Digiplan PDS15-2

Ministep Drive

$1750.00

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PDS Series Drive
User Guide
(PDS13 PDS15 PDS15-D)

For engineering assistance in Europe:
Parker Hannifin plc
Digiplan Division
21 Balena Close
Poole, Dorset
England, BH17 7DX
Telephone: 0202-699000
Fax: 0202-695750

For engineering assistance in the U.S.:
Parker Hannifin Corporation
Digiplan Division
5500 Business Park Drive
Rohnert Park, CA 94928
USA
Telephone: (800) 358-9070
Fax: (707) 584-8015

Part No: 1600.171.02 1st June, 1994

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 a user 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 it while it is in operation.

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 perform any system connections. Never disconnect the motor with power on; this will damage the drive and the motor connector contacts. Follow the steps described below to complete the basic configuration of your system.

Related Publications - The following publications may be helpful resources:

- Digiplan & Compumotor Programmable Control Systems & Drives Catalogue
- Schram, Peter (editor). The National Electric Code Handbook (Third Edition). Quincy, MA: National Fire Protection Association

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User Guide Change Summary

This user guide, version 1600.171.02 supersedes version 1600.171.01.

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

INTRODUCTION

Product Description

The PDS series of single-axis packaged ministep drives consists of the PDS13 & PDS15, with peak current ratings of 3A and 5A respectively. A further 5A version, known as the PDS15-D is also available with a built-in regenerative dump circuit. PDS series drives are high-performance, MOSFET, 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 are powered Direct On-Line (DOL) from mains supplies of 110V to 240V (nominal) AC. An internal switch mode power supply is used, incorporating Power Factor Correction (PFC) to minimise distortion of the AC supply.

The PDS series of drives have 4 selectable resolutions between 400 steps/rev and 4000 steps/rev, set using the front panel switches.

Motor short-circuit protection is assured across and between phases and between any phase and earth. If a wiring fault occurs the drive fault LED will be lit up - see **Maintenance and Troubleshooting**.

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

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 differential inputs are fully opto isolated for maximum noise immunity.

The system may be configured to allow the clock signal to be provided by the drive's internal clock source. Two separate programmable speeds are available. These are set by front panel pots marked “Fast” and “Slow”, a third pot allows adjustment of the acceleration and deceleration times. The speed control potentiometers may be mounted remotely via the front panel D-type connector.

The internal clock source signal is brought out to the drive control connector for monitoring purposes.

The drive and integral power supply are contained in one compact enclosure, cooled by natural convection. Wall or panel vertical mounting is recommended to allow access to the front panel connectors and controls.

SPECIFICATION

PDS Series Drive Specifications

Parameter	Value
Amplifiers	
Type	MOSFET Chopper
Motor resolution	400, 1000, 2000 and 4000 steps/rev (user-selectable)
Protection	
Short circuit	Phase-to-phase, across phases and phase to ground
Peak output current	3A/phase (PDS13), 5A/phase (PDS15) - switch reduceable
Standby current reduction	To 80% or 50% of programmed peak value after 100ms (switch-selected)
Maximum stepping rate	200kHz @ 4000 steps/rev
Nominal chopping frequency	20kHz
Command Interface	
STEP/DIR/SHUTDOWN Configured as differential opto-isolated inputs	
Drive requirements	3 to 5V differential
max input current	21mA
min input current	10mA
STEP	
Minimum pulse width	1µs
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	Unassigned NPN transistor (see figure 3) Active Low (transistor switched to 0V) +1.0V max. @ 5mA max. High (transistor off) +24V max.
Internal clock out	Open collector NPN transistor - emitter connected to drive 0V (GND)
Power up reset time	1 - 2 secs

Table 1. PDS Series Drive Specifications

PDS Series Drive Specifications (Continued)

AC Power input	
Drive supply voltage	95V to 264V AC (absolute limits)
Supply frequency range	47 to 63Hz
Power factor	Better than 0.9 over input voltage range and output power range
Input current	
PDS13	2A rms max
PDS15	3A rms max
Recommended supply protection	3A MCB type 'C' characteristics
Internal Clock Source	
Speed range	
Fast	1 rps - 50 rps
Slow	0.05 rps - 2.0 rps
Acceleration/deceleration range	20.0 - 500 rps^2
Internal clock out signal	1µs pulse width (fixed)
Output current range	
PDS13	0.9A - 3A (300mA steps)
PDS15	2.5A - 5A (350mA steps)
Standby reduction	50% or 80%
Environmental	
Drive dimensions	Height 250mm(9.8in), Width 50mm (2in), Depth 190mm (7.5in)
Weight	1.8Kgms (4lbs)
Operating temperature	0° - 40°C (32° - 104°F)
Ingress protection	IP20
Max. power dissipation of drive unit	
PDS13	18Watts
PDS15	28Watts
PDS15-D	43Watts
Motors	
Type	2-Phase hybrid or permanent magnet (normally 1.8°)
Number of leads	4, 6, or 8 (5 lead not suitable)
Minimum Motor Inductance	1mH
Optimum Inductance range	1mH-10mH
Power/Motor connection	refer to **Installation**

Table 1. PDS Series Drive Specifications (Continued)

Pin	Name	I/O	Min. on State Current	Max. Current	Nominal Voltage	Signal Levels	Comments
1 14	STEP+ STEP-	I	10mA	21mA	5V	TTL	note 1, 2, 4
2 15	DIRECTION+ DIRECTION-	I	10mA	21mA	5V	TTL	note 1, 2
6	Slow Adjust	I	-	20mA	12V	-	-
7	Fast Adjust	I	-	20mA	12V	-	-
9 21	Fault+ Fault-	O	-	5mA (at 1.0V)	24V	Unassigned transistor 26V max.	Active Low under fault condition note 3
12	Slow Run	I	-	1.5mA	12V	Low <0.8V High = O/C	Active low
13	Fast Run	I	-	1.5mA	4.3V	Low <0.8V High = O/C	Active low
16 17	Shutdown+ Shutdown-	I	10mA	21mA	5V	TTL	note 2
19	Adjust Common	O	-	20mA	12V	-	-
20	Internal clock out	O	-	15mA	24V	Open collector Low <250mV @ I_C 10mA	Active low
25	GND	I/O	-	-	-	-	Signal return

Table 2. Control I/O Signal Specification

note 1 Do not change state of ‘DIRECTION+’ and ‘DIRECTION-’ inputs within 2.5µs of STEP transition to STEP+ high, STEP- low.
note 2 See Figure 9 for input circuit.
note 3 See Figure 7 for output circuit.
note 4 Mininum pulse width 1µs, maximum frequency 200kHz.

INSTALLATION

Power Connections

Input power is taken directly from AC supplies via the front panel mounted IEC 3-way mains inlet socket. A power cord is supplied with the drive.

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. A good source of information on grounding requirements is the National Electrical Code published by the National Fire Protection Association of Boston, Massachusetts.

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. A central earth stud is recommended.

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.

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 peak should be used with the PDS15, 4.5A with the PDS13. 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 PDS 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.
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.

Regenerative

Applications which involve rapid deceleration of high-inertia loads

Power Dump Option

may require that the drive is fitted with a power dissipation circuit. The PDS15-D has the same electrical specification as the PDS15 but incorporates a power dump with a continuous rating of 15 watts (170 watts peak). You will need the PDS15-D in the following situation:

Metric formula - if the deceleration time **$t<\{J\omega^2 - 0.1\}$**
where t is the deceleration time in seconds
J is the total system inertia in Kg-m^2
ω is the maximum speed in revolutions per second

Imperial formula - if the deceleration time **$t<\{0.02J\omega^2 - 100\}$**
where t is the deceleration time in milliseconds
J is the total system inertia in oz-in^2
ω is the maximum speed in revolutions per second

If the expression in brackets is negative, the power dump option is not required. This option is strongly recommended for size 42 (106) motors.

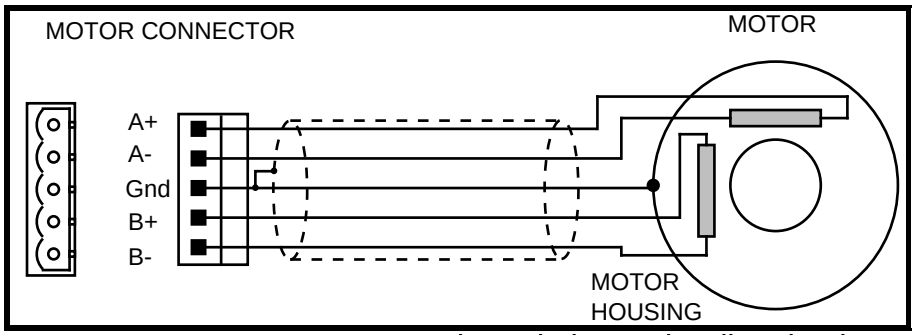
Note that a program to calculate if a power dump is required is available from Compumotor and Digiplan Technical Support departments (Windows 3.1 required). This program is also available on Compumotor's Bulletin Board Service (Tel: 707/584-4059 in USA).

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

Once you have determined the motor's wiring configuration, connect the motor leads to the connector marked "MOTOR" on the front panel. The motor cable earth conductor and screen should be connected to the terminal marked "GND".



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

Figure 1 PDS Drive Motor Connections

Drive Connections to 'S' or 'QM' Motors

Compumotor 'S' series and 'QM' series motors are electrically identical. In the case of 23 and 34 (57 and 83) frame sizes, the motors are constructed with an 8 core cable to allow you to select either a series or parallel wiring configuration.

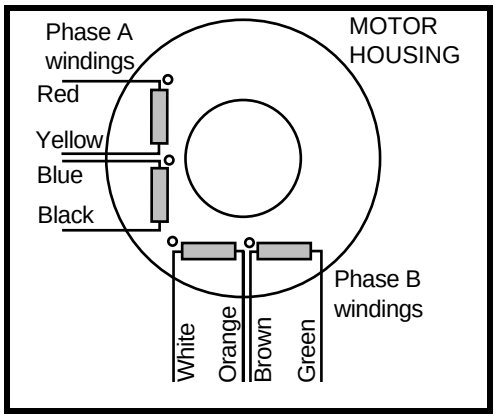


Figure 2 8-Lead Motor Winding Colour Code for S or QM Motors

The 42 (106) frame size motors are constructed with a 4 core motor cable to connect to the drive - these motors can be configured by removing the rear cover plate and rewiring at the screw terminals. The following diagrams illustrate the connection methods for these motors.

QM106-178/ S106-178 Series and Parallel Connections

This motor is pre-wired in series. If you remove the motor's back panel, access is provided to re-wire the motor in parallel.

The motor wiring colour code is:

Motor Terminal	Wire Colour	Drive Terminal
1	Red	A+
3	Black	A-
5	Green	B+
4	White	B-
Body	Bare (Screen)	Gnd

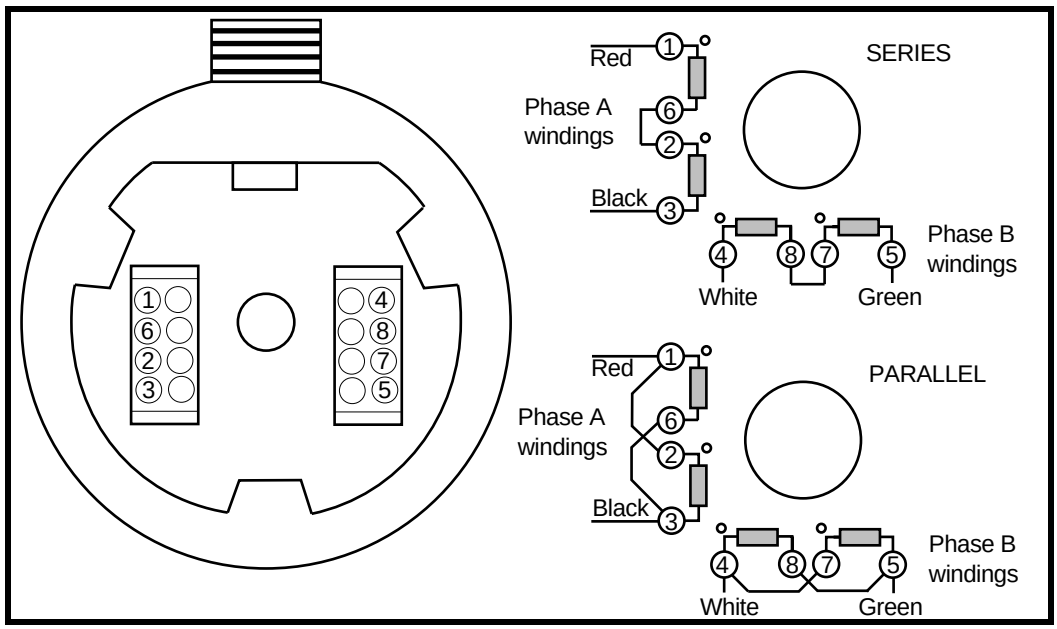


Figure 3 QM106-178/S106-178 Series and Parallel Connections

QM106-205/ S106-205 Series and Parallel Connections

This motor is pre-wired in series. If you remove the motor's back panel, access is provided to re-wire the motor in parallel.

The motor wiring colour code is:

Motor Terminal	Wire Colour	Drive Terminal
1	Red	A+
3	Black	A-
8	Green	B+
7	White	B-
Body	Bare (Screen)	Gnd

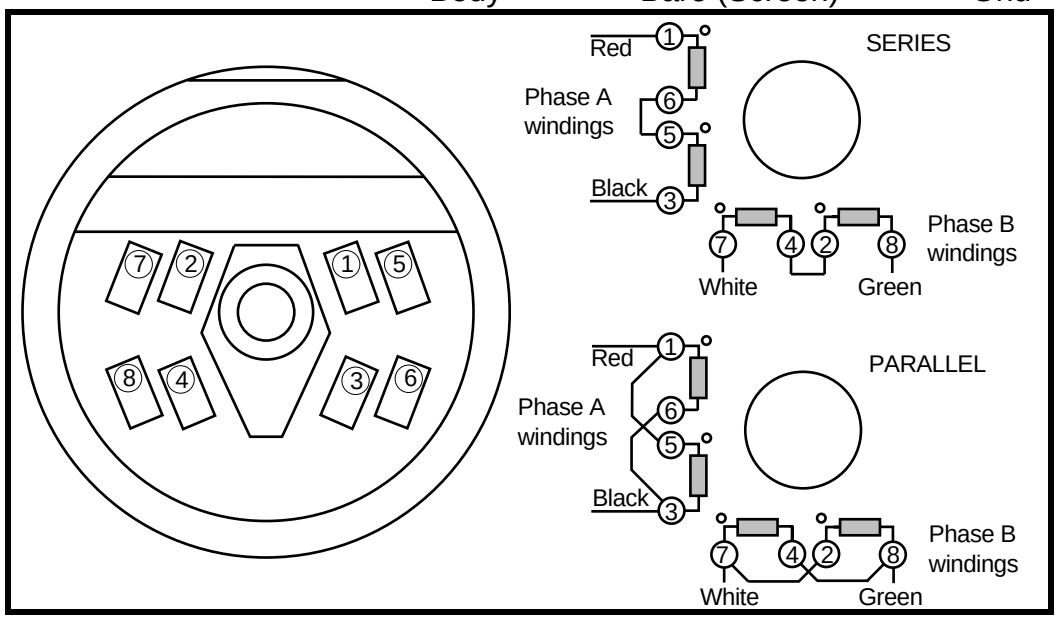


Figure 4 QM106-205/S106-205 Series and Parallel Connections

QM106-250/ S106-250 Series and Parallel Connections

This motor is pre-wired in series. If you remove the motor's back panel, access is provided to re-wire the motor in parallel.

The motor wiring colour code is:

Motor Terminal	Wire Colour	Drive Terminal
1	Red	A+
3	Black	A-
5	Green	B+
4	White	B-
Body	Bare (Screen)	Gnd

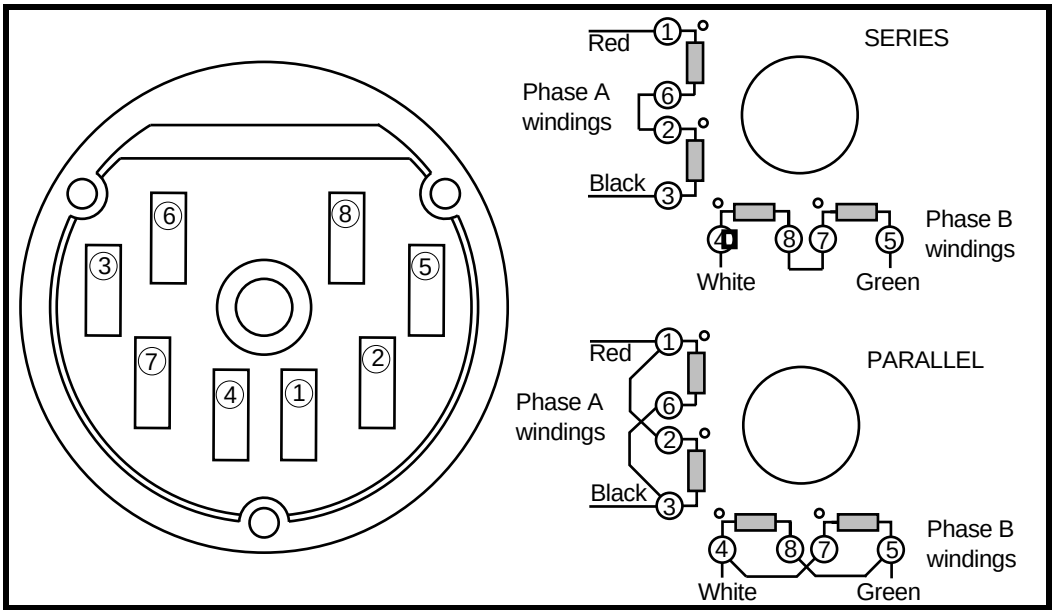


Figure 5 QM106-250/S106-250 Series and Parallel Connections

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, 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, Digiplan SM	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 OEM Series†	4-lead 8-lead	- Red	- Black	- Green	- White	Internally wired in parallel Link blue & yellow Link orange & brown
Digiplan/Compumotor QM Motor	8-lead	Red	Black	White	Green	Link Yel & Blue Link Org & Brown
Digiplan/Compumotor S Motor	8-lead	Red	Black	White	Green	Link Yel & Blue Link Org & Brown

† Size 23 only. Size 34 can only be operated in Parallel.

Table 3. 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, Digiplan SM	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	Black	Green	White	
Digiplan/Compumotor QM Motor	8-lead	Red & Blue	Blk & Yellow	Wh & Brn	Green & Org.	
Digiplan/Compumotor S Motor	8-lead	Red & Blue	Black & Yellow	White & Brown	Green & Orange	

* Use correct White for each phase. † Size 34 only. Size 23 can only be operated in Series.

Table 4. Motor Connection Data - Windings in Parallel

Compumotor S and QM Motor Drive Settings

When using Compumotor ‘S’ and ‘QM’ motors you will need to set the PDS drive current settings as shown in Table 5.

The ‘S’ motor and ‘QM’ motor are electrically identical e.g. an S57-51 is the same as QM57-51. In the following table, under motor

type, a suffix ‘S’ refers to series connected and ‘P’ refers to parallel connected.

Motor Type	PDS13			PDS15			Peak Motor Current (Amps)	Rotor Inertia Kg-cm^2 (oz-in^2)
	SW6	SW7	SW8	SW6	SW7	SW8		
S/QM-57-51S	ON	OFF	OFF	*	*	*	1.2	0.088 (0.48)
S/QM-57-51P	ON	OFF	ON	OFF	OFF	OFF	2.3	
S/QM-57-83S	OFF	ON	OFF	*	*	*	1.5	0.234 (1.28)
S/QM-57-83P	ON	ON	ON	OFF	ON	OFF	3.1	
S/QM-57-102S	ON	ON	OFF	*	*	*	1.7	0.32 (1.75)
S/QM-57-102P	ON	ON	ON	ON	ON	OFF	3.5	
S/QM-83-62S	OFF	OFF	ON	*	*	*	2.2	0.64 (3.50)
S/QM-83-62P	ON	ON	ON	OFF	ON	ON	4.4	
S/QM-83-93S	ON	ON	ON	ON	OFF	OFF	2.9	1.23 (6.70)
S/QM-83-93P	X	X	X	ON	ON	ON	5.6	
S/QM-83-135S	ON	ON	ON	ON	ON	OFF	3.5	1.87 (10.24)
S/QM-83-135P	X	X	X	ON	ON	ON	6.9	
S/QM-106-178S	X	X	X	ON†	ON†	ON†	6.0	8.05 (44.0)
S/QM-106-178P	X	X	X	ON†	ON†	ON†	12.0	
S/QM-106-205S	X	X	X	ON†	ON†	OFF†	3.6	9.51 (52.00)
S/QM-106-205P	X	X	X	ON†	ON†	ON†	7.2	
S/QM-106-250S	X	X	X	ON†	ON†	ON†	6.2	12.14 (63.00)
S/QM-106-250P	X	X	X	ON†	ON†	ON†	12.4	

* Minimum drive current too high for motor.
X Unsuitable motor/drive combination.
† 106 (42) size motors must use PDS15-D option (regenerative power dump).
PDS13 is 3 amps Peak Max. and PDS15 is 5 amps Peak Max.

Table 5. PDS Current Drive Settings for Compumotor ‘S’ and ‘QM’ Motors

Compumotor OEM Motor Drive Settings

The 34 frame size motors (OEM-83-62/93/135) have identical drive current settings to the 'QM' motors listed in Table 5. Size 34 (83) motors are internally wired in Parallel.

In Table 6, under 'Motor Type', a suffix 'S' refers to series connected. The parallel connection can not be used for size 23 (57) motors.

Motor Type	PDS13			PDS15			Peak Motor Current (Amps)	Rotor Inertia Kg-cm² (oz-in²)
	SW6	SW7	SW8	SW6	SW7	SW8		
OEM-57-40S	OFF	ON	ON	OFF	OFF	OFF	2.7	0.07 (0.380)
OEM-57-51S	ON	ON	ON	OFF	ON	OFF	3.3	0.12 (0.650)
OEM-57-83S	ON	ON	ON	ON	ON	OFF	3.8	0.25 (1.360)

Table 6. PDS Current Drive Settings for Compumotor 'OEM' Motors

Digiplan SM and STEBON Motor Drive Settings

Table 7 lists the PDS Drive current settings you need to make when using Digiplan 'SM' and STEBON motors.

In Table 7, under 'Motor Type', a suffix 'S' refers to series connected and 'P' refers to parallel connected.

Motor Type	PDS13			PDS15			Peak Motor Current (Amps)	Rotor Inertia Kg-cm² (oz-in²)
	SW6	SW7	SW8	SW6	SW7	SW8		
SM-57-51S	OFF	OFF	OFF	*	*	*	1.1	0.11 (0.60)
SM-57-51P	OFF	OFF	ON	*	*	*	2.1	
SM-57-83S	OFF	OFF	ON	*	*	*	2.3	0.23 (1.26)
SM-57-83P	ON	ON	ON	OFF	ON	ON	4.7	
SM-57-102S	OFF	OFF	ON	*	*	*	2.3	0.30 (1.64)
SM-57-102P	ON	ON	ON	OFF	ON	ON	4.6	
SM-83-62S	ON	ON	ON	OFF	ON	OFF	3.2	0.60 (3.30)
SM-83-62P	X	X	X	ON	ON	ON	6.4	
SM-83-93S	ON	ON	ON	OFF	OFF	ON	4.0	1.25 (6.83)
SM-83-93P	X	X	X	ON	ON	ON	7.9	
SM-83-135S	ON	ON	ON	ON	ON	OFF	3.8	2.00 (10.93)
SM-83-135P	X	X	X	ON	ON	ON	7.6	
SM-106-140S	X	X	X	OFF†	ON†	ON†	5.0	3.65 (19.96)
SM-106-140P	X	X	X	ON†	ON†	ON†	9.9	

* Minimum drive current too high for motor.
X Unsuitable motor/drive combination.
† 106 (42) size motors must use PDS15-D option (regenerative power dump).
PDS13 is 3 amps Peak Max. and PDS15 is 5 amps Peak Max.

Table 7. PDS Current Drive Settings for Digiplan 'SM' and STEBON Motors

Signal Connections

Step + Pin 1 & Step- Pin 14

A pulse on these inputs causes the motor to advance on the leading edge of the pulse (see Figure 6). The pulse should be at least 1µs 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.

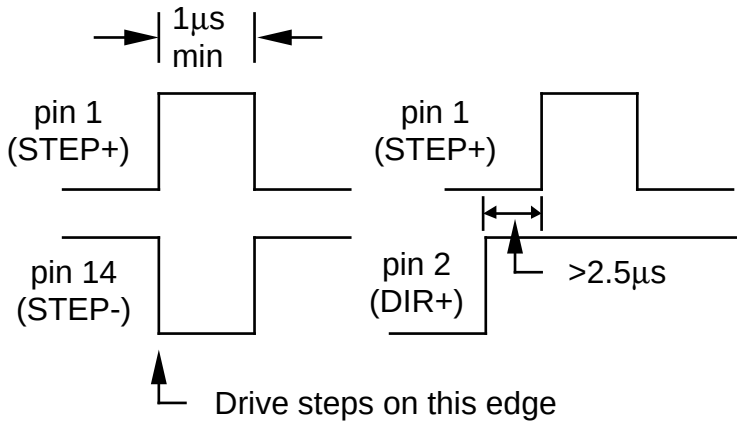


Figure 6. STEP Timing Diagram

Direction+ Pin 2 & Direction- Pin 15

These inputs (pins 2 and 15) 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 present for at least 2.5µs before the leading edge of the step pulse [transition to STEP+ (high) STEP- (low)].
The Direction inputs are configured as TTL opto isolated inputs.

Slow Rate Adjust (Pin 6)

An external variable resistor (100K Ohm, 10 turn recommended) or a fixed resistor may be connected between this terminal and "Adjust Common" (pin 19) to control the slow speed of the internal clock source. When using external speed controls, turn switch 3 off in order to isolate the internal potentiometers.

Fast Rate Adjust (Pin 7)

An external variable resistor (10K Ohm, 10 turn recommended) or fixed resistor may be connected between this terminal and "Adjust Common" (pin 19) to control the fast speed of the internal clock source. When using external speed controls, turn switch 3 off in order to isolate the internal potentiometers.

Fault (Pin 9 & 21)

This output is a transistor signal which turns on in the event of a fault. See Figure 7 for possible external wiring connections.

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.

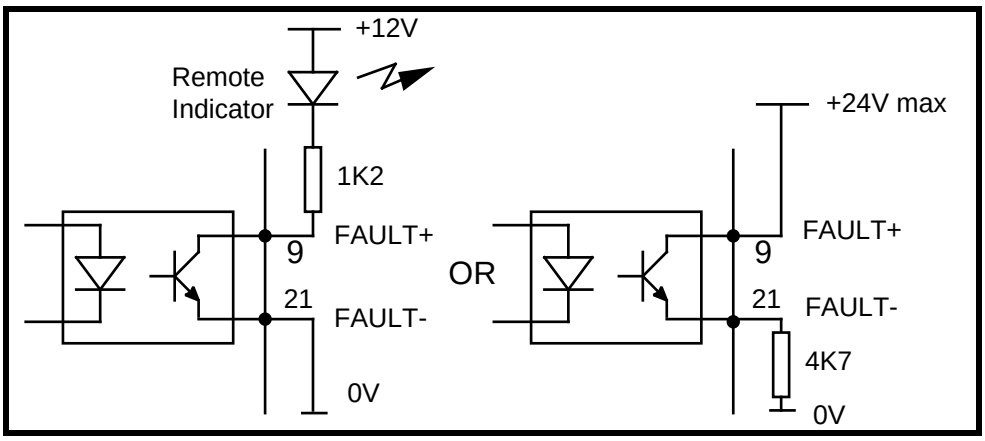


Figure 7. Fault Output Examples

Slow Run (Pin 12)

Connect this input to GND directly to run the internal clock source at the slow rate.

Fast Run (Pin 13)

Connect this input to GND directly to run the internal clock source at the fast rate.

Shutdown+ Pin 16 & Shutdown- Pin 17

These differential inputs (pins 16 and 17) 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.

Adjust Common (Pin 19)

Common return connection for external speed controls (nominal +12V).

Internal Clock Out (Pin 20)

This open collector output (NPN transistor) goes low every time the drive sees a step pulse from the internal clock source. It must be pulled up using an external resistor. Pulse width is 1µs.

GND (Pin25)

Control signal return.

Internal Speed Control

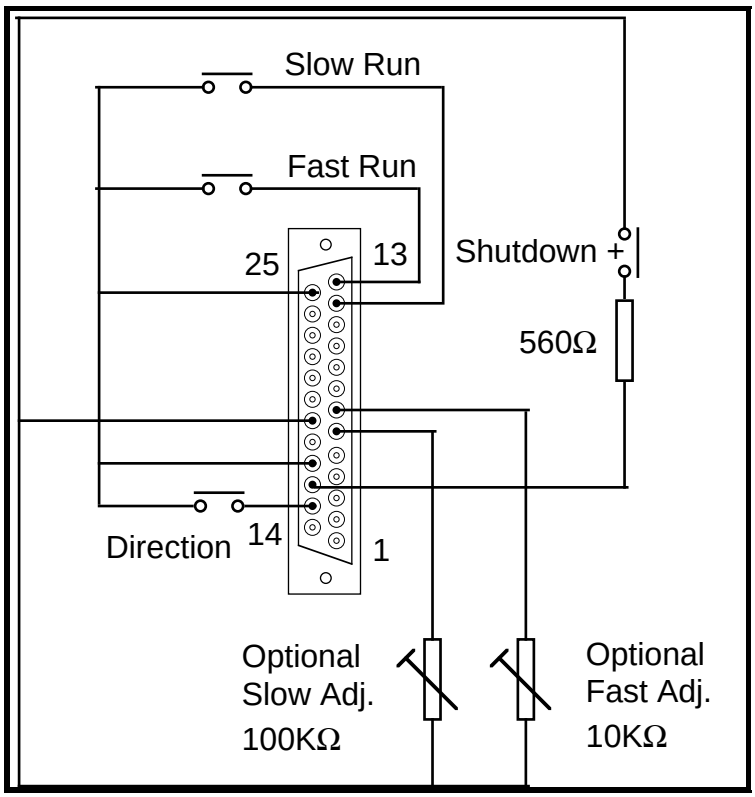
The drive contains a two speed oscillator circuit to allow “jogging” of the motor. This clock source produces a linear ramp up to the FAST speed setting. The SLOW speed setting is not ramped. Three 20 turn potentiometers are provided on the front panel to adjust the settings of the oscillator. The SLOW and FAST presets adjust the frequency of the corresponding range and hence the motor velocity. Note that motor resolution does not effect the velocity setting. Clockwise rotation of a potentiometer produces an increase in motor velocity. The FAST and SLOW potentiometers can optionally be

replaced by externally wired, remote potentiometers - see Figure 8. These external controls can be used to give a machine operator remote control of the motor.

Clockwise rotation of the ACCEL potentiometer increases the rate of motor ramp up to a maximum possible figure of 500 rps^2. The ACCEL potentiometer can not be replaced by an external variable resistor.

Optional Advance Rate Pot and Switch Connections

Figure 8 shows typical external connections required when using the internal clock source. External variable resistance values of 100KΩ for Slow and 10KΩ for Fast are recommended.
When using external speed controls, turn switch 3 off in order to isolate the internal potentiometers.



Note: Screened cable should be used (maximum length 2 metres)

Figure 8. Signal Connections

Input Circuits

The Step, Direction and Shutdown inputs are configured as differential TTL compatible opto-isolated inputs with reverse polarity protection. Figure 9 shows details of the input circuits used.

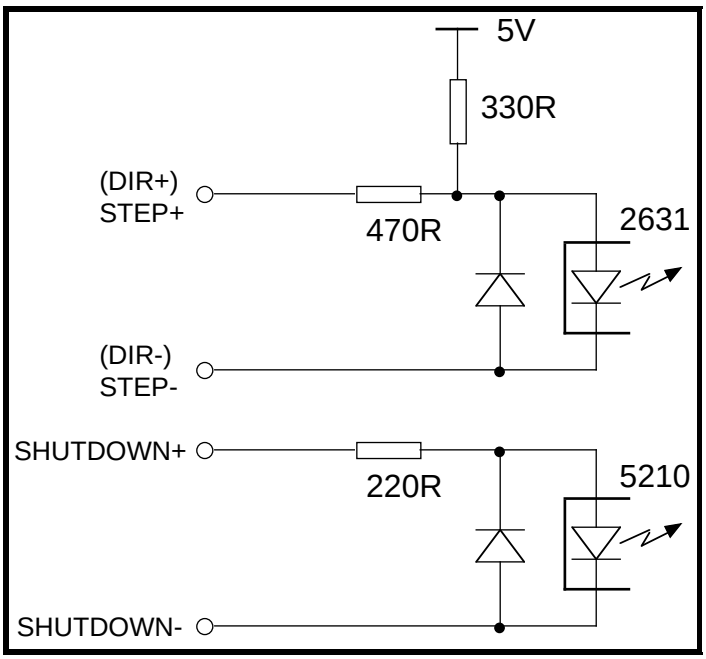


Figure 9. Drive Input Circuits

Using the PDS with Compumotor 6000 Series Controllers

The PDS directly connects to 6000 series stepper controllers using the Indexer-Drive cable supplied with the 6000 product. When setting up the controller, the following commands should be used to match drive and indexer:

PULSE: Must be set to 1µs or greater
DRES: Set indexer to the same resolution as the drive(s). Drive resolution is configured by switches 4 and 5. Valid settings are 400, 1000, 2000 or 4000 steps per rev.
DRFLVL: Set to active low (default for 6000 series)

Example of 2 axes of PDS connected to 6200 controller:

Command	Description
PULSE1,1	Sets the 6200 to 1µs pulse width
DRES4000,4000	Set indexer to same resolution as drive (4000 steps/rev).
DRFLVL0	Fault signals are active low
INFEN1	Enable input functions

Note that if a drive fault occurs and is cleared, a 6000 controller can automatically reset the drive latch by toggling the shutdown input signal as follows:

Command	Description
DRIVE00	Shutdown both axes (motors de-energised)
DRIVE11	Enable both drives and clear fault latches.

Mechanical/ Environmental

Enclosure Considerations

The drive and its switch mode power supply are contained in a single case measuring 250mm (9.84 inches) High, by 50mm (1.97 inches) Wide, by 190mm (7.5 inches) Deep.
Note: Enclosure depth does not take connector dimensions into account. These need an additional 60mm.

Environmental Specifications

Digiplan recommends you operate and store your PDS Drive system under the following conditions:

- Operating Temperature: 0° to 40°C (32° to 104°F)
- Relative Humidity: 0% to 95% (non-condensing)
- Storage Temperature: -40° to 85°C (-40° to 185°F)

The recommended orientation of the drive enclosure is back panel, vertical mounting.

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

Installation Considerations

The drive is designed to be installed vertically as shown in Figure 10. Air vents on the top and bottom panels allow convection cooling. At least 50mm minimum clearance around the air vents is recommended for unobstructed ventilation and reliable operation.

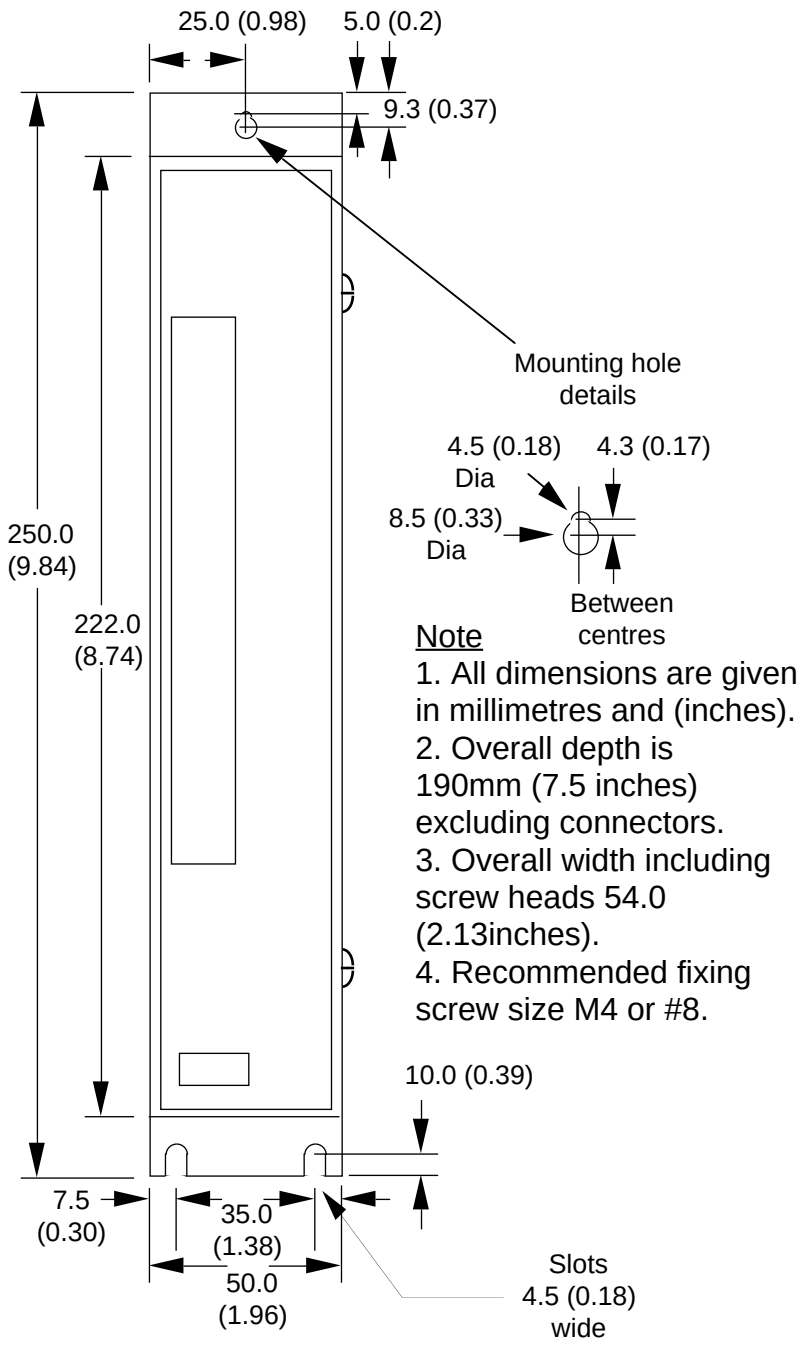


Figure 10 Drive Mounting Hole Locations

SETTING UP

Drive Switch Settings

SWITCH NUMBER	FUNCTION	COMMENTS
1	Selftest	Default OFF
2	Standby current reduction	Default ON
3	INT/EXT speed control	Default ON
4, 5	Step resolution	Default all OFF
6, 7, 8	Peak current setting	Default all ON

Table 8. Switch Settings

Selftest Switch1

The selftest switch is used to check the operation of the drive. Set to the ON position to cause the motor to rotate at the slow speed potentiometer setting. The default setting of selftest is OFF i.e. not selected.

Standby Switch 2

Switch 2 determines the level of standby current. With switch 2 ON, the current will reduce by 50% at standby. With switch 2 OFF, current will be reduced to 80% of the programmed value at standby.

Switch 3

Turn the switch ON for internal speed control or OFF for external speed control. **This switch must be ON to enable the self test facility, if external speed potentiometers are not connected.**

Step Resolution Switch 4, 5

DIP Switches 4 and 5 determine the step resolution of the drive, as defined in Table 9.
Note: cycle the power for switch settings to take effect.

SWITCH SETTINGS		RESOLUTION IN STEPS/REV
4	5	
ON	ON	400
ON	OFF	1000
OFF	ON	2000
OFF	OFF	4000

Table 9. Step Resolution Settings

Peak Current Setting Switch 6, 7, 8

DIP Switches 6, 7 and 8 determine the peak current setting of the drive, as defined in Table 10.

SWITCH SETTINGS			PDS13 PEAK CURRENT	PDS15 PEAK CURRENT
6	7	8		
ON	ON	ON	3.0A	5.0A
OFF	ON	ON	2.7A	4.6A
ON	OFF	ON	2.4A	4.3A
OFF	OFF	ON	2.1A	3.9A
ON	ON	OFF	1.8A	3.6A
OFF	ON	OFF	1.5A	3.2A
ON	OFF	OFF	1.2A	2.9A
OFF	OFF	OFF	0.9A	2.5A

Table 10. Peak Current Settings

Acceleration/ Deceleration Rate Adjustment

The acceleration and deceleration rates of the drive are controlled by the front panel acceleration control, which provides a range of 20 to 500 rev/sec/sec.

Preliminary Testing

Initially do not make any connections to the 25-way D-type connector. With power OFF, ensure that switch 3 is in the ON position and that the motor is connected correctly. Set the SLOW potentiometer to its mid-way position (the potentiometers are all 20 turn). Apply power and check the motor for holding torque. The red FAULT LED should be OUT and the green POWER LED should be LIT. If all is well, close switch 1 and the motor will start turning. The velocity can be varied by rotating the SLOW potentiometer (clockwise increases velocity). The success of this preliminary test confirms correct drive-motor wiring. Power down and turn OFF switch 1.

If you wish, you can now plug in your Compumotor Indexer cable and test the drive using the indexer. Alternatively, by making the wiring connections shown in Figure 8 you can operate the drive via the internal clock source.

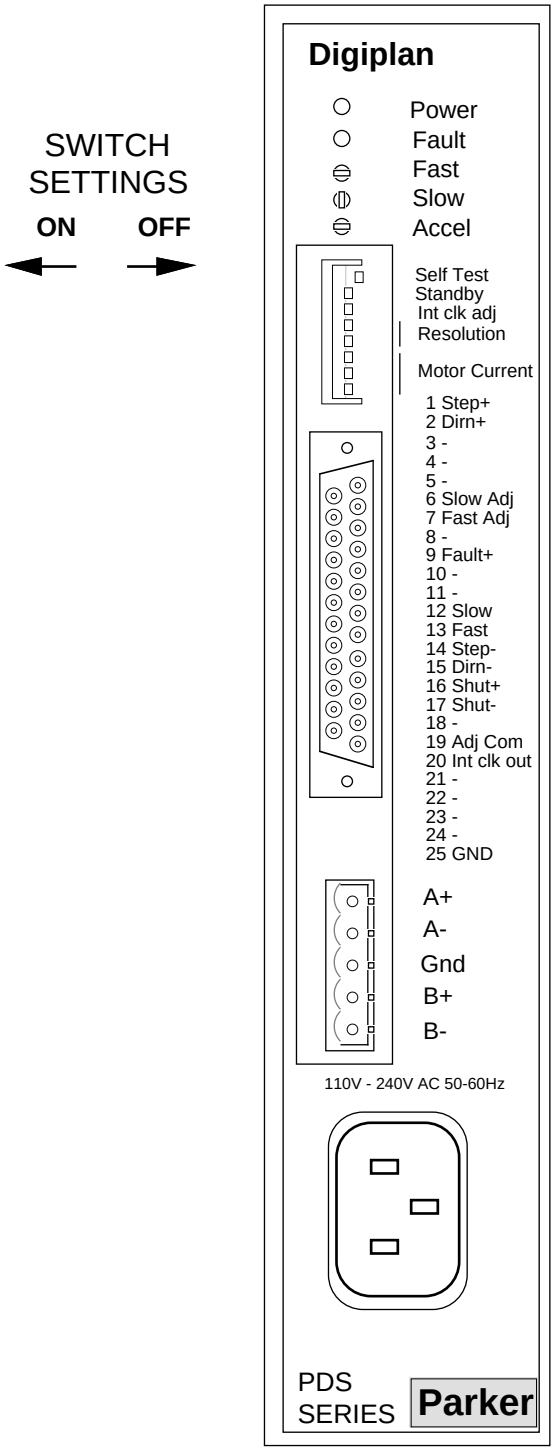


Figure 11. Front Panel Layout

MAINTENANCE & TROUBLESHOOTING

Maintenance

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

Motor Maintenance

Periodically check the motor to ensure that no bolts or couplings have become loose during operation, and check the motor cable or leads periodically for signs of wear. Do not make very tight bends or pull on the cable during normal operation. Check all cable connectors.

Drive Maintenance

Check that the drive is clear of loose material and has a free flow of air through the ventilation slots. 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

Fault LED

The red LED indicates one of the following fault conditions:

1. Motor wiring short-circuit either across phases or between phases.
2. Motor wiring short-circuit phase to GND (earth).
3. Motor supply overvoltage or undervoltage.
4. Internal supply failure.
5. Drive internal overtemperature.

The fault LED will also light up if the motor is decelerating a high - inertia load too quickly. The drive will shut down under this condition. If this occurs, you can either reduce the deceleration rate/load inertia, or use a PDS15-D (power dump option). See INSTALLATION section for more information on the regenerative power dump option.

Note that the fault LED comes on momentarily when power is removed from the drive. This is caused by the supply rails dropping below a safe operating level, and is an indication that the fault circuitry is functioning correctly. You should always ensure that the fault LED is extinguished before re-applying the power.

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 DIP switch selection is not set properly.
- 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.
- If the power LED is out and the motor will not energise, the drive must be returned for repair.

If the unit has holding torque and the motor shaft still fails to move, here are some possible 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. Try running the motor using the self-test switch.

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.

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 switch 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 conditions. Disconnect the motor from the load and run it without a load connected. Check the switch current settings.

Motor Overheats

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

Motor Runs the Wrong Way

Turn off the power and interchange the connections between A+ and A- on the motor connector.

Internal Clock Source Won't Run

If no external speed controls are used, check that switch 3 is ON so that the internal potentiometers are functional.

Self Test Fails to Run Motor

See above.

Returning the System

If you must return your drive system for repairs or upgrades, use the following steps:

1. Get the serial number and the model number of the defective unit, and a purchase order number to cover repair costs in the event the unit is determined by the manufacturers to be out of warranty.

2. When you return the unit please provide as much of the following information as you can.

- What is the extent of the failure/reason for return?
- How long did it operate?
- Did any other items fail at the same time?
- What was happening when the unit failed (i.e., installing the unit, cycling power, starting other equipment, etc)?
- How was the product configured (in detail)?
- With what equipment is the unit interfaced?
- What is the application?
- What was the system environment (temperature, enclosure, spacing, unit orientation, contaminants, etc.)?

3. In the UK, call Digiplan for a GRA (Goods Returned Authorisation) number. Returned products cannot be accepted without a GRA number. The phone number for Digiplan Repair

Department is 0202 690911. For Customer Service/Applications Department phone 0202 699000.

Ship the unit to: Parker Hannifin plc
Digiplan Division,
21, Balena Close,
Poole,
Dorset,
England.
BH17 7DX

4. In the USA, call Parker Compumotor for a Return Material Authorization (RMA) number. Returned products cannot be accepted without an RMA number. The phone number for Parker Compumotor Applications Department is (800) 358-9070.

Ship the unit to: Parker Hannifin Corporation
Digiplan Division
5500 Business Park Drive, Suite D
Rohnert Park, CA 94928
Attn: RMA # xxxxxxx
Where xxxxxxx is your allocated RMA number.

5. Elsewhere: Contact the distributor who supplied the equipment.

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