its own individual star point earth which should be hard wired (using an insulated copper conductor) back to the cabinet’s ‘clean earth’ connection point.

Power Supply Connections

XL drives must be powered from DC supplies only.



IMPORTANT

Connect positive voltage to pin 1 and negative to pin 2. Reversing polarity will damage the drive.

Figure 3-1. X1 Connections

Mating connector type is: Wieland 8213B/10 F OB, part number 25.323.4053.0

Supply Requirements

XL drives must be powered from DC supplies as specified below:

Drive Type	DC Supply Voltage between DC+ and DC-
XL25	20 to 84V absolute limits
XL50	40 to 84V absolute limits
XL80	40 to 84V absolute limits

Table 3-1. Drive Supply Voltages

Note: DC+ identifies the positive side of a DC supply.

The power supply must be isolated from the mains.

Safety Earth Requirements

The drives must be earthed, using the earth pin on X1 (pin 3).

XL Power Supply

The XL_PSU module is a 250W, power factor corrected, switched mode power supply for use with XL stepper drives. Designed for direct operation from world-wide single phase AC input voltages, the supply is capable of powering up to six drives without the need for an EMC mains input filter*. The use of the XL_PSU offers the following benefits:

- Auto-adapts to supplies between 95 and 264V AC
- No EMC filter*
- Less cabinet space
- Built-in +24V DC supply

*For drives with up to 30 metre motor leads.

Physical Appearance

Housed in a slim, 50mm-wide metal case, the XL_PSU is shown in Figure 3-2. This form of case matches the appearance of the XL drives and has the same height and depth.

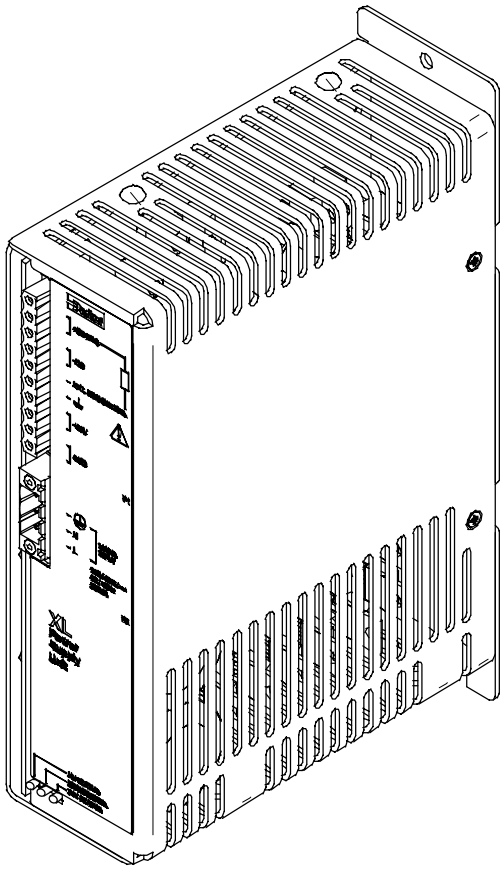


Figure 3-2. XL_PSU Switched Mode Power Supply

AC Supply Connections

Input AC supplies need to be connected to the 3-way mains input connector P2. Use approved mains cable, with a minimum wire size of 0.75mm^2. The supplied mating connector is a Phoenix Contact, having the name MSTB 2,5/3-STF-5,08 and order number 1777992.

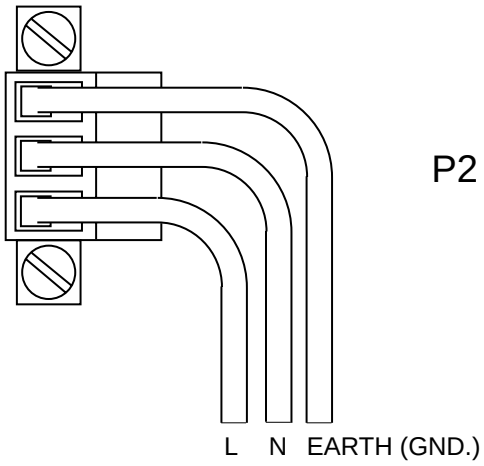


Figure 3-3. P2 Power In Socket Wiring

Output Connections

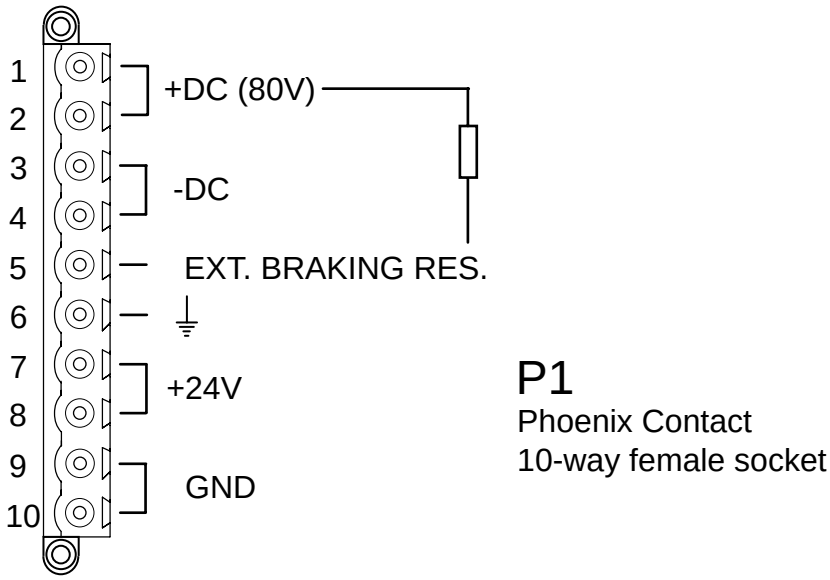


Figure 3-4. P1 Output Power Connector

Power out (+80V) is taken from pins 1 and 2 (use 32/02 1 mm^2 cable), the return connection being pins 3 and 4. +24V is available on pins 7 and 8 with the return connection being made to the GND pins 9 and 10. The earth pin 6 is internally connected to the -DC pins 3 and 4. The supplied mating connector is a Phoenix Contact, having the name IC 2,5/10-STF-5,08 and order number 1825394.

No connection exists between the earth pin 6 and the GND pins 9 and 10

Supply/Drive Connections

When used to supply up to six drives the power supply can be wired as shown in Figure 3-5.

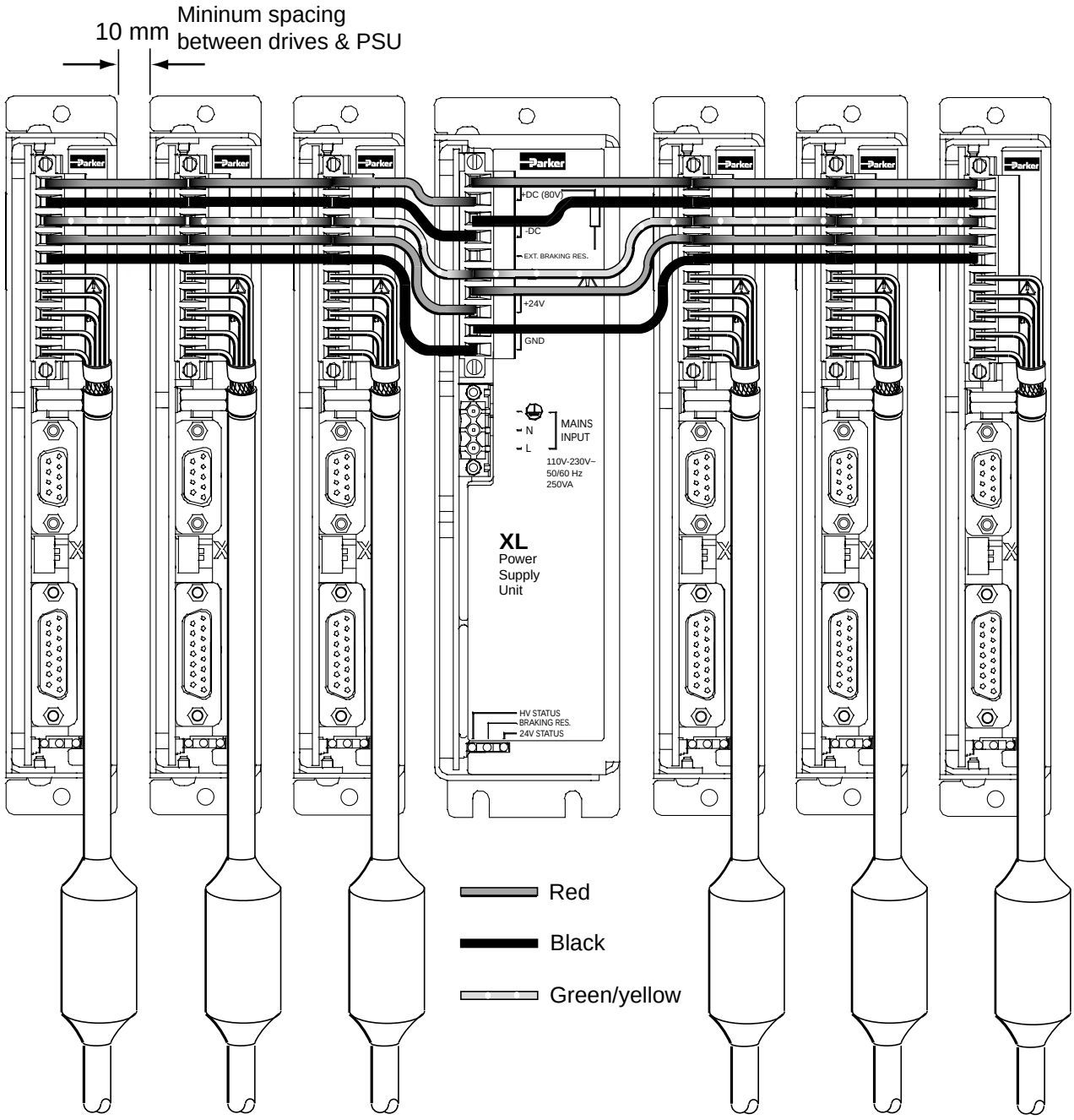


Figure 3-5. Power Supply and Drive Connections

Note: A kit of five connecting links is available, called ‘XL-connect’. You will need one kit for every drive.

Power Dump/Braking Resistor Considerations

The XL power supply incorporates a regenerative power dumping circuit which may be used to divert regenerated power into a dump or brake resistor. The need for such a circuit should ideally be determined during system design, but the calculations are repeated here for reference.

Calculating the Need for a Braking Resistor

For one drive axis a dump resistor will be required if the deceleration time in seconds is less than ($J\omega^2$-0.2), where J is the total inertia in $kg.m^2$ and ω is the maximum speed in revs/sec. In a multi-axis system where a number of axes are decelerating at the same time, a given axis will not pump the HV up, provided that the deceleration time on that individual axis is greater than $J_1\omega_1^2$, where J_1 is the inertial of axis 1 and ω_1 is the angular speed of axis 1. Generally, other operating axes will absorb power from the supply and will add greater capacitive loading and will therefore reduce the need for power dumping. If it is known that certain conditions will cause several axes to decelerate together (say axes 3 & 4), then check that the $J\omega^2$ value minus the deceleration time for each axis (both 3 & 4), added together, do not give a result that is greater than 0.2. If they do, a dump resistor is likely to be required.

External Braking Resistor Installation

If required, an external braking resistor may be fitted between pins 1 and 2 of P1 and pin 5 of P1, as shown. The need for a braking resistor should be considered if the application requires large inertial loads to be decelerated quickly. During deceleration if the drive faults-out with over voltage or the braking resistor LED flashes orange - requesting power dumping, it is likely a braking resistor needs to be fitted.

Note: If a braking resistor is fitted, a ferrite ring-core needs to be fitted over the braking resistor leads, as shown in Figure 3-6. A suitable ring-core is the Parker Chomerics part number H8FE-1115-NC, as used for the drive's motor cable. The ferrite may be held in place using heat shrinkable tubing, or cable ties. An in-line 5 X 20 mm fuse is recommended to be fitted between pin 2 of P1 and the braking resistor. The fuse should have a maximum value of 3.15A with a time delay low breaking characteristic.

The braking resistor should be wired using 16/02 0.5 mm^2 cable.

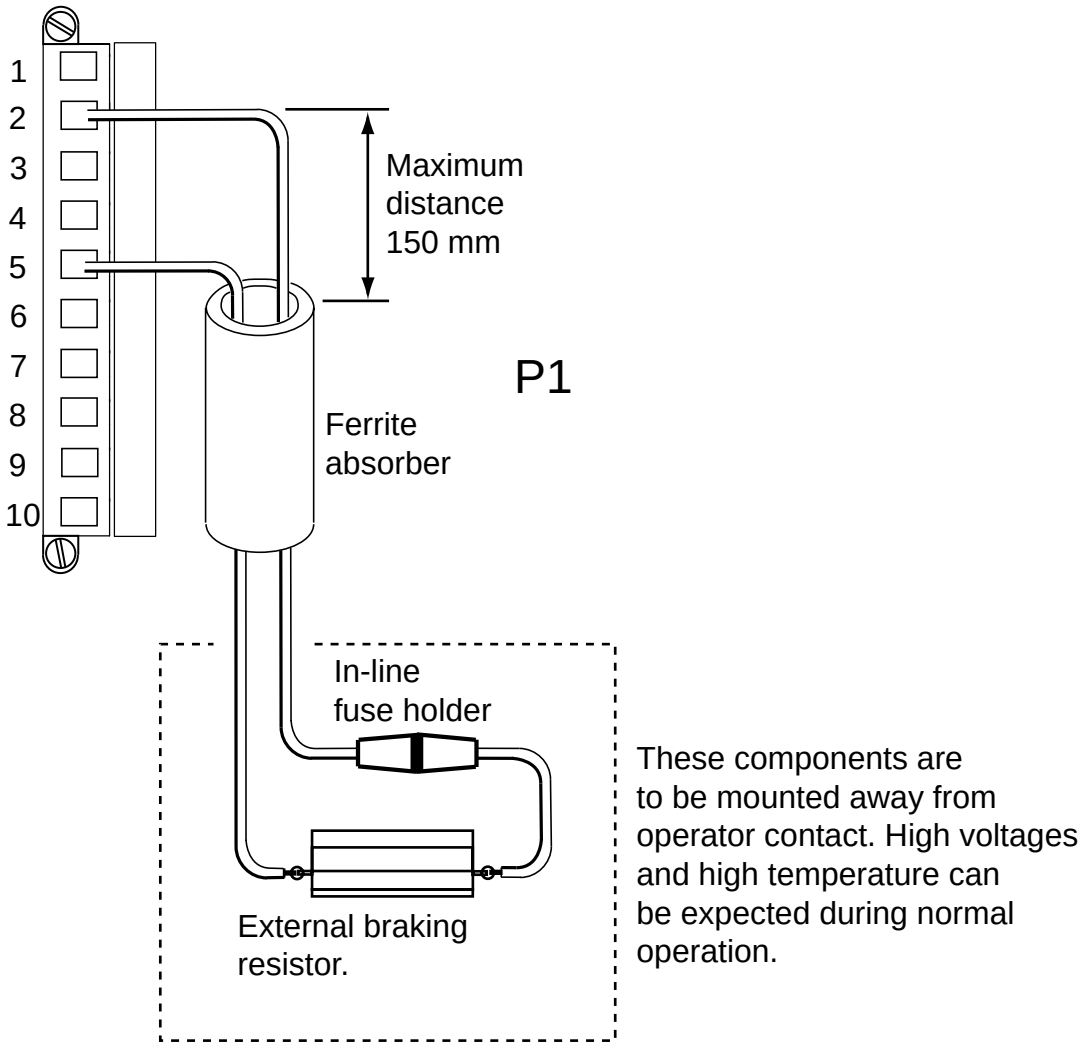


Figure 3-6. Braking Resistor Wiring

An internal dump switch has a peak rating of 800W. The dump resistor used should be 10 Ohms (nominal) with a power rating of 100W.

LED Indicators Function

Three tri-state LEDs are positioned on the front panel of the XL_PSU. Their function is described in Table 3-2.

Position	Colour	Function
Left	Orange	AC Input present and PSU fault. No HV output
	Green	AC Input present
	No colour	AC input off
Middle	Orange	Dump request
	Green	80V DC present
Right	Red	24V disabled by overcurrent fault
	Orange	24V supplied by external supply
	Green	24V supplied by XL_PSU
	No colour	No 24V present

Table 3-2. LED Indicators Function

WARNING – Risk of damage and/or personal injury

The XL drives and XL_PSU power supply described in this user guide contain no user-serviceable parts. Attempting to open the case of any unit, or to replace any internal component, may result in damage to the unit and/or personal injury.

Discrete Power Supply Recommendations

If the XL_PSU is not being used individual XL drives can be powered from transformer/bridge rectifier power supplies of the type shown in Figure 3-7. This design suggests suitable component values for powering particular drive types, but can be adapted to power more than one drive provided component power ratings are not exceeded.

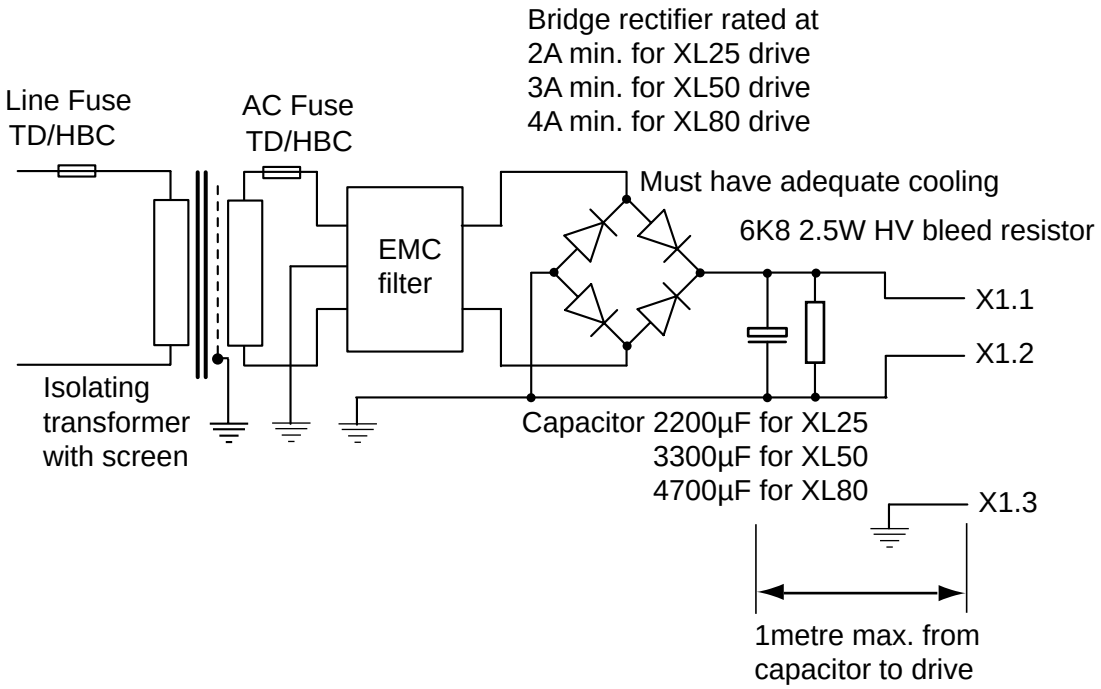


Figure 3-7. Drive Power Supply

Note: The -DC input must be reliably earthed at X1.3.

Transformer Sizing

A DC input is required by the drive, which can be generated by rectifying and smoothing the secondary voltage of a transformer. This is an unregulated supply so do not select a secondary voltage which generates a DC output that exceeds 80V.

The size of transformer required for a stepper drive installation depends very much on the application and on the maximum shaft power delivered by individual motors. However, the following figures may be taken as a guide.

Assuming a torque margin of 25-30% has been allowed, the maximum demand from a single XL25 drive is approximately 80VA, 125VA for an XL50 and 170VA for an XL80. These are peak figures, which in most practical situations, and particularly in point-to-point positioning systems, will cause the average power demand to be much lower than this. The peak power demand may be significantly higher if a high performance enhanced-hybrid motor is used.

In multi-axis applications, the peak demand will depend on the maximum number of axes running simultaneously; very little power is used by a stationary axis. You should allow approximately 10VA for a stationary XL25 axis, 15VA for a stationary XL50 axis and 25VA

for a stationary XL80 axis. For example, a typical system with four XL50 drives in which no more than two axes are in motion at any one time would comfortably operate from a 250-300VA transformer.

It is worth noting that in a one-off or low volume application it is usually preferable to be slightly generous in sizing the transformer, rather than spend a great deal of engineering effort trying to calculate the minimum possible rating. In low-power systems the potential savings in transformer cost are not large, although size and weight may also be a consideration. In a higher volume application the same principles apply to the prototype installation, but measurements of the supply current drawn under working conditions will give a useful guide to the final specification required.

Low Voltage Operation

The drive specification allows for 24V DC -15%, which works out at a little over 20V. This is the lowest that the supply should ever fall to if the risk of an under voltage fault is to be avoided. Supply ripple could use up part or all of this tolerance, so make sure that any ripple on the DC supply does not cause the input to dip below 20V.

Fuses

Fuses should be time delay, high breaking capacity and should be rated for the number of drives and expected in-rush current.

AC Fuse

The secondary AC fuse is intended to protect power supply components and should have a value twice that of the bridge rectifier current rating with a minimum value of 5A to prevent nuisance blowing.

Line Fuse

Fit line fuses to protect the transformer and associated wiring. If you cannot identify the live wire, fuse both phase conductors. Calculate the fuse value using:

$$\frac{1.5 \times VA}{\text{supply volts}}$$ in amps, but needs to be a minimum of 2A to cope with in-rush current

Fuse types should be anti-surge HBC (High Breaking Capacity).

+24V Supply Connections

XL drives require a logic supply of +24V DC at 100mA per drive to power the oscillator. Note: Drive control from an external step/direction source makes this supply unnecessary.

The +24V supply is connected to X1.4 and the return to X1.5, the total wire length, from supply to drive, must not exceed 10m.

Connect the +24V supply 0V line to system earth (0V) at some convenient point before the EMC filter input.

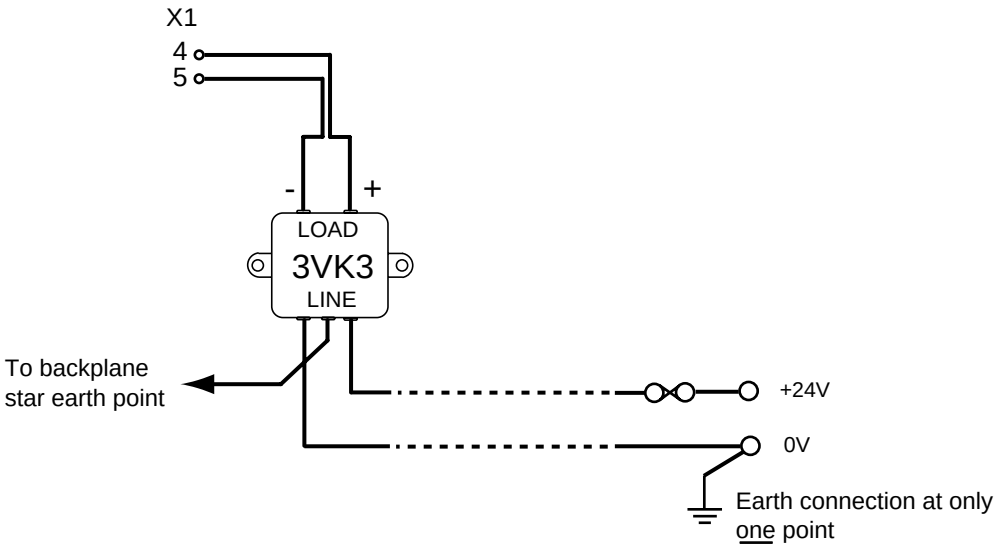


Figure 3-8. +24V Supply Connections

The supply should be fused with a quick acting fuse, rated at 3A for up to 10 axes, with a 2A increase for every extra 5 axes. Note: The +24V supply used must meet the voltage requirements specification of +24V DC +10% -15%, ripple <1V p-p.

EMC Installation

These EMC installation recommendations are based on the expertise acquired during the development of compliant applications which Parker believe are typical of the way a drive or drives may be used. Provided you have no special installation requirements or untypical operating environment requirements, XL drives will conform with current EMC Directives, as defined at the front of this user guide.

General Requirements

XL drives will require an external filter to meet EMC installation compliance requirements, unless they use the XL_PSU. It is recommended that the drive is mounted on a conductive panel which is shared with the EMC filters. If the panel has a paint finish, it will be necessary to remove the paint in certain areas to ensure filters and drives make a good large-area metal to metal contact between case and panel.

Filters should be mounted close to the drive and supply wiring kept as short as practical. Attempt to layout the wiring in a way that minimises cross-coupling between filtered and non-filtered conductors. This means avoiding running wires from the output of a filter close to those connected to its input. Where you wish to minimise the cross-coupling between wires avoid running them side-by-side one another, if they must cross, cross them at 90° to each other. Keep wiring supported and close to cabinet metalwork. A typical EMC layout is given in Figure 3-9.

Recommended EMC filter types are CORCOM 6FC10 for loads up to 6A and 3VK3 for the +24V supply up to 3A. Larger systems may require higher current rated filters.

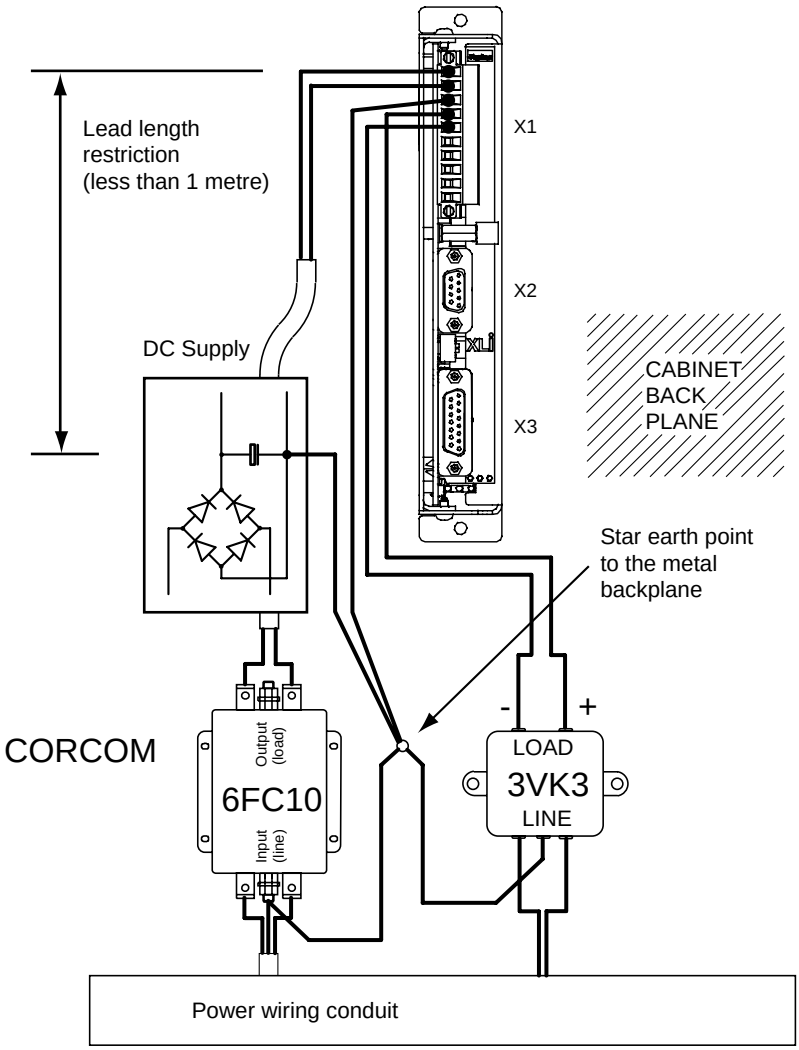


Figure 3-9. XL25/XL50 EMC Installation

Motor Connections (EMC)

The recommended wire size for XL25/XL50/XL80 motor cables, of length less than 20m, is 1mm^2. For motor cable lengths greater than 20m (up to a maximum of 50m) use a wire size of 2.5mm^2. Use a cable containing five conductors plus the braided screen (such as Lapp 34805), the green wire being used to provide an earth return to the drive. Termination at the motor must be made using a 360° bond to the motor body, and this may be achieved by using a suitable clamp. Many stepper motors are designed to accommodate an appropriate terminal gland which can be used for this purpose.

All motor connections must be made using a high quality braided-screen cable. Cables using a metallised plastic bandage for an earth screen are unsuitable and in fact provide very little screening. Care must be taken when terminating the cable screen, the screen itself is comparatively fragile; bending it round a tight radius can seriously affect the screening performance. The selected cable must have a temperature rating which is adequate for the expected operating temperature of the motor case.

At the drive end of the cable, a 360° connection to the screen should be made using the brass P-clip provided beneath the motor connector. The diameter of the P-clip is 6mm for use with the ready made motor cables having 1mm^2 conductors. The P-clip needs to be firmly clamped to the copper braid. If the connection appears loose, fold the braid back on itself to increase the amount of braid under the clip and re-tighten.

Custom cables will require the cable insulation to be removed to expose the braided screen. If you are using a motor cable with 2.5mm^2 conductors the size of the brass P-clip will need to be 9mm to accommodate the increased cable diameter. A ferrite absorber, with a specification matching that of the Chomerics H8FE-1115-NC, is also required to be positioned on the motor cable using heat shrink sleeving or cable ties. The position of the absorber should be just below the drive, as shown in Figure 3-10. Always secure the cable using the P-clip, as shown. Do not rely upon the connector alone holding the motor cable in place. **The X1 connector must not be stressed by hanging cables, as this may lead to connector over-heating**.

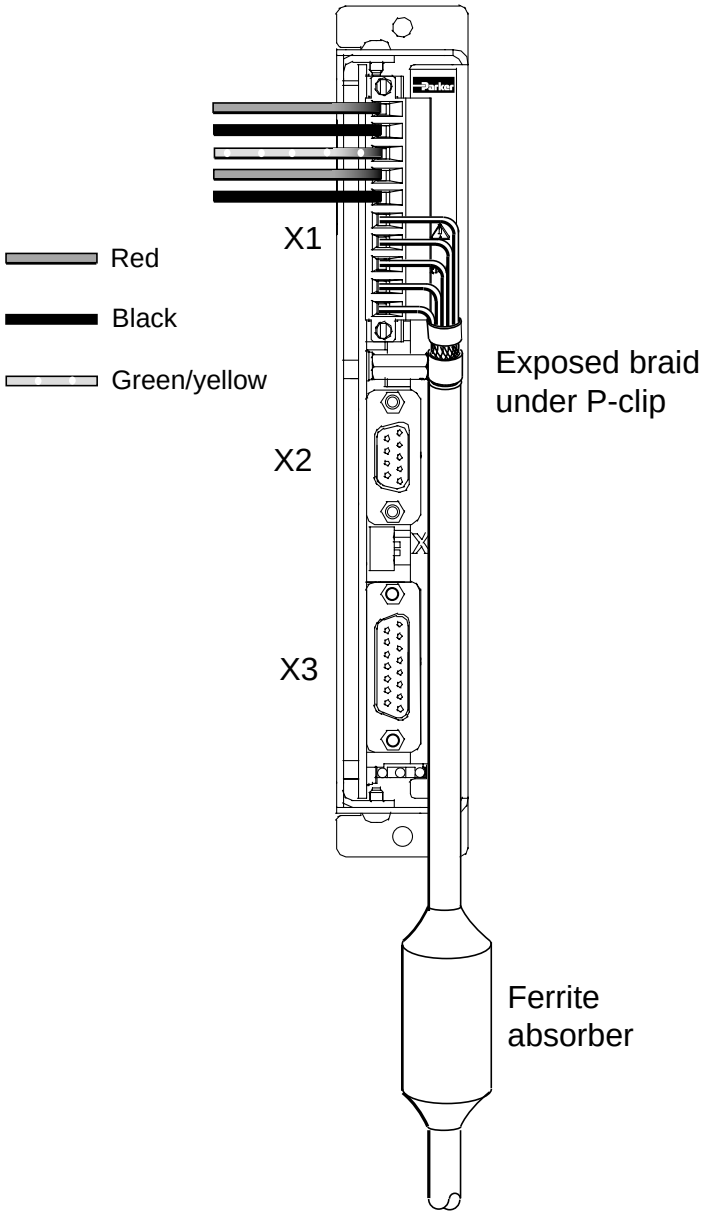


Figure 3-10. Position of absorber & motor wiring details

There must be no break in the 360° coverage that the screen provides around the cable conductors. If a connector must be used it should retain the 360° coverage, possibly by the use of an additional metallic casing where it passes through the bulkhead of the enclosure. The cable screen must not be bonded to the cabinet at the point of entry. Its function is to return high-frequency chopping current back to the drive. This may require mounting the connector on a sub-panel insulated from the main cabinet, or using a connector having an internal screen which is insulated from the connector housing. Within the cabinet itself, all the motor cables should lie in the same trunking as far as possible. They must be kept separate from any low-level control signal cables. This applies particularly where the control cables are un-screened and run close to the drive.
Note that the motor cable routing within the equipment cabinet should be kept at least 300mm away from I/O cables carrying control signals.

Ferrite absorber specifications

The absorber used for motor cables is made from a low-grade ferrite material which has high losses at radio frequencies. The absorber acts like a high impedance in this waveband. The recommended component is produced by Parker Chomerics and is suitable for use with a cable having an outside diameter up to 10mm. The specification is as follows:
Chomerics part number H8FE-1115-NC
Outside diameter 17.5mm
Inside diameter 10.7mm
Length 28.5mm
Impedance at 25MHz 80 ohm
Impedance at 100MHz 120 ohm
Curie temperature 130°C (the device should not be operated near this temperature)

Motor Selection

Usually optimum performance will be obtained when the current rating of the motor is between 1 and 1.5 times the drive rating, but remember the current rating of a motor is its DC rating, whilst drives are rated at peak output. To match a particular motor's current rating, multiply the drive's peak output current by 0.7. Drives can be de-rated to accommodate motors with lower current ratings (using the bit switch), however the high speed torque will be reduced.

Do not use a drive setting which gives an output current greater than the motor rating.

With 4 lead motors the bipolar rating is quoted and this should match the criteria stated above.

With 8 lead motors the bipolar rating of the motor, which is normally quoted, refers to a parallel winding connection. With the windings connected in series the current rating of the motor connection will be 50% that of the bipolar rating, and the motor will give improved low-speed torque, but reduced high-speed torque.

The XL25/XL50/XL80 will drive motors having an inductance as low as 0.5mH, but the recommended motor inductance range is between 0.8mH and 10mH.

Performance of the XL25/XL50/XL80 is optimised for the following motor types, listed in Table 3-3 and Table 3-4.

Motor Type	Motor Rated Current in Amps*	Motor Inductance in mH per phase	XL80	XL50	XL25
SY561	4.2	1.0			✔
SY562	4.2	2.6		✔	✔
SY563	6.5	1.2		✔	
SY871	4.2	1.6		✔	✔
SY872	6.5	1.5	✔	✔	
SY873	8.4	1.7	✔	✔	
SY1072	8.0	2.4	✔	✔	
SY1073	10.0	2.7	✔		

*(parallel connection)

Table 3-3. SY Optimum Motor Types

Motor Type	Motor Rated Current in Amps*	Motor Inductance in mH	XL80	XL50	XL25
STT57-51P	3.0	2.0		✔	✔
STT57-83P	6.6	0.8		✔	
STT57-102P	6.5	1.0		✔	
STT83-62P	4.5	1.5	✔	✔	
STT83-93P	7.0	2.0	✔	✔	
STT83-135P	10.0	1.6	✔		
STT57-51M	1.4	9.5			✔
STT57-83M	2.7	5.7			✔
STT57-102M	4.1	2.5	✔	✔	
STT83-62M	2.4	5.2			✔
STT83-93M	5.6	3.2	✔	✔	
STT83-135M	5.4	5.6	✔	✔	

*(parallel connection)

Table 3-4. ST Optimum Motor Types

Motor Voltage Ratings

Motors with a withstand voltage rating from phase to earth of 1000V AC should be used. An insulation withstand rating of 500V AC is acceptable if an isolating transformer with earth screen is used to power the system, and the secondary is earthed, as specified.

Large Motors

The largest recommended motor size is a 34-frame 3-stack. Please contact Parker EMD if you wish to use a larger frame motor.

Motor Connections (at the motor)

Motor connections should be made directly between the drive and motor, the use of any switching devices, such as contactors is not recommended.

In the majority of applications the drive will be used with an eight lead motor with the windings connected in parallel or series, as shown in Figure 3-11. Motor connections will need to be determined from the motor's data sheet. These are normally identified by wire colour or terminal markings, depending upon the make of the motor.

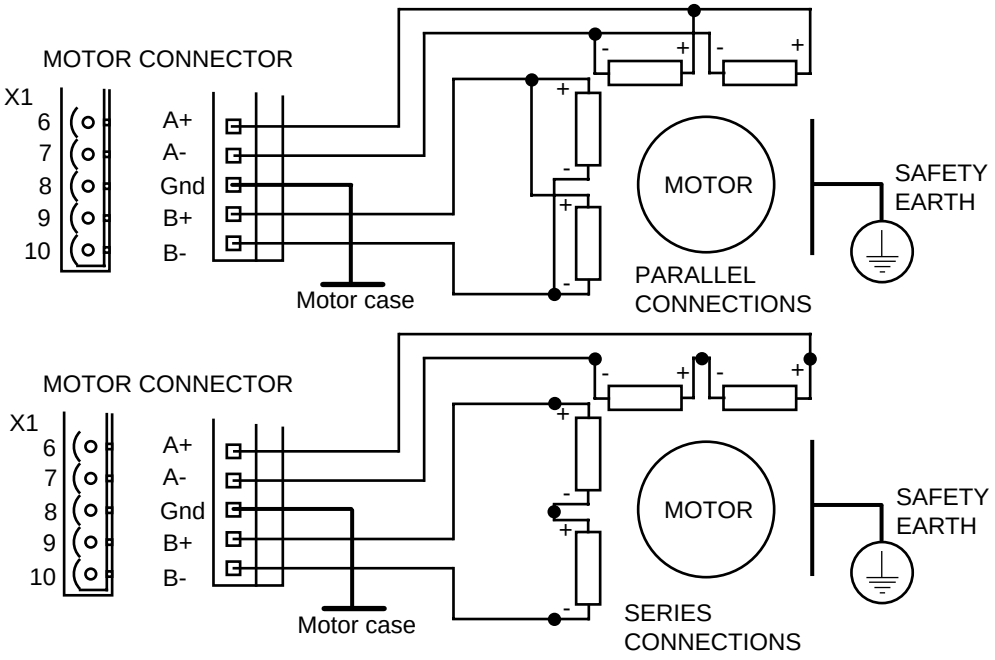


Figure 3-11. 8 Lead Motor Connection Options

WARNING - High Temperature

The motor case temperature may exceed 70°C and should be guarded from operator contact.

Motor Safety Earth/Ground Connection

It is recommended that the case of an installed motor is independently bonded to a local safety earth point. The safety earth lead should be at least 2.5mm^2 in area.

Motor Overload/Short Circuit Protection

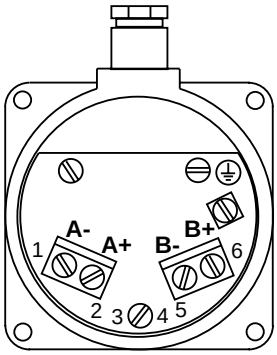
The motor outputs are protected against overload and short circuits. The motor output will shut down within one second, when an overload of 250% of peak motor current is applied.

Note: In the case of stepper motors, locked rotor conditions do not cause an overload, so the only foreseeable failure mode is a short circuit which is immediately detected by the protection circuit.

Motor Wiring Identification Tables

The following tables supply serial and parallel connection information for a range of different motor types.

Note: The SY56 can be supplied as a 4-terminal motor, as shown in Figure 3-12.



SY56 Series terminal layout, viewed from the back of the motor

Figure 3-12. SY56 Motor Connections

MAKE	TYPE	A+	A-	B-	B+	NOTES
Parker EMD STT/STL	8-lead	Red	Yel	Pink	Blk	Link Blue & Violet, link White & Grey
	T.Box	1	2	3	4	Link 5 & 6, link 7 & 8
Parker OEM Series	4-lead	-	-	-	-	Internally wired in parallel
	8-lead	Red	Black	Green	White	Link Blue & Yellow Link Orange & Brown
Parker QM & S Motors	8-lead	Red	Black	White	Green	Link Yel & Blue Link Org & Brown
Parker QM & S Motors (except 106-205)	T.Box	1	3	4	5	Link 2 & 6 Link 7 & 8
Parker QM & 106-205 RS & TS	T.Box	1	3	7	8	Link 5 & 6 Link 2 & 4
Parker EMD SY 56 Series	8-lead	Blue	Green	Red	Brown	Link White to Black Link Grey to Yellow
	T.Box	-	-	-	-	Internally wired in parallel
Parker EMD SY 87/102 Series	8-lead T.Box	blue 5	green 8	red 4	brown 1	Link Yel & Gry, Link Blk & Wh Link 7 & 6, Link 3 & 2
Pacific Scientific	6-lead	Black	Orange	Red	Yellow	White/Blk/Org,
	8-lead	Black	Orange	Red	Yellow	Link Wh/Blk & Wh/Org Link Wh/Red & Wh/Yel
	T.Box	1	3	2	4	Link 5 & 6, Link 7 & 8
Astrosyn, Rapidsyn, Slo-syn	6-lead	Red	Red/Wh	Grn	Grn/Wh	White & Black N/C
	T.Box (X6)	1	3	4	5	2 & 6 N/C
Slo-syn	8-lead	Red	Red/Wh	Grn	Grn/Wh	Link Black & White Link Org & Blk/Wh
	T.Box (X8)	1	3	5	4	Link 2 & 6, Link 7 & 8
Stebon	8-lead T.Box	Red 1	Yel 2	Pink 3	Blk 4	Link Blue & Violet, link White & Grey Link 5 & 6, link 7 & 8
M.A.E	6-lead	Grn/Wh	Grn	Red	Red/Wh	White & Black N/C
	8-lead	Black	Orange	Red	Yellow	Link Wh/Blk & Wh/Org Link Wh/Red & Wh/Yel
	T.Box	6	5	8	7	Link 1 & 3, Link 2 & 4
Zebotronics	T.Box	5	8	4	1	Link 2 & 3, Link 6 & 7
Oriental	6-lead	Black	Green	Red	Blue	Yellow & White N/C
Sonceboz	8-lead	Green	Grn/Wh	Red	Red/Wh	Link Org & Blk/Wh Link Black & White
Japan Servo	6-lead	Red	Blue	Green	Yellow	2 X White N/C
Escap	8-lead	Brown	Org/Wh	Red	Yel/Wh	Link Brn/Wh & Org Link Red/Wh & Yellow
Bodine	8-lead	Brown	Orange	Yellow	Red	Link Wh/Brn & Wh/Org Link Wh/Yel & Wh/Red
	T.Box	1	3	4	2	Link 5 & 7, Link 6 & 8

Table 3-5. Motor Connection Data - Windings in Series

MAKE	TYPE	A+	A-	B-	B+	NOTES
Parker EMD STT/STL	8-lead T.Box	Red & Blue 1 & 6	Yel & Violet 2 & 5	Wh & Pink 3 & 8	Blk & Grey 4 & 7	
Parker OEM Series	4-lead 8-lead	Red Red & Blue	Black Black & Yellow	Green Green & Org	White White & Brown	
Parker QM & S Motors	8-lead	Red & Blue	Black & Yellow	White & Brn	Green & Orange	
Parker QM & S Motors (except 106-205)	T.Box	1 & 2	3 & 6	4 & 7	5 & 8	
Parker QM & 106-205 RS & TS	T.Box	1 & 5	3 & 6	2 & 7	4 & 8	
Parker EMD SY 56	8-lead T.Box	Blu & Gry 2	Grn & Yel 1	Red & Blk 5	Brn & Wh 6	
Parker EMD SY 87/102Series	8-lead T.Box	Blu & Gry 5 & 6	Grn & Yel 8 & 7	Red & Blk 4 & 3	Brn & Wh 1 & 2	
Pacific Scientific	6-lead 8-lead T.Box	Black Black & Wh/Or 1 & 5	Wh/Blk/ Orange Orange & Wh/Blk 3 & 6	Red Red/ Wh/Yel 2 & 7	Wh/Red/ Yellow Yellow & Wh/Red 4 & 8	Org & Yellow N/C
Astrosyn, Rapidsyn, Slo-syn	6-lead T.Box (X6)	Red 1	Black 6	Green 4	White 2	Red/Wh & Grn/Wh N/C 3 & 5 N/C
Slo-syn	8-lead T.Box (X8)	Red & White 1 & 2	Blk & Red/Wh 3 & 6	Grn & Blk/Wh 4 & 7	Org & Grn/Wh 5 & 8	
Stebon	8-lead T.Box	Red & Blue 1 & 6	Yel & Violet 2 & 5	Wh & Pink 3 & 8	Blk & Grey 4 & 7	
M.A.E	6-lead 8-lead T.Box	Grn/Wh Black & Wh/Or 3 & 6	White Or & Wh/Blk 1 & 5	Red Red & Wh/Yel 4 & 8	Black Yel & Wh/Red 2 & 7	Grn & Red N/C
Zebotronics	T.Box	5 & 6	8 & 7	4 & 3	1 & 2	
Oriental	6-lead	Black	Yellow	Red	White	Grn & Blue N/C
Sonceboz	8-lead	Grn & Blk/Wh	Or & Grn/Wh	Red & White	Blk & Red/Wh	
Japan Servo	6-lead	Red	White*	Green	White*	
Escap	8-lead	Brn & Orange	Brn/Wh & Org/Wh	Red & Yellow	Red/Wh & Yel/Wh	
Bodine	8-lead T.Box	Brn & Wh/Or 1 & 7	Wh/Brn & Or 3 & 5	Yel & Wh/Red 4 & 6	Wh/Yel & Red 2 & 8	

*use correct white for each phase
For 6-lead motors, connections shown are for one half-winding.
N/C means No Connection

Table 3-6. Motor Connection Data - Windings in Parallel

Control Wiring

The XL drive connector layout is shown in Figure 3-13.

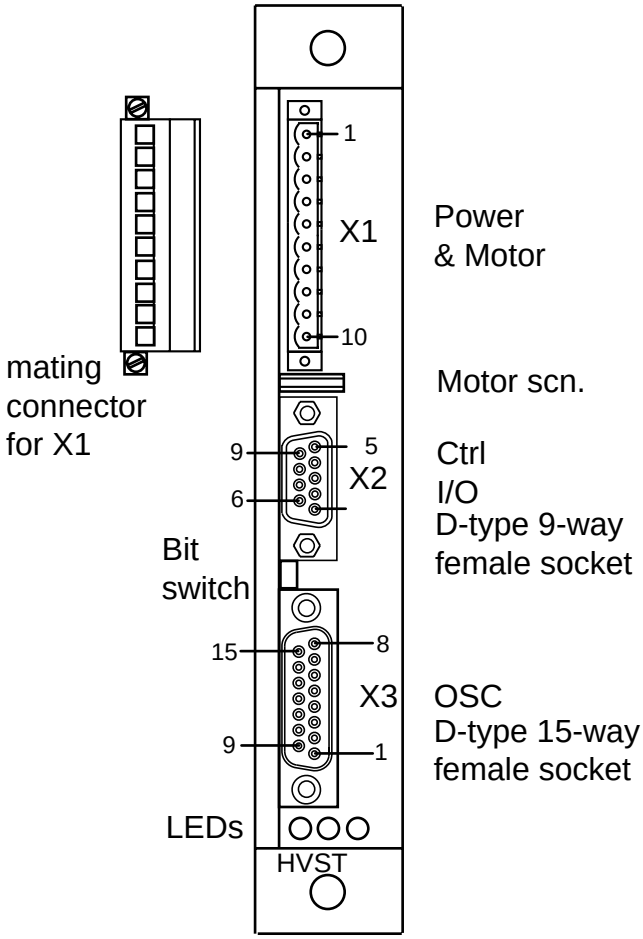


Figure 3-13. XL Connector Layout

Terminal Description

X3 Connector

User control signals are routed to the drive's internal oscillator via connector X3. A multi-way screened cable should be used for all control signal connections, with the screen terminated onto the D-type shell.

Connector Type

15-way D-type female connector.

Connector Pin Out

Connector Pin	Signal Name
1	12V osc. reference ±5%
9	12V osc. reference ±5%
2 & 10	FAST ADJUST
3 & 11	SLOW ADJUST
4 & 12	External acceleration Capacitor FAST
5	$\overline{\text{Osc. monitor output}}$*
6	Direction
7	$\overline{\text{FAST}}$
8	$\overline{\text{SLOW}}$
13	$\overline{\text{Shutdown}}$
14	Analogue input FAST 0-10V
15	0V ground return for all control inputs

Table 3-7. X3 Signal Connections

*Output pulse width typically 1µs (maximum frequency 200 kHz). This is an open collector output which will require an external pull-up resistor of 4k7 Ω (0.25W) to the +24V supply.

X2 Connector

Connector X2 is used for axis control, where an external controller is used to provide system intelligence and generates the necessary Step and Direction signals. A multi-way screened cable should be used for these control signals, where the screen makes a 360° connection at both ends of the cable.

Connector Type

9-way D-type female.

Connector Pin Out

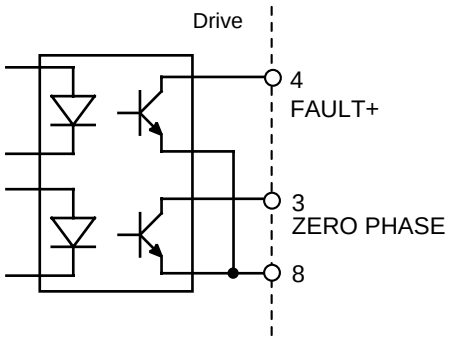
Connector Pin	Signal Name
1	Step + [stepdown +]
2	Dir. + [stepup +]
3	Zero Phase* (open collector NPN active low)
4	Fault (open collector NPN active high)
5	Shutdown +
6	Step - [stepdown -]
7	Dir. - [stepup -]
8	Fault, Zero Phase External Reference (open collector opto-coupler outputs, 5mA max. current at 30V max.)
9	Shutdown -

Table 3-8. X2 Signal Connections

*Low going signal which occurs 50 times per motor revolution. If the drive is set to 4000 steps/rev, the zero phase signal will be active every 80 motor steps, or every 8 motor steps when the drive is set to 400 steps/rev.

Note: The FAULT and ZERO PHASE outputs are connected internally as shown. The FAULT output transistor is normally turned ON, turning OFF when a fault occurs. The ZERO PHASE output transistor is normally OFF and turns ON at positions of zero phase.

Note: The FAULT and ZERO PHASE outputs are connected internally as shown. The FAULT output transistor is normally turned ON, turning OFF when a fault occurs. The ZERO PHASE output transistor is normally OFF and turns ON at positions of zero phase.



Motor Connector (Part of X1)

Motor connections need to be made using a side entry plug, as specified below. For full motor cable wiring details see the EMC installation information.

It is recommended that motor connections are made directly between the motor and drive, avoiding any switching devices, such as contactors or relays. However, if such switching is essential, precautions must be taken to ensure motor connections are switched in both phases when the drive is de-energised and the motor current has collapsed to zero. It is essential to ensure that the contactor/relay does not open or close when the drive is energised.

Connector Type

Mating connector type is: Wieland 8213B/10 F OB, part number 25.323.4053.0

Connector Pin Out

Pin Connection	Signal Name
6	Motor Phase A+
7	Motor Phase A-
8	Motor GND (drain)
9	Motor Phase B+
10	Motor Phase B-

Table 3-9. Part of X1 Motor Connections

4. Control of XL Step Direction Drives

Overview

This section describes the operation of XL step direction drives using the internal oscillator or external control. Internal oscillator operation is used for stand-alone applications, where a single axis is being controlled manually or via a dedicated interface. External control allows the drive to be used in multi axis applications where an external controller provides all the necessary intelligence and generates the required Step and Direction signals.
Compared to the DIN Rail H & L drives: XL does not offer boost, has only a DC power input, and has no power dump option, unless used with the XL_PSU.

Default Settings

When the drive leaves the factory the default settings are as follows:

Control	**step/direction**
Standby	**current reduction 50%**
Resolution	**4000 steps per rev.**
Current	**50% of peak rating**

To alter these default values see Bit Switch Settings later in this section.

Control of the XL step-direction drive

XL drives are controlled by step and direction signals. These signals may be derived either from an external step-direction source or from the internal oscillator built into the drive. The drive will also accept step-up/step-down signals from an external source.

Using an external step-direction source

The step and direction inputs are designed to accept differential signals with TTL levels. This arrangement gives improved noise immunity over single-ended systems. The step-direction and shutdown input circuits are shown in Figure 4-1. Bit switch 2 should be OFF when using a step-direction source.

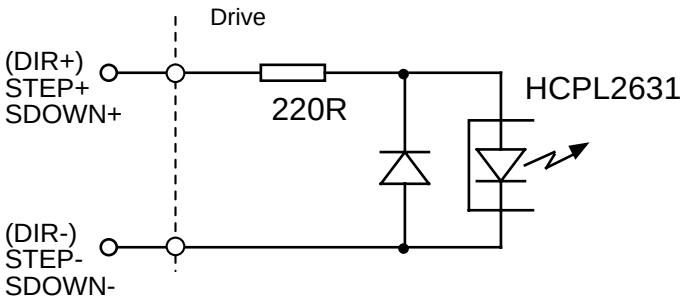


Figure 4-1. Step, Direction and Shutdown Input Circuit

The motor performs a step when Step+ goes high with respect to Step-. The maximum frequency on the step input is 200kHz, allowing a theoretical maximum speed of 3000rpm to be achieved at a resolution of 4000 steps/rev. In practice the maximum attainable speed will

depend on the characteristics of the motor in use. The allowable width of the step pulse depends on the maximum input frequency to be used; the pulse width should never exceed the interval between pulses, in other words the signal becomes a square wave at the maximum frequency. Therefore at 200kHz the maximum pulse width is 2.5µS. The minimum step pulse width is 1µS.

With the motor connected according to the information supplied, it should rotate clockwise when viewed from the shaft end when Direction+ is high with respect to Direction-. The direction signal should only be changed when the motor is stationary, and to maintain positional integrity the first step pulse should not occur within 1µS of a direction change.

Using a step-up/step-down source

Some types of stepper controller generate an output in the form of two independent step pulse trains, one for each direction of rotation. The XL drive will accept this type of signal when bit switch 2 is ON.

Connect the step-down signal to the normal step inputs and the step-up signal to the direction inputs. The motor should rotate clockwise from a step-up pulse and counter-clockwise from a step-down pulse. The guidelines regarding step pulse width are the same for step-up/step-down as for step-direction operation.

Using the internal oscillator

XL step-direction drives incorporate an internal oscillator which will deliver a controlled pulse stream to the drive. The oscillator may be controlled by operator push-buttons, relay contacts or external NPN transistors. It has two speed ranges, designated Slow and Fast, which are both adjustable by means of external programming resistors. Separate control inputs are provided for each speed range; these inputs are internally pulled up to +12V, and must be taken to 0V to start the oscillator. The input circuits are shown in Figure 4-2.

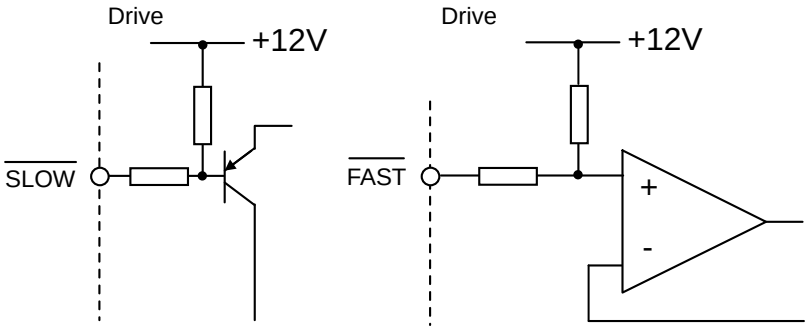


Figure 4-2. Enable circuits for Slow and Fast Inputs

When the Slow input is taken low, the oscillator will run at a constant frequency determined by the Slow Range programming resistor. The frequency must therefore correspond to a speed within the start-stop range of the motor. Taking the Fast input low will cause the oscillator to accelerate up to the programmed Fast speed at a preset rate. The preset rate may be reduced by the addition of an external capacitor. Alternatively, an analogue input allows the Fast speed to be controlled by an external signal in the range 0-10V DC.

A separate Auxiliary Direction input is provided to control motor direction when the internal oscillator is used. This input is internally pulled up to +12V and if left open-circuit will produce counter clockwise (CCW) rotation, for a correctly wired motor. Taking this input low will reverse direction provided that the differential Direction+ and Direction- inputs are open-circuit.

Setting the oscillator speeds

The programmed speed in each range is determined by an external resistor connected between the appropriate Adjust input and one of the two 12V reference pins (see Figure 4-3). Two reference pins are provided to minimise the number of connections that need to be made to a single pin.

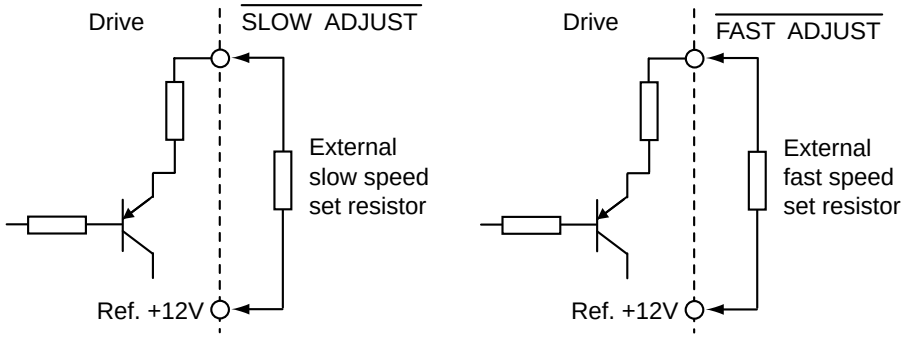


Figure 4-3. Slow and Fast Adjust Inputs

The required resistor value may be estimated from Tables A & B below. These tables show the approximate shaft speeds obtained at a resolution of 4000 steps/rev; at 2000, 800 or 400 steps/rev, the shaft speed will be respectively 2, 5 and 10 times faster for the same resistor value. Note that the quoted speeds are nominal and are subject to a 20% tolerance.

If a potentiometer is to be used to vary the speed, it is preferable to use the analogue control input rather than to adjust the Fast programming resistor. The analogue control input operates via the acceleration/deceleration circuit, therefore turning the potentiometer rapidly will not de-synchronise the motor.

Resistor ohms	Speed revs/sec
100K	0.3
56K	0.6
33K	1.1
22K	1.7
10K	3.7
5.6K	6.4
3.3K	10.2
2.2K	14.2
1K	25.1
560	35
330	44
220	50
100	59
0	69

Table 4-1. Fast range speed vs. resistor value at 4000 steps/rev.

Resistor ohms	Speed revs/sec
100K	0.3
56K	0.6
33K	1.0
22K	1.5
10K	2.7
5.6K	4.0
3.3K	5.2
2.2K	6.1
1K	7.5
560	8.2
0	9.3

Table 4-2. Slow range speed vs. resistor value at 4000 steps/rev.

Using the analogue speed control input

This input allows the oscillator speed to be determined by an analogue voltage in the range 0-10V DC. +10V will produce the full programmed speed and 0V zero speed. The speed/voltage characteristic is approximately linear. There is a nominal 0.5V deadband at the 0V end to ensure that the oscillator can be stopped completely.

The analogue control voltage may be derived from a potentiometer connected between pin 1 and pin 12 on connector X11/X21. The suggested resistance of the potentiometer is 2K; this is also the minimum allowable value. A larger value of potentiometer can be used (up to 10K), but the speed control achieved by using the higher value potentiometer will be less linear.

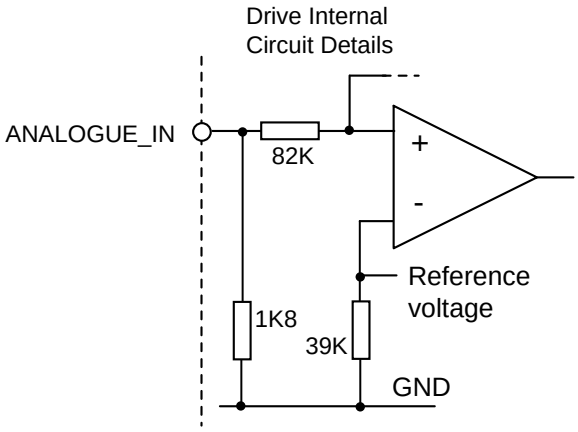


Figure 4-4. Analogue Input

Setting the acceleration/deceleration rate

When using the fast speed range, the oscillator accelerates up to and down from the programmed speed. The acceleration profile is basically exponential (see Figure 4-5), whilst the deceleration profile is linear. The default acceleration and deceleration times are 45mS and 30mS respectively.

These times may be extended by fitting an external capacitor between pin 4 and pin 1 on X3 (the negative end of the capacitor to pin 4). The internal acceleration capacitor is 4.7µF; the acceleration & deceleration times will be in proportion to the total capacitance. So an external 4.7µF capacitor will give an acceleration time of 90mS, and a 47µF capacitor will give 495mS (these times are subject to a 20% tolerance).

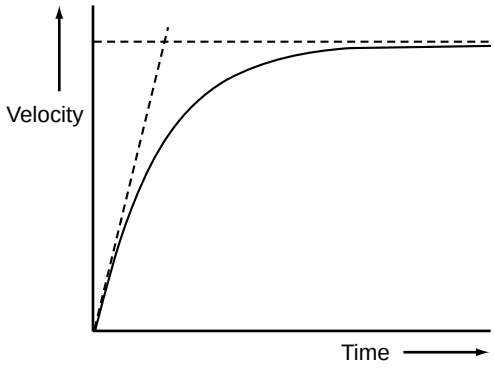
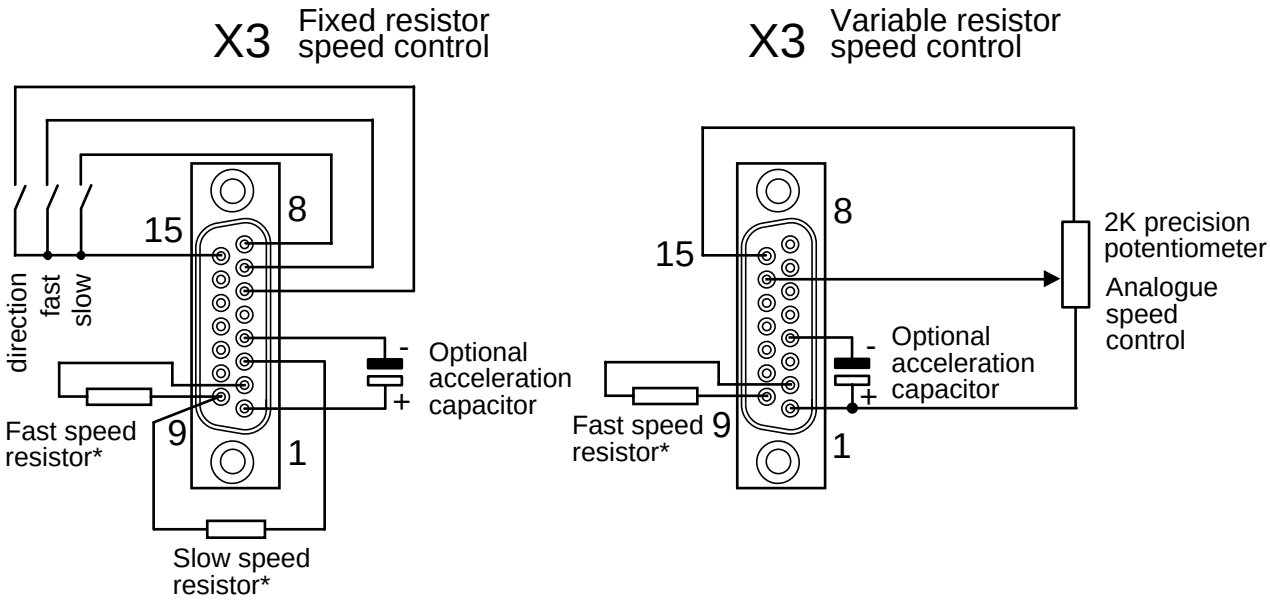


Figure 4-5. Acceleration Profile

External Oscillator Connections



* Multi-turn potentiometers could be used to give adjustable pre-set speeds.

Figure 4-6. External Oscillator Control

Additional control signals on the step-direction drive

Shutdown. The differential Shutdown inputs (X2 pins 5 and 9) allow the drive to be remotely de-energised, in other words the output stage will be turned off completely which leaves the motor shaft free to rotate. The drive is de-energised when Shutdown+ goes high with respect to Shutdown-. There is also an auxiliary Shutdown input on pin 13 of connector X3 which is internally pulled up to +12V and will de-energise the drive when taken to 0V.

The motor shaft should not be rotated at high speed with the drive de-energised as this may damage the power output stage.

Fault. If the drive shuts down as a result of a fault condition, such as an external short circuit or over-temperature fault, the Fault output will turn OFF. This output is opto-isolated but has a common return with the Zero Phase signal (see circuit in Figure 4-7). The signal may be used to indicate to an external controller that the drive has shut down. De-energise and re-energise the drive, or cycle the power, to reset the fault condition. Please refer to the troubleshooting section for information on fault diagnosis.

The opto is ON for a drive HEALTHY signal and so turns OFF under fault conditions.

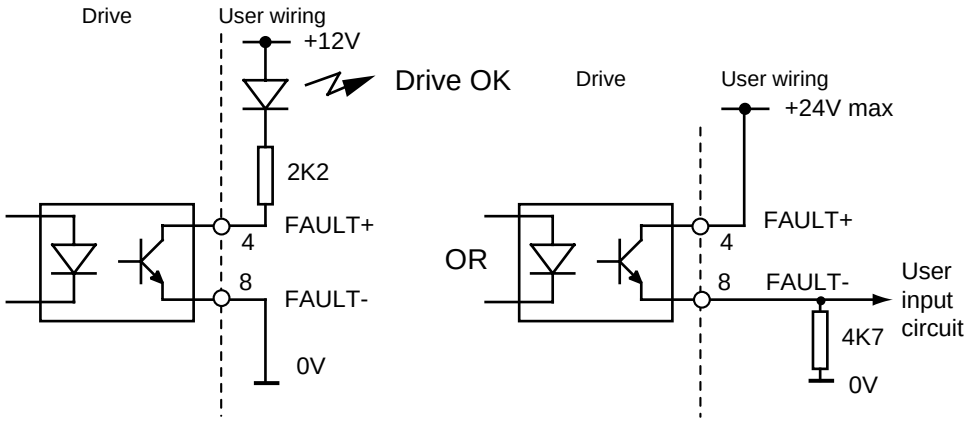


Figure 4-7. Fault Output Configurations

Zero Phase. The 'Zero Phase' condition corresponds with a specific current combination in the motor windings which occurs 50 times per revolution. This output turns on when the drive is at each Zero Phase point, and it indicates that the motor shaft is in one of 50 specific and repeatable orientations. The function may be used to improve homing repeatability by offsetting the effect of small variations in the home switch operating point.

The drive is reset to the Zero Phase state at power-up (orange LED).

Oscillator monitor. This is an output signal which may be used to monitor the step pulse stream from the internal oscillator. For instance it may be taken to a counter to indicate current position or to provide feedback when the oscillator is used within a positioning system. The signal comes from an NPN open-collector transistor which turns on during each step pulse. The pulse width is typically 1µs wide and a maximum frequency of 200kHz.

Bit Switch Settings

Configuration of step direction drives is performed by bit switch settings. Located between connectors X2 and X3 the bit switch is mounted as shown in Figure 4-8. If you alter bit switch settings, the new setting will only take effect by cycling the power to the drive.

The drive is supplied with all bit switches turned OFF, as shown.

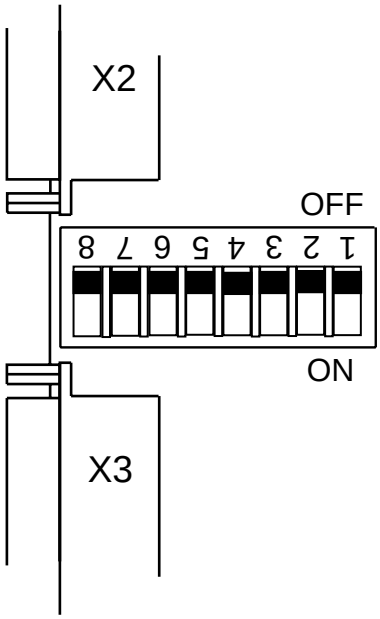


Figure 4-8. Bit Switch Layout

Switch Functions

Switch Number	Function	Description
1	Reserved	-
2	Step/dir. (OFF default) Step+/Step- (ON)	Allows conventional or two step line control
3	Standby 50% (OFF default) 70% (ON)	Standby select
4	Resolution bit 1	Set motor resolution
5	Resolution bit 2	Set motor resolution
6	Current select bit 1	Set motor current
7	Current select bit 2	Set motor current
8	Current select bit 3	Set motor current

Table 4-3. Bit Switch Functions

Bits 4 and 5 set the resolution according to the following table:

Bit switch 4	Bit switch 5	Motor resolution in steps per rev
OFF	OFF	4000*
OFF	ON	2000
ON	OFF	800
ON	ON	400

* default value

Table 4-4. Motor Resolution Settings

Bits 6,7 and 8 set the motor current as a percentage of the drive's peak current rating:

Bit switch 6	Bit switch 7	Bit switch 8	Current level as a percentage (%)
ON	ON	ON	100
ON	ON	OFF	90
ON	OFF	ON	80
ON	OFF	OFF	70
OFF	ON	ON	60
OFF	ON	OFF	50
OFF	OFF	ON	50
OFF	OFF	OFF	50*

* default value

Table 4-5. Motor Current Settings

5. Maintenance and Troubleshooting

Maintenance

XL systems do not require any routine maintenance, but occasional checking of the following points is recommended.

Motor inspection

Periodically check the motor to ensure that the mounting bolts and couplings are tight. Check that the motor cables are not being damaged by moving parts and are not being pulled or forced into tight bends during machine operation. Check all cable connectors and particularly the safety earth connection.

Drive inspection

Check that the drives are clear of loose material and that there is adequate clearance to allow a free flow of air through the ventilation slots. Check that drive fixing screws are tight and that the motor screen connection is secure.

Troubleshooting

IMPORTANT NOTE - ensure that power is turned off before any connections are removed or changed. **Removing a drive with power applied can turn a recoverable fault situation into a major problem.**

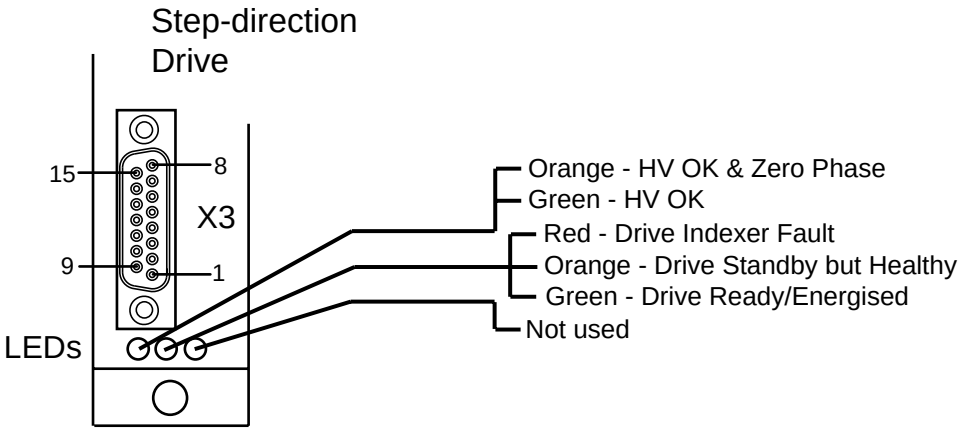
Drive LED indications

In the event of any system malfunction, the first thing to check is the status of the LEDs on the front of the drive module. If no LEDs are illuminated, verify that power is turned on and that the correct supply (see Table 3-1) is present at the X1 connector. If it is, but there are still no LEDs illuminated, the drive is faulty and needs to be returned for repair.

WARNING – Risk of damage and/or personal injury

The XL drives and XL_PSU power supply described in this user guide contain no user-serviceable parts. Attempting to open the case of any unit, or to replace any internal component, may result in damage to the unit and/or personal injury.

The drive LEDs are 3-colour devices and provide information on the state of the drive as shown in Figure 5-1.



Note: Standby means the drive is shutdown or de-energised.

Figure 5-1. Drive LED Indicators

Power (left) LED

In normal operation this LED is either green or orange. When **green** it indicates that the power supply is healthy; **orange** shows both that power is healthy and that the drive is in its zero phase state. The LED should show orange when the drive is first powered up and no step pulses have been applied.

Drive Status (middle) LED

In normal operation this LED should be **green**, showing that the drive is healthy and is energised, i.e. not in a standby condition.

When this LED is **orange**, the drive is in a standby or de-energised state but is otherwise healthy. In this condition there will be no holding torque from the motor and the drive will not respond to step pulses. If this is the cause of the problem, check the status of the differential Shutdown inputs (X2 pins 5 and 9) and also the auxiliary Shutdown input on X3 pin 13.

If the centre LED is **red** it indicates that the drive has shut down due to a fault condition. This may be due to any of the following causes:

1. The power input voltage is either too high or too low. Check that the supply is within the limits specified in the Hardware Reference Section.

2. The X1 connector may not be fully inserted into the drive - check that the wiring is not preventing the connector from being pushed fully home.

3. There is a short circuit across two of the motor connections or between one of the motor connections and ground. Disconnect power, remove X1 and check the motor connections with a meter. This condition may also arise if a very low inductance motor is used - the preferred range is 0.8mH to 10mH.

4. The drive has shut down due to excess temperature rise. Check that the ventilation slots at the top and bottom of the housing are not obstructed and that there is free flow of air through the drive. Make sure that the drive is not mounted directly above a source of heat such as a power supply, and if possible check the ambient temperature in the vicinity of the drive casing. Allow the drive to cool down and re-check. If the motor has ample torque for the application, try reducing the current setting on the bit switch which will reduce the drive dissipation.

5. There is an internal fault in the drive or with the internally-generated logic supply. In either case the drive will need to be returned for repair.

Right LED

This LED has no function in the XL25/XL50 or XL80 drive.

Further checks

If you can safely do so, check that there is holding torque from the motor. However, take care not to touch any part of the system if this could result in personal injury should unexpected motion occur - see the safety warning at the front of this User Guide.

Drive LEDs OK but no holding torque from the motor

Disconnect power, remove X1 and check the motor connections for continuity across each phase. Check that the drive has not been de-energised by a Shutdown signal as detailed above.

Motor has holding torque but will not run

This suggests that step pulses are not reaching the drive, or that they are not at the required level. This could be caused by bit switch 2 being in the ON position whilst the direction input signal is active. Note: If you are attempting to operate in STEP/DIRECTION mode, but the motor only steps in one direction, check the setting of bit switch 2 (it should be OFF).

If step pulses are generated by an external source, the required signal on the step and direction inputs is differential at nominal TTL (5V) levels. The minimum differential voltage is 3.5V and step pulses must be at least 1µS wide.

If the internal oscillator on the drive is being used to generate step pulses, but the motor is not moving, check the following points:

1. An external 24V DC supply is required to run the internal oscillator (it is not needed if the drive is controlled from an external step/direction source). The oscillator will not run if the polarity of this supply is incorrect - positive should be on X1 pin 4 and negative (or 0V) on X1 pin 5.

2. For the oscillator to run, a logic low level (<1V) must be present on either the Slow or Fast control inputs, or the analogue speed control input must be above the 0.5V deadband.

3. An appropriate speed control resistor or potentiometer must be fitted between the Slow and/or Fast range set input and a 12V reference terminal (two reference terminals are provided to make wiring easier).

If an oscilloscope is available, the oscillator output pulses may be checked on the Monitor terminal (X3 pin 5), provided a pull-up resistor is fitted.

Returning the System

If a drive module is found to be faulty, you should contact your Parker Automation Technology Centre or the machinery manufacturer who supplied the product. Equipment for repair should NOT be returned directly to Parker without prior authorisation. Repairs will be carried out by Parker but will be processed via your supplier.

Parker may at their discretion authorise direct shipment to and from Poole, Offenburg or Rohnert Park, but only by prior arrangement with your supplier. Existing UK, European and USA customers who purchase equipment directly from Parker should contact Poole, Offenburg or Rohnert Park for further information (contact numbers are at the front of this User Guide).

6. Hardware Reference

Drive Specification - XL25 XL50 & XL80

Functional Specification

Parameter	Value
Amplifier type	MOSFET chopper
Motor resolution	400, 800, 2000, 4000 steps/rev
Maximum stepping rate	200kHz at 4000 steps/rev
Nominal chopping frequency	28kHz (XL25), 20kHz (XL50 & XL80)
Protection circuits	Short circuit (phase-to-phase, across phases and phase to ground), motor overcurrent, over/under voltage, logic supply fault, over temperature, ext. 24V reversed
Maximum output current	XL25: 2.5A peak +/-10% XL50: 5A peak +/-10% XL80: 8A peak +/-10%
Output current adjustment	50% to 100% of maximum current, switch selectable in 10% increments
Standby current reduction	50% or 70% selected by switch
Standby reduction time	30mS from last step pulse
Nominal motor bus voltage	80V DC
Supply voltage, DC operation	XL25: 20 to 84V absolute limits XL50: 40 to 84V absolute limits XL80: 40 to 84V absolute limits
Optional logic supply input*	24V DC +10% -15%, ripple <1V p-p
Logic supply current*	100mA
LED status indicators (tri-colour)	HV OK/zero phase, drive OK/energised/fault
Motor inductance range (recommended)	0.8 - 10mH
Step, Direction and Shutdown input levels	Differential TTL
Fault & Zero phase outputs	OPTO outputs 5mA max. at 30V max.

* required for internal oscillator only

Table 6-1. Functional Specification

Oscillator Specification

Parameter	Value
Speed ranges at 4000 steps/rev	
Fast range	0-50 revs/sec
Slow range	0-8 revs/sec (higher speeds available at lower drive resolution)
Speed adjustment - slow	External resistor - see table 4-2
Speed adjustment - fast	External resistor or 0-10V analogue input
Analogue fast speed adjustment	<0.5V = zero speed, +10V = max speed
Preset acceleration time (Fast range only)	45mS
Preset deceleration time (Fast range only)	30mS
Accel/decel time adjustment	External capacitor (for capacitor C in µF, new accel time = preset time x {C+4.7}/4.7)
Oscillator monitor output	NPN open-collector transistor, 30mA max ON current, 30V max OFF voltage. 1µs pulse width, 200kHz max.
+12V reference supply current limit	10mA

Table 6-2. Oscillator Specification

Drive Environment Specification

Parameters	All drive types
Environment	Pollution degree 2, Installation category II
Operating temperature range	0 to 50°C ambient
Storage temperature range	-20 to 70°C
Humidity	5 to 95% non-condensing
Cooling	Natural convection
Housing	Aluminium
Protection class	IP20
Weight of drive	XL25/XL50 0.4kg XL80 0.45kg

Table 6-3. Environment Specification

XL_PSU Electrical Specification

Parameter	Value
Input voltage	
Nominal	110 to 230 V AC RMS
Min/Max	95 to 264V AC RMS
Mains supply frequency range	50/60Hz +/- 2Hz
Input power factor	Better than 0.9 at 250W load
Output voltage	80V DC ±5% (no load)
Output current	
230V AC input, no 24V load	3.1A continuous, 7.5A peak
230V AC input, max 24V load	2.6A continuous, 7.0A peak
<150V AC input, no 24V load	2.5A continuous, 6.2A peak
<150V AC input, max 24V load	2.0A continuous, 5.7A peak
Protection	Short circuit / overload protected
On board capacitance	6600µF
24V Auxiliary output	
Voltage	24V DC +10% -15%
Current	1.8A Max
Protection	Short circuit / overload protected
Output cable length restriction	not to exceed 10m in length
Total output power	250W continuous
Peak	600W for 1 second. Below input voltages of 150V AC, output power is 200W continuous, 500W peak.
Protection circuits	
XL_PSU Module	Overtemperature
Output	
Current	Short circuit / Overload
Power	Excessive continuous power
+24V supply	
Current	Short circuit
Voltage	Reverse polarity
Connection / disconnection	Hot plugging protection

Table 6-4. XL_PSU Electrical Specification

XL_PSU Mechanical Specification

Parameter	Value
Housing	Two part brushed aluminium case
Dimensions	
Depth	130 mm Max
Width	50 mm Max
Height	175 mm Max (195 mm at flange mount)
Weight	1 kg

Table 6-5. XL_PSU Mechanical Specification

XL_PSU Environment Specification

Parameter	Value
Pollution	Degree 2
Installation category	II*
Operating temperature range	0 to 50°C ambient
Storage temperature range	-20° to 70°C
Humidity	5 to 95% non condensing
Altitude	2000 metres
Ingress protection	IP20
Cooling	Natural convection with integral fan. Unit to be mounted vertically with at least 50mm free space above and below the package. Side clearance of 10mm free space both sides.

Table 6-6. XL_PSU Environment Specification

*Note: Installation category (also called Overvoltage Category) specifies the level of mains voltage surges that the equipment will be subjected to. The category depends upon the location of the equipment, and on any external surge protection provided. Equipment in an industrial environment, directly connected to major feeders/short branch circuits, is subjected to Installation Category III. If this is the case, a reduction to Installation Category II is required. This can be achieved by use of an isolating transformer with an earthed screen between primary and secondary, or by fitting varistors from live to neutral and from neutral to earth. Varistors for a 120V AC input should be rated to absorb at least 40 Joules. For example, DIN-rail mounted surge suppressor RS 240-062 (110V AC, 70J) or Farnell 294-275 (110V AC, 80J) would be suitable. Varistors for a 240V AC input should be rated to absorb at least 80 Joules. For example, DIN-rail mounted surge suppressor RS 240-078 (240V AC, 140J) or Farnell 294-287 (240V AC, 140J) would be suitable.

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