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Digiplan, Compumotor and Daedal form part of the Parker Hannifin Motion & Control Group. Products include stepper, brush and brushless servo systems, controllers and positioning stages, as well as complete custom-designed systems.

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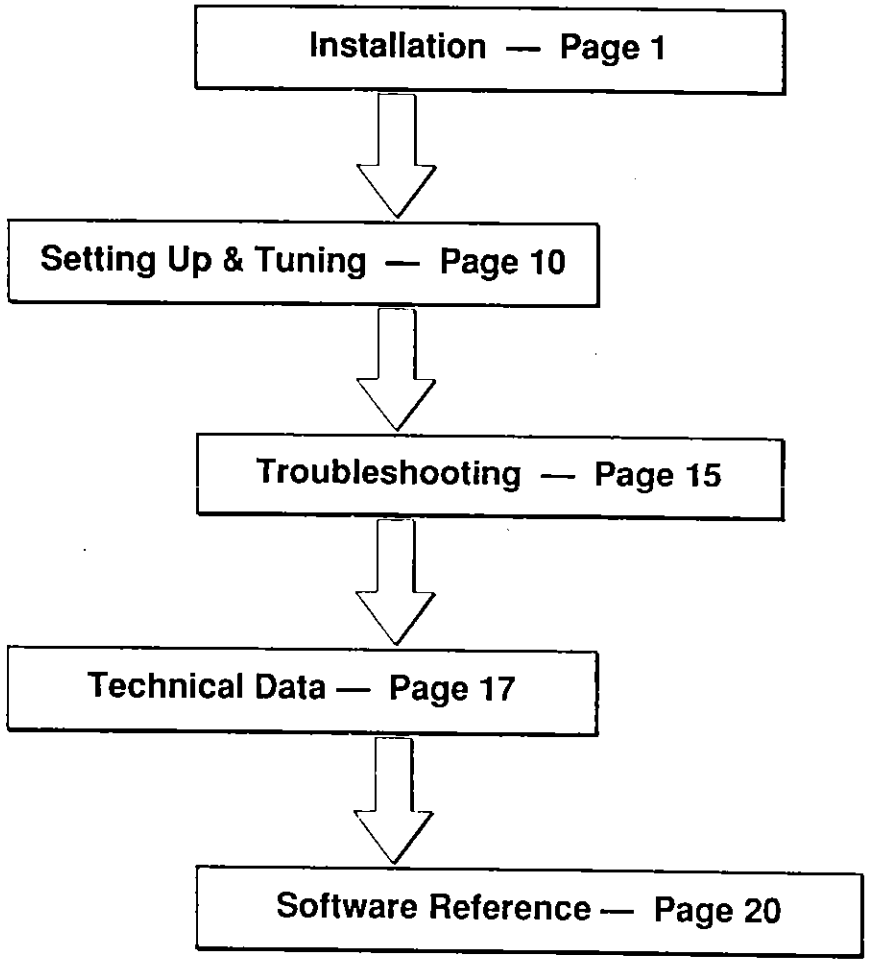
DS Series Brushless Servo Drives
Installation & Commissioning Guide

Parker
Motion & Control

Introduction

This guide provides a quick reference for the installation, commissioning & troubleshooting of all DS series servo drives. Please refer to the full User Guide for further details and programming information.

SAFETY WARNING *- the products referred to in this information are capable of producing rapid movement and very high forces. Unexpected motion may occur especially during the development of motion programs. KEEP WELL CLEAR of any machinery driven by this equipment and never touch it while it is in operation. When power is applied, take particular care to avoid contact with internal drive components or transformer terminals.*



INSTALLATION

Location

Install the drive only in a vertical position and allow sufficient clearance above and below to ensure an adequate flow of cooling air. Where possible, avoid installing the drive above other drives or heat-producing equipment. DS drives may be fitted alongside each other with a minimum spacing of 3mm (0.12") - this is to allow removal of the terminal covers.

Two alternative positions are provided for the drive fixing brackets (see Fig 1). These allow the drive to be mounted wholly within the enclosure (position A) or with the heat sink projecting from the rear (position B).

The drive dimensions and fixing centres are shown in Fig. 1.

Electrical Connections

The main electrical connections are shown in Fig. 2. Your attention is drawn to the earth connections which are essential to minimise radiated interference as well as to guarantee personal safety.

It is recommended that you install an earth bus bar as close as possible to the drive module(s), and this becomes the system earth stud. This bus bar should be at least 20mm x 6mm (0.8" x 0.25") copper and ideally less than 0.5m (20") long. It should be mounted on insulated supports. Only one cable should connect the earth terminal on each drive to the bus bar.

Power Connections

The 3-phase AC input is wired to the power connector on the top of the drive. The supply to the drive must be protected either by HRC fuses (see ratings below) or by equivalent mcb switches equipped with thermal and magnetic trips.

Drive	Fuse rating
DS140	6A
DS220	10A
DS420	16A
DS600	16A
DS750	20A

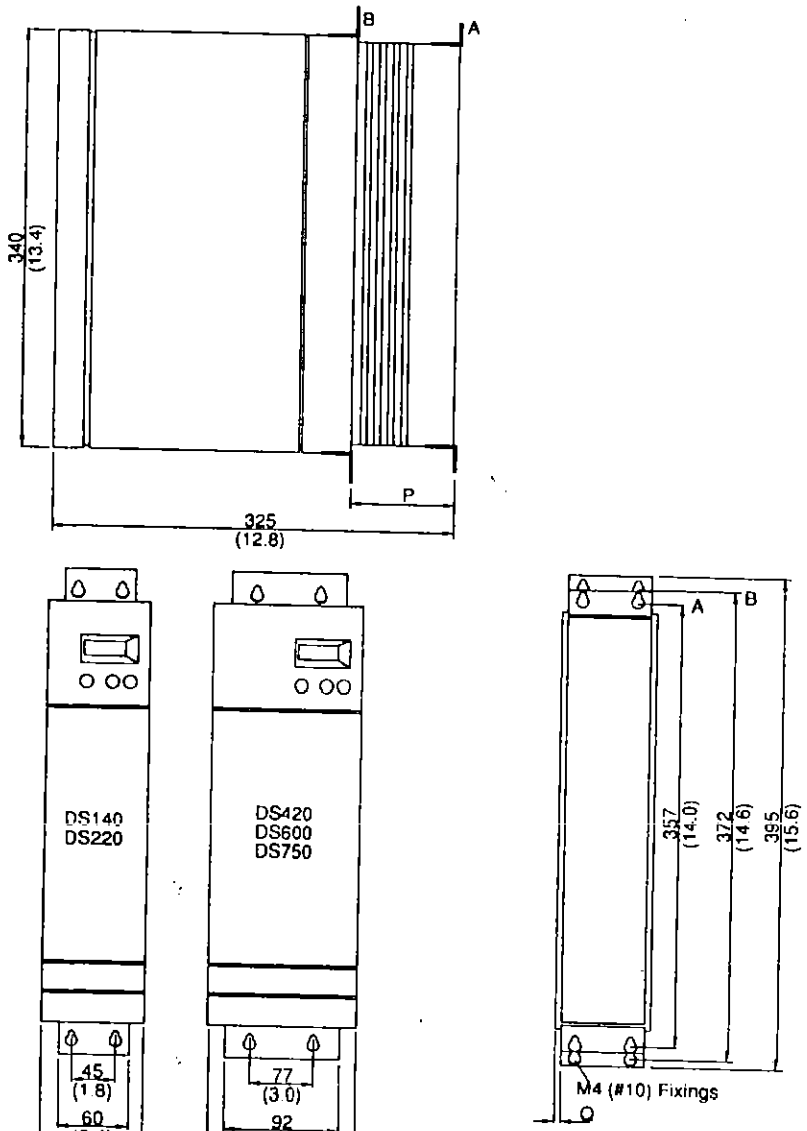


Figure 1. Dimensions

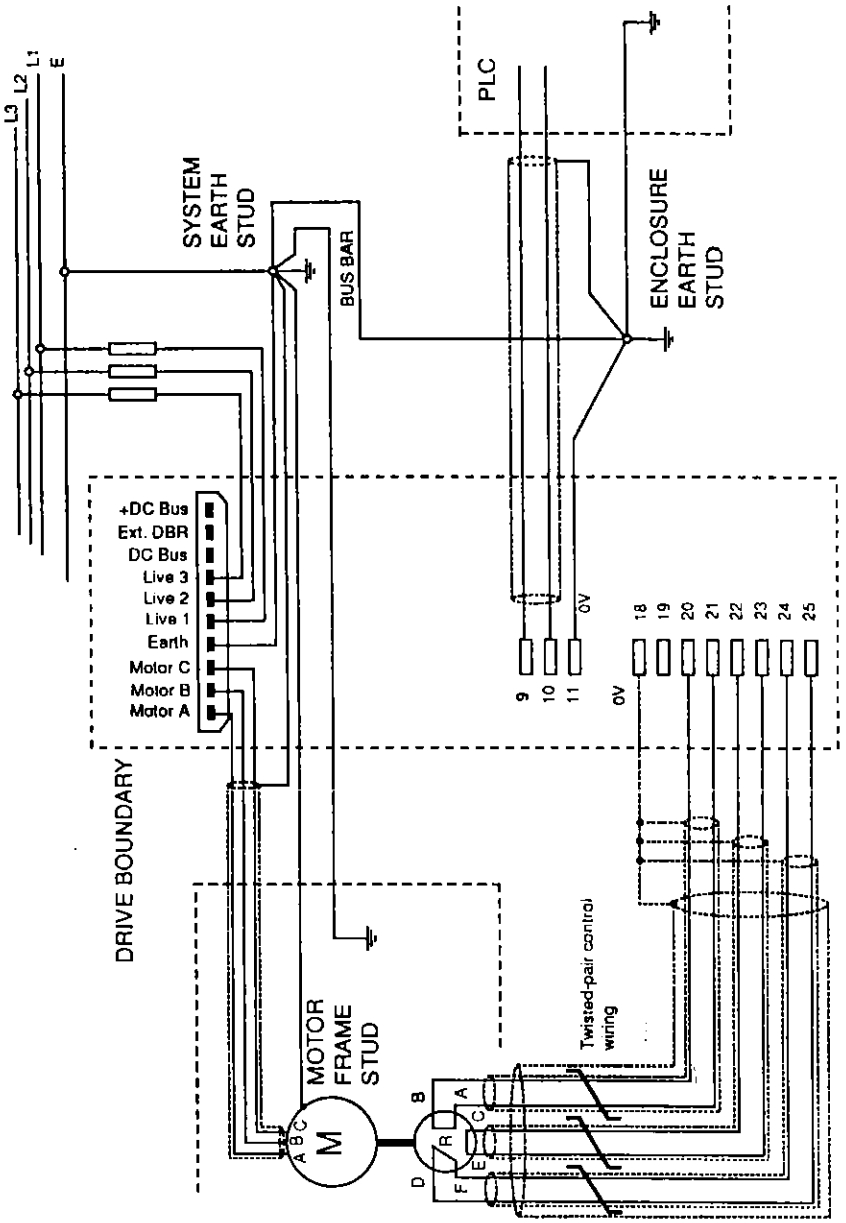


Figure 2. Electrical Connections

Motor & Resolver Connections

It is important that the DSM motor is connected in accordance with the wiring information that follows. Pay particular attention to the requirement to earth the motor housing - the drive operates direct-on-line and **the motor windings carry voltages in excess of 600V.** The earth wire should be at least 2.5mm^2 (12 AWG) in cross-sectional area.

Connections Using A Digiplan DS Cable Kit

These cables are fitted with motor-end connectors only, allowing the cable to pass through conduit or cable glands. The drive end of the cable is ready prepared with the individual leads identified. Mating drive-end connectors are supplied with the drive and are attached by means of screw terminals.

Motor cable (the larger of the two cables)

The three black cables fitted with cable markers should be wired to the power connector at the top of the drive (the pins are identified on the front panel of the drive). The green flying lead is the connection to the cable screen and should be connected back to the system earth stud.

Lead no.	Drive terminal	Signal
Black (A)	Motor A	Motor phase 1
Black (B)	Motor B	Motor phase 2
Black (C)	Motor C	Motor phase 3
Green	System earth stud	Cable screen

In order to minimise radiated interference, the motor earth connection is made externally to the screened cable feeding the motor windings. You will therefore find a separate green/yellow earth wire in the kit; this wire must be connected between the earth terminal on the motor body and the system earth stud (see Figure 2). **The motor housing will not be earthed unless this connection is made.**

Resolver cable

Lead no.	Drive terminal (connector B)	Signal
1	20	Cosine low
2	21	Cosine high
3	22	Sine low
4	23	Sine high
5	24	Excitation low
6	25	Excitation high
7	18	Cable screen
8	1	Thermistor A
9	3	Thermistor B

Note that terminal 1 on the drive is a multi-function input which can be used as an external trip, external current limit or thermistor input. When used as a thermistor input a 1K5 resistor must be fitted between terminals 1 and 2 (see diagram).

Brake connections

When the motor is fitted with the optional brake, connections are made to leads 10 and 11 on the resolver cable. To release the brake, 24V DC must be applied to these leads.

Connections For User-Supplied Cables

The following table shows the connections required when you make up your own motor & resolver leads. Note that the motor cable should be screened and the screen connected back to the system earth stud. The motor body earth connection should be made using a separate wire which is external to the screen. Recommended minimum cable sizes are 1.5mm^2 (14 AWG) for the DS140 and DS220 drives, and 2.5mm^2 (12 AWG) for the larger units. The resolver cable should contain twisted pairs with individual screens as well as an overall screen.

Motor cable			Resolver cable		
Motor plug	Drive terminal	Signal	Resolver	(connector B)	Signal
A	Motor A	Motor phase 1	A	21	Cosine high
B	Motor C	Motor phase 3	B	20	Cosine low
C	Motor B	Motor phase 2	C	22	Sine low
			D	25	Excitation high
			E	23	Sine high
			F	24	Excitation low
			G	1	Thermistor A
			H	3	Thermistor B
			J	-	Brake (if fitted)
			K	-	Brake (if fitted)
			-	18	Cable screen

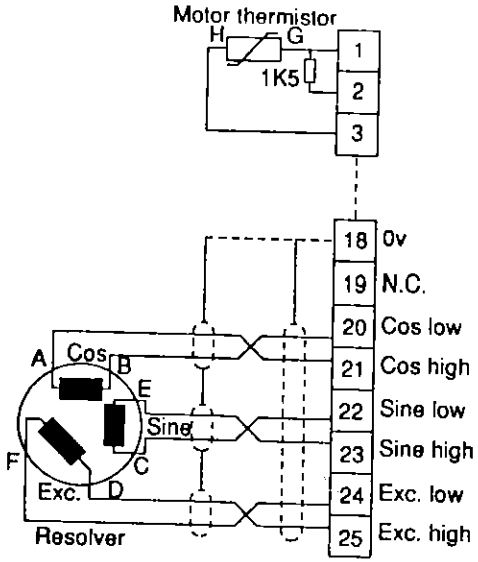


Figure 3 Resolver Connections

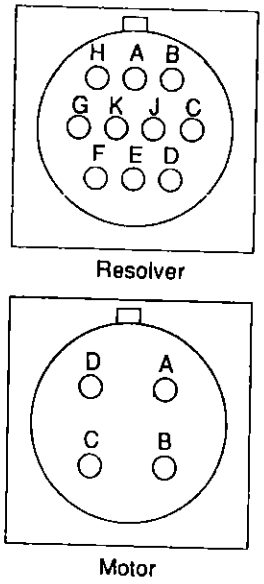
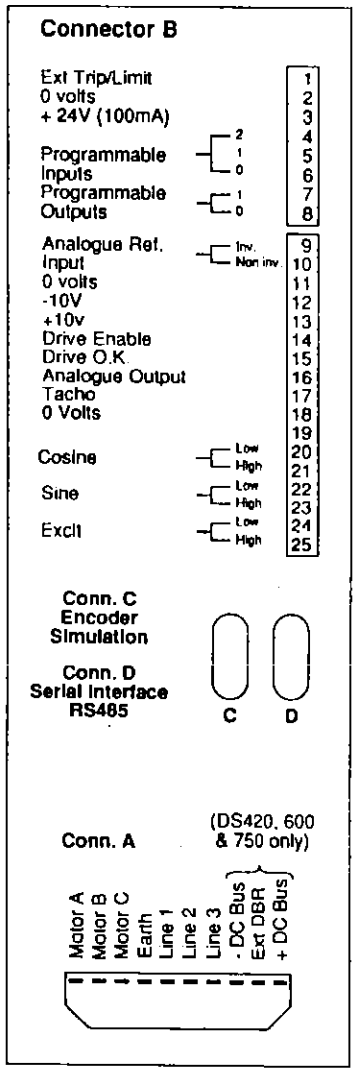


Figure 4. Motor & Resolver Connector Details

Control connections

Please refer to Fig. 5 and the following tables for information on the control signal connections. A single earthing point should be used for the control wiring as shown in Fig. 2, and the use of screened cable is strongly recommended.



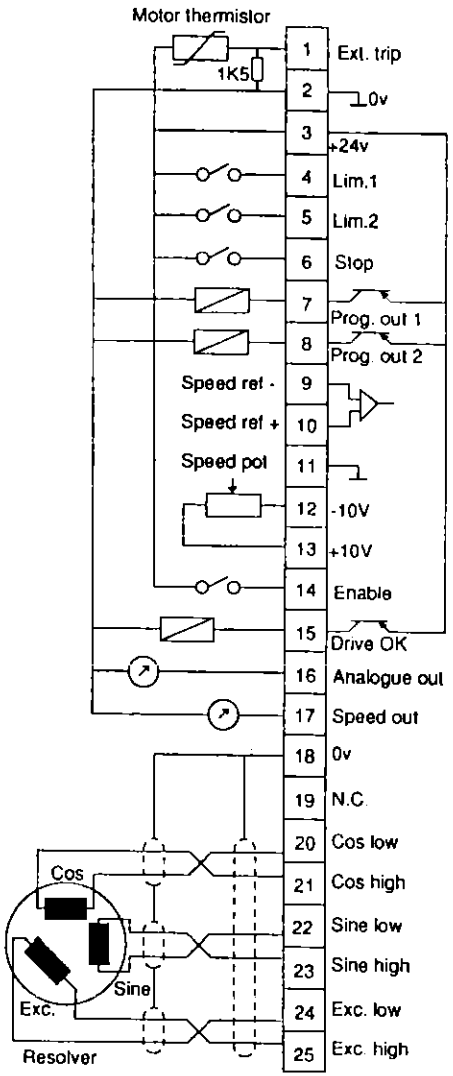


Figure 5 Control Connections

Signal connector B

Term	Function	I/O	Description
1	External trip/I limit	In	Analogue input used as external current limit or trip (from motor thermistor)
2	Zero volts	-	Common return for digital inputs
3	+24V	Out	DC power supply for I/O circuits, 100mA max.
4	Programmable input	In	Digital speed select or limit switch input (together with B5)
5	Programmable input	In	Digital speed select or limit switch input (together with B4)
6	Start/stop/orientate	In	Digital input programmable to stop & hold or stop, orientate & hold.
7	Programmable Out	Out	Digital output with 7 alternative functions set by parameter 30
8	Programmable Out	Out	Digital output with 7 alternative functions set by parameter 31
9	Analogue Ref. Input (inverted)	In	Inverted analogue input, velocity or torque selectable.
10	Analogue Ref. Input (non - inverted)	In	Non-inverted analogue input, velocity or torque selectable.
11	Zero volts	-	Control signal common.
12	- 10 volts	Out	Voltage reference, 10mA maximum
13	+ 10 volts	Out	Voltage reference, 10mA maximum
14	Drive enable	In	Digital input to enable the power stage (enabled by + 24V)
15	Drive OK.	Out	Digital output to indicate drive healthy (indicated by + 24V)
16	Analogue output (programmable)	Out	Analogue output, selectable between velocity demand, torque demand & motor current
17	Tachogenerator	Out	Tacho signal output for speed indication
18	Zero volts (screen)	-	Dedicated connection for resolver.
19	Not connected		NO CONNECTION MAY BE MADE TO THIS TERMINAL
20	Cos low	In	0V return for cosine input
21	Cos high	In	Cosine signal from resolver
22	Sin low	In	0V return for sine input
23	Sin high	In	Sine signal from resolver
24	Excit. low	Out	0V return for excitation output
25	Excit. high	Out	Excitation signal at 7.812 kHz for resolver

Signal connector C

Term	Function	I/O	Description
1	A	Out	Simulated encoder, channel A
2	$\overline{A}$	Out	Simulated encoder, channel $\overline{A}$
3	B	Out	Simulated encoder, channel B
4	$\overline{B}$	Out	Simulated encoder, channel $\overline{B}$
5	C	Out	Simulated encoder, channel C
6	$\overline{C}$	Out	Simulated encoder, channel $\overline{C}$
7	Frequency Ref.	In	Digital input; frequency between 30Hz & 450 kHz is equivalent to analogue reference between 0v & 10v
8	Direction Ref.	In	Digital input used in frequency/reference mode to determine direction (+24v = CW)
9	Not used	-	

Signal connector D

Term	Function	I/O	Description
1	GND	-	Earth
2	TX	Out	Serial comms transmit, non-inverted
3	RX	In	Serial comms receive, non-inverted
6	$\overline{TX}$	Out	Serial comms transmit, inverted
7	$\overline{RX}$	In	Serial comms receive, inverted

Note: Terminals 4, 5, 8 and 9 are not used.

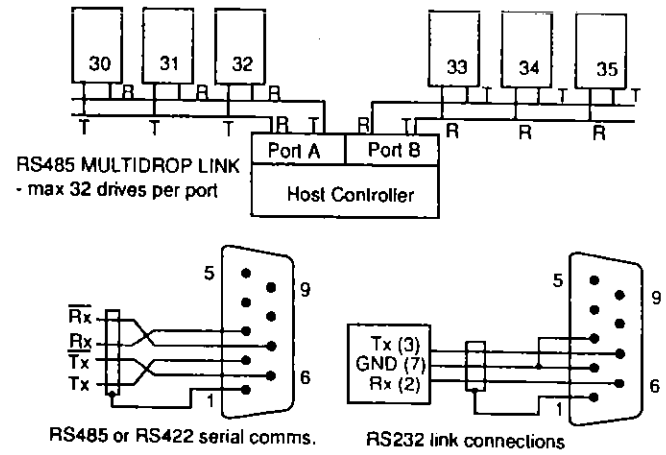


Figure 6 Serial Port Connections

SETTING UP & TUNING

Programming Information

The configuration of the drive is controlled by the setting of parameters and bits.

Parameters may take a range of values, an example of a parameter being the setting of peak current with a value in the range 0 to 100, representing 0% to 100% of the drive peak current.

Bits are 'switches' and can have a value of either '0' or '1'.

Parameters and bits may be changed using either the keypad or the serial communications link. The keypad will normally display either the actual speed of the motor in RPM or 'Rdy' (ready). This will depend on whether the start/stop input is high and the drive is enabled. If the drive is displaying something other than a numerical value or 'Rdy' then there is either a fault (refer to **DS Fault Codes**), or the keypad is in edit mode.

To edit data using the keypad press the **MODE** button once. The display will alternately flash the number of the parameter (Pr) or bit (b) that was previously edited, and the current value of that parameter or bit.

Use the **UP** and **DOWN** buttons to cycle through the parameters and bits. The **UP** key will cycle through the parameters 0 up to 99 and then the bits from 0 up to 99. Bit 99 is followed by parameter 0. The **DOWN** key will cycle through the parameters and bits in the reverse direction.

Once the data you wish to edit is flashing on the display, press the **MODE** button a second time to change the value of that parameter or bit.

Use the **UP** and **DOWN** buttons to increase or decrease the value displayed.

To exit the edit mode press the **MODE** button to return to the normal display. If you do not press either the MODE key or the UP or DOWN key for approximately 5 seconds then the display will revert to normal - this applies for all display modes. You can disable this function by setting bit 50 to 1.

Parameters are normally held in RAM. The RAM may be 'saved' to EEPROM (in the removable keypad), and the parameters in the EEPROM are then loaded into RAM on power up. If any parameter changes between power down and power up then bit 5 is set to '1' and the default parameters are loaded from EPROM into RAM. If this occurs it is necessary to then 'save' these parameters to the EEPROM before power down - otherwise bit 5 will be set again on power up.

The keypad display will indicate a fault condition by displaying a fault code. The fault codes are listed in the Troubleshooting sections.

Initial settings and resolver phasing

1. Ensure all connections are made correctly before you turn on the power. From a forward viewing position the motor cable is on the left of the power connector and the AC input cable on the right. The earth is connected in between motor and AC supply cables.

2. Turn on the drive but leave it disabled (Enable input 14 open-circuit).

3. Set b11=1 and b56=1. This sets up the drive to detect motor overheating via the thermistor input on terminal 1. Set Pr99 to 4200 if you need to use the full speed range on size 5 motors (DSM50340 - 51140). The default value for Pr99 is 3200 which is appropriate for size 7 motors. Set the parameters Pr45 and Pr55 from the table below according to the type of motor you are using.

	Pr45 Values					Pr55
Motor Type	DS140	DS220	DS420	DS600	DS750	Values
DSM50340	41					6
DSM50540	50	46				6
DSM50840		50	35			6.5
DSM51140			43	28		7
DSM71430			39	25		8
DSM71930				48	38	8.5
DSM72630					43	9.5

4. Set Pr95 to '8' (for eight-pole motors). Set bit 99=1 to save the programmed values, and then cycle power to the drive.

5. Examine Pr83, this will show the rotor position as a number between 0 and 2047. Rotate the motor shaft in a clockwise direction (from the front) and ensure that the value of Pr83 increases. If the value decreases, interchange the connections on one of the resolver phases (e.g. terminals 20 & 21).

6. Ensure bit 2 is set to '0' and connect the 'Enable' input to +24V.

7. Ensure the motor is unloaded and located in a safe position, since the motor will step round during the phasing process.

8. Set bit 49=1. The motor will start to move in a clockwise direction, each move should be approximately 15°. A total of 24 moves should occur, producing a single revolution. If only 18 moves occur then the value of Pr95 has not been set correctly - repeat the process from step 4.

9. Once the motor has completed the 24 moves, a value will flash on the LED display - record this value. Hold the MODE key pressed for at least 2 seconds to exit this mode.

10. Examine the value of Pr16 and add it to the value you recorded in step 9. Enter the result as the new value of Pr16. If the recorded value is negative then subtract this from the current value in Pr16.

11. Remove the 24V from the enable input to disable the drive. Set bit 2 =1 to enable the drive in software and set bit 99=1 to save the phasing parameters.

12. For size 5 motors operating with a velocity-mode amplifier, the default value for the integral gain (Pr15) may be too high. Reduce the value by approximately 50% or until the noise produced by the motor is negligible. If necessary switch the drive over from velocity to torque mode (see below), and apply +24V to the Enable input to switch the amplifier on.
The drive is now ready for use.

Changing to torque mode

The default settings of the drive is in velocity mode. To change to torque mode, disable by software (set b2=0) and then set b6=1. Re-enable by setting b2=1 and save the new configuration by setting b99=1. Note that you cannot change modes without first setting bit 2=0.
When operating in torque mode, no further adjustments are normally required.

Velocity Loop Tuning

Zero speed calibration (offset)

The speed reference generator may sometimes have an offset, with the result that at zero reference the motor turns slowly. Pr06 can be programmed to compensate; the value entered is the actual RPM of the motor at zero speed reference. The resolution of 0.1 permits precise setting of the compensation offset.

Dynamic calibrations

Final calibration is performed with the motor coupled to its normal load. In the majority of applications little change will be found necessary for most parameters after the preliminary settings have been made. If any change should be necessary, due for example to a high load inertia (>3x motor inertia), use the following procedure.

Note: calibration tests involve movement of the load. Care must be taken to ensure that the motion does not over-ride limit switches.

1. **Preliminary settings**

Set b07 = 0
b12 = 0
b13 = 1
b18 = 0
Pr58 = maximum speed trip (= Pr99)
Pr99 = full-scale speed of the motor

To use the internal digital reference as a signal source, remove the connection to terminal B6 and set the reference parameters as follows:-

Set b17 = 1
Pr00 = Pr99 ÷ 5
Pr01 = -Pr99 ÷ 5
Pr02 = Pr99 ÷ 5
Pr03 = -Pr99 ÷ 5

Pr19 = 2.5 (= 0.2Hz)
Pr21 = 1

To use an external signal generator, set b17 to 0 and disconnect terminals B6, B9 and B10. Link B9 to B11 (ground), and connect the signal generator to B10 with the common to B11.

- Program the generator to deliver a square wave output of 4V amplitude (i.e. -2V to +2V), at a frequency of 0.2Hz.
- Adjust both channels of the oscilloscope to a sensitivity of 1V per division, with a scan time of 20ms per division.
- Attach probe A to terminal B17 and probe B to terminal B16.
- Attach probe earth to terminal B11 or B18 (0V common).
- Select the channel B trigger on the oscilloscope.

Note:
When using a signal generator the signal frequency may be increased to reduce the stroke. The speed may be decreased by reducing the signal amplitude to a minimum of 1V.
Using the internal digital reference, speed may be reduced by decreasing the programmed values of Pr00, Pr01, Pr02, Pr03 or the frequency may be increased by decreasing the value of Pr19.

2. Tuning Procedure

Enable the drive by applying a 24V signal on terminal B14 and by setting b02=1. Wave forms such as those shown in Figure 7 show a proportional gain setting that is too low.

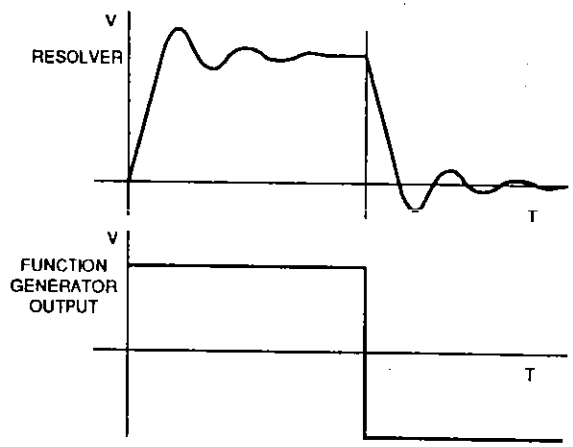


Figure 7 Proportional Gain Low

Increasing the value of Pr13 (proportional gain) will achieve a trace similar to Figure 8A which, however, shows poor derivative effect.

Increasing the value of Pr14 (derivative gain) will reduce the overshoot and remove the oscillation, to achieve a result similar to Figure 8B, but at the expense of increased current. Pr15 (integral gain) is not likely to require adjustment, but if it is adjusted do not use a value in excess of 250.

Excessive gain demands extra current, which in turn may increase the heating of the motor, causing motor shaft oscillation and possibly leading to the I^2t current limitation being exceeded.

Too high a derivative gain tends to slow down the speed of response, as shown in Figure 8C.

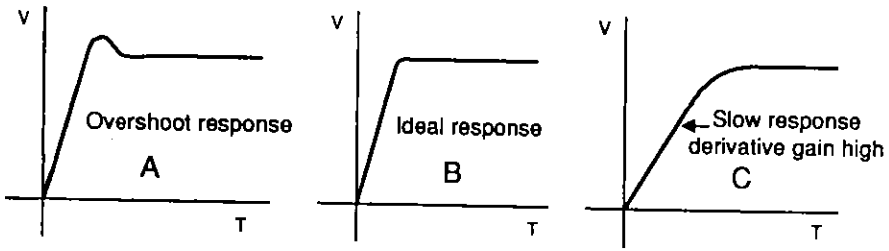


Figure 8 System Responses

TROUBLESHOOTING

Fault symptoms	Possible solution
Motor will not energise	Ensure 1.+24V is applied to input 14 (b10=1) 2.b2='1' (software enable) 3.Drive is not in fault state (b33>0)
Motor accelerates to full speed	Motor phasing is incorrect, perform phasing routine Drive is in torque amp mode with analogue or digital reference applied
Motor is energised but will not move when voltage applied <> 0	Limits are active, examine inputs 4 & 5 Stop and hold function is active, check input 6 and b18 Digital reference is selected, check b17=0
Drive is enabled but motor has no holding torque	Check current settings (Pr42, Pr45) Examine analogue input current limit (b11)
Unable to edit/save parameters	Security code is active, enter correct code in Pr25
Cannot communicate via the RS485 serial link	Tx/$\overline{Tx}$ and Rx/$\overline{Rx}$ lines are crossed Polarity of wiring is incorrect EOT character not sent to initiate message Drive address incorrectly set Data format is incorrect

DS Fault Codes

If an alarm situation arises, the drive will trip out and an error code will be displayed as listed below:

dOI	Drive operating incorrectly - complete processor lock-up
PA	Drive overtemp pre-alarm - drive will shortly overheat
th	Drive overtemperature fault - drive has overheated
OS	Drive overspeed - the programmed speed threshold has been exceeded
SC	Short circuit on +24V supply - an excess of 100mA drawn
rb	Resolver break - poor connection between drive and resolver
ou	Overload - current exceeds 110% of peak value
Et	External trip - normally the motor overtemperature sensor

Returning the System

If you have been through the troubleshooting information and have not resolved the problem, you can obtain technical assistance from your local distributer or by calling Digiplan direct (numbers are at the front of this guide).

If you need to return the equipment for repair, please follow these 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. Before you return the unit, have someone from your organisation with a technical understanding of the equipment and its application include answers to as many of the following questions as possible:

- What is the extent of the failure/reason for return?
- How long did it operate?
- 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)?
- What was the application?

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
Rohnert Park, CA 94928

Attn: RMA # xxxxxxx

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

TECHNICAL DATA

Parameter	Value
Input power supply voltage	
Phase	Balanced 3-phase, 3-wire
Frequency	50Hz to 60Hz
Voltage	min 380V - 10% to max 460V + 10%
Output voltages	
Motor	Service voltage 380V to 460V ±10%
DC bus voltage	740V maximum
Input control voltages	
Analogue	±10V, 10K impedance
Digital	Input impedance 15K =0 if earthed; =1 if +24V applied
Output control voltages and references	
±10V reference ±10%	10mA drive capability
Analogue	±10V, 1K impedance
Digital	Transistor PNP open collector 10mA drive capability
Tachogenerator	3V per 1000rpm if full scale is 3000rpm 3V per 4000rpm if full scale is 6000rpm
Simulated encoder	Balanced lines driven by line drivers RS422
+24V supply	100mA drive capability
Environment	
Ambient temerature	0°C to 50°C
Maximum altitude	1000m
Storage temperature	-40°C to +55°C
Humidity	non-condensing
Derating	
Max ambient temperature	50°C
Altitude	Where the site is above 1000m, reduce the normal full load current by 1.0% for each additional 100m.
Serial interface	
Mode	RS485 full duplex
Ingress protection (IP) enclosure	
Grade	IP20 specification

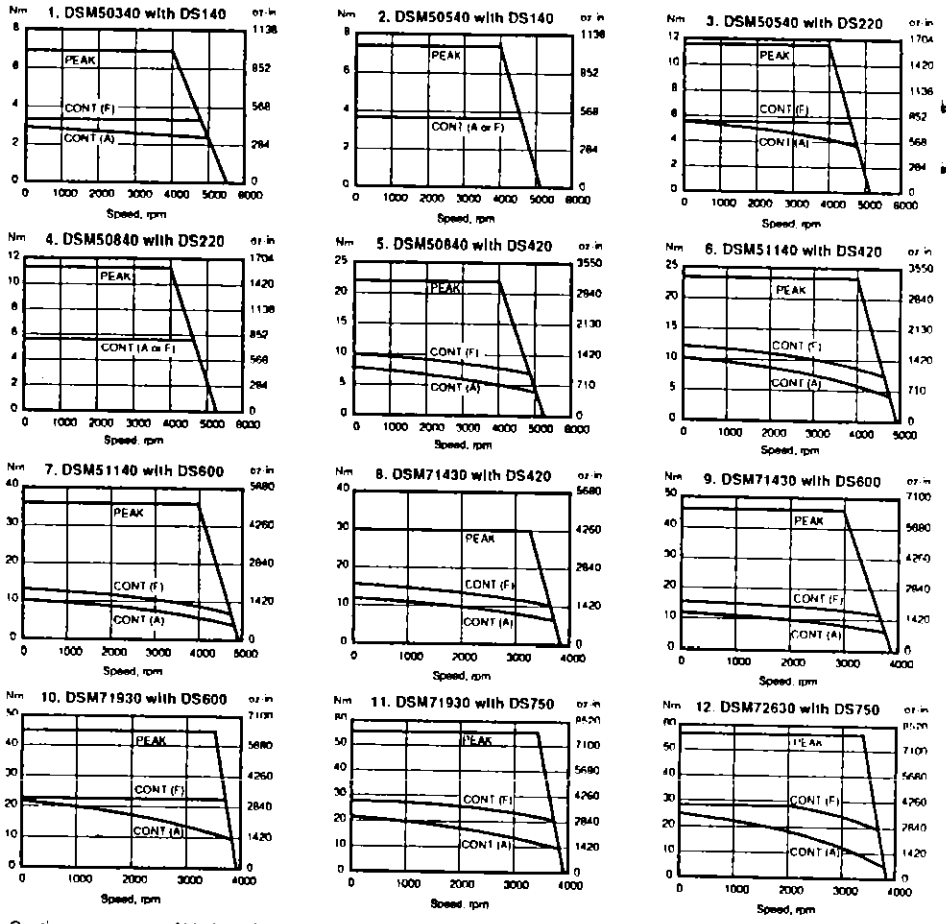
Power output and losses

Drive model	Apparent power kVA	Nominal continuous current rating A	Peak current A	Losses W
DS140	1.3	2.8	5.6	70
DS220	2.6	4.4	8.8	110
DS420	4.3	8.5	17.0	210
DS600	8.7	13.0	26.0	300
DS750	12.9	16.0	32.0	375

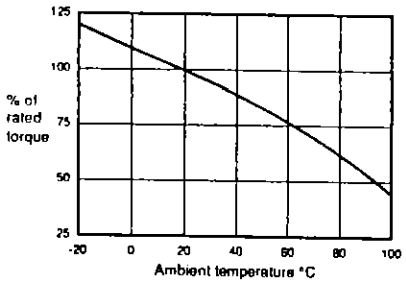
Braking resistors

Drive model	Resistor size	Maximum regenerative power
DS140 DS220	80R, 150W	150W continuous, 1.5kW peak for 10s with a minimum cooling time of 90s.
DS420 DS600 DS750	40R, 300W	300W continuous, 3kW peak for 10s with a minimum cooling time of 90s.

Performance data



Continuous curves: (A) in free air, ΔT = 65°C. (F) flange-mounted, ΔT = 100°C. All curves are for 415v AC input.



TEMPERATURE DERATING

Performance data is based on operation in a 20°C ambient. The graph shows the allowable torque as a percentage of the rated value when operating at other ambient temperatures.

SOFTWARE REFERENCE

Software Parameters and Bits

Parameters

No.	Description	Range	Default	Read/ Write
Pr00	Digital speed reference	±3000 if Pr99 < 3200 ±6000 if Pr99 > 3000	0	R/W
Pr01	Digital speed reference			
Pr02	Digital speed reference			
Pr03	Digital speed reference			
Pr04	Voltage level of DC bus	0 - 1024V (4V resolution)	*	R/O
Pr06	Analogue ref. input offset	-50.0 to +50.0	0	R/W
Pr07	Speed loop bandwidth	1 = bandwidth limit 320Hz 2 = bandwidth limit 160Hz 3 = bandwidth limit 80Hz 4 = bandwidth limit 40Hz 5 = bandwidth limit 20Hz	1	R/W
Pr08	Digital current reference	-100.0% to +100.0%	0	R/W
Pr09	Acceleration ramp CW	1mS to 3000mS (per 1000rpm)	200	R/W
Pr10	Acceleration ramp CCW	1mS to 3000mS (per 1000rpm)	200	R/W
Pr11	Deceleration ramp CW	1mS to 3000mS (per 1000rpm)	200	R/W
Pr12	Deceleration ramp CCW	1mS to 3000mS (per 1000rpm)	200	R/W
Pr13	Proportional gain	0 to 255	30	R/W
Pr14	Derivative gain	0 to 64	30	R/W
Pr15	Integral gain	0 to 100	30	R/W
Pr16	Resolver phasing	0 to 2047	0	R/W
Pr17	Digital reference	0 to 3 (indicates Pr0-3 selected)		R/O
Pr18	Digital input configuration	0 to 3 : Input 4 Input 5 Pr18 0 0 0 0 1 1 1 0 2 1 1 3		R/O
Pr19	Digital ref. scan time	0.1 to 6000 seconds	10	R/W
Pr20	Digital ref. selector	=0 selects Pr00 speed ref. =1 selects Pr01 speed ref. =2 selects Pr02 speed ref. =3 selects Pr03 speed ref.	0	R/W
Pr21	Digital ref. selector enable	=0 enables Pr20 selection =1 auto select with Pr19 time =2 enable i/p 4 & 5 if b16=0	0	R/W
Pr22	Drive address (RS485)	0 to 32	1	R/W
Pr23	Baud rate (can only be set at keypad)	300, 600, 1200, 2400, 4800, 9600, 19200	9600	R/W
Pr24	Digital run reference	±6000rpm	*	R/O
Pr25	Security code (see manual)	1 to 9999	0	R/W
Pr26	Drive module code	140, 220, 420, 600, 750.	*	R/O
Pr27	Shaft orientation function	0 to 2047	0	R/W

Parameters (continued)

No.	Description	Range	Default	Read/ Write
Pr30	Digital output 1 selector	=0 select I^2t alarm =1 select temp. pre-alarm =2 select I-limit alarm =3 select direction indicator =4 select zero speed indicator =5 select at-speed indicator =6 select speed-loop saturation indicator	0	R/W
Pr31	Digital output 2 selector	As above	0	R/W
Pr39	Analogue current input	-100% to +100% (-10V to +10V)	*	R/O
Pr40	Clamped current demand	-100% to +100%	*	R/O
Pr41	Current limitation value	0% to +100% of Ipeak	*	R/O
Pr42	Maximum current limit [= (Imax/Ipk) x 100]	0% to +100% of Ipeak	100	R/W
Pr43	I^2t limit (100=not in I^2t)	0% to +100% of Ipeak when current is in I^2t region	*	R/O
Pr45	Nominal current [= (Inom/Ipk) x 100]	20% to 50%	50	R/W
Pr55	Motor thermal time constant	0.4 to 10	7	R/W
Pr56	Motor at-speed window (lower)	± full scale speed (Pr99)	5	R/W
Pr57	Motor at-speed window (upper)	± full scale speed (Pr99)	5	R/W
Pr58	Maximum speed limit	0 to 6500 rpm	3200	R/W
Pr59	Motor speed feedback	± 6500 rpm	*	R/O
Pr68	Set encoder resolution	0=256 steps/rev 1= 512 steps/rev 2= 1024 steps/rev 3= 2048 steps/rev	1	R/W
Pr80	I^2t level [100% activates I^2t limitation]	0% to 100% of Pr42	*	R/O
Pr83	Rotor position	0 to 2047 (2048 counts/rev)	*	R/O
Pr98	Last alarm store	Displays last fault state	*	R/O
Pr99	Speed range	200 to 6000 rpm	3200	R/W

Bits

No.	Description	Range	Default	Read/ Write
b00	Change security code (manual)	**********	0	R/W
b01	Recall parameters from EEPROM	=1 to recall parameters	0	R/W
b02	Drive enable	=1 to enable (see i/p 14)	1	R/W
b03	Alarm reset	=1 to cancel alarm or trip	0	R/W
b04	Drive enable status	=0 indicates b02=0 or alarm	*	R/O
b05	Recall defaults from EPROM	=1 to recall defaults	0	R/W
b06	Power-amp reference selector [disable drive to change b06]	=0 velocity amplifier =1 torque amplifier (see b08)	0	R/W
b07	Enable acceleration ramps	=1 to enable accel/decel	0	R/W
b08	Current ref. mode selector [torque amp. mode only]	=0 analogue input =1 digital Iref. (Pr08)	0	R/W
b09	Digital stop i/p status	=1 if i/p 6 (stop) = 24V	*	R/O
b10	Digital enable i/p status	=1 if i/p 14 (enable) = 24V	*	R/O
b11	Current limit selector	=0 current limit = 100% =1 I = Imax[V(i/p 1) + 10V]	0	R/W
b12	Analogue o/p selector 1 [o/p 16]	=0 see b13 =1 o/p represents Imotor	0	R/W
b13	Analogue o/p selector 2 [o/p 16]	=0 o/p rep. clamped I.demand =1 o/p rep. post-ramp demand	0	R/W
b14	Digital reference selector	=0 velocity amp, analogue in =1 velocity amp, pulse input	0	R/W
b16	Digital speed ref. selector [i/p 4 & 5 - limits/selector]	=0 & Pr21 = 2 selects Pr0-3 =1 inputs act as limits	0	R/W
b17	Speed ref. input selector	=0 analogue speed ref. used =1 digital ref. (Pr0-3) used	0	R/W
b18	Digital stop selector	=0 function enabled by h/w =1 & b53 = 1 then stop with ramp to position and hold =1 & b53 = 0 & b22 = 0 then stop and hold without ramps =1 & b53 = 0 & b22 = 1 then stop and hold with ramps	0	R/W
b21	BCC enable	=1 to enable BCC	1	R/W
b22	Ramp-to-stop function	=1 stop & hold with ramps	1	R/W
b23	Limit switch ramp function	=1 ramp to stop on limit	1	R/W
b33	Alarm status	=0 min of 1 alarm is active =1 no alarms are active	*	R/O
b38	Direction of motor rotation	=1 rep. forwards/clockwise	*	R/O
b41	Zero speed status	=1 motor at zero speed	*	R/O
b42	At-speed status [see Pr56 & Pr57]	=0 motor speed outside range	*	R/O
b48	Speed loop saturation status	=1 speed loop in saturation	*	R/O
b49	Resolver phasing [see setting up DS servo later]	=1 to enable phasing	0	R/W
b50	Display return function	=1 disable display return	0	R/W

Bits (continued)

No.	Description	Range	Default	Read/ Write
b51	Serial link data format	=0 8 data bits, no parity =1 7 data bits even parity	0	R/W
b52	Serial Link Mode	=0 ANSI standard =1 terminal mode	0	R/W
b53	Digital stop mode selector	=0 stop and hold =1 orientate, stop and hold	0	R/W
b55	External trip alarm	=1 external trip is active	*	R/O
b56	External trip enable	=1 trip enabled	0	R/W
b81	Digital o/p short circuit	=1 short circuit present	*	R/O
b82	Digital o/p dc overvoltage	=1 dc bus voltage > 840V	*	R/O
b83	Digital o/p dc undervoltage	=1 dc bus voltage < 400V	*	R/O
b84	Digital o/p overcurrent	=1 current exceeds 110% Ipk	*	R/O
b85	Digital o/p overtemperature	=1 heatsink temp > 95°C	*	R/O
b86	Digital o/p resolver fault	=1 fault (transfer ratio low)	*	R/O
b87	Digital o/p overspeed trip	=1 motor speed > Pr58	*	R/O
b89	Digital o/p I^2t integration	=1 I^2t limitation active	*	R/O
b91	Digital o/p overtemp prealarm	=1 heatsink temp > 75°C	*	R/O
b96	At-speed relative / absolute	=0 absolute =1 relative absolute: b42 = 1 when Pr56 < (actual motor speed) < Pr57 relative: b42 = 1 when (ref + Pr56) < (actual motor speed) < (ref + Pr57) where ref. is the analogue i/p demand.	1	R/W
b99	Save RAM to EEPROM	=1 to save parameters	0	R/W

Useful Parameters/Bits

To disable the drive
- a) in software set bit 2=0, or
- b) in hardware connect input 14 to 0V or open circuit.

To enable the drive set bit 2=1 and connect input 14 to +24V.

To save parameters to the EEPROM set bit 99=1.

To restore parameters from the EEPROM disable drive in software and then set bit 1=1.

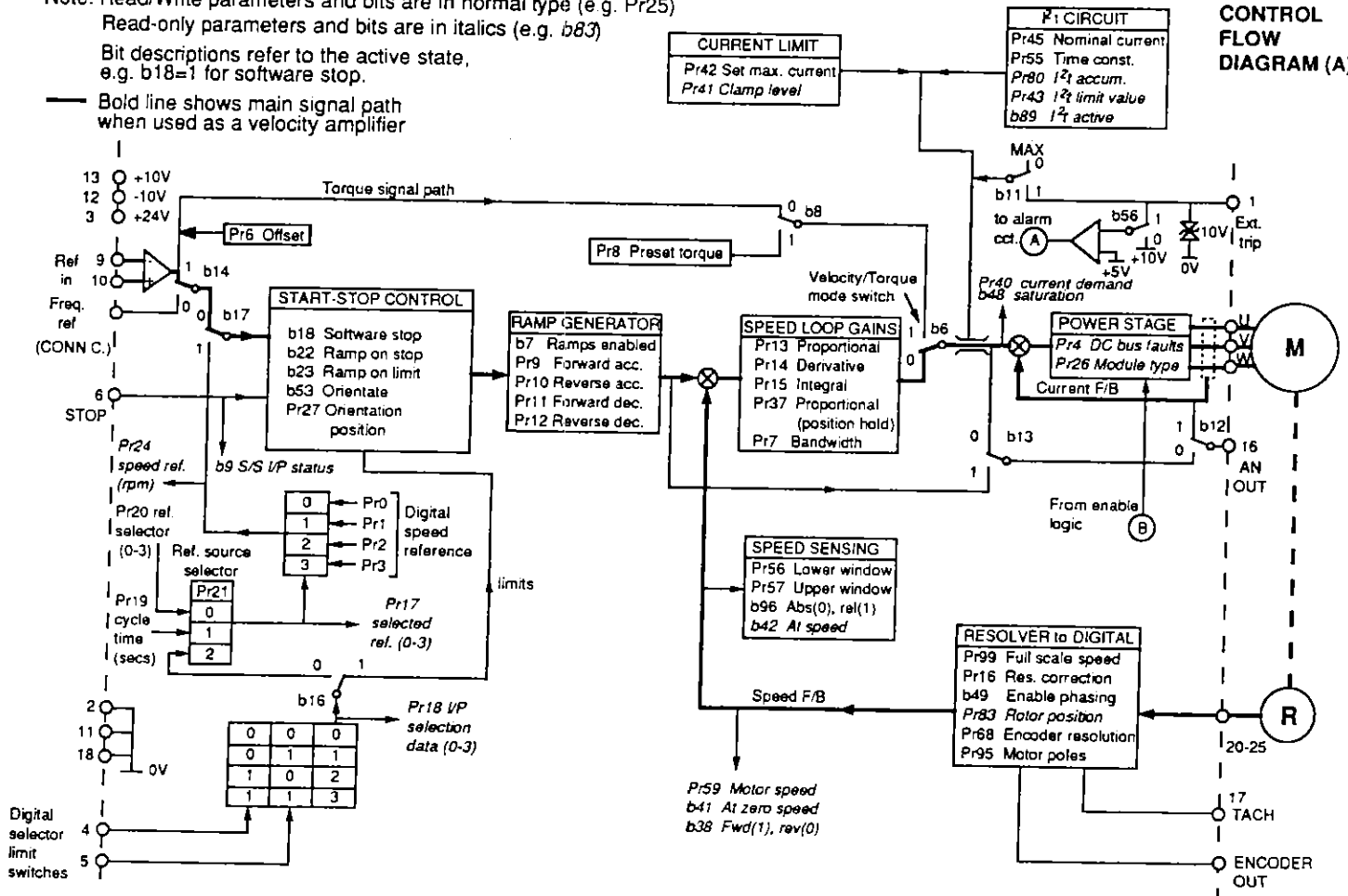
To restore default parameters from the EPROM, set bit 5=1.

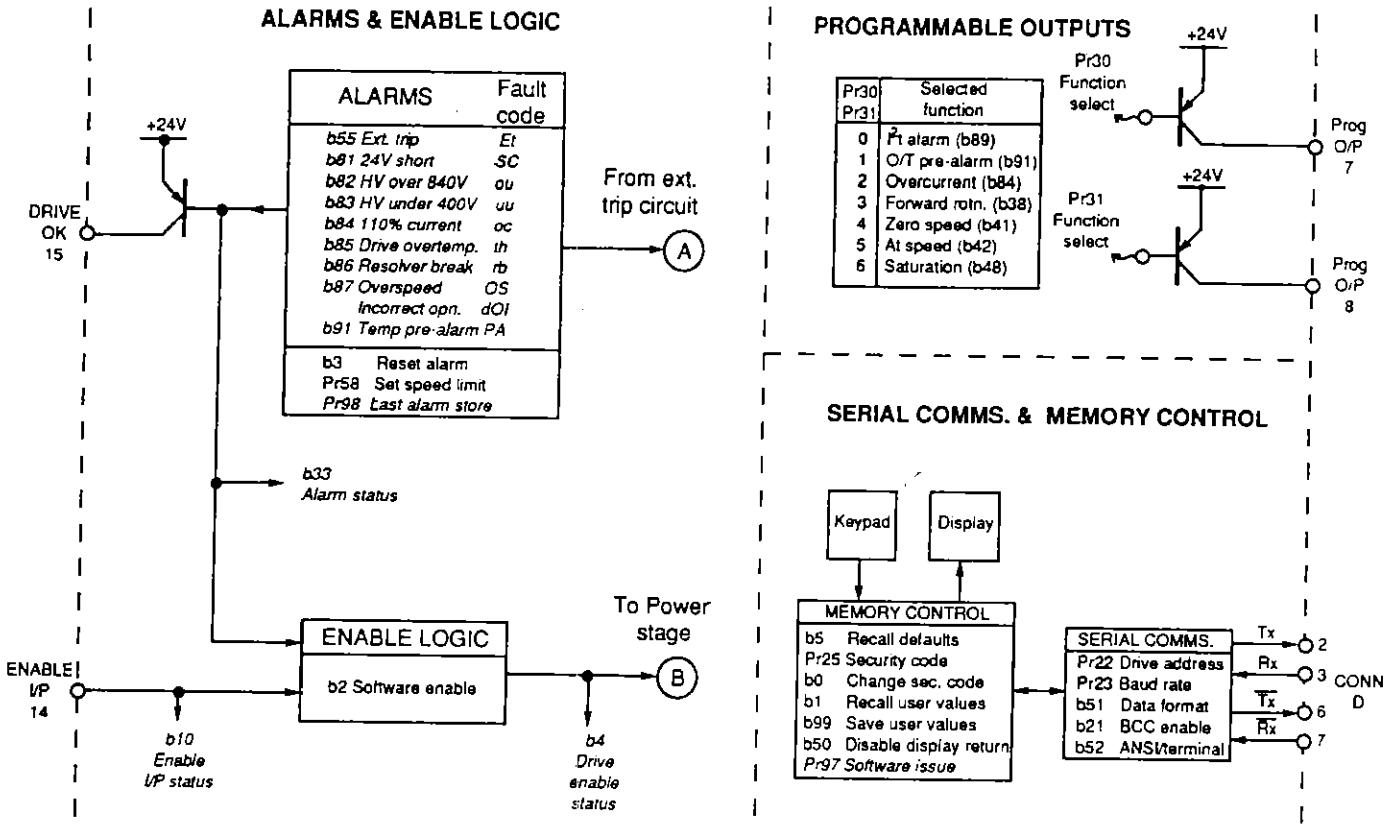
To reset the drive set bit 3=1.

To check the software revision of the drive examine parameter 97.

Note: Read/Write parameters and bits are in normal type (e.g. Pr25)
Read-only parameters and bits are in italics (e.g. *b83*)
Bit descriptions refer to the active state, e.g. b18=1 for software stop.
— Bold line shows main signal path when used as a velocity amplifier

CONTROL FLOW DIAGRAM (A)





Note: Read/Write parameters and bits are in normal type (e.g. Pr25)
Read-only parameters and bits are in italics (e.g. *b83*)