CE

OEM 230 Series Drive
User Guide

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IMPORTANT INFORMATION FOR USERS

Installation and Operation of Digiplan Equipment

It is important that Digiplan 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.

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.

High voltages exist within enclosed units, on rack system backplanes (motherboards) and on transformer terminals. Keep clear of these areas when power is applied to the equipment.

Ensure the AC power is disconnected before attempting to make any system connections. Never disconnect the motor with power on; this will damage the drive and the motor contacts.

Do not handle the drive until 8 minutes after removing power to ensure that the capacitors have discharged unless for the purpose of link changing which may be performed with care as soon as power is removed.

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

EMC INFORMATION

EMC Information is presented in boxed paragraphs (such as this one). Information in this User Guide consists of recommendations only; compliance is not guaranteed. The OEM 230 series of drives are sold as complex components for use by professional system builders. They are not intended for sale to end users.

Table of Contents

User Guide Change Summary

The following is a summary of the primary changes to this user guide since the last version was released. This user guide, version 1600.170.02, supersedes version 1600.170.01.

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 chapter is changed, the change bar is located on the outside margin of the chapter title.

Major changes introduced at revision 02 are:

LVD Compliance

EMC installation guidelines

Warning symbols used on the OEM 230 series of drives have the following meanings:

Refer to the accompanying documentation

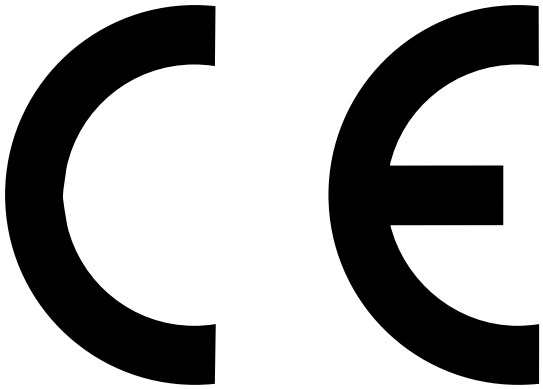
Protective conductor terminal

Risk of electric shock

Alternating current

Hot surface

Frame or chassis terminal



Product Type: **OEM 230, OEM 330, OEM 530 and OEM 530-D**

The above products are in compliance with the requirements of directives

- **73/23/EEC** **Low Voltage Directive**
- **93/68/EEC** **CE Marking Directive**

The OEM 230 Series of drives are sold as complex components to professional assemblers, as components they are not compliant with Electromagnetic Compatibility Directive 89/336/EEC. However, information is offered in this User Guide on how to install these drives in a manner most likely to minimise the effects of drive emissions and to maximise the immunity of drives from externally generated interference.

INTRODUCTION

Product Description

The OEM 230 Series consists of the OEM230, OEM330, OEM530 and the OEM530-D drives. OEM 230 Series Drives are high-performance, bipolar, chopper-regulated stepper drives designed for optimum performance in low and medium power applications. A recirculating chopper regulator improves operating efficiency, minimizes power consumption and reduces motor and drive heating. They may be powered directly from DC supplies or the secondary winding of a centre tapped isolating transformer. One transformer, or one DC supply can power several drives in a multi-axis system. Separate logic and motor supply inputs allow you to use up to a 60-volt DC motor supply, providing extra torque at high speeds.

The motor current selecting link, mounted on the drive, allows you to configure the drive for a wide range of stepper motors.

OEM 230 Series Drives operate rotary stepper motors at resolutions of either 200 steps/rev (full-step) or 400 steps/rev (half-step), and can also be used to operate linear stepper motors.

Motor short-circuit protection is assured across and between phases (not phase-to-ground).

The drives are suitable for use with hybrid and permanent magnet stepping motors having 4, 6, or 8 leads.

The drive may be mounted in a rack or by means of the fixing holes provided.
The drives can be used as stand alone units with separate control inputs and motor connection/power inputs.
An on-board clock can be used to control drive motion or an external step/direction source can be used.

The step, direction and shutdown inputs are fully opto isolated for maximum noise immunity, but they can be configured as single ended non-isolated inputs.

The system may be configured to allow the step signal to be provided by the on-board step source. Two separate programmable speeds are available. These are set by resistors connected to the D-type connector and may be selected remotely, with controlled acceleration and deceleration between the two speeds. When the on-board clock source is used, a controller with access to the ‘clock monitor’ signal can use the Fast, Slow and Direction inputs to control motor movement.

SPECIFICATION

OEM 230 Series Drive Specifications

Parameter	Value
Amplifiers	
Type	Bipolar Chopper
Motor resolution	200 or 400 steps/rev (user-selectable)
Protection	
Short circuit	Phase-to-phase and across phases **(not phase to ground)**
Nominal output current (two-phase-on)	2A/phase (OEM220), 3A/phase (OEM330), 5A/phase (OEM530) - link reduceable
Maximum stepping rate	10kHz @ 200 steps /rev (Full step) 20kHz @ 400 steps /rev (Half step)
Nominal chopping frequency	18kHz
Command Interface	
STEP/DIR/SHUTDOWN	
Configured as differential opto-isolated TTL inputs	
Drive requirements	>3.5V high, <0.8V low +5V max. max input current ±15mA min input current ±6.3mA
Configured as single ended non isolated 5V signals with active low inputs	intended to be driven open collector
Drive requirements	>3.5V high, <0.8V low +5V max.
Maximum current	15mA
STEP	
Minimum pulse width	5μs
Drive clocks on transition to state ()	STEP+(high) STEP-(low)
DIR	
Shaft reversal on transition	DIR+, DIR-
SHUTDOWN	
Motor shutdown on transition to state ()	SHUTDOWN+(high) SHUTDOWN-(low)
Fault, Clock Monitor	Open-collector NPN transistors Low (transistor switched to GND) +0.35V max. @ 15mA max. High (transistor off) +30V max.
Power up reset time	0.2 - 0.6 secs
Drive dimensions	Overall 100 x 182 x 35mm (3.9 x 7.2 x 1.4 inches) card 100 x 167mm (3.9 x 6.6 inches)

Table 1. OEM 230 Series Drive Specifications

OEM 230 Series Drive Specifications (Continued)

AC Power Fed Operation	
Drive supply voltage	44-0-44VAC ±10% for 60VDC (supply range 18Vrms to 44Vrms)
Supply frequency range	47 to 63Hz
Logic supply voltage	18-0-18VAC (+10%, -15%) at 6VA (14VA with max current drawn from auxiliary DC output)
Drive power requirements	
OEM230	100VA max
OEM330	150VA max
OEM530/530-D	300VA max
DC Power Fed Operation	
Motor supply	24V to 60V DC (70V DC absolute maximum)
PSU Continuous current ratings	
OEM230	1.75A
OEM330	2.5A
OEM530/530-D	4.0A
Logic Supply Requirements	24V DC (+10%, -20%)
Current Requirements	
Drive only	250mA
With max auxiliary output load	550mA
Fuses	
FS1 (Logic Supply)	1A
FS2 (Motor Supply)	3.15A (OEM230), 4A (OEM330), 6.3A (OEM530)
Fuse type FS1 & FS2	Quick-acting, low breaking capacity, 5 x 20mm
Dump fuse	500mA TL LB, 5 x 20mm (for OEM 530-D)
Internal Clock Source	
Speed range	
Fast	600 - 20,000 steps/sec (ramped)
Slow	30 - 1,000 steps/sec (not ramped)
Factory preset acceleration time	60 ms
Factory preset deceleration time	30 ms
Power	
Auxiliary output load	24VDC nominal 300mA maximum
Transformer rating	TO193 - 300VA TO194 - 600VA
Output	
Current range	
OEM230	300mA - 3.0A
OEM330	900mA - 4.5A
OEM530/530-D	1.5A - 7.5A
Tolerance of current level	±10%
Motors	
Type	2-Phase hybrid or permanent magnet (normally 1.8°)
Number of leads	4, 6, or 8 (5 lead not suitable)
Inductance range	0.7mH-30mH
Power/Motor connection	refer to section in the manual

Table 1. OEM 230 Series Drive Specifications (Continued)

Pin	Name	I/O	Min. on State Current	Max. Current	Max. Voltage	Signal Levels	Comments
1	Step +	I	±6.3mA	±15mA	5V	TTL	note 1, 3
2	Direction +	I	±6.3mA	±15mA	5V	TTL	note 1, 2
3	On Board Clock Monitor	O		15mA (at 0.35V)	30V	Open collector 30V max	Active low
4	Slow Adjust	I	-------	20mA	12V	-------	
5	Fault	O	-------	15mA (at 0.35V)	30V	Open collector 30V max.	Active high
6	Slow	I	-------	1.5mA	12V	Low <0.8V High = Open Circuit	Active low
7	Fast	I	-------	1.5mA	12V	Low <0.8V High = Open Circuit	Active low
8	Adjust Common	O	-------	20mA	12V	-------	---
9	Step -	I	±6.3mA	±15mA	5V	TTL	note 1, 3
10	Direction -	I	±6.3mA	±15mA	5V	TTL	note 1, 2
11	Shutdown +	I	±6.3mA	±15mA	5V	TTL	note 1
12	Shutdown -	I	±6.3mA	±15mA	5V	TTL	note 1
13	0V	I/O					
14	Fast Adjust	I	-------	20mA	12V	-------	
15	24V AUX output			300mA	26.4V max (16V min)		

Table 2. Control I/O Signal

note 1 For single ended control make solder connection at link pads on reverse of drive. Drive '(-) inputs' from open collector transistor, ON state <0.8V, OFF state max 5V, leave '(+) inputs' open circuit.

note 2 Do not change state of 'DIRECTION+' and 'DIRECTION-' inputs within 5μs of STEP transition to STEP+ high, STEP- low.

note 3 Minimum pulse width is 5μs

INSTALLATION

Installation Requirements

OEM 230 Series drives must be installed by competent personnel familiar with the the installation, commissioning and operation of motion control equipment. In the final application the equipment must be enclosed to prevent the operator coming into contact with any high voltages. This includes the transformer, drive and motor terminations.

The OEM 230 Series of drives are not EMC compliant, they are sold as a complex component for use by professional assemblers of motion control systems. Where a system is not required to conform with the European EMC directive the installation procedure described in this section may be followed. Systems which are to conform to the European EMC directive should be assembled using these procedures and additionally the EMC specific installation recommendations, described at the end of this Section. Digiplan cannot guarantee EMC compliance.

In the final application, the equipment must be enclosed to prevent operator access to everything other than signal I/O connector SKT2. Metal equipment cabinets offer the most advantages for siting the equipment since they can provide operator protection, EMC screening and can be readily fitted with interlocks arranged to remove all AC power when the cabinet door is opened. This form of installation also allows the fitting of metal trays beneath the equipment to act as a flame barrier, which must be provided in the final installation, in accordance with LVD requirements.

Power Connections

The layout and pin numbering of drive edge connectors is shown in Figure 1. The 15-way D-type socket, SKT2 is used for all the drive control functions and is compatible with Compumotor indexer connections.
The signal function of each pin is described in Indexer Connections.

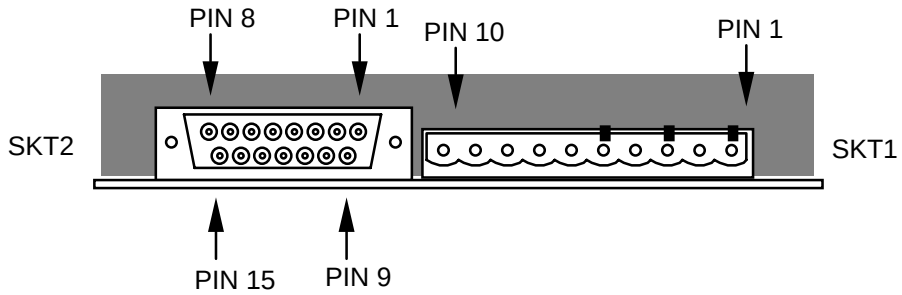


Figure 1. Drive Connector Pin Numbering

The insulation ratings for power connections (SKT1) should be at least 350V where the insulation is between power and signal wiring. A higher insulation rating will be required for the mains wiring.

Transformer wiring needs to be at least 1mm^2 in area and the primary wiring should be routed well away from the secondary wiring and signal wiring. Note: the drive 0V connection must be earthed.

A disconnect device must be provided which isolates all mains supply current-carrying conductors. If the mains supply is permanently connected, a switch or circuit breaker must be included in the wiring. It must be placed close to the equipment (less than 1 metre) and marked as the disconnecting device for the equipment.

SKT1 Keying Pegs

Connector SKT1 is used for both motor connections (Pins 1-5) and power connections (Pins 6-10). The connector is fitted with keying pegs to prevent the cross-connection of Motor and Power plugs. The position of the keying pegs is illustrated in Figure 2.

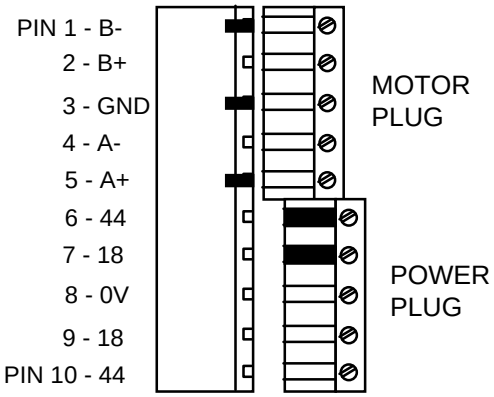


Figure 2. SKT1 Keying Peg Layout

Wiring Guidelines

Proper grounding of electrical equipment is essential to ensure the safety of personnel. You can reduce the effects of electrical noise due to electromagnetic interference (EMI) by grounding. All Digiplan equipment should be properly grounded.
In general, all components and enclosures must be connected to earth ground to provide a low impedance path for ground fault or noise-induced currents. All earth ground connections must be continuous and permanent. Digiplan recommends using a central earth stud e.g. mounted on a rack end-plate or close to it. AC ground, the transformer shield, the power plug 0V terminal and the enclosure metalwork should all be connected to this stud. In particular, you should connect any 0V bus with an 18AWG (1mm^2) cable kept as short as possible.

The motor ground connection should be connected to the motor cable shield at the drive end only. To avoid ground loops, the motor cable shield should not be connected to the motor casing.

Transformer Connections

As illustrated in Figure 3, the transformer leads are connected to the 5-way boxed power connector which plugs into part of SKT1. The power connector is fitted with keying pegs to prevent it being inserted in the motor connection part of SKT1. Details of the position of keying pegs are given in Figure 2.

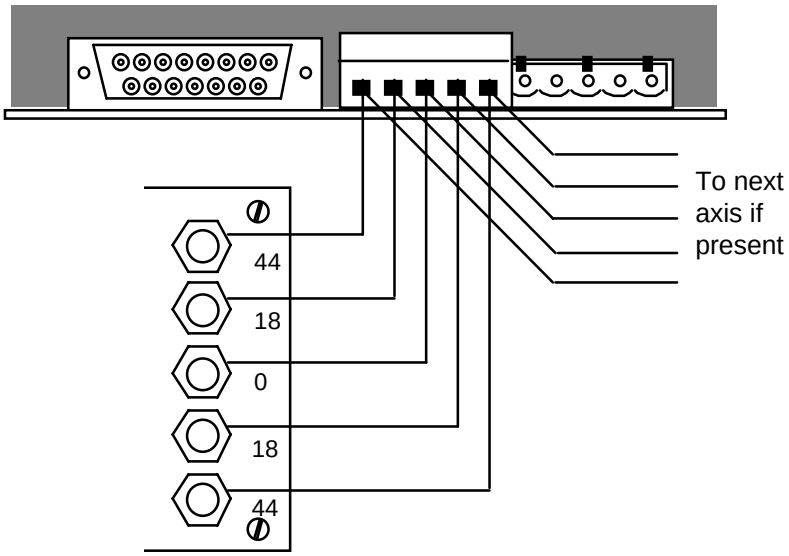


Figure 3. Secondary Transformer Connections

Where the transformer rating is adequate, the same secondary can be used to power multiple axes as shown in Figure 3.

Transformer Wiring

Depending on your application, the OEM 230 Series Drive can be powered with either the TO193 or TO194 transformer. If an alternative transformer is used, it must have an earthed screen between primary and secondary. The insulation rating between primary and secondary must also be adequate, a minimum of 2300V AC RMS is recommended.

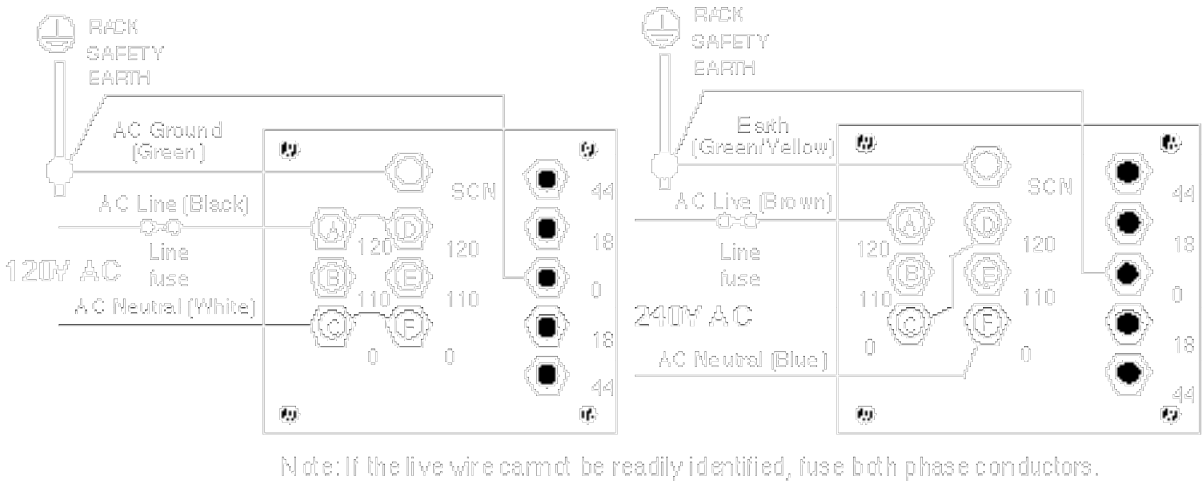


Figure 4 Primary Supply Transformer Wiring

Be sure to connect the AC ground (GND) and SCN (Earth Ground) to the safety earth.

Line Fuses

Line fuses need to be added to protect the transformer and associated wiring. If the live wire cannot be readily identified. fuse both phase conductors. The value of fuse required is given by:

$$\frac{15 \times VA}{\text{supply volts}} \quad \text{in amps}$$

Fuse types should be anti-surge HBC. Recommended values are:

For TO193 (300VA) 3.15A TL HBC
For TO194 (600VA) 5.0A TL HBC

Input Voltage	Connect AC Line to:	Connect AC Neutral to:	Connect Studs:
110	B	C	B&E; C&F
120	A	C	A&D; C&F
220	B	F	C&E
230	A	F	C&E
240	A	F	C&D

Table 3. Transformer Primary Connections

WARNING - danger of electric shock

Do not connect the transformer to the drive while power is applied to the transformer. Do not touch the wiring studs on the transformer after it is plugged into an AC outlet. This can be fatal.
Always wire the transformer first, then check the secondary output voltages on open-circuit BEFORE you connect the transformer to the Drive. ***Note: Be sure to connect the AC ground (GND) to SCN (Earth Ground).***

DC Operation

The OEM230 series may be powered from DC supplies as shown in Figure 5. Separate motor and logic supplies are required when operating at motor supply voltages greater than 24V (up to a maximum of 70V). Both motor and logic supply connections may be taken to a single 24V supply.

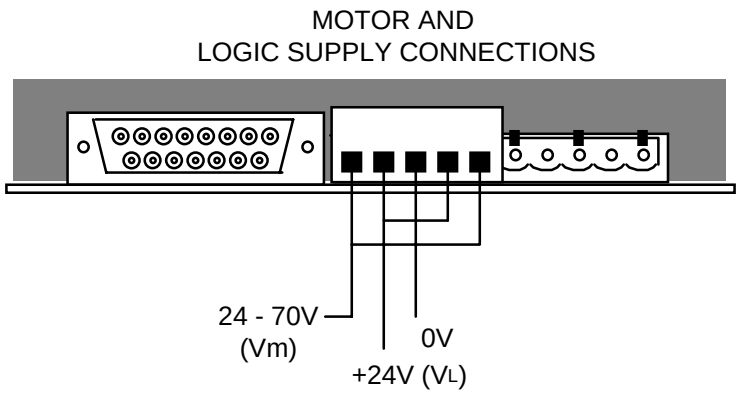


Figure 5. Connections For Alternative DC Supplies

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 (refer to specification).

For maximum high speed torque a motor rating of 7.5A should be used with the OEM530, 4.5A with the OEM330 and 3.0A with the OEM230. The drives can be derated to accommodate motors with lower current ratings however, the high speed torque will be reduced.

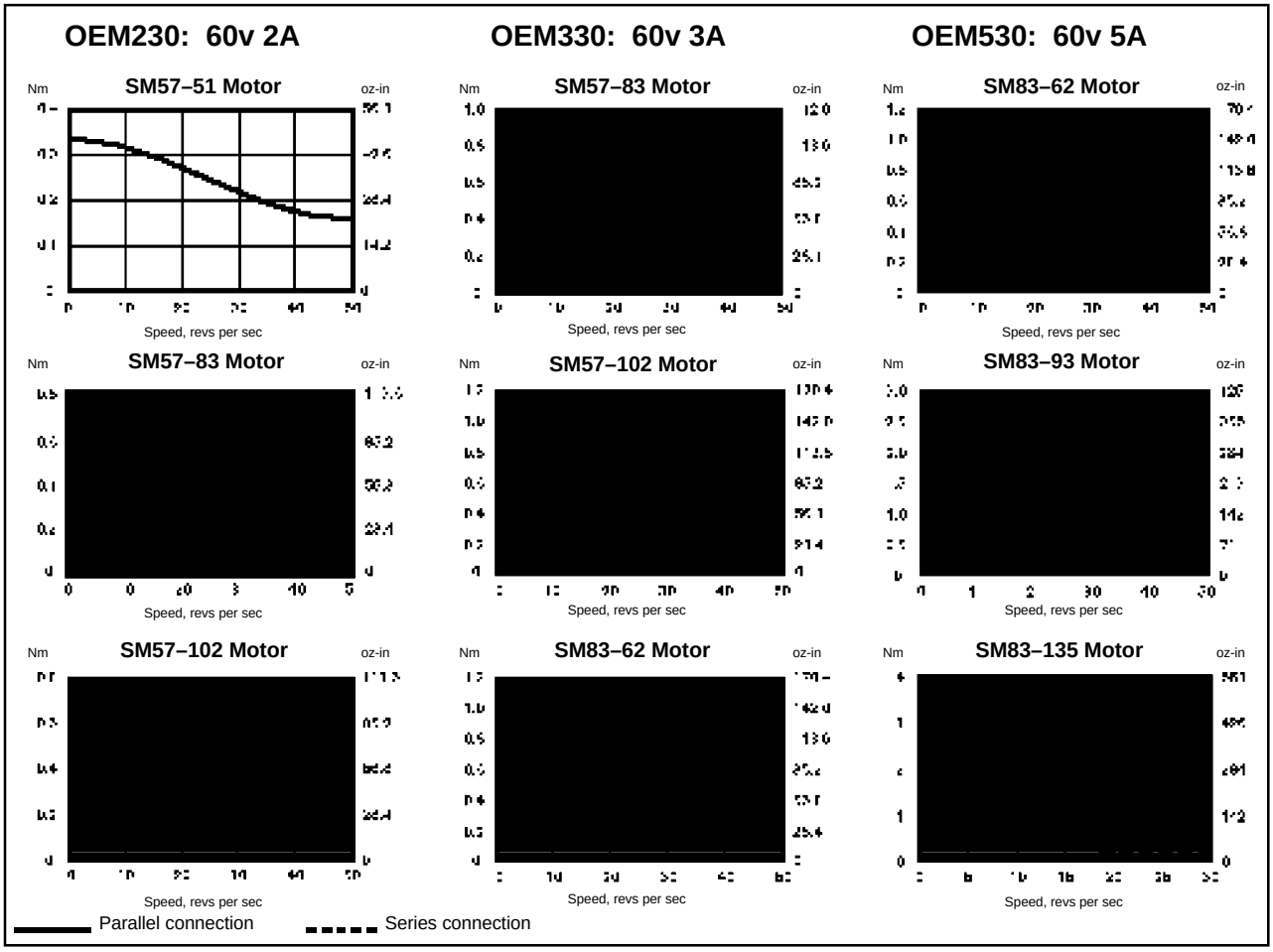
Do not use a drive setting which gives an output current greater than the motor rating.

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

With 6 lead motors the unipolar rating is quoted, but for best performance with the OEM Drives the centre tap of each winding should be left unconnected and the connections made between the winding ends. This will give a bipolar rating 70% of the quoted motor unipolar rating. So a motor unipolar rating of 3.0A should be used with the OEM230.

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.

Torque speed data for SM series stepper motors



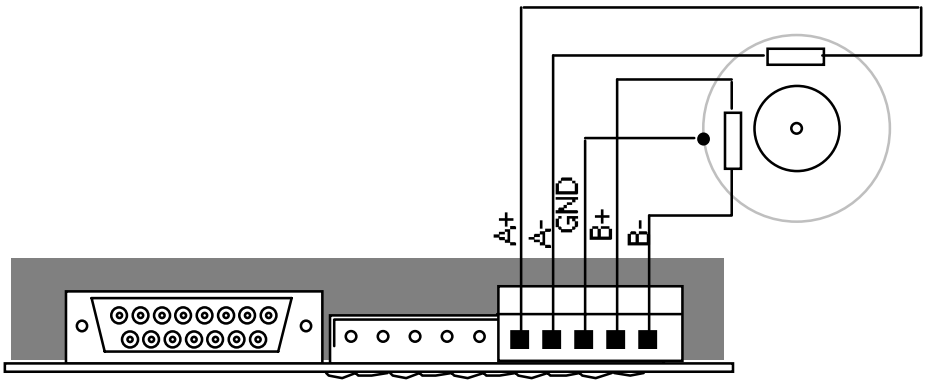
Long Motor Leads

Using a motor with long leads will cause the cabling resistance to become significant when compared to the resistance of the motor. The DC volt drop of the cable and motor connection, when measured at the drive, should not exceed 5 volts in order to limit power dissipation in the drive and maintain maximum system performance.

Motor Connections

If you purchased a Digiplan stepper motor with the drive system please refer to the Digiplan Motor Manual for connection details.

Once you have determined the motor's wiring configuration, connect the motor leads to connector SKT1 on the drive. Note: The motor connection part of SKT1 is fitted with keying pegs to prevent the power plug from being fitted in this position.



To reverse motor rotation relative to the direction input, interchange connections to A+ and A–.

Figure 6 OEM Drive Motor Connections

Motor Insulation

Motor insulation must be capable of withstanding voltages of at least 500V.

Motor Cable

The recommended gauge for OEM 230 drives is 1mm^2. Use a cable containing five conductors plus the braided screen, the fifth (green) wire being used to provide a safety earth return to the drive. The temperature rating of the cable should be at least 80°C.

Motor Earth

The motor body must be reliably earthed. Also see **Motor Connections** in the **EMC Installation** sub-section.

WARNING: The case of a motor can become very hot. Precautions may need to be taken to prevent operator contact.

N.C. - no connection.

MAKE	TYPE	A+	A–	B-	B+	NOTES
Sigma	6-lead	Black	Orange	Red	Yellow	White/Blk/Org, White/Red/Yel N.C.
	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,	6-lead	Red	Red/Wh	Grn	Grn/Wh	White & Black N.C.
Slo-syn	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	Red	Yel	Pink	Blk	Link Blue & violet, link White & Grey
	T.box	1	2	3	4	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	1	4	5	8	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
Digiplan/Compumotor	4-lead	-	-	-	-	Internally wired in parallel
OEM Series	8-lead	Red	Black	Green	White	Link blue & yellow, Link orange & brown
Digiplan/Compumotor QM Motor	8-lead	Red	Black	White	Green	Link Yel & Blue Link Org & Brown

Table 4. Motor Connection Data - Windings in Series

For 6-lead motors, connections shown are for one half-winding.
N.C. - no connection.

MAKE	TYPE	A+	A–	B-	B+	NOTES
Sigma	6-lead	Black	Wh/Blk/ Orange	Red	Wh/Red/ Yellow	Or & Yellow N.C.
	8-lead	Black & Wh/Or	Or & Wh/Blk	Red/ Wh/Yel	Yel & Wh/Red	
	T.box	1 & 5	3 & 6	2 & 7	4 & 8	
Astrosyn, Rapidsyn, Slo-syn	6-lead	Red	Black	Green	White	Red/Wh & Grn/Wh N.C.
	T.box(x6)	1	6	4	2	3 & 5 N.C.
Slo-syn	8-lead	Red & White	Blk & Red/Wh	Grn & Blk/Wh	Org & Grn/Wh	
	T.box(x8)	1 & 2	3 & 6	4 & 7	5 & 8	
Stebon	8-lead	Rd & Blue	Yel & Violet	Wh & Pink	Black & Grey	
	T.box	1 & 6	2 & 5	3 & 8	4 & 7	
M.A.E.	6-lead	Grn/Wh	White	Red	Black	Grn & Red N.C
	8-lead	Black & Wh/Or	Or & Wh/Blk	Red & Wh/Yel	Yel & Wh/Red	
	T.box	3 & 6	1 & 5	4 & 8	2 & 7	
Zebotronics	T.box	1 & 2	3 & 4	5 & 6	7 & 8	
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	Brn & Wh/Or	Wh/Brn & Orange	Yel & Wh/Red	Wh/Yel & Red	
	T.box	1 & 7	3 & 5	4 & 6	2 & 8	
Digiplan/Compumotor OEM Series	4-lead 8-lead	Red Red & Blue	Black Yellow & Black	Green Green & Orange	White Brown & White	
Digiplan/Compumotor QM Motor	8-lead	Red & Blue	Blk & Yellow	Wh & Brn	Green & Org.	

* Use correct White for each phase.

Table 5. Motor Connection Data - Windings in Parallel

Signal Connections

Step + Pin 1 & Step- Pin 9

A pulse on these inputs causes the motor to advance on the leading edge of the pulse (see Figure 7). The pulse should be at least 5µs long. Consult your indexer user guide for instructions on how to change the output pulse width.
The Step inputs are configured as TTL opto-isolated inputs, but can be configured as non-isolated single ended inputs.

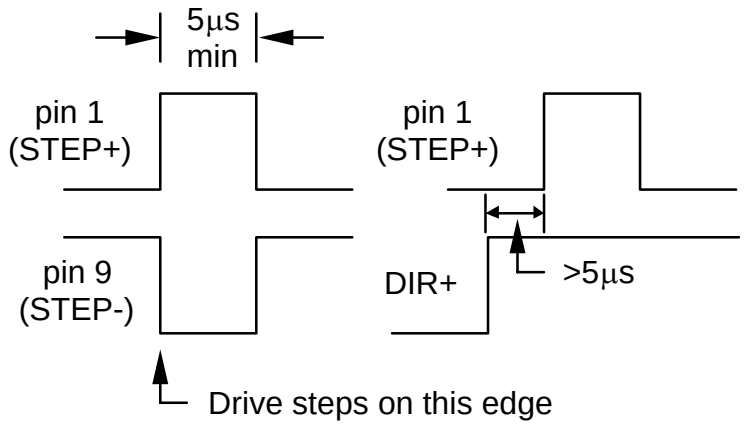


Figure 7. STEP Timing Diagram

Direction+ Pin 2 & Direction- Pin 10

These inputs (pins 2 and 10) control the direction of the motor shaft rotation. Changing the level of these inputs changes the direction in which the shaft moves. The logic level at this input needs to be stable within 5µs of the leading edge of the step pulse [transition to STEP+ (high) STEP- (low)].
The Direction inputs are configured as TTL opto-isolated inputs, but can be configured as non-isolated single ended inputs.

Clock Monitor (Pin 3)

This open collector output allows the on-board clock source to be monitored externally. The output should be externally pulled up through a suitable resistor. The drive steps on the falling edge of the signal which consists of a low going pulse having a width between 5 and 8µs. This output can also be used to monitor an opto-isolated clock source driving the board.

Slow Rate Adjust (Pin 4)

An external 100KΩ variable resistor or a fixed resistor may be connected between this terminal and "Rate Common" (pin 8) to control the slow speed of the internal clock source.
The highest speed will be obtained with zero resistance.

Fault (Pin 5)

This is an output signal which goes high in the event of an overload fault. It is driven by an open-collector transistor and should be pulled up by an external resistor when the signal is required. The resistor should be returned to a voltage no higher than +30V, and should not allow more than 15mA to flow when the output is low.

When a fault occurs, the drive will de-energise. Once the fault has been cleared the drive may be re-energised by either cycling the Shutdown signal or by cycling the power to the drive. The Fault output will return low as soon as the drive is shut down.

You can establish a visual fault verification by installing an LED as illustrated in Figure 8. Here the LED will be lit unless there is a fault.

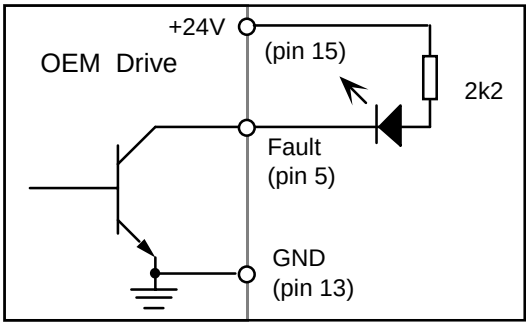


Figure 8. Fault Output Example

Slow (Pin 6)

Connect this input to GND directly or through an open collector transistor to run the internal clock source at the slow rate.

Fast (Pin 7)

Connect this input to GND directly or through an open collector transistor to run the internal clock source at the fast rate.

Rate Common (Pin 8)

Common return connection for external speed controls.

Shutdown+ Pin 11 & Shutdown- Pin 12

These differential inputs (pins 11 and 12) are used to energise and de-energise (shutdown) the motor. When the shutdown+ input is taken high and shutdown- is low, the drive is shut down and the motor shaft may be rotated ***slowly*** by hand.

NOTE: Back-driving the motor at excessive speed may damage the drive.

Cycling the shutdown input resets a fault condition, provided the cause of the fault has been removed.

GND (Pin13)

Control signal return.

Fast Rate Adjust (Pin 14)

An external 10KΩ variable or fixed resistor may be connected between this terminal and "Rate Common" (pin 8) to control the fast speed of the internal clock source. The highest speed will be obtained with zero resistance.

+24VDC Out (Pin 15)

This output is used to supply up to 300mA to an external control module such as an indexer card.

Optional Advance Rate Pot and Switch Connections

Figure 9 shows typical external connections required when using the internal clock source.

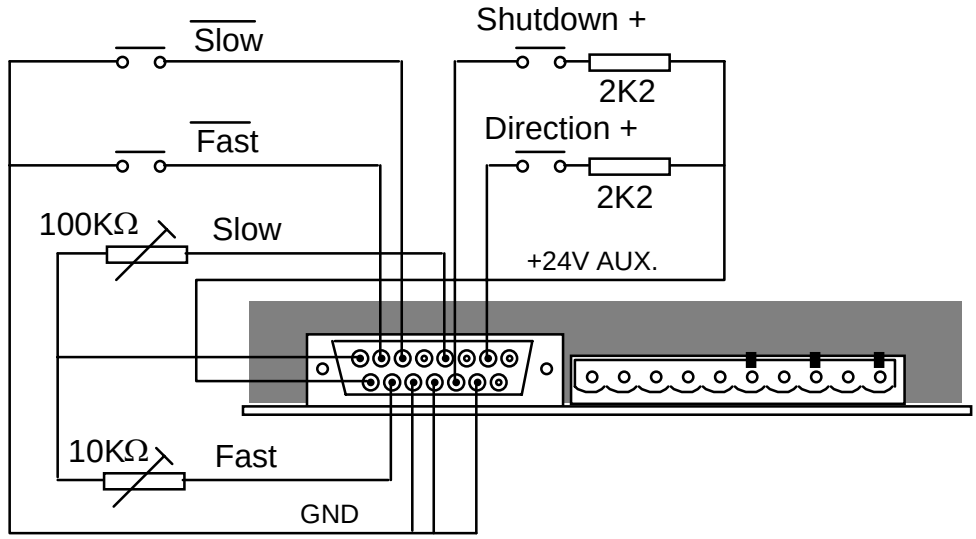


Figure 9. Signal Connections

Input Circuits

The Step, Direction and Shutdown inputs are configured as differential TTL opto-isolated inputs with reverse polarity protection. Details of the input circuits are shown in Figure 10. The Step and Direction input circuits are identical.

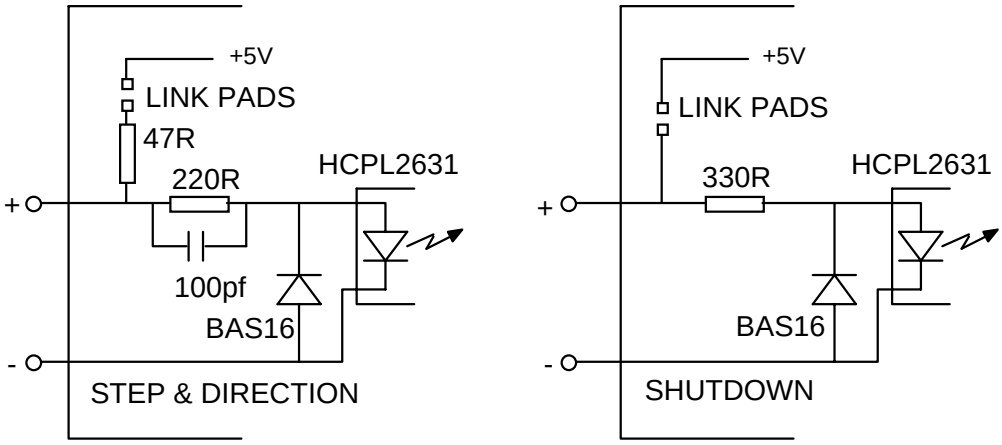


Figure 10. Drive Input Circuits

Single Ended Input Configuration

Any of the three differential TTL opto-isolated inputs can be converted to single ended non opto-isolated inputs by making the on-board solder link. Figure 11 shows the required circuit configuration when single ended operation is selected. Ensure that the external connection is made to the appropriate negative (-) input.

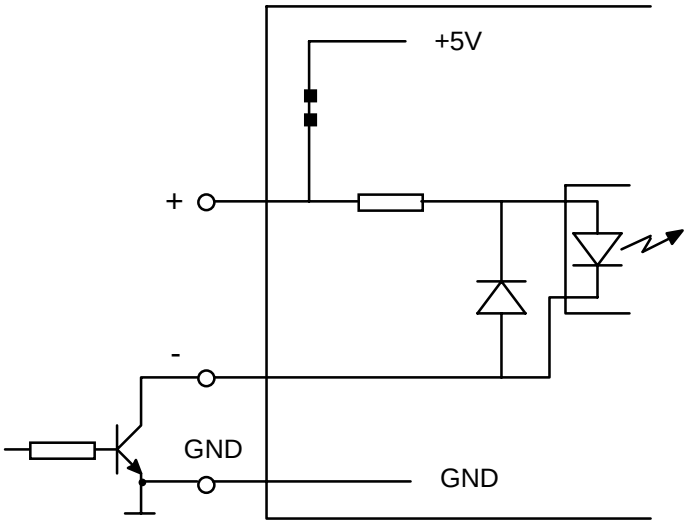


Figure 11 Single Ended Input Circuit Configuration

Input Circuit Links

The links pads (STEP, SHUT and DIR) are located on the underside of the OEM Drive board, as shown in Figure 12. Links are made by shorting the appropriate solder pads using tinned copper wire. When you add or remove links, take care to avoid solder splashes or damage to the drive.

Before connecting any of the links remove all power from the drive and observe anti static handling precautions.

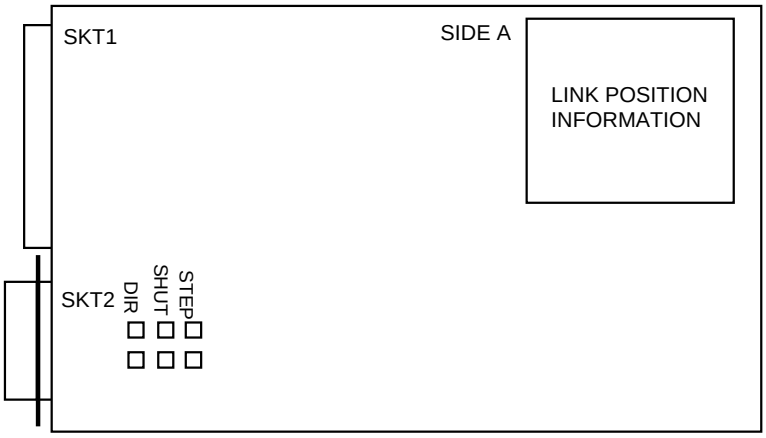


Figure 12 Position of Solder Pad Links

Output Circuits

The Fault and Clock monitor outputs use open collector transistors. The output circuits are shown in Figure 13.

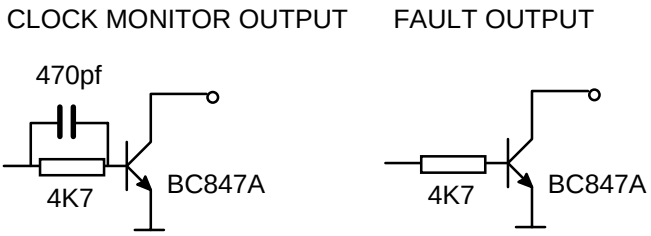


Figure 13 Output circuits

Connection to Compumotor Indexers

The 15 pin signal connector on the OEM230 has the same pinouts for Step, Direction and Shutdown signals as a standard Compumotor Indexer. The interconnecting lead should, therefore, have the 6 corresponding pins connected together as shown below. The remaining pins have different functions on the drive and the indexer, so it is important that NO OTHER PINS ARE INTERCONNECTED.

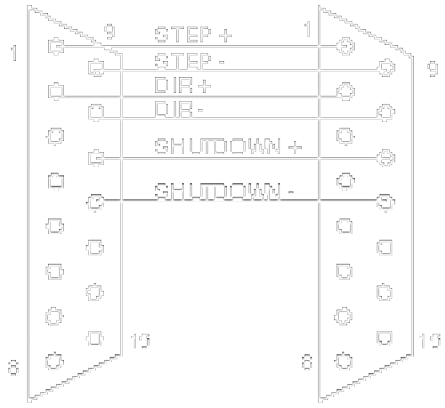


Figure 14 Interconnecting lead for Compumotor Indexers

Mechanical/ Environmental

Enclosure Considerations

You should install the drive system in an enclosure to protect it against atmospheric contaminants such as oil, moisture, dirt and to prevent operator access. In the USA, the National Electrical Manufacturers Association (NEMA) has established standards that define the degree of protection that electrical enclosures provide. The enclosure should conform to NEMA Type 12 standards if the intended environment is industrial and contains airborne contaminants. Proper layout of components is required to ensure sufficient cooling of equipment within the enclosure.

Environmental Specifications

Digiplan recommends you operate your OEM 230 Series Drive system under the following conditions:

- Operating Temperature: 0° to 50°C (32° to 122°F)
- Relative Humidity: 0% to 95% (non-condensing)
- Storage Temperature: -40° to 85°C (-40° to 185°F)

The drive board must be mounted either horizontally with the components uppermost or vertically. **Do not use inverted vertical mounting i.e., with the links at the top of the board.**

The mains input to the isolating transformer is Installation Category III maximum.

The OEM 230 Series of drives can be used in a Pollution Degree 2 environment i.e., one in which only non-conductive pollution occurs.

In exceptional circumstances, such as running the motor continuously in full-step mode and at maximum current, forced-air cooling may be needed to maintain the local ambient temperature within specification.

Installation Considerations

The drive may be installed in a conventional card guide provided the system mounting instructions are observed. Standard card clamps may be used to retain the drive within a rack.

For mounting outside of a rack four holes are provided for the drive to be supported by PCB spacers or pillars. Hole dimensions are for 4-40 UNF or M3 clearance (3.4mm).

Only insulating pillars and fixings must be used (e.g., nylon) with a maximum AF dimension of 6.35mm (0.25 inch).

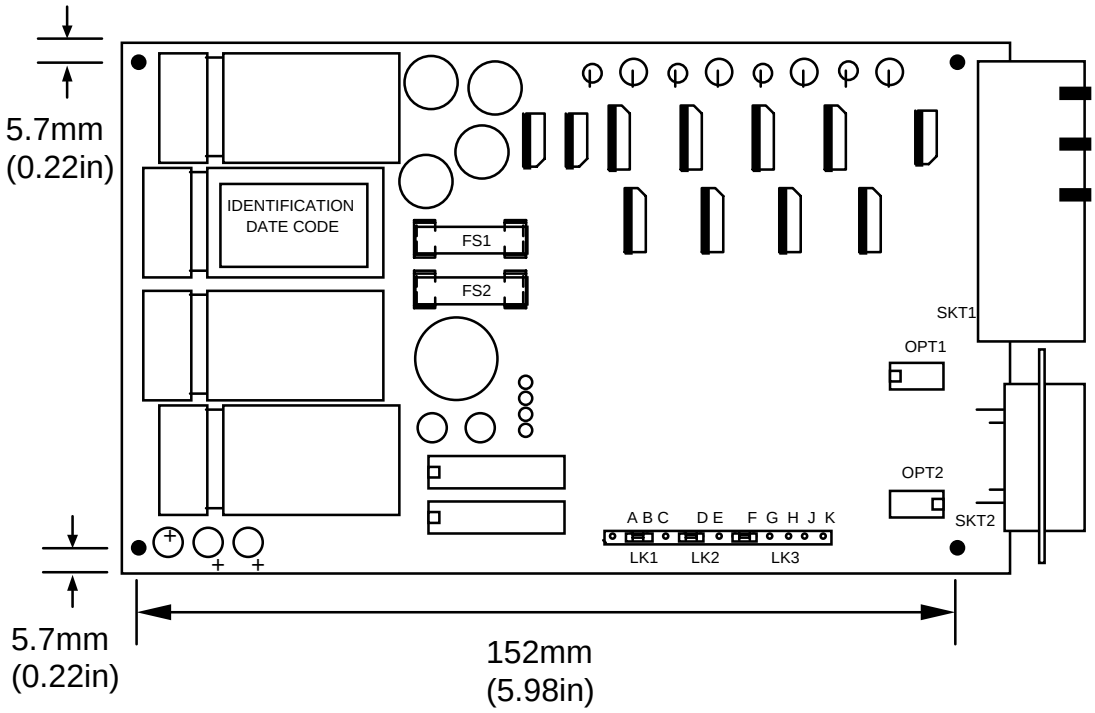


Figure 15 Drive Mounting Hole Locations

EMC Installation

It should be stressed that although these recommendations are based on the expertise acquired during the development of fully compliant products, and on tests carried out on each of the product types, it is impossible for Digiplan to guarantee the compliance of any particular installation. This will be strongly influenced by the physical and electrical details of the installation and the performance of other system components. Nevertheless it is important to follow *all* the installation instructions if an adequate level of compliance is to be realisable.

External enclosures

The measures described in these recommendations are primarily for the purpose of controlling mains conducted emissions. To control radiated emissions, all OEM drives and rack systems must be installed in a steel equipment cabinet which gives adequate screening against radiated emissions. This external enclosure is also required for safety reasons. With the exception of drive front panels in rack-based units, there must be *no user access* while the equipment is operating. This is usually achieved by fitting an isolator switch to the door assembly. Drives and filters must be in electrical contact with the panel to which they are mounted. If the panel has a paint finish, it will be necsssary to remove the paint in certain areas where required.

To achieve adequate screening of radiated emissions, all panels of the enclosure must be bonded to a central earth point. The enclosure may also contain other equipment such as motion controllers, and the EMC requirements of these must be considered during installation. Always ensure that drives and rack systems are mounted in such a way that there is adequate ventilation.

It is not necessary to fit front panels to the drives if the rack system is wholly contained within the enclosure. However, if a 19” case is used with no door or cover in front of the rack, then drive front panels must be fitted.

Equipment Racks

The OEM230 Series of drives may be mounted within a rack system.

For EMC-compliant installation, the rack system can be fitted with an earth bonding strip running across the back of the rack (see Figure 16). This is for the bonding of screened motor leads and transformer feed leads to the rack system. The rack metalwork is also earth-bonded to this tie bar.
Note: the earth/grounding strip may be mounted either above or below the rack to permit easy removal of the drives.

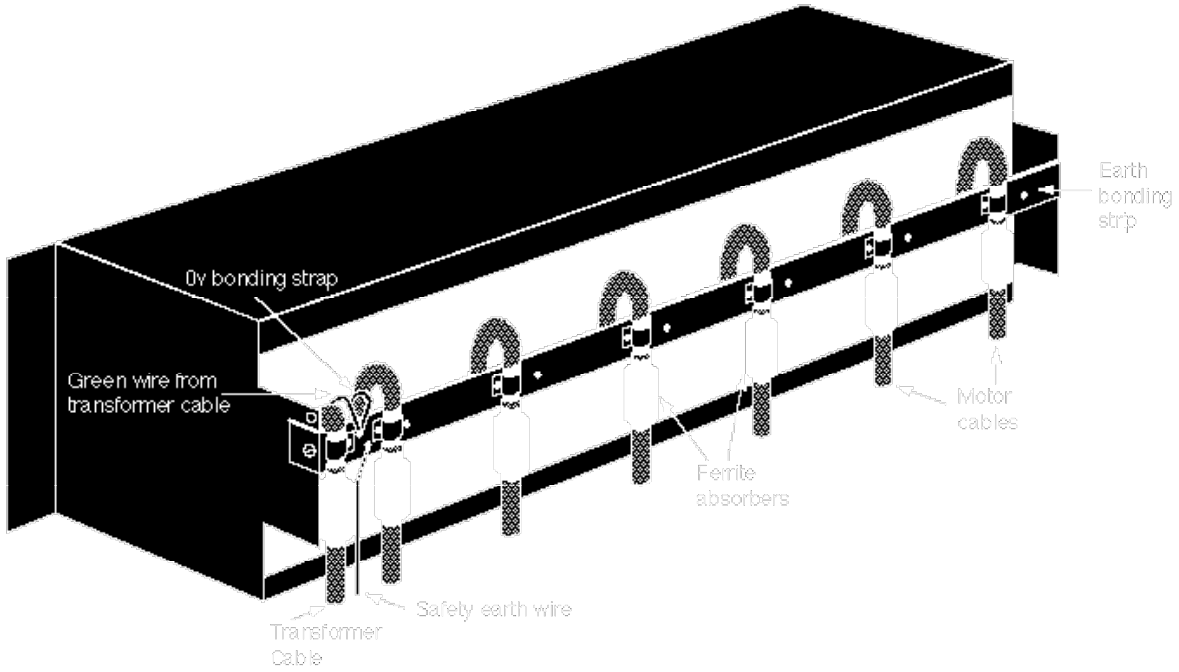


Figure 16. Rack EMC Wiring

Filtering the AC mains supply

A filter must be installed between the incoming AC supply and the mains transformer. A suitable filter is Ducati S-221-16. Mount the filter within 50mm of the transformer as shown in Figure 17. Ensure that there is no paint on the mounting panel under the filter mounting lugs - it is vital that there is good large-area contact between the filter and the panel.

Connect the incoming AC supply cable to the push-on terminals on the filter, with the earth lead connected to a local earth stud or bus bar. Route the supply cable so that it runs close to the walls of the enclosure. Connect the filter output terminals to the transformer primary, keeping the leads twisted together and as short as possible. Take an earth connection from the stud to the SCN terminal on the transformer, and run this lead close to the AC supply leads (see Figure 17).

5-core 1mm^2 screened cable (with a braided screen) should be used between the transformer and the rack (looking at the back of the rack). Use a green wire for the 0V connection. At the transformer end run the cable back towards the mounting panel, expose a short length of the screen and anchor the cable close to the filter with a P-clip. When routing this cable to the rack, keep it away from the input cable to the filter.

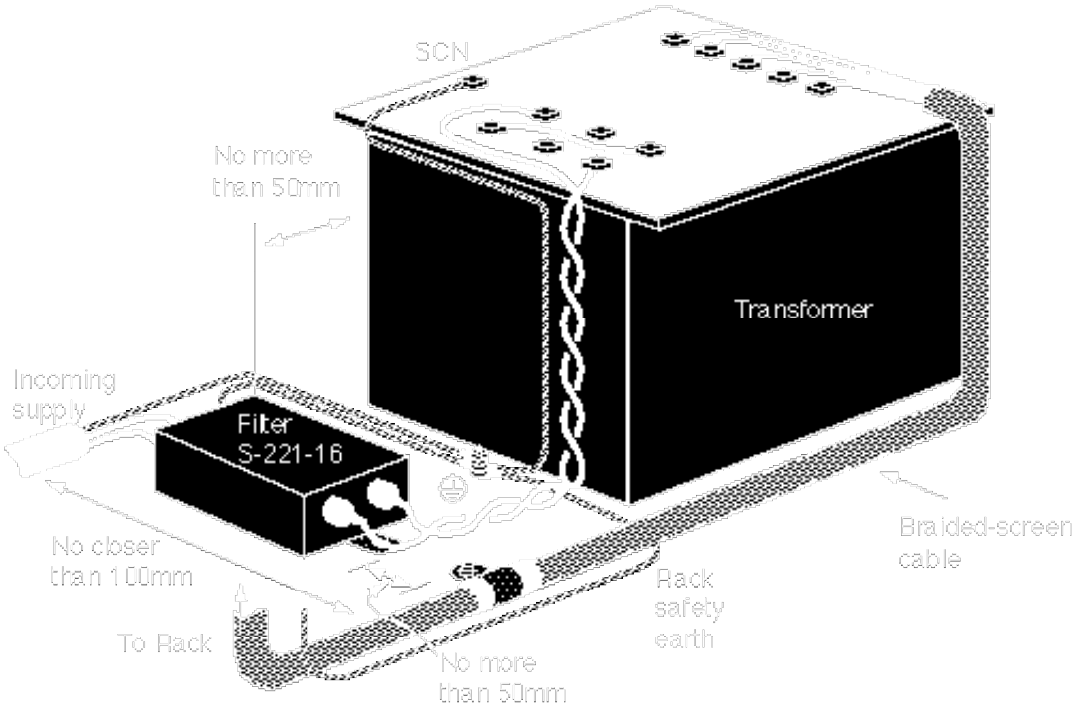


Figure 17. Rack Transformer Wiring

At the rack end, fit a ferrite absorber over the cable and connect the appropriate wires to the Vm and 18V AC terminals on the drive. Fit the earth bonding strip to the rack end plates. When fitting the bonding strip, use spring washers underneath the nuts and tighten securely - this is to ensure continuity between the bonding strip and the rack metalwork. Reconnect the earth wire from the first motherboard to the stud on the earth bonding strip.

Route the transformer cable over the earth bonding strip and identify the location of the mounting point for the P-clip (refer to Figure 16). Expose approximately 12mm of the braided screen at this point and anchor the cable to the bonding strip. Locate the absorber 15-25mm from the P-clip using heat-shrink sleeving. Connect the green 0V wire from the transformer to the stud on the bonding strip, together with a 2.5mm2 green/yellow safety earth wire. Run this wire alongside the screened transformer cable back to the earth stud beside the transformer.

If the OEM230 Series drive is used on its own, mounted on a panel, follow the same installation for the transformer and mains filter. Ensure that the panel on which the drive is mounted is earthed. Take the motor earth connection to a stud on the panel as well as into the GND terminalin the motor connector. The 0V wire of the transformer secondary may be earthed at the transformer instead of the drive.

Motor Connections

The recommended gauge for OEM drives is 1mm^2. Use a cable containing five conductors plus the braided screen, the fifth (green) wire being used to provide a safety earth return to the drive and should also be connected to the earth bonding strip on the back of the rack to avoid breaking the safety earth connection when the drive board is removed from the rack.
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 conductive terminal gland which can be used for this purpose.

At the rack end, prepare the end of the cable as shown in Figure 18 and fit a ferrite absorber. Anchor the cable screen to the earth tie bar using the P-clip behind the corresponding drive. Connect the four wires from the motor windings to the appropriate terminals on the motor connector. Attach the green (earth) wire to the tie bar adjacent to the P-clip holding the braided screen using a ring terminal.

If the motor cable is more than 4 metres long, a separate safety earth connection will be required since the impedance of the 1mm^2 wire inside the screened cable will be too high. Use a 2.5mm^2 cable connected to the motor body and terminate it on the tie bar next to the P-clip for that axis. Run this cable close to the screened cable from the motor. If there is no suitable termination point on the motor body, remove the paint from the area of one of the mounting bolts and use an appropriate ring terminal.

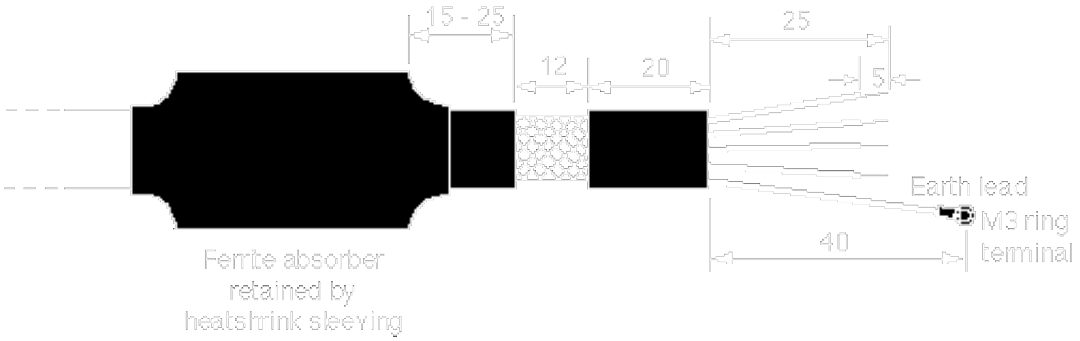


Figure 18. Motor Cable Preparation (Drive End

Control signal wiring

To ensure adequate immunity it is necessary for control circuits leaving the enclosure to be adequately screened, with the screen of the cable bonded back to the tie bar on the rack. Cable with a braided screen should be used, not metallised foil, and should consist preferably of twisted pairs to minimise magnetic coupling. It is strongly recommended to use opto-isolated drive motherboards where the controller is mounted outside the main enclosure.

Where screened leads are used in control circuits that are only opto-isolated at one end, the screen must be referenced to earth at the non-isolated end. When using a rack with non-opto-isolated motherboards, bond the screen to the earth tie bar close to the corresponding drive.

Ferrite absorber specifications

The absorbers described in these installation instructions are made from a low-grade ferrite material which has high losses at radio frequencies. They therefore act like a high impedance in this waveband.

The recommended components are produced by Parker Chomerics and are suitable for use with 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•
Impedance at 100MHz	120•
Curie temperature	130°C (the device should not be operated near this temperature)

Handling and installing the ferrite absorbers

Take care when handling the absorbers - they can shatter if dropped on a hard surface. For this reason the suggested method of installation is to use a short length of 19mm diameter heat-shrink sleeving. This gives a degree of physical protection while the cable is being installed. The sleeving should have a shrink ratio of at least 2.5:1. Cable ties may be used as an alternative, however they give no physical protection to the absorber.

SETTING UP

Setting Up

Take care, unexpected motion may occur at any time, especially during the commissioning of motion control equipment.

Drive Links

LK	POSITION	FUNCTION	COMMENTS
1	A	High range standby out	High current range, no standby reduction
	*B	High range, standby in	High current range, 50% standby reduction
	C	Low range, standby out	Low current range, no standby reduction
2	*D	HALF STEP	half stepping
	E	FULL STEP	full stepping
3	See Table 7		

* Factory preset position

Table 6. Drive Link Settings

Three jumper links allow drive functions to be selected.

Link 1

Standby current reduction is only possible when a drive is being used in its high range of output current. With Link 1 in the "A" position no motor current reduction is selected when the motor is stationary. With Link 1 in the "B" position the motor current is reduced by 50% (when the motor is stationary) within 30-35ms after the last step pulse. When a drive is being used in its low current range, standby current reduction is not available and you should fit Link 1 in position C.
When operating a drive in its high current range always use standby reduction (position "B") where possible.

Link 2

With Link 2 in the "D" position the drive will function in the half-step mode, producing 400 steps/rev. In the "E" position full stepping is selected, producing 200 steps/rev. The half-step mode is preferred in most applications, the slight torque loss being offset by smoother operation at low speeds.

Link 3

Link 3 determines the motor current selection for each drive type, see Table 7. The low current range settings are half the value of the high current range settings.

Link 1 position	Link 3 position	Motor Current (Amps)		
		OEM530	OEM330	OEM230
B*	F	5.0	3.0	2.0
B*	G	4.5	2.7	1.6
B*	H	4.0	2.4	1.2
B*	J	3.5	2.1	0.9
B*	K	3.0	1.8	0.6
C	F	2.5	1.5	1.0
C	G	2.25	1.35	0.8
C	H	2.0	1.2	0.6
C	J	1.75	1.05	0.45
C	K	1.5	0.9	0.3

Table 7. Current Range Settings

*Note: use position A instead of position B to inhibit the automatic 50% current reduction at standstill. This will maintain full holding torque at standstill, but will increase motor and drive heating. The automatic standby function is not available with Link 1 in position C.

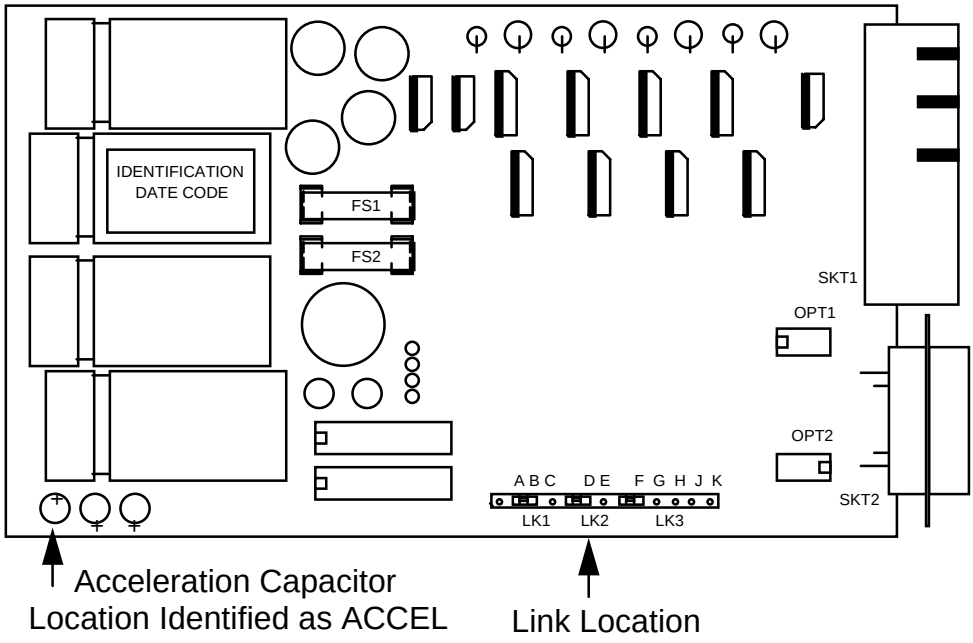


Figure 19. OEM 230 Series Drive Link Locations

Acceleration/ Deceleration Rate Adjustment

The Fast and Slow set speeds are selectable by control lines available via SKT2.

The acceleration and deceleration rates between the two on-board clock source speeds are factory set to 60ms (nominal) for accelerating from Slow speed to 95% of Fast speed, and 30ms (nominal) for decelerating from Fast speed to Slow speed. These times may be increased by the addition of an extra capacitor (at position marked ACCEL - see Figure 19) on the drive module. If a capacitor value of 10µF is fitted the acceleration and deceleration times will increase to 120ms and 60ms respectively. A capacitor of minimum 16V rated voltage should be used. When fitting observe polarity. Note: polarity is the reverse of adjacent capacitors. If you need to fit a capacitor which is physically too large to fit into the ACCEL allocated position, contact Digiplan or your supplier.

Preliminary Configuration

By making the appropriate power supply, motor and on-board clock source connections, illustrated in Figures 20 you can construct a preliminary system test configuration. This will allow you to become familiar with the drives main features.

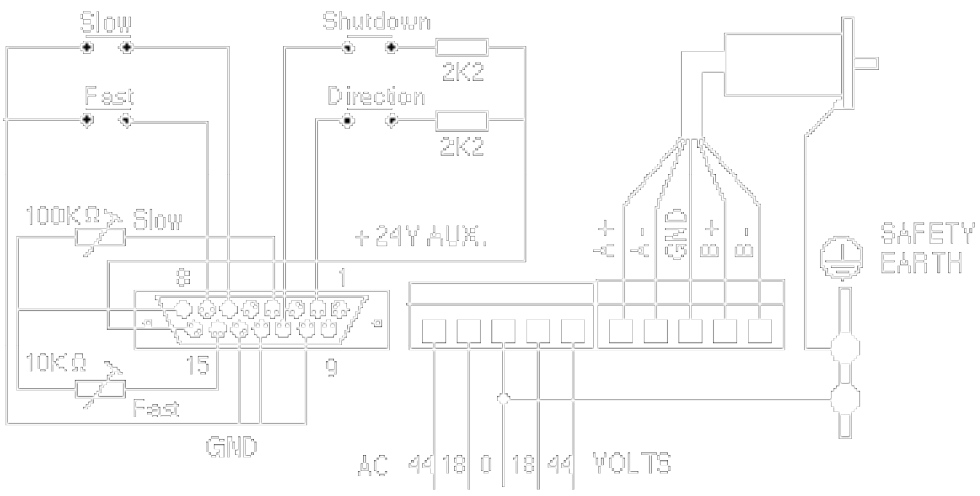


Figure 20. Preliminary Configuration

Before you power-up the drive you must ensure the power supply and motor cables are correctly connected and the motor securely held. Once you are satisfied that all connections are correctly made, apply power to the drive which will power up in its enabled state (evident by holding torque on the motor).

Closing the shutdown switch will de-energise the drive, removing holding torque from the motor.

A latched fault condition may be cleared by cycling the shutdown command.

You can check for correct operation of the drive by performing the following test sequence:

1. Close the slow switch and check for rotation.

2. Check speed varies with alteration of the slow speed pot.

3. Close the direction switch and check the motor reverses.

4. Close the fast switch and check for rotation at high speed, varying with alteration of the fast pot setting.

5. Open the fast and slow switches and check rotation stops.

This completes the test sequence. Remove power from the drive.

MAINTENANCE & TROUBLESHOOTING

Maintenance

Take care, unexpected motion may occur at any time whilst troubleshooting motion control equipment.

Routine maintenance is not necessary, but occasional checking of the following points is recommended.

Motor Maintenance

You should inspect the motor to ensure that no bolts or couplings have become loose during operation. This will prevent minor defects from developing into more serious problems.

You should inspect the motor cable or leads periodically for signs of wear. You should not make very tight bends or apply excessive tensile force to the cable during normal operation. Check all cable connectors.

Drive Maintenance

Check that the drive is free of loose particles and has a free flow of air over its entire surface. Enclosures must be connected to earth ground to provide a low-impedance path for ground-fault or noise-induced currents. Check the security of the ground connections.

Troubleshooting

Use the following information to help in identifying the problem. If the problem persists, call one of the numbers at the front of this User Guide for engineering assistance.

Motor Fails to Move

Test the motor to see if it has holding torque. If there is no holding torque, here are some probable causes:

- There is no power.
- Current selection links are not set properly.
- There are bad connections or bad cables in the power supply circuit. Disconnect the power connector, then use a meter to monitor continuity in the power circuits.
- There are bad connections or bad cables in the motor circuit. Disconnect the power to the drive and remove the motor connector. Using a meter, check the continuity in the motor circuit between pins A+ and A- of the motor connector. Repeat for pins B+ and B-.
- Check the resistance of the motor and cables to make sure that shorts do not exist between phases or to earth GND. The

resistance across each motor phase should be consistent and there should be no connection between motor phases and between each phase and earth ground.

- Check the motor cables for signs of damage.
- The shutdown input may be active.
- The drive fuses may be blown. Disconnect power from the drive, remove the drive from the rack, and inspect the line fuses FS1 and FS2, on the OEM Drive card. **If the logic fuse FS1 is blown, try replacing it. If the motor supply fuse FS2 is blown, return the drive for repair.**

If the unit has holding torque and the motor shaft still fails to move, here are some probable causes:

- The load is jammed. You should *hear* the drive attempting to move the motor. Remove power from the driver and verify that you can move the load manually away from the point of the jam.
- Clock pulses are not reaching the drive, or the signal levels are inadequate. If possible, check the signal levels with an oscilloscope or DMM.

Motor Stalls

A motor stall during acceleration may be caused by one or more of the following factors:

- The torque requirements may be excessive.
- The acceleration ramp may be too steep - lower acceleration may be required. Check the torque/speed curves in the published data and make sure you are trying to run the motor within the system capabilities.
- The load inertia and rotor inertia may be grossly mismatched.
- System resonance.

If the motor stalls during the constant velocity portion of a move, the shaft and/or coupler may be damaged or binding due to improper coupling or excessive motor load.

A stall may occur if the link setting for the motor current selection is incorrect. The motor may not be receiving enough current to drive the load.

Motor is Jerky or Weak

Check that there are no mechanical problems at the load causing variable loading condition. Disconnect the motor from the load and

run it without a load connected. Check the link settings for proper current settings.

Motor Overheats

If the motor exceeds its maximum motor case temperature rating, failure will eventually result. Check your link settings to ensure that the current setting is correct for the motor you are using.

Motor Shaft Develops Signs of Wear

The motor shaft may wear prematurely if there is foreign material rubbing against the shaft, or if the load is not coupled properly. Check couplings for tightness.

Returning the System

Contact the Parker Automation Technology Centre or the machinery manufacturer who supplied the product. Equipment for repair should NOT be returned directly to Digiplan without prior authorisation. Repairs will be carried out by Digiplan but will be processed via your supplier.

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

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