

CE
**SV-M & SV-S Series
Servo Drive
User Guide**

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IMPORTANT INFORMATION FOR USERS

Installation and Operation of Motion Control Equipment

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

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

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



SAFETY WARNING

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

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

A permanent mains safety earth connection must be made to the earth terminal on drives and power supplies before applying mains power.

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

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The following Warning and Caution labels are fitted to the drive:

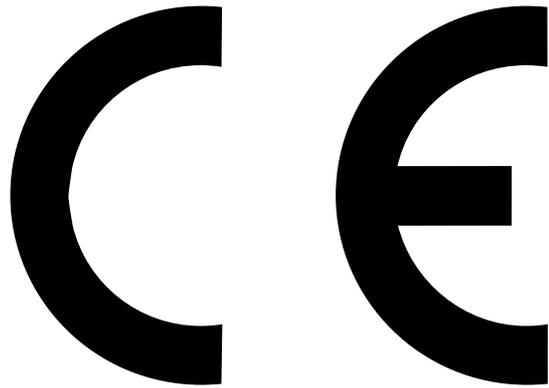
	CAUTION VORSICHT ATTENTION
	Hot surface. Do not touch • Heiße Oberfläche! Nicht berühren! Surface brûlante. Ne pas Toucher.

	WARNING ACHTUNG ATTENTION!	
	Risk of electric shock if case is not earthed. Connect earth before connecting supply • Entstehung von gefährlichen elektrischen Spannungen möglich, falls Gehäuse nicht geerdet ist. Vor Anschluß der externen Versorgungsspannung Geräterden • Risque de choc électrique en cas de non branchement sur la terre. Brancher la terre avant l'alimentation.	

	WARNING ACHTUNG ATTENTION!
	High voltages remain after power removed. Do not remove cover. No user-servicable parts inside • Nach Entfernen der Versorgungsspannung können im Gerät noch hohe Spannungen anstehen. Gerät nicht öffnen Gerätemodifikationen und-reparaturen dürfen nur vom Hersteller ausgeführt werden • Hautes tensions résiduelles apres coupure de l'alimentation. Ne pas ôter le boîtier. Eléments internes non disponibles à l'utilisateur.

Symbols used on the SV-M/SV-S 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: SVP100M, SV0200M, SV0500M, SV1500M
SV2500S, SV4500S, SV8500S

The above product is in compliance with the requirements of directives

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

The SV-M/SV-S Series of drives are sold as complex components to professional assemblers, as components they are not compliant with Electromagnetic Compatibility Directive 89/336/EEC unless they are fitted with an external filter.

Contents

Contents	i
Section 1. Introduction & Specifications	1
Section 2. Installation of SV-M Drives.....	9
Section 3. Installation of SV-S Drives.....	27
Section 4. I/O & Control for all Drives	49
Section 5. SOFTWARE REFERENCE.....	63
Software Parameters	71
Status Values	90
Section 6. Maintenance & Troubleshooting.....	93
Appendix A. Motor and Resolver Cables.....	97
Appendix B. Use of the Parameter Editor.....	103
Appendix C. Motor and Resolver Alignment.....	109
Index.....	109

User Guide Change Summary

This user guide, version 1600.225.02 supersedes version 1600.225.01.

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.

Major changes introduced at revision 02 are:

- Correct identification of SV2500S Power Connector

- Changes to Auxiliary 24V Supply Filtering for SV-S drives

- X9 output scaling factors added

- Changed weight and dimensions for the SV-S Series

Section 1. Introduction & Specifications

Product Description

The SV-M and SV-S range of servo drives provide an LVD compliant solution for applications requiring analogue velocity or torque control. Multi-axis applications can take advantage of the SV-M series of drives, where separate power modules can be shared between drives. The SV-S range, using built-in power supplies, would find extensive use in single axis applications.

All power supply modules or drives can be directly operated from 3-phase supplies, and the SV2500S has the additional option of being able to be used with a single phase 230V supply for greater flexibility. With the exception of the SV4500S and SV8500S all drives will require an external supply of +24V to power the internal control circuits. The SV4500S and SV8500S have a built-in +24V supply, but can use an external supply if it is more convenient to do so.

The complete range of drive types are given below:

<u>Drive</u>	<u>Switching VA</u>
SVP100M	3.3kVA
SV0200M	3.8kVA
SV0500M	6.8kVA
SV1500M	15.0kVA

<u>Drive</u>	<u>Shaft power</u>
SV2500S	1.5kW
SV4500S	3.5kW
SV8500S	5.5kW

Configuration of drive parameters can be performed by push buttons mounted on the front panel or via an RS232 link. A three character LED display is used for viewing drive parameters or drive status information whilst programming via the push buttons.

All drive types support 4, 6 or 8 pole motors, and are compatible with the HDX motor range. A brake output is routed directly to the motor, avoiding external relay circuits.

Monitoring outputs on the drive include a simulated encoder output with a relocatable marker pulse, allowing the use of the drive within a servo control loop with the ability to generate the marker pulse at any physical shaft position. Additional analogue outputs include a torque reference, tacho, DC bus level and motor current monitor.

Admissible AC Power Connections

Three-phase drives can be powered from the following types of AC power systems:

A TN - mains system type A and B, in which the earth/ground is connected as part of the supply, as shown in Figure 1-1. In this system all exposed conductive parts of the installation are connected to the earth/ground point of the source of the supply.

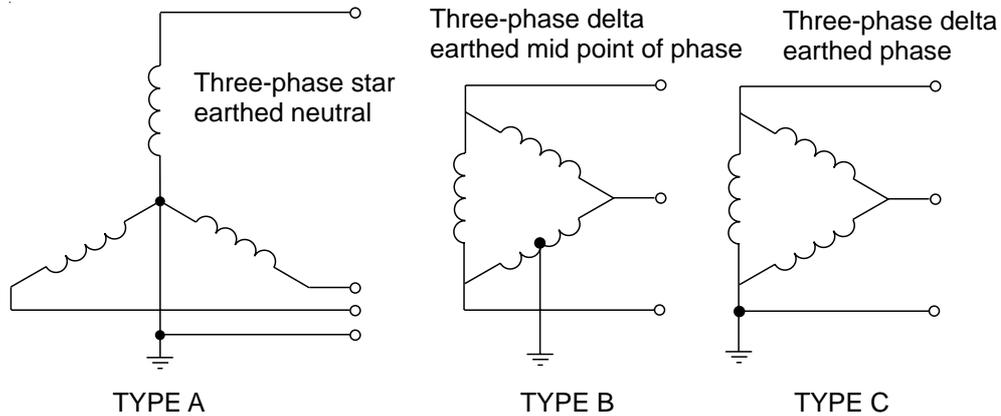


Figure 1-1. TN Mains Supply Systems

The three-phase delta earthed phase (type C) supply will only meet LVD requirements if the line to ground voltage is less than 416V AC.

IT mains supply systems, where the source of the supply has no direct connection to ground, do not meet European LVD insulation standards if the line-to-line voltage exceeds 416V AC.

SV-M Drives

Front panel supply, motor and brake connections allow several SV-M drives to be readily wired in a multi-axis group when mounted in-line. The connections are protected by a front panel cover, which is shown removed in Figure 1-2.

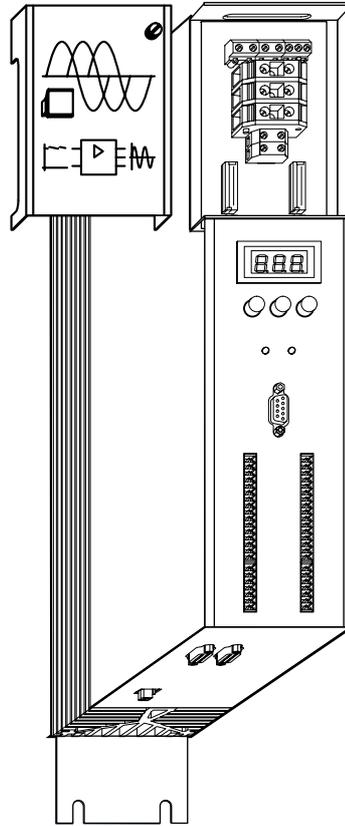


Figure 1-2. SV-M Servo Drive

SV-M Drive Electrical Specification
SV-M Drive Ratings

Model number	Continuous current	Peak (<5s) current	DC bus voltage	Minimum Continuous power	Power dissipation
P100M	5.5A	8.5A	560V	3.3kVA	140W
O200M	6.5A	8.5A	560V	3.8kVA	120W
O500M	11.5A	17.0A	560V	6.8kVA	250W
1500M	25.0A	50.0A	560V	15.0kVA	250W

Table 1-1. SV-M Drive Ratings

Power Supply Specifications

Parameter	Value
Power	
Supply voltage	See Power Supply Ratings - Table 1-3
Drive current	See Power Supply Ratings - Table 1-3
AC	
AC supply tolerance	+10% -15%
Supply frequency	50-60Hz
Safety specification	VDE0160
Control	
Control voltage	+24V DC \pm 10%, ripple <1V p-p
Control current	1A max. per drive, 1A per motor brake
Standby contact	
Standby contact rating	0.5A, 125V, 30W
Protection	
Overtemperature	Heatsink temperature >85°C
Undervoltage	DC output <80V
Overvoltage	Braking resistor switched in at preset level
Phase failure monitoring	Red LED flashes on phase failure, system disabled after 40 seconds (3-phase supply only)

Table 1-2. SV-M Power Supply Specification

Power Supply Ratings

Model number	Continuous power	Peak (<3s) power	AC supply voltage	DC output voltage	AC supply protection
NMD10	10kVA	20kVA	460V 3-phase	650V	16A
NMD20	20kVA	40kVA	460V 3-phase	650V	35A

Table 1-3. SV-M Power Supply Ratings

SV-M Housing and Environmental Specification

Parameter	Value
Enclosure rating	IP20
Isolation	VDE0160
Ambient temperature	0° - 45°C
Mounting	Direct or through panel (P100M direct mounting only)
Weight	
P100M	5.1kg
0200M	6.9kg
0500M, 1500M	7.1kg
NMD10	7.6kg
NMD20	8.1kg
Humidity	0 - 95% non-condensing
Installation category	II
Pollution degree	2

Table 1-4. SV-M Environment Specification

SV-S Drives

SV-S drives with integral power supplies are shown in Figure 1-3. Power connectors are mounted on the top of all the SV-S drives, but motor connections are on the top side of the SV2500S and on the under side of the SV4500S and SV8500S.

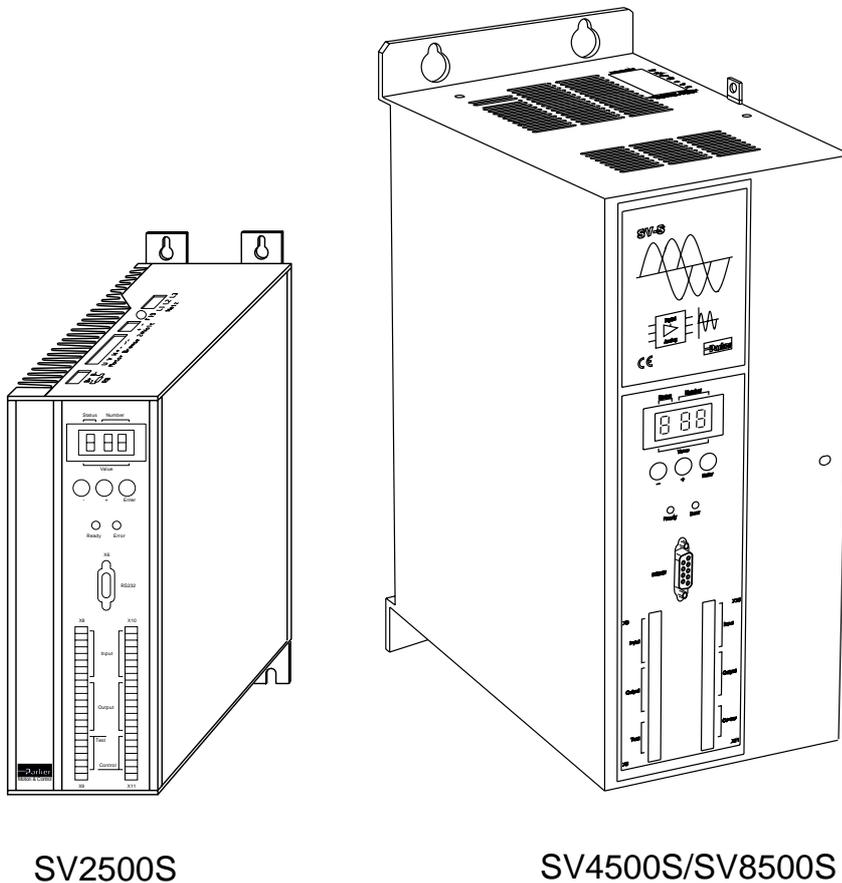


Figure 1-3. SV-S Servo Drives

SV-S Drive Electrical Specification

SV2500S Specification

Parameter	SV2500S
Supply Voltage	230V AC 1-phase or 3-phase
Supply Tolerance	+10% -15%
Supply Frequency	45-65Hz
Supply Fuses	16A (230V 1-phase) 10A (230V 3-phase)
Bus Voltage	
Output Continuous Current Rating	6.3A RMS
Output Peak Current Rating	12.6A RMS
Continuous output power	1.5kW
Maximum power dissipation	80W
Control voltage requirements	+24V DC±10%, ripple <1Vp-p
Storable regenerated energy	27Ws (capacity = 1,000µF)
Dump Capacity using external ballast resistor BRM5/01	250W continuous or 2.5kW for 2 secs duration with a 10 secs min. cool time
Cooling	Convection

Table 1-5. SV2500S Drive Specification

SV2500S Housing and Environmental Specification

Parameter	Value
Enclosure rating	IP20
Isolation	VDE0160
Ambient temperature	0° - 45°C
Mounting	Direct wall mounting
Weight	3.9kg
Humidity	0 - 95% non-condensing
Installation category	II
Pollution degree	2

Table 1-6. SV2500S Environment Specification

SV4500S/SV8500S Drive Electrical Specification

Parameter	Drive Type	
	SV8500S	SV4500S
Supply Voltage	380-480V AC 3-phase	380-480V AC 3-phase
Supply Tolerance	+5% -10%	+5% -10%
Supply Frequency	50-60Hz	50-60Hz
Supply Fuses	16A	10A
Bus Voltage	560V nominal	560V nominal
Output Continuous Current Rating	12.5A RMS	6.5A RMS
Output Peak Current Rating	25A RMS	13A RMS
Output Current Tolerance	±10%	±10%
Internal Dump Capacity (note 1)	300W continuous	300W continuous
Cooling	Fan	Fan

Table 1-7. SV4500S/SV8500S Drives Specification

note 1: an external ballast resistor may be fitted - 22 or greater.

SV4500S/SV8500S Housing and Environmental Specification

Parameter	Value
Enclosure rating	IP20
Isolation	VDE0160
Ambient temperature	0° - 45°C
Mounting	Direct
Weight	5.2kg both drive types
Humidity	0 - 95% non-condensing
Installation category	II
Pollution degree	2

Table 1-8. SV4500S/SV8500S Environment Specification

Section 2. Installation of SV-M Drives

Installation

This section describes the installation of SV-M drives, and contains information that is specific to SV-M drives and their associated power supplies. Information common to all SV drives, such as programming and I/O interfacing is fully described in later sections. Generally, the differences between the multi-axis and stand-alone drive types is restricted to power connections, motor connections and certain mechanical mounting options.

The drive must be installed in an enclosure to protect it from atmospheric contaminants such as oil, moisture, dirt, etc. No operator access should be allowed to the drive while it has AC power applied. Metal equipment cabinets offer the most advantages for siting the equipment since they can provide operator protection, EMC screening and can be fitted with interlocks arranged to remove all AC power when the cabinet door is open. 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.

System Components

A typical configuration will require one or more of the following components:

- Drive
- Power supply
- Motor
- Connection leads
- Parameter editor software
- Documentation

Note: You will also need to make available a separate +24V DC supply for the drive control circuits and a motor holding brake (if used). The current capacity of this supply should be rated as described in **24V Power Supply Rating** later in this section.

Drive Types

SVP100M	3.3kVA
SV0200M*	3.8kVA
SV0500M*	6.8kVA
SV1500M*	15.0kVA

* Can be through-panel mounted - see Dimensions and Mounting Options.

Power Supplies

Two types of 3-phase direct on line power supplies are available to power SV-M drives:

NMD10	10kVA
NMD20	20kVA

Motor Types

SV-M drives can be used with the motor types listed in Table 2-1. If you wish to use a motor other than the types listed, you will need to change motor parameters P01 to P09 to suit your chosen motor (see Software Reference section).

Drive Type	Motor Type	J (kgmm ²)	P01 value
SVP100M	HDX55C4-32S	24	126
	HDX70C4-44S	60	123
	HDX92C4-44S	85	124
	HDX92E4-44S	118	125
	HDX115A6-64S	240	221
SV0200M	HDX92E4-44S	118	125
	HDX115A6-88S	240	221
	HDX115C6-88S	460	222
	HDX115E6-130S	680	223
SV0500M	HDX115C6-88S	460	222
	HDX115E6-88S	680	320
	HDX142C6-88S	1150	321
	HDX142E6-130S	1700	322
SV1500M	HDX142E6-88S	1700	420
	HDX142G6-88S	2200	421
	HDX142J6-88S	2700	520
	HBMR190C6-130S	5500	403
	HBMR190E6-88S	8200	500
	HBMR190J6-180S	14000	501

Table 2-1. SV-M Predefined Motor Types

Connection Leads

Each drive is supplied with mating screw terminal connectors for the front panel Analogue I/O and Digital I/O connections.

Motor and resolver cables and RS232 connection leads are common to all drive types. Details of all lead types can be found in Appendix A.

Software

Each drive is supplied with PC software (SV_PARA) which enables drive parameter data to be loaded to a drive or uploaded from a drive via the RS232 interface. You may also use the software to edit and list parameters.

Documentation

Each drive is supplied with a user guide (this document) part number 1600.225.xx which provides you with the necessary information to set up and install a drive for your application.

Environment Considerations

SV-M drives and power supplies are fully-enclosed within metal cases which provide good physical protection and effective electromagnetic shielding. The installation must be arranged to prevent operator access to the drive or its power supply whilst AC power is being supplied.

Power Supplies

Power supplies available for use with SV-M drives are:

NMD10
NMD20

Each supply is powered, direct on line, from a 3-phase AC input of up to 460V. The NMD10 has a continuous power rating of 10kVA (20kVA peak) and the NMD20 20kVA (40kVA peak). The DC output bus is routed to drives via jumper cables which are protected by a removable front plate. Both supplies have overheating protection and their outputs are also protected against undervoltage and overvoltage. A built-in supply phase monitoring system flashes a red LED if a phase failure occurs and will disable the system after 40s if the condition persists.

Power supply modules are the same size as the larger drive modules (SV0200M, SV0500M & SV1500M) and are designed for side-by-side mounting. The NMD20 is heavier than the NMD10, but occupies the same case size.

You can also fit external ballast resistors to the NMD20, giving it the ability to handle high regenerated energy levels.

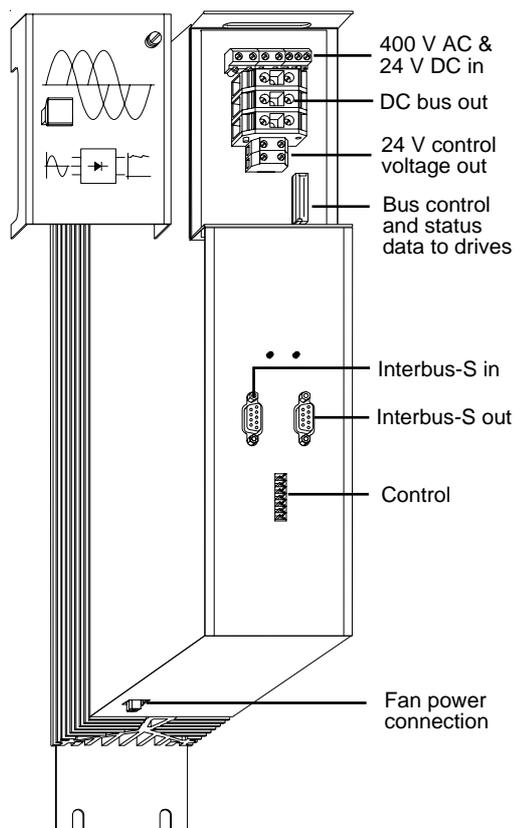


Figure 2-1. NMD10/NMD20 Power Supply

Power Supply Characteristics

These characteristics are applicable to both types of power module.

AC Supply Voltage	460V +10% -15%
Supply Frequency	50-60Hz
Safety Specification	VDE0160
Control Voltage (required for operation)	+24V DC \pm 10%, ripple <1V p-p
Standby Contact Rating	0.5A, 125V, 30W
Overheating Protection	System disabled when heatsink temperature >85°C*
Undervoltage Protection	System disabled when output voltage <80V DC*
Overvoltage Protection	Ballast resistors switched in at a preset level
Phase Failure Monitoring	Red LED flashes on phase failure, system disabled after 40s

*These protection circuits will also illuminate the red LED, when they operate.

Table 2-2. Characteristics of NMD10/20 Supplies

Power Supply Ratings

Model	Continuous Power	Peak Power	AC Supply Volts	DC Output Voltage	Required AC Supply Protection
NMD10	10kVA	20kVA	460V 3-phase	650V	16A
NMD20	20kVA	40kVA	460V 3-phase	650V	35A

Table 2-3. Power Supply Power and Voltage Ratings

Power Connections (X1)

3-Phase supply connections are made via X1 screw terminal block connector. The main protective earth connection is also made to this connector. It is recommended the supply connections are made using insulated copper conductors with a cross sectional area of at least 1.5mm² (16awg tri-rated cable) and having a voltage rating of 1500V AC RMS

WARNING - Electric Shock Hazard

Ensure that AC power is disconnected before attempting to connect or disconnect the NMD power supply.

Supply Fusing

Power supplies need to be protected using cartridge fuse-links. The rating for each power supply is:

NMD10	16A
NMD20	35A

Power Out Connections (X2)

DC power from the supply is routed to all associated drives via the X2 screw terminal block connector. These DC bus and protective earth connections are routed to drives via jumper cables, linking side-by-side mounted drives and supply modules by a series of short direct connections. The links used are supplied with the power supply (see Figure 2-6).

Control Connections X8 (7-way Phoenix)

Signals associated with emergency stop and safety chain wiring are made via power supply (NMD10 and NMD20) control connector X8.

X8 pin Number	Name	Function
1	+24V	voltage supply (output)
2	GND	voltage supply (output)
3	P	readiness contact
4	S	readiness contact
5	NA+	emergency stop input
6	NA-	emergency stop input
7	screen	Cable screen

Table 2-4. X8 PSU Connections

Stop Wiring

Opening the stop contact between X8/5 and X8/6 will deactivate all drives supplied from the NMD10 or NMD20 power module. You can form an external stop circuit as shown in Figure 2-2. Any open circuit in the primary circuit will open the stop circuit relay causing the drives to be de-energised. This circuit may be used as part of a **Category 0** emergency stop circuit.

The voltage free relay contact shown within the power supply (readiness contact) is normally open and only closes when all drives fed from the NMD supply are initialised to a working state. If a fault occurs on any axis, this contact will open causing the stop relay to open which in turn will cause all drives to de-energise. All drives, with the possible exception of the drive causing the original fault will report an error E55, meaning they have been deactivated by an stop condition.

The readiness contact has a rating of 0.5A, 30V, 30W.

Stop wiring and 24V supply wiring can be made using 7/0.2mm equipment wire.

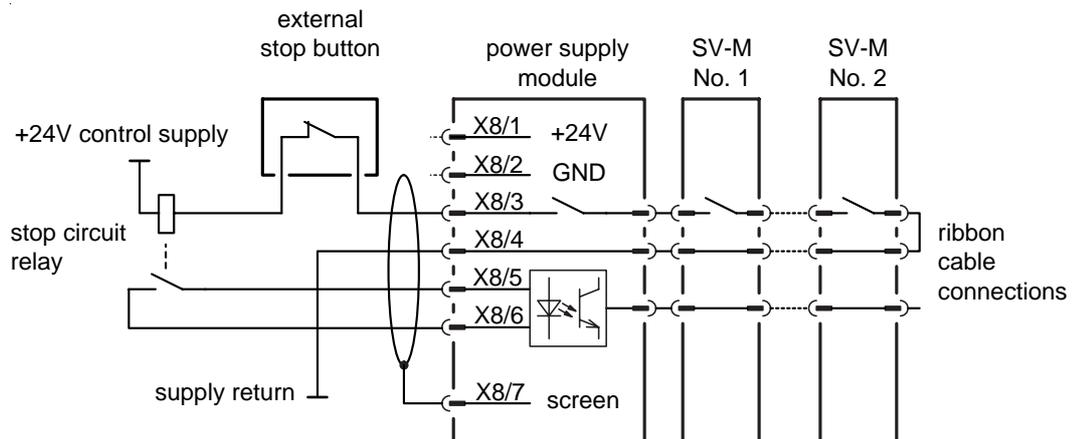


Figure 2-2. Stop Wiring For NMD10 & NMD20

Ribbon Cable Connections (X4)

Bus control and status data signals are passed between drives and their associated power supply via the ribbon cable connected to X4. Each drive needs to be connected and the drive furthest away from the power supply will need to have its X4 connector terminated, using the termination plug supplied with the NMD power supply.

Ballast Resistor Connections (X5 on NMD20)

If a particular application is operating on the edge of the power dump safe operating area, you may see the red and green diagnosis LEDs both come on together, indicating a ballast circuit overload. The additional regenerated energy can be dissipated by using extra ballast resistors connected to the NMD20 power supply. The connection used is shown in Figure 2-3.

Note: Only the NMD20 power supply has the external connections that allow extra ballast resistors to be added.

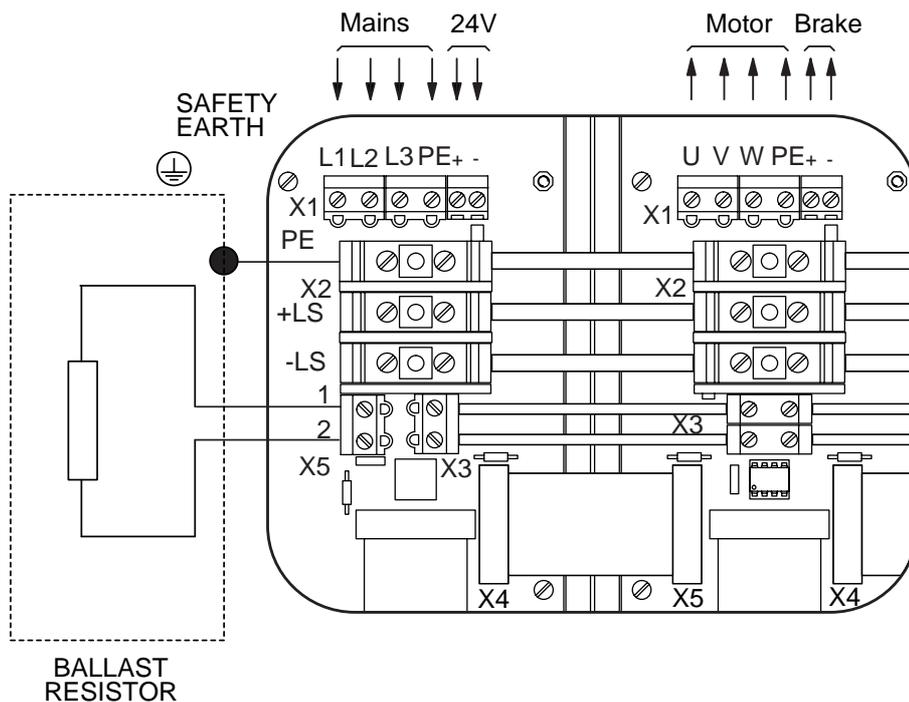


Figure 2-3. Ballast Resistor Connection

Ballast Resistor Selection

Some of the regenerated energy supplied by the decelerating motor is stored in the power supply capacitors.

NMD10 and NMD20 1100µF/173Ws

Total energy dissipation capability within the power supplies is:

NMD10/NMD20	Duration	Cool Down Time
17kW	<50ms	10s
4.5kW	<1s	50s
120W	Unlimited	
250W with fan	Unlimited	

Table 2-5. Dissipation in NMD10/NMD20

Energy dissipated in a NMD20 power supply with external ballast resistors fitted is:

NMD20 15 Ballast Resistors	Duration	Cool Down Time
Size 1:0.57kW	Unlimited	
37kW	<0.4s	120s
Size 2:0.74kW	Unlimited	
37kW	<0.6s	120s
Size 3:1.50kW	Unlimited	
37kW	<1.2s	120s

Table 2-6. Dissipation in NMD20 Ballast Resistors

If you require more information in order to decide the selection of ballast resistor power rating - please consult your supplier.

24V Supply

In common with the drives, both power supply types require a separate 24V DC supply to power internal control circuits, which allows the operation of communication and diagnostic facilities to be maintained in the event of a 3-phase power failure. The supply is brought into the power supply via connector X1.

24V Power Supply Rating

The 24V DC power supply required to support communications and system diagnostics is also required to supply drive cooling fans (if fitted) and motor holding brakes (if fitted). The supply should have the following specification:

Output voltage	24V DC \pm 10%
Ripple	<1V p-p
Current capacity	see below

Because the current capability of the 24V supply is system dependent you will need to calculate the total current required using the following figures:

SV-M drive	600mA per drive
SV2500S drive	600mA per drive
NMD10 power supply	1A
NMD20 power supply	1A
Fan supply	100mA per fan
Motor brake	see Table 2-7

Motor Type	+24V Brake Current Requirements
HDX55	0.29A
HDX70	0.26A (*0.35A)
HDX92	0.5A
HDX115	0.5A
HDX142	1.0A
HBMR190	1.6A

* high torque version

Table 2-7. +24V Brake Current Requirements for Various Motor Types

SV-M Drives

SV-M Drives are designed for use in multi-axis systems, where two or more drives can share a single power supply. The three higher power drives share the same package style and dimensions and can be through panel mounted. Note the same style and dimensions are also used for the NMD10 and NMD20 power supplies, which allows consistent in-line mounting of drives and supplies.

Dimensions and Mounting Details

All drives and power supply units can be mounted directly on to a flat surface, as shown in Figure 2-4. The recommended mounting position is upright, as shown, with a minimum of 65mm clearance above and below the drive for good ventilation.

All dimensions are given in mm.

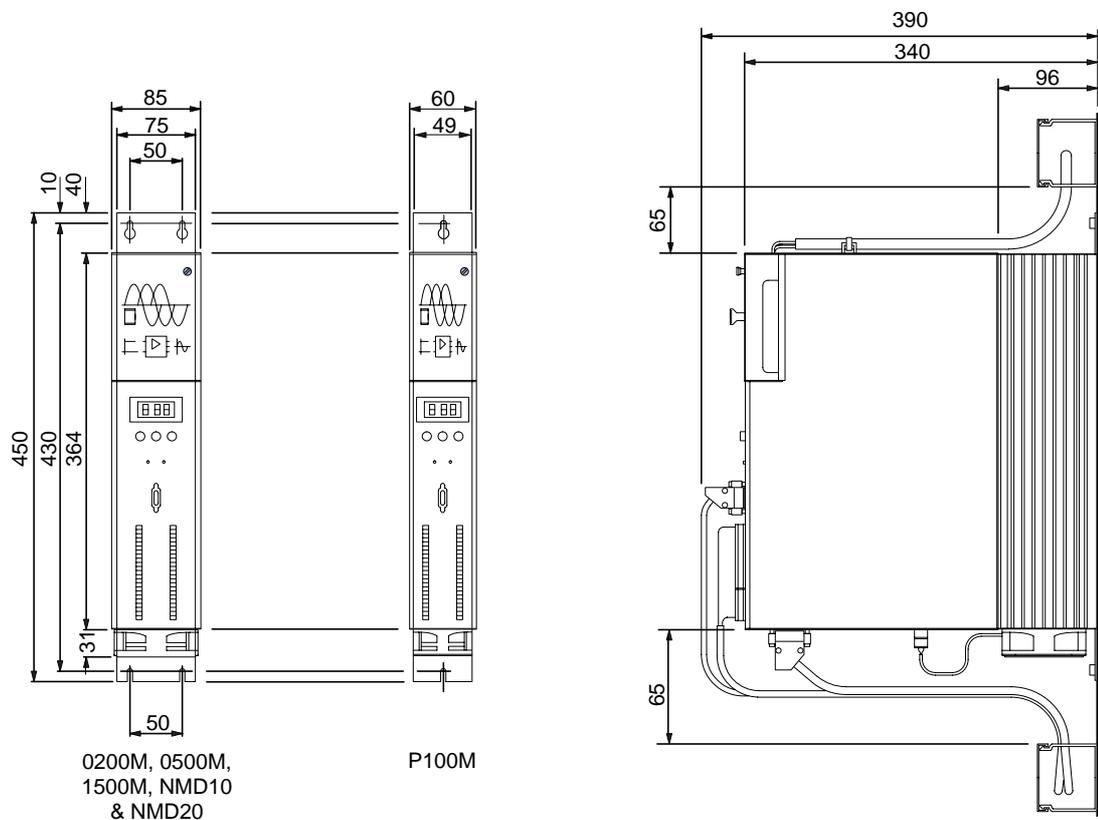
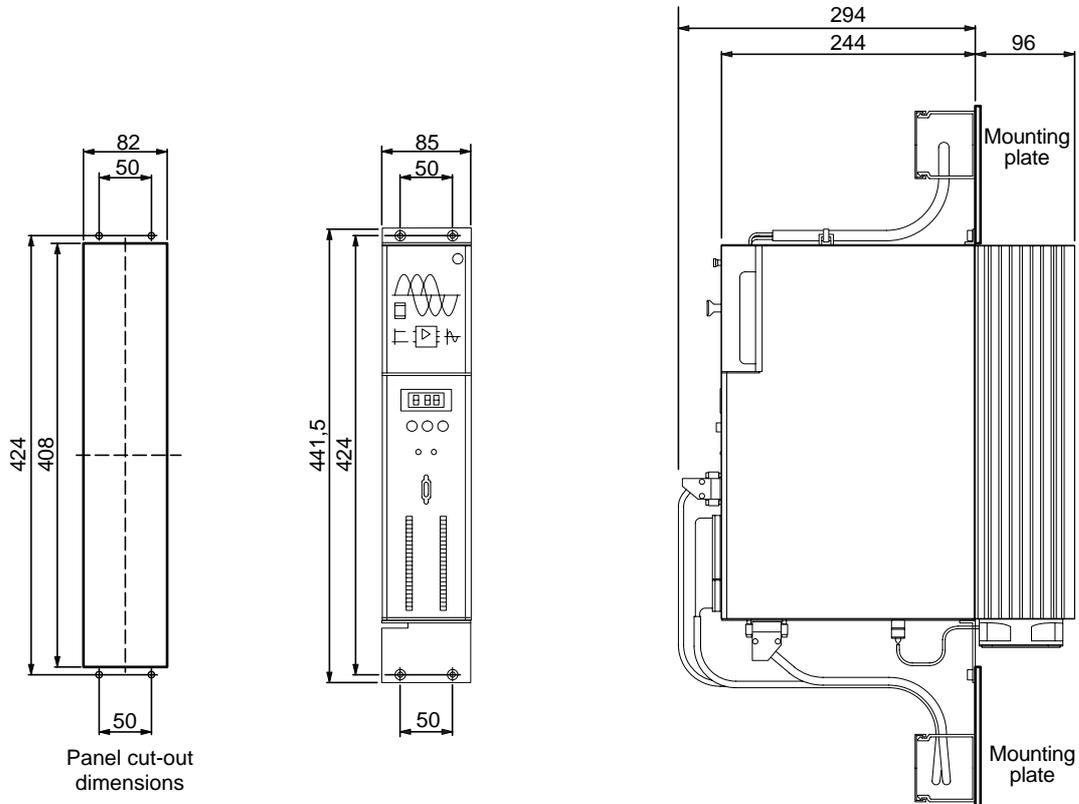


Figure 2-4. Direct Panel Mounting

All drives, apart from the P100, may also be mounted with the heatsink protruding through the mounting surface as shown in Figure 2-5. This has the advantage of allowing heat dissipated by the drive to be lost externally - preventing heat build-up within equipment cabinets.



All backplate & bracket fixings accept M6 screws.
For through-panel mounting, use brackets type MTS2/01

Figure 2-5. Through Panel Mounting

SV-M Drive I/O Specification

Parameter	Value
Command Interface	
Analogue inputs 1 & 2	
Voltage range	±10V differential
Input impedance	20k
Attenuation	1:1 or 1:10 (input 2 only)
Control inputs	
Number of inputs	4 all opto isolated
Logic low level	0 - 7.5V
Logic high level	14 - 32V
Input current	10mA
Functions	Programmable via parameters
Control outputs	
Output type	NPN transistor open emitter output
Voltage rating	24V (from external supply)
Current rating	100mA
Active state	High (transistor on)
Protection	Short-circuit protected
Function	Programmable via parameters
RS232 Interface	
Baudrate	4800 or 9600
Format	8-bits, 1 start bit, 1 stop bit
Handshaking	Hardware and software (XON/XOFF supported)
Encoder simulation	
Channels	A, B, Z with complement
Resolution	512 or 1024 pulses/rev
Z pulse location	Programmable in 1.4° steps
Output level	5V (RS485)
Supply requirements	5V at 100mA

Table 2-8. SV-M Electrical Specification

SV-M Drive Main Connections

All drive types will require DC bus connections from either the NMD10 or NMD20 power supplies as well as the independent 24V DC power supply connection.

DC bus connections are made using the drive and power supply front panel connections, located under the front panel screw mounted cover. Details of the supply and drive interconnections are given in Figure 2-6. In addition to the DC bus connections you will also need to connect the 24V DC controller voltage supply and the ribbon cable control bus.

On the drive furthest from the power supply, the control bus will need to be terminated at connector X4, using the supplied termination plug. This applies even if only one drive is used.

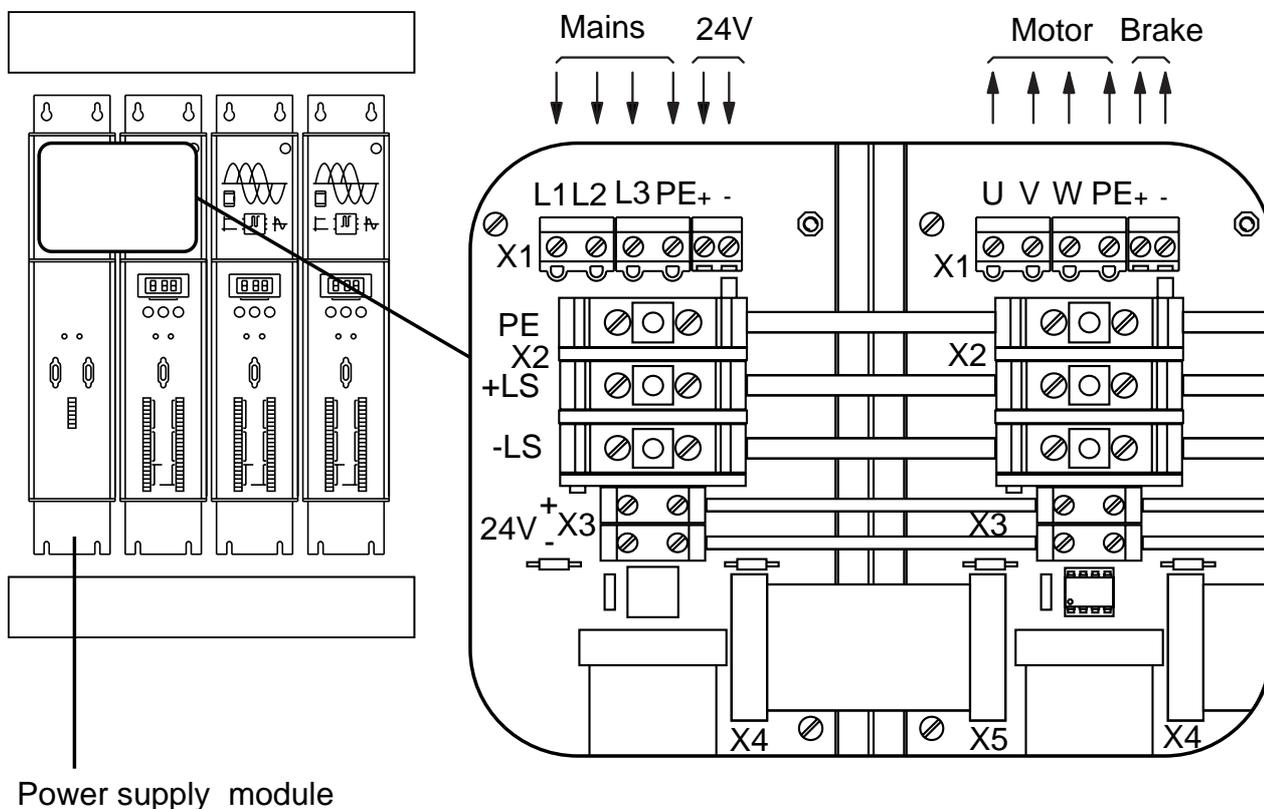


Figure 2-6. Drive, Power, Motor & Brake Connections

Wiring Guidelines

Proper grounding of electrical equipment is essential to ensure the safety of personnel. 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 busbar is recommended.

Motor & Brake Wiring

Standard motor cables include the holding brake wiring and are made via the drive's X1 screw block terminal, as shown in Figure 2-6. Details of motor cables are given in Appendix A.

Pre-Installation Test

Before installing the drive in its final target application it is worth performing a pre-installation test of the drive's functions to ensure the drive is working correctly and to become familiar with its operation and control. A recommended pre-installation test circuit for a single axis SV-M drive with a NMD power supply is shown in Figure 2-7. SV-M drives must be installed by competent personnel familiar with the installation, commissioning and operation of motion control equipment.

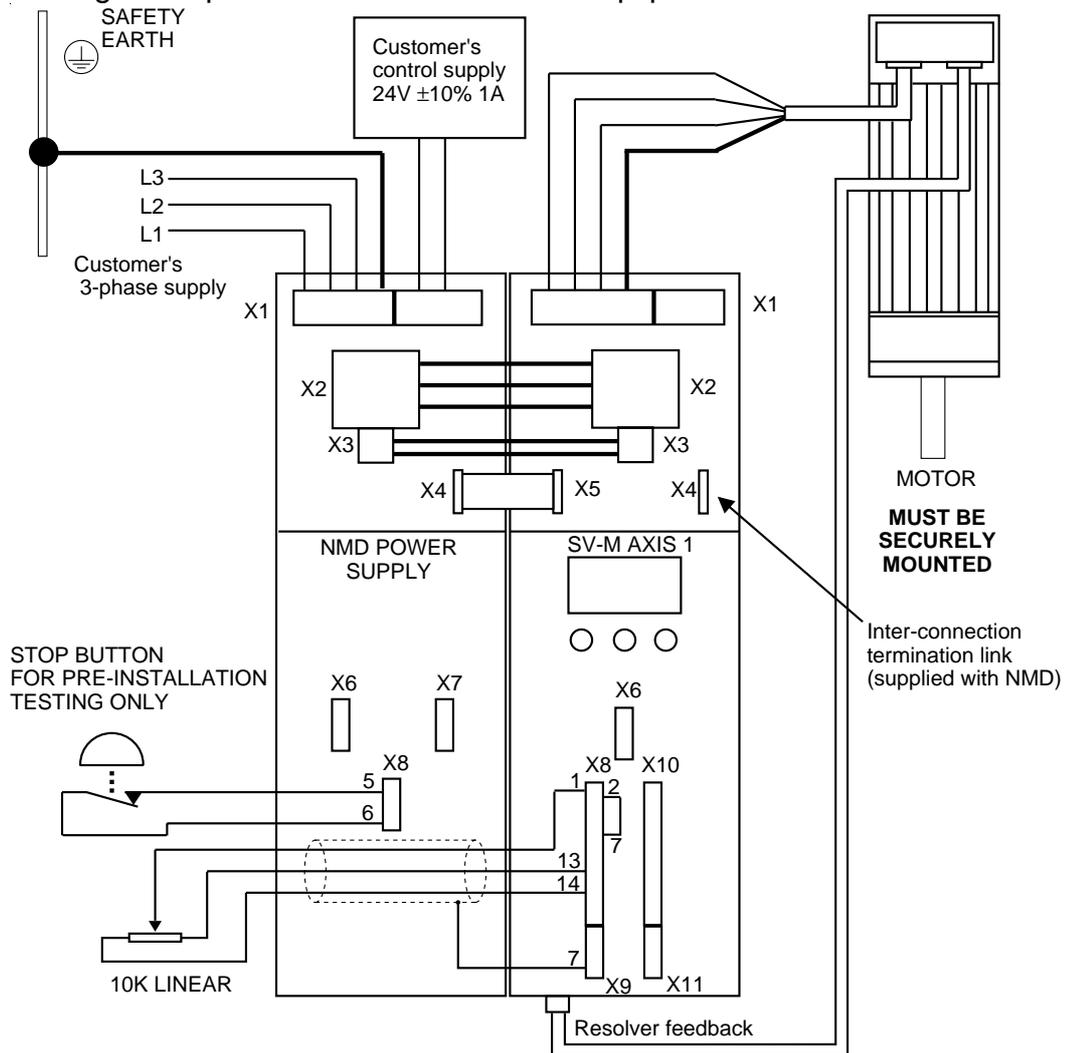


Figure 2-7. SV-M Pre-installation Test Circuit

The safety earth connection must be made as shown to minimise the risk of electric shock.

Please take note of the warning given at the beginning of this User Guide. Motion control equipment is capable of making rapid unexpected movements of high force, especially during the development of controller programs and the commissioning of equipment.

This pre-installation test assumes you are using a recommended motor part, the configuration data for which has been pre-loaded into the drive. If a standard motor part is not being used refer to the Software Reference section for details of motor parameter setup.

Note: always check the motor type before energising the drive.

Testing the SV-M Drive

Use the following procedure to test the drive:

WARNING - ELECTRIC SHOCK HAZARD

Replace all panels and wiring covers before applying AC power to the test circuit.

1. Power up the drive whilst holding down the '-' button on the front panel. This ensures the motor will be de-energised.
2. Using the front panel buttons, press '+' to enter the parameter mode setup ('P' on the display), press 'enter' to select a particular parameter. Using the '+' and '-' buttons parameter numbers can be selected by ramping up and down the list of numbers available. Select parameter **P0**, press 'enter' to give it a value, and again using the '+' and '-' buttons ramp up to the value **302**, then press 'enter'. This procedure has assigned parameter **P0** the value **302** which is a password that enables you to change drive parameters.
3. The drive needs to know what type of motor it is to be used with. This is achieved by identifying the motor with a 3 digit number which is entered into parameter **P1**. A list of motor types and their associated numbers is given in Table 2-1. The appropriate number is entered into parameter **P1** using the technique described in step 2. By default, the drive will now be configured as operating in velocity mode for the entered motor type.
4. The drive automatically calculates the main servo tuning parameters to give a stable system. However, to do this you will need to input the minimum and maximum ratios of load inertia compared to motor inertia. These values are calculated as follows:

$$P81 = \frac{\text{Minimum external load inertia}}{\text{Motor inertia}} \times 10$$

$$P82 = \frac{\text{Maximum external load inertia}}{\text{Motor inertia}} \times 10$$

Example

For a minimum load equal to the motor inertia, P81=10.

For a maximum load of 5 times the motor inertia, P82=50.

The range of values which can be entered is 0 to 999, equivalent to inertia ratios up to 99.9:1. Please see Table 2-1 for motor moments of inertia. Do not include the motor inertia with the external load inertia in the calculations.

Enter the calculated values of P81 and P82 as described in step 2.

5. Temporarily short-circuit X8/1 and X8/2, and energise the drive by setting **P34** to **1**. The motor shaft will start rotating slowly.

6. Adjust the signal balance by setting parameter P31 to 1, to activate the auto balance adjustment. A further fine adjustment can be made by altering the value of P30.

7. Position the 10Kohm potentiometer to mid track and remove the short circuit link between X8/1 and X8/2. The basic configuration can be assumed to be working if velocity control of the motor is achieved by the adjustment of the potentiometer.

8. After the drive is fully configured, set P0 to 270. This prevents further adjustment of any of the drive parameters - effectively locking out the front panel adjustment.

Section 3. Installation of SV-S Drives

Installation

This section describes the installation of SV-S drives, and contains information that is specific to SV-S drives. Information common to all SV drives, such as programming and I/O interfacing is fully described in later sections. Generally, the differences between the multi-axis and stand-alone drive types is restricted to power connections, motor connections and certain mechanical mounting options.

The drive must be installed in an enclosure to protect it from atmospheric contaminants such as oil, moisture, dirt, etc. No operator access should be allowed to the drive while it has AC power applied. Metal equipment cabinets offer the most advantages for siting the equipment since they can provide operator protection, EMC screening and can be fitted with interlocks arranged to remove all AC power when the cabinet door is open. Provision must also be made within the installation to contain the spread of fire by the fitting of a flame barrier, as defined in the LVD enclosure requirements. In many applications this requirement will be met simply by installing the drive within a cabinet fitted with a solid metal base. If the cabinet base is ventilated a flame barrier will be required that conforms with the baffle dimensions defined in the European Standard EN 61010-1.

System Components

A standard shipment will consist of the the following system components:

- Drive
- Motor
- Connectors and leads
- Parameter editor software
- Documentation

Note: You will also need to make available a separate +24V DC supply for the drive control circuits and a motor holding brake (if used) for the SV2500S Drive only. The current capacity of this supply should be rated as described in **24V Power Supply Rating** in Section 2. For reasons of AC supply isolation in cabinets, you may choose to use a separate 24V supply for the SV4500S and SV8500S. Whenever a separate 24V supply is used its input or output must be filtered as described in **Auxiliary 24V Supply Filtering**.

Drive types

The SV-S drive types are listed below:

<u>Drive Type</u>	<u>Shaft Power</u>
SV2500S	1.5kW
SV4500S	3.5kW
SV8500S	5.5kW

Connectors and Leads

Each drive is supplied with mating screw terminal connectors for the front panel Analogue I/O and Digital I/O connections.

Motor and resolver cables and RS232 connection leads are common to all drive types. Details of all lead types can be found in Appendix A.

Software

Each drive is supplied with PC software (SV_PARA) which enables drive parameter data to be loaded to a drive or uploaded from a drive via the RS232 interface. You may also use the software to edit and list parameters.

Documentation

Each drive is supplied with a user guide (this document) part number 1600.225.xx which provides you with the necessary information to set up and install a drive for your application.

Motor Selection

The SV-S Series of drives is designed for use with the motor types listed in column two of Table 3-1. If you wish to use a motor not listed in Table 3-1 you will need to change motor parameters P01 to P09 to suit your particular motor type (see Software Reference section).

Table 3-1 lists the range of SV-S drive types against the recommended motor types, the rotor inertia for each motor and the value of parameter P01 required for each motor. The value entered for P01 automatically assigns the correct motor parameter values for the chosen motor.

Drive Type	Motor Type	J (kgmm²)	P01 value
SV2500S	HDX92E4-44S	118	125
	HDX115A6-88S	240	221
	HDX115C6-88S	460	222
	HDX115E6-130S	680	223
SV4500S	HDX115A6-64S	240	023
	HDX115C6-88S	460	222
	HDX115E6-130S	680	223
	HDX92E4-44S	118	125
SV8500SV	HDX115C6-88S	460	222
	HDX115E6-88S	680	320
	HDX142C6-88S	1150	321
	HDX142E6-88S	1700	420
	HDX142E6-130S	1700	322
	HDX142G6-88S	2200	421

Table 3-1. SV Drive Motor Types

SV-S Drives

Powered direct-on-line from a three phase supply, the SV-S range of servo drives provide an LVD compliant solution for applications requiring analogue velocity or torque control.

The drives are designed for use with stand-alone single axis applications or within multi-axis applications where each axis is required to have its own independent power supply.

Each drive type is self contained in its own rugged metal casing with provision for direct, flat surface, mounting.

SV2500S Drive

The SV2500S is physically the smallest drive in the SV-S Series and uses convection cooling provided by the heatsink area forming one side of the package. When installing a number of drives side-by-side, allow 92mm between centres, giving a 2mm clearance between units.

The drive is operated direct-on-line from 230V AC supplies, either single phase or three phase. Minimum input voltage is 100V AC for a single phase supply and 80V AC for a three phase supply. Provision has been made for the connection of an external ballast resistor to dissipate excessive regenerated energy during deceleration.

Programming information and I/O control is common to all other SV Series drives and is fully described in later sections of this user guide.

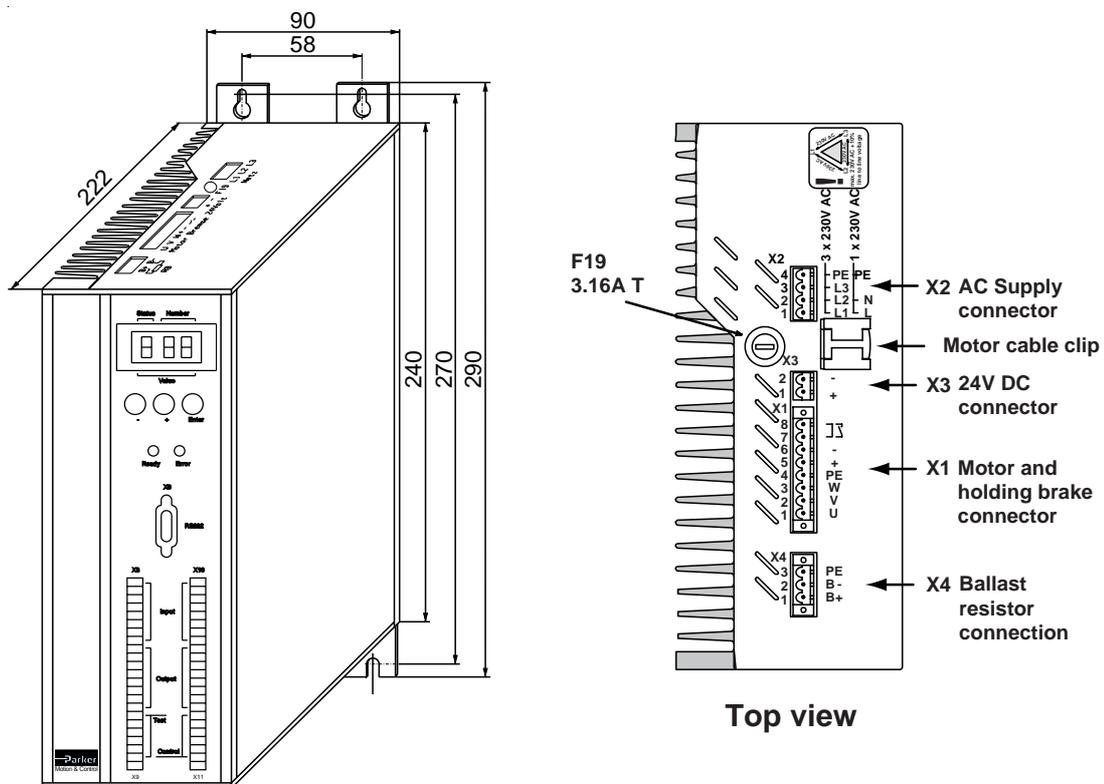


Figure 3-1. SV2500S Drive

Dimensions and Mounting Details

The recommended mounting position is upright, as shown, with a minimum of 65mm clearance above and below the drive for good ventilation and for connector access.

All dimensions are given in mm.

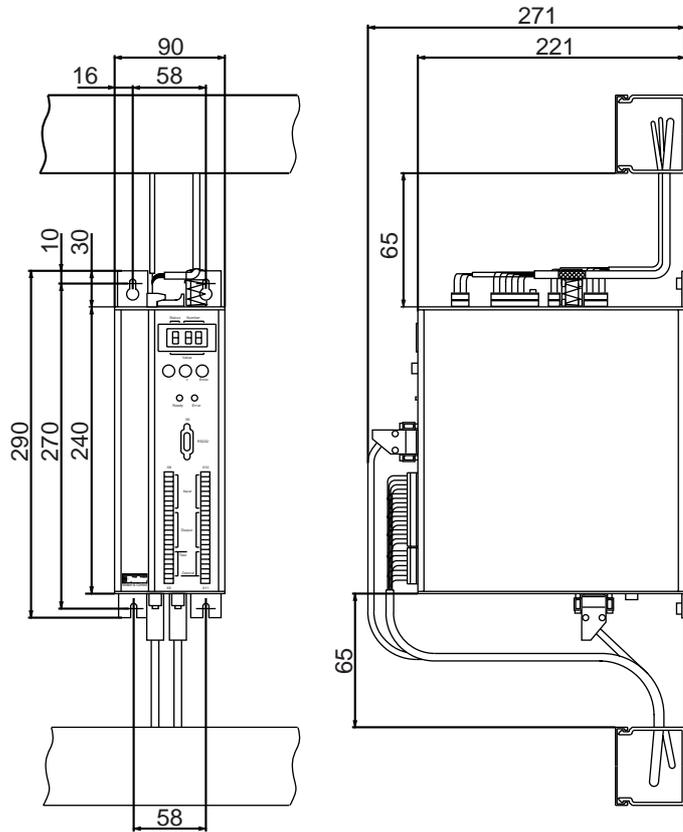


Figure 3-2. SV2500S Drive Dimensions

SV4500S and SV8500S Drives

SV4500S and SV8500S drives share the same style and case dimensions. Cooling is provided by forced air being drawn into the base of the unit and expelled through the top ventilation slots. Consequently, clearance must be provided to allow sufficient air flow above and below the drive. Note: during arduous duty cycles with regeneration, the temperature of the air being expelled from the top of the drive can exceed 50°C above ambient.

Both drive types are powered direct-on-line from AC three phase supplies of 380 to 480V.

As with the SV2500S, provision has been made for the connection of an external ballast resistor. Also, all programming and I/O control is common to all other SV Series drives and is fully described in later sections of this user guide.

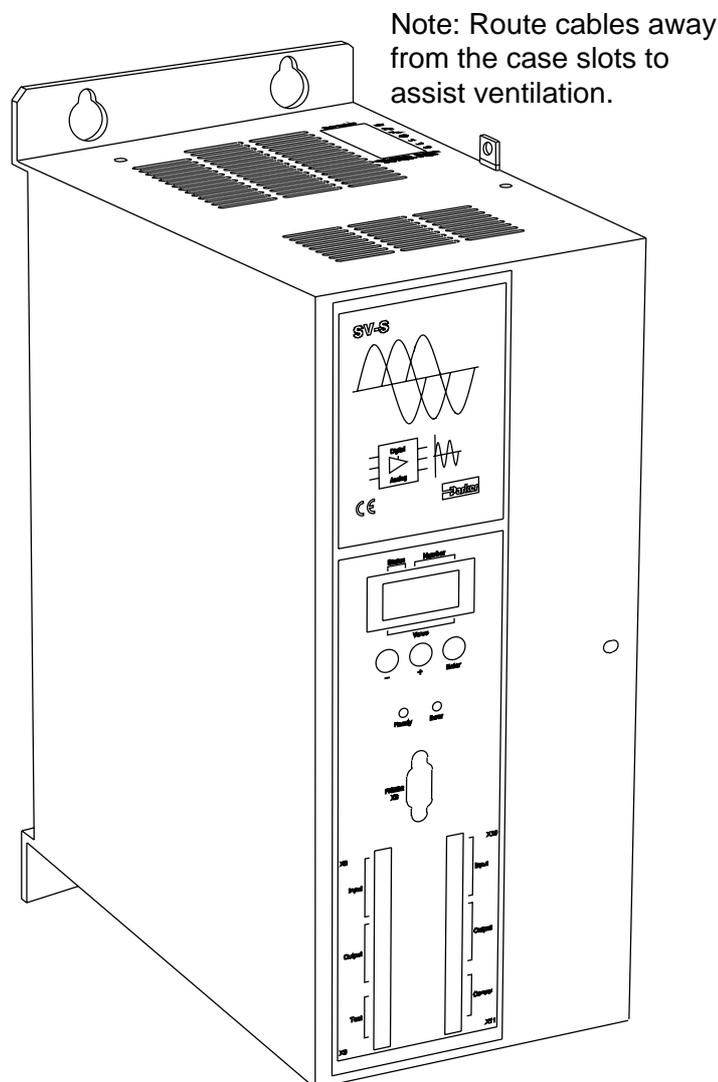


Figure 3-3. SV4500S and SV8500S Drives

Dimensions and Mounting Details

The recommended mounting position is upright, as shown in Figure 3-3, with a minimum of 100mm clearance above and below the drive for good ventilation.

All dimensions are given in mm.

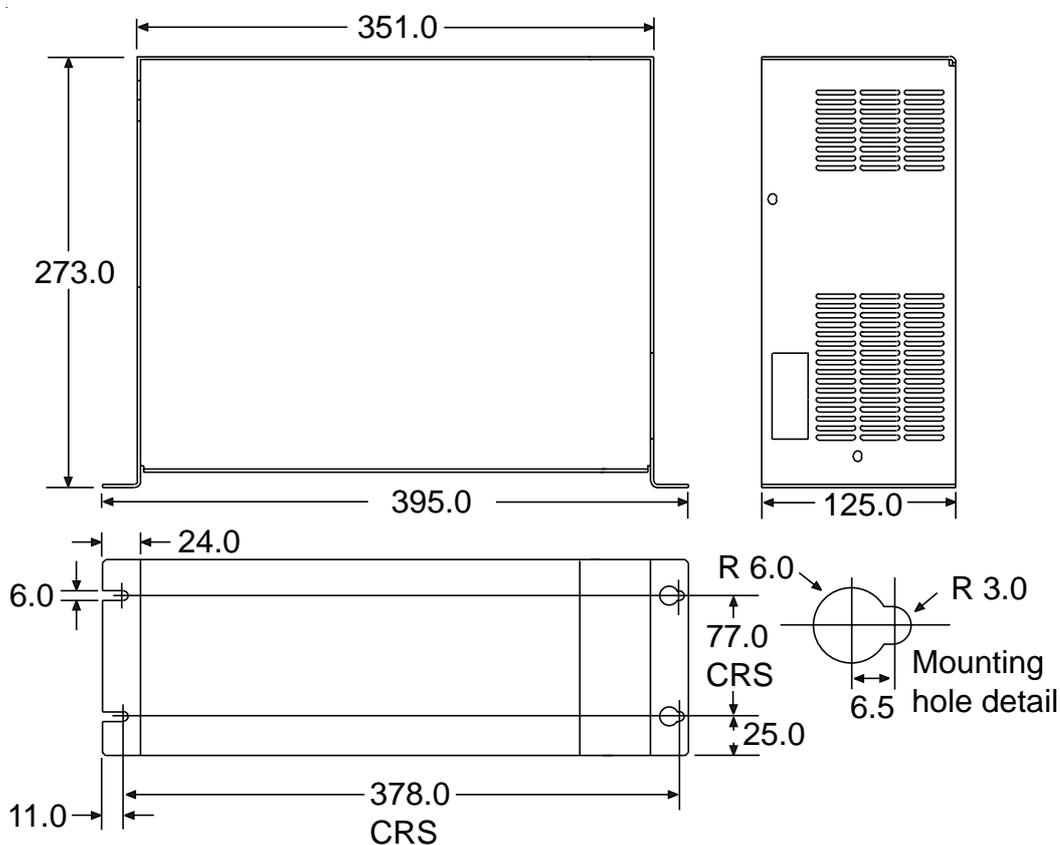


Figure 3-4. SV4500S and SV8500 Dimensions

Environment Considerations

The SV4500S and the SV8500S drive and power supply are fully-enclosed within metal cases which provide good physical protection and effective electromagnetic shielding. Forced air cooling is used, provided by a fan built into the base of the drive. Air is drawn in via the vents in the base of the drive and expelled through the vents in the top of the drive.

The installation must be arranged to prevent operator access to the drive or its power supply whilst AC power is being supplied.

Power Connections

Within the SV-S Series of drives, only the SV2500S can be powered from a 230V AC supply, although this can be derived from a single phase or three phase system. The SV4500S and SV8500S both require a 380 to 480V three phase supply. Supply connections to all types of drive are made to the top of the drive, but the SV2500S has a different connector layout from the higher power versions.

The safety earth connection must be made to minimise the risk of electric shock caused by drive leakage currents (10mA max.).

Wiring Guidelines

Proper grounding of electrical equipment is essential to ensure the safety of personnel. 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 busbar is recommended.

SV2500S Power Connections (X2)

The drive uses Phoenix square pin connectors and cable mounting screw terminal mating halves are supplied with the drive. Power is supplied via the 4-way connector shown in Figure 3-5, shown wired for a single phase 230V AC supply.

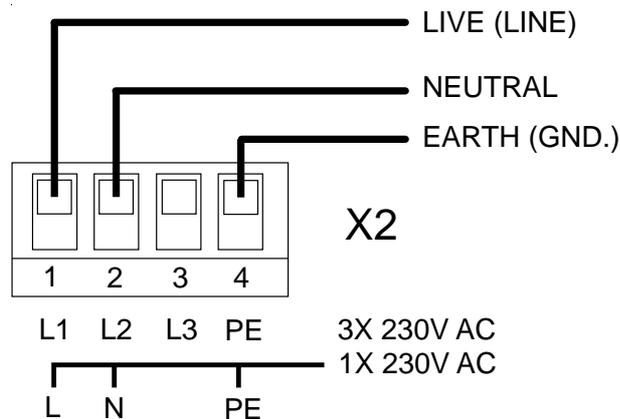


Figure 3-5. SV2500S Supply Connections

Fuse Requirements

The SV2500S supply needs to be fused as follows:

3-phase 230V operation 10A
1-phase 230V operation 16A

High breaking capacity fuses, should be used positioned as close as possible to the equipment being protected.

SV2500S Dump Connections

The SV2500S drive has no internal ballast or power dump resistor. If an application requires one to be fitted the connections are made to the X4 connector mounted on the top of the drive, shown in Figure 3-6.

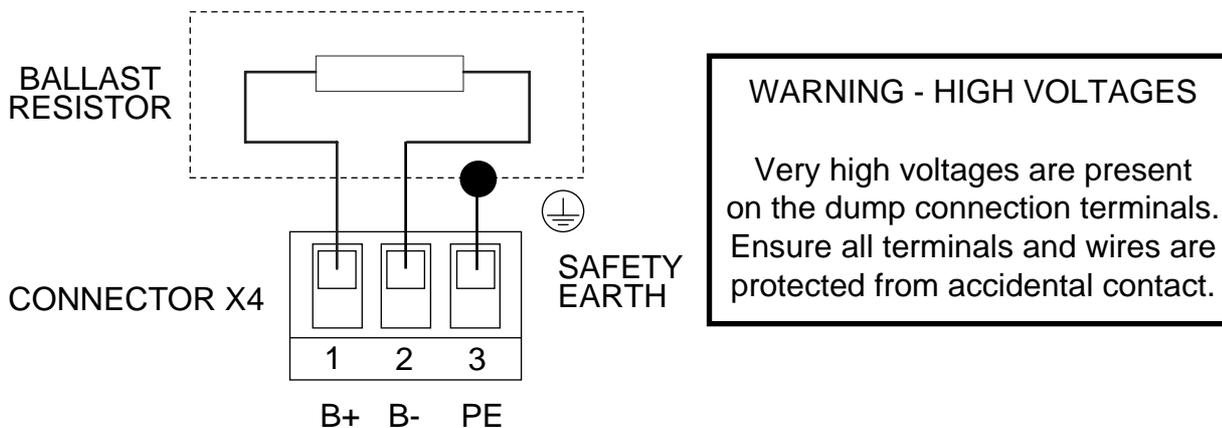


Figure 3-6. SV2500S Ballast Resistor Connections

SV4500S and SV8500S Power & Dump Connections

Both drive types are designed to be powered from three phase supplies of 380V to 480V, when generating an internal +24V supply. When an external +24V supply is used the drive can be operated from a three phase supply between 90V and 480V. The direct wire, 3-phase power connections (L1, L2, L3) are located on the top of the drive and are shown in Figure 3-7. The connector is designed to accept wire tails in the individual screw terminals. The same terminal block is shared with internal and external dump resistor connections.

The protective earth conductor must be securely fitted to the main protective earth connection point shown in Figure 3-7.

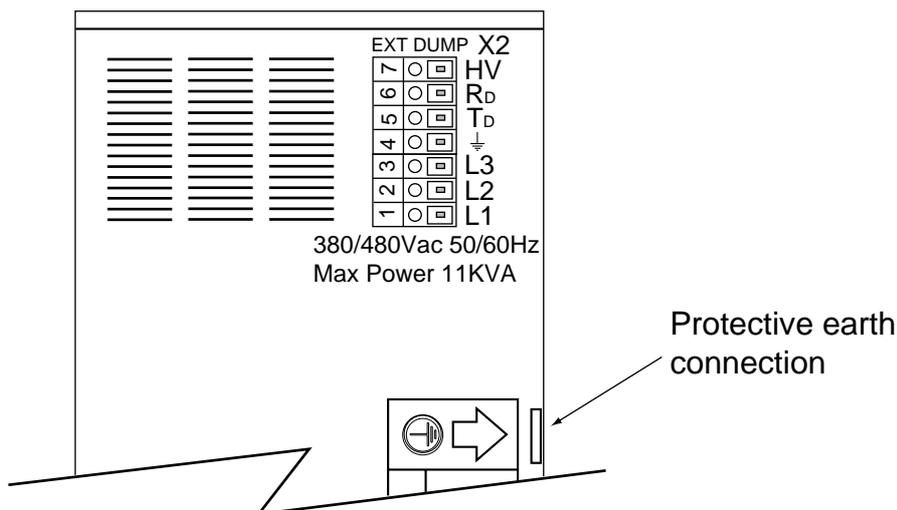


Figure 3-7. SV4500S/SV8500S Drive Power Connections

AC power wiring needs to be made with 2.5mm² (14AWG) wire. The earth (ground) connection should be made using colour coded 2.5mm² (14AWG) wire using crimped ring terminal contacts. The cable used should be rated for at least 1500V AC.

All ring terminal contacts need to be assembled as shown in Figure 3-11, with the split ring washer used to tension the electrical contact on the drive's protective earth connection.

Fuse Requirements

The supply will need to be fused as follows:

SV4500S	10A
SV8500S	16A

High breaking capacity fuses or equivalent MCB switches equipped with thermal and magnetic trips, should be used, positioned as close as possible to the equipment being protected.

SV4500S/SV8500S Dump Connections

In normal operation an insulated wire link is made between RD and TD to use the internal 33Ω dump resistor. When an external dump resistor is used the link is removed and the external dump resistor is connected between HV and TD. The resistance value of the external dump resistor must be 22 absolute minimum and of sufficient power rating to dump the regenerated energy during motor deceleration. If you need help deciding the wattage of resistor required, please consult your supplier.

The dump circuit will operate when the internal DC bus voltage exceeds 800V.

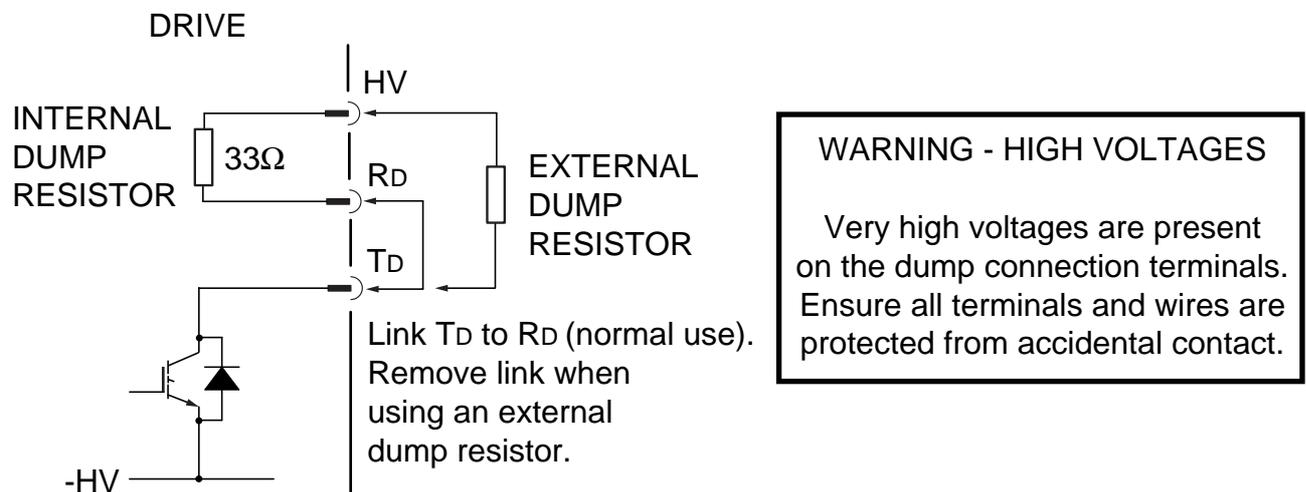


Figure 3-8. SV4500S/SV8500S Dump Connections

EMC Filter for SV2500S

The SV2500S can use a CORCOM 12FC10 EMC filter, as shown in Figure 3-9. The installation of such a filter needs to follow all the guide lines given for the SV4500S and SV8500S, given in the following sub-section. Supply wires and earth (ground) need to be made using 2.5mm² (14AWG).

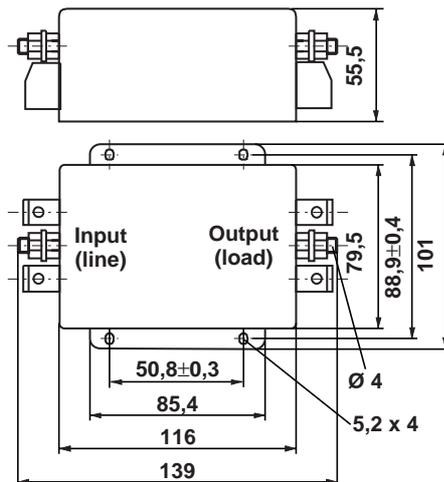


Figure 3-9. EMC Filter for SV2500S (single phase)

Electrical Specification

EMC Filter

The recommended filter part for the SV2500S (single phase operation) is a Corcom 12FC10, which has the following electrical specification:

1-phase mains EMC filter
 Current capacity 12A Max.
 Mains frequency 50-60Hz
 Voltage rating 250V AC

Attenuation

Frequency	.03MHz	.1MHz	1.0MHz	10.0MHz	30.0MHz
Line to ground in 50 circuit	30dB	55dB	84dB	78dB	60dB
Line-to-line in 50 circuit	33dB	55dB	93dB	93dB	88dB

Earth leakage current

Maximum leakage current @ 250V AC 50Hz line to ground 5.2mA

Alternative filter types may be used provided the given specification can be met or improved upon.

When powered from a 3-phase 230V supply, a CORCOM 12FCD10 EMC filter should be used. This filter has a similar characteristic to the 25FCD10 used with the SV8500S and has the dimensions given in Figure 3-12.

EMC Filter Installation for SV4500S & SV8500S

If you are intending to use a SV4500S/SV8500S with an external EMC filter, it is recommended the filter is mounted next to the drive as shown in Figure 3-10. Both the drive and filter must have good electrical contact with the cabinet metalwork, which can be achieved for the drive by making use of its un-painted mounting surface areas located on the underside of the top and bottom metalwork fixings. This will require any surface coating to be removed on the panel to which the drive is being mounted, but only over the area making contact with the drive. In a similar fashion, the surface coating of the panel beneath the EMC filter's mounting metalwork will also need to be removed to ensure good electrical contact between filter and mounting panel.

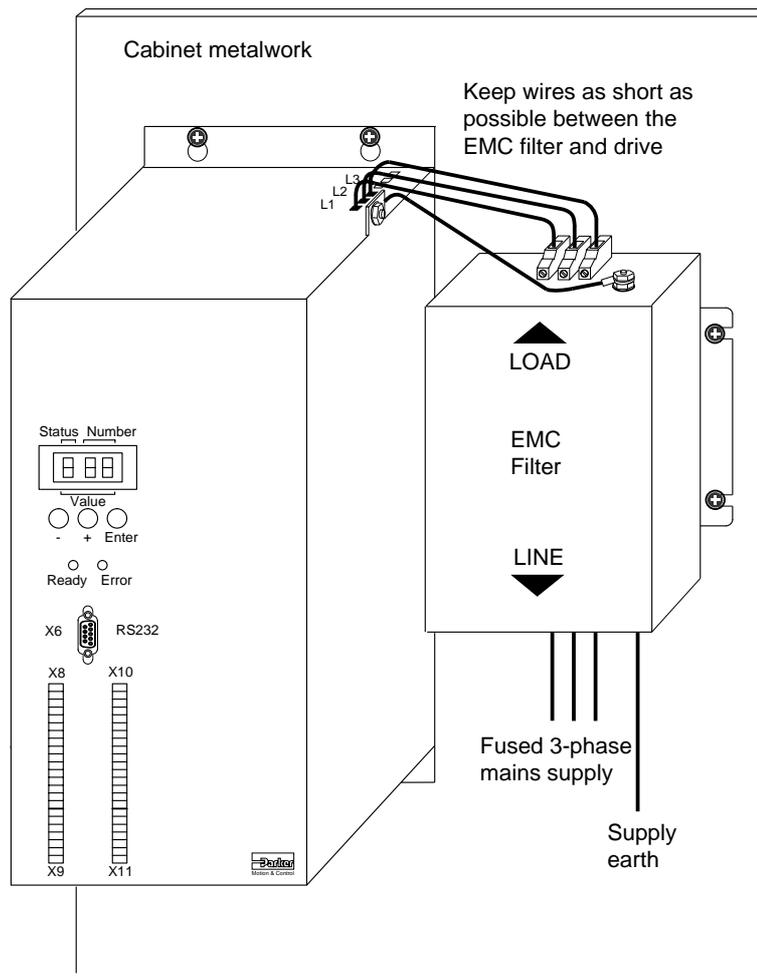


Figure 3-10. EMC Filter Installation

Wiring between the EMC filter and drive needs to be made with 2.5mm² (14AWG) wire kept as short as possible. The earth (ground) connection should be made using colour coded 2.5mm² (14AWG) wire using crimped ring terminal contacts. The cable used should be rated for at least 1500V AC.

All ring terminal contacts need to be assembled as shown in Figure 3-11, with the split ring washer used to tension the electrical contact on the drive's protective earth connection and the lockwasher on the EMC filter.

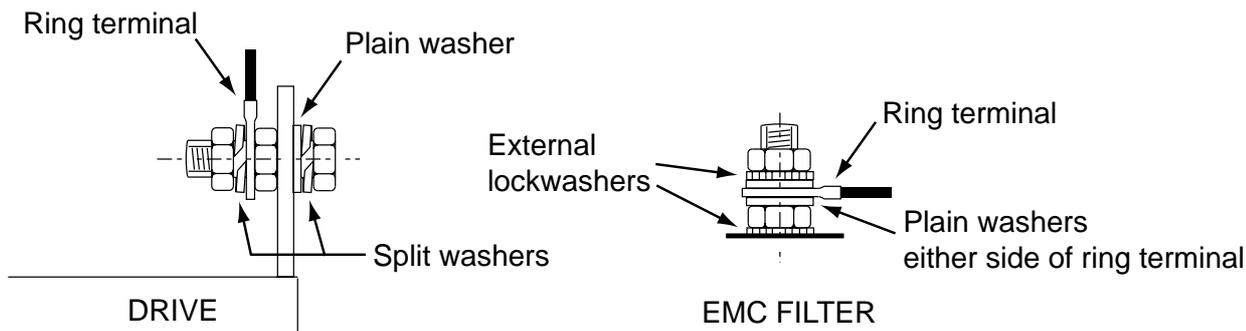


Figure 3-11. Crimp Ring Terminal Fixing Detail

EMC Filter

The recommended filter part is a Corcom 25FCD10 for the SV8500S and 12FCD10 for the SV4500S, which has the following electrical specification:

3-phase mains EMC filter

Current capacity 25A @ 440V AC phase to phase
 Mains frequency 50-60Hz
 Voltage rating 250V AC phase to ground
 440V AC phase to phase

Attenuation

Frequency	.03MHz	.1MHz	1.0MHz	10.0MHz	30.0MHz
Line to ground in 50 circuit	26dB	40 dB	75 dB	45 dB	50 dB
Line-to-line in 50 circuit	13dB	46dB	75dB	65dB	60dB

Earth leakage current

Maximum leakage current, each 6A @ 250V AC 50Hz line to ground 4.9mA
 Maximum leakage current, each 25A @ 250V AC 50Hz line to ground 9.8mA

Alternative filter types may be used provided the given specification can be met or improved upon.

CAUTION

There are no 3-phase supply input fuses within the drive. Supply fuses will need to be fitted before the EMC filter.

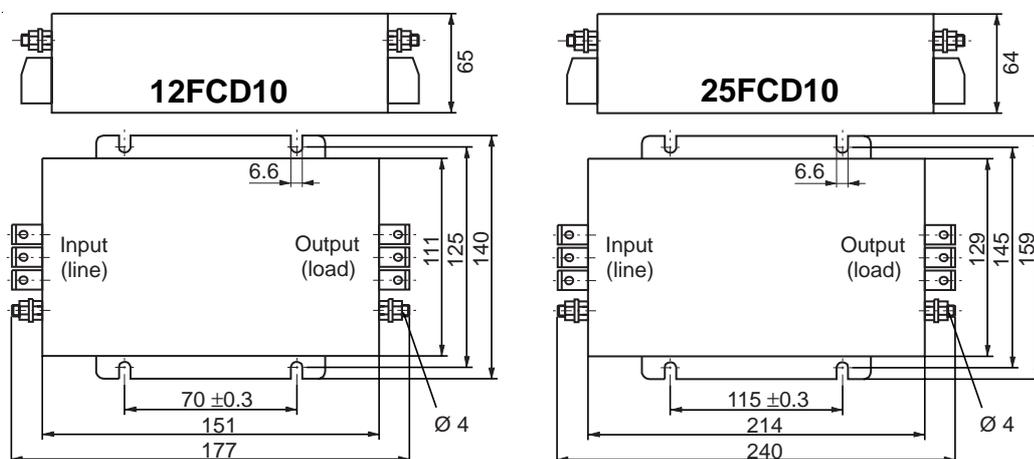
3-Phase EMC Filters

Figure 3-12. EMC Filter for SV2500S/SV4500S and SV8500S

Surge Protection

Using one of the EMC mains filters specified will provide protection against mains surges of 2kV (1.2/50 μ s rise/fall time). If the drive and filter combination are used in an environment where surge levels greater than 2kV may be expected, or where an EMC filter is not used, additional surge suppression systems will need to be provided. Contact Parker or your Automation Technology Centre if your application needs extra surge protection.

Motor, Brake and Supply Connections

Motor and resolver cables are described in Appendix A. At the motor end cables are terminated in a plug or tails, depending upon the size of the motor being powered. At the drive end all motor cables are terminated as tails for connection to direct or indirect connectors.

The protective earth wire within the motor cable must be securely connected at both ends. Motors connected to cable tails have a dedicated earth/ground connection - see Appendix A for details.

SV2500S Motor and Brake

The SV2500S drive has a combined motor and holding brake connector, arranged as shown in Figure 3-13. For electrical noise reduction reasons, you should clamp the cable screen in the 360° fixing provided on top of the drive.

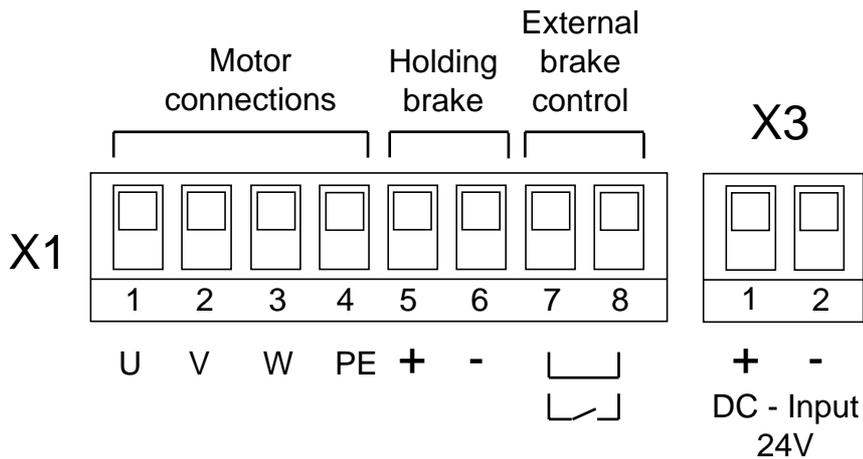


Figure 3-13. SV2500S Motor Connections, Holding Brake & 24V

External Brake Control

Motor and holding brake connections are made to X1 pins 1 to 6 inclusive. The external brake control connections X1/7 and X1/8 are linked together for normal operation. If you require external brake control, opening a contact between X1/7 and X1/8 will apply the holding brake regardless of the state of the drive. However, if the drive has applied the holding brake it cannot be released by the external contacts i.e., the brake can only be applied and released by the external control contact whilst the drive is expecting it to be released.

This facility can be used to brake a stationary motor when it is holding a vertical load, although care needs to be taken to make sure the brake cannot be applied when the motor is commanded to move.

SV2500S 24V DC Input (X3)

In-line with the motor connector is the +24V DC supply input (X3), required by the drive for powering the internal logic circuits and external options such as motor holding brake or cooling fan. The supply ratings are the same as the SV-M requirements described in Section 2, 24V Supply. See the filter requirements for this input in the sub-section entitled *Auxiliary 24V Supply Filtering*, later in this section.

SV4500S & SV8500S Motor and Brake Connections

Motor drive connections are positioned on the base of the drive. A 6-way connector provides the U, V and W phase supplies, a safety earth supply and the motor holding brake supply. For electrical noise reduction reasons, you should clamp the cable screen in the 360° fixing provided on the base of the drive.

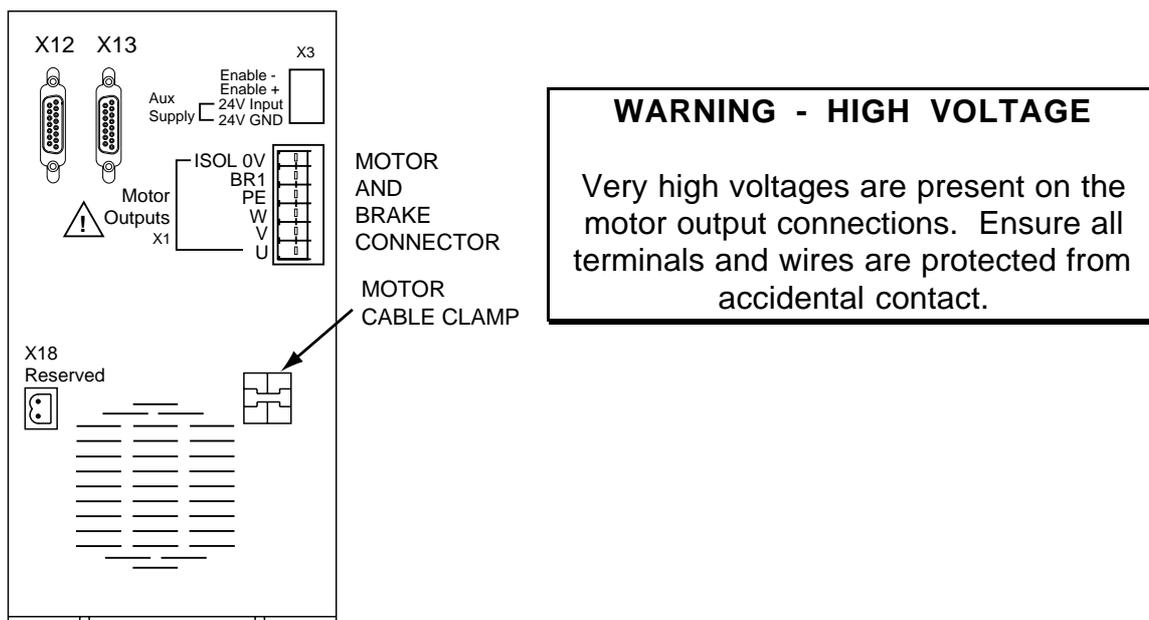


Figure 3-14. Drive Motor Connections

Motor connection leads and pin-out details are given in Appendix A.

Auxiliary 24V Supply

Both the SV8500S and SV4500S have built-in power supplies used for powering internal logic and analogue circuits. A supply of +24V is generated internally from which multiple $\pm 15V$ and 5V supplies are derived. In a situation where the drive's controller needs to be kept 'alive' when power is removed from the drive, an external +24V supply can be used. In practice this situation can arise when the drive is mounted in a cabinet and cannot be supplied with 3-phase power when the cabinet door is open. By providing an external +24V supply, cabinet doors can be opened without resetting the drive's controller.

When the drive is fed from an external +24V DC supply, the internal 24V power supply will shut down. The supply used should be short circuit current limited, using a suitable fuse. See **24V Supply** in *Installation of SV-M Drives* for an estimate of current requirements.

The "enable" connections allow the power output stage of the drive to be disabled. For the SV4500S and the SV8500S drives, **enable +** is always connected to **enable -**, permanently enabling the power output stages of both types of drive. Note: this is a hardware method of disabling the output stage: no software control is used.

Auxiliary 24V Supply Filtering

To meet EMC conducted emissions standards, it is necessary to filter either the input or output of the Auxiliary 24V supply.

For input mains filtering, a suitable filter is the Corcom 3VB3, or equivalent. Alternatively, individual 24V power supplies outputs can be filtered using Corcom 3VK3 filters, or equivalent.

If the 24V is used for supplying any other equipment such as a PLC the feed to the SV drives must be separately filtered using a chassis mounted filter attached to the cabinet backplane metalwork.

All 24V wiring must be contained within the equipment cabinet and routed close to the drive metalwork.

SV-S Stop Circuit Wiring

Drive Connector X11 (7-way Phoenix)

24V control supply, stop circuit wiring connections.

X11 pin Number	Name	Function
1	+24V	
2	GND	
3		
4		
5	Stop circuit	+24V source
6	Return	Comparator input
7	Screen	Cable screen

Table 3-2. X11 Connections

Stop Wiring

Opening the stop contact between X11/5 and X11/6 will deactivate all drives sharing the same circuit. You can form an external stop circuit as shown in Figure 3-15. Any break in the circuit will disable the power stage on all interconnected drives. Any open circuit in the external stop circuit will open the stop circuit relay causing the drives to be de-energised. This circuit may be used as part of a **Category 0** emergency stop circuit.

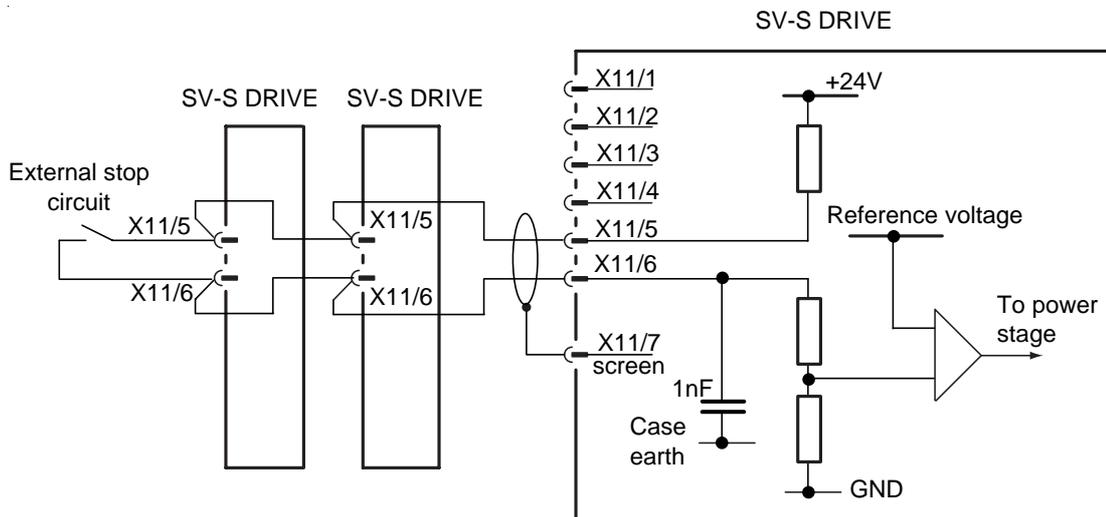


Figure 3-15. Stop Wiring

Pre-Installation Test

Once the drives power connections and safety earth connections have been made it is worth performing a pre-installation test of the drive to ensure all of the installation work completed so far is working correctly. By checking the installation at this stage you may avoid later commissioning delays.

SV-S drives must be installed by competent personnel familiar with the installation, commissioning and operation of motion control equipment.

The safety earth connection must be made as shown in Figure 3-16 to minimise the risk of electric shock and the power line inputs L1 to L3, must be fused.

By supplying the external +24V DC supply and avoiding any loading of the motor (to minimise load current), drives can be operated from an AC line voltage of 90V.

The motor need not be installed in its final position, but it must be securely mounted to prevent its body moving during test, and it must not be connected to any mechanical load during pre-installation testing.

Please take note of the warning given at the beginning of this User Guide. Motion control equipment is capable of making rapid unexpected movements of high force, especially during the development of controller programs and the commissioning of equipment.

A recommended pre-installation test circuit for a single axis SV-S drive is shown in Figure 3-16. This pre-installation test assumes you are using a recommended motor part, the configuration data for which has been pre-loaded into the drive. If a standard motor part is not being used refer to the Software Reference section for details of motor parameter setup.

Note: always check the motor type before energising the drive.

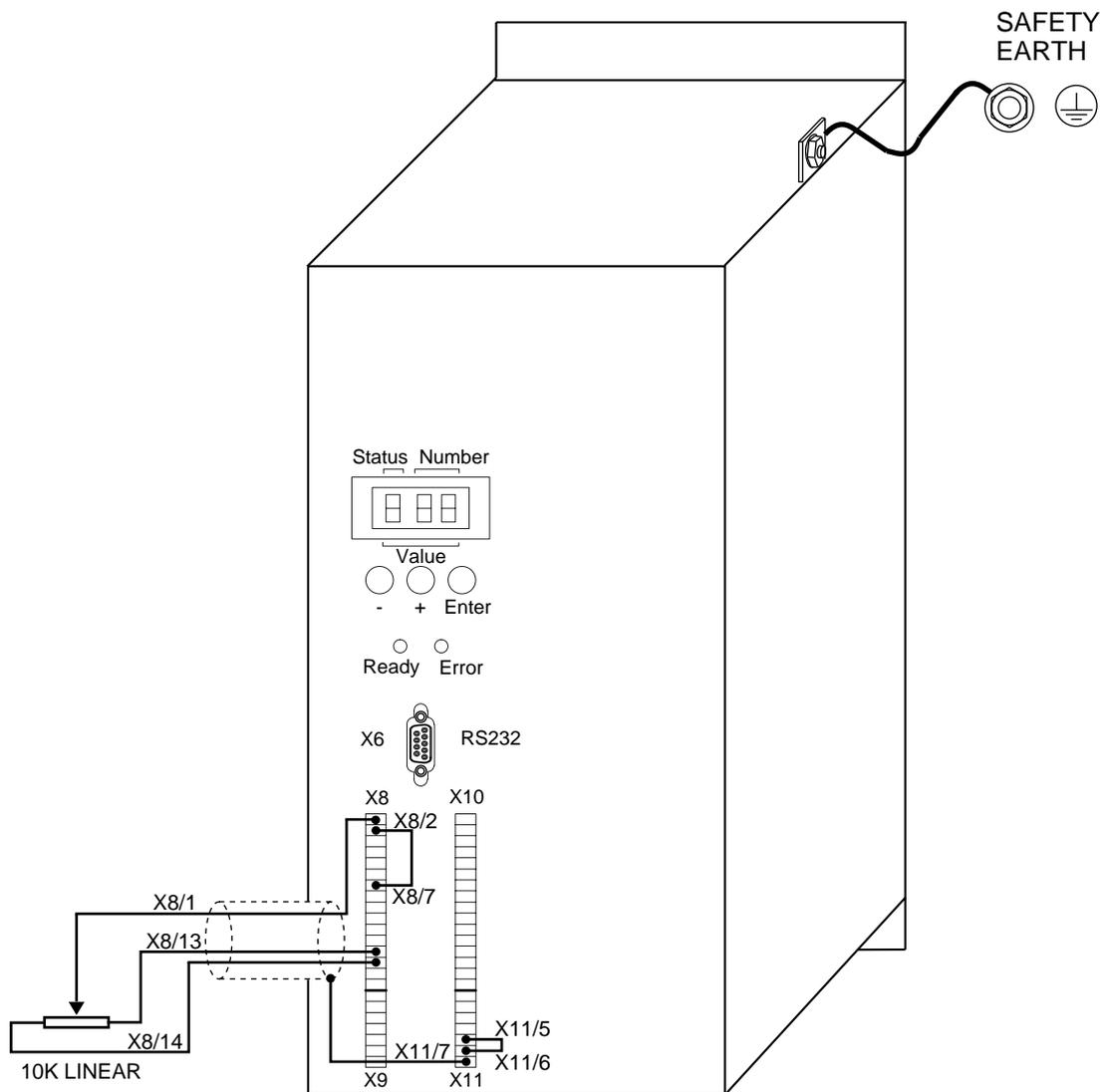


Figure 3-16. SV-S Pre-installation Test Circuit

Pre-installation Motor Connections

For pre-installation testing the motor can be wired and mounted as shown in Figure 3-17. Note: The wiring shown is for the SV4500S/SV8500S drives, although the SV2500S can be wired in a very similar manner using connection information already described. You must make sure that the motor is firmly mounted to a secure base.

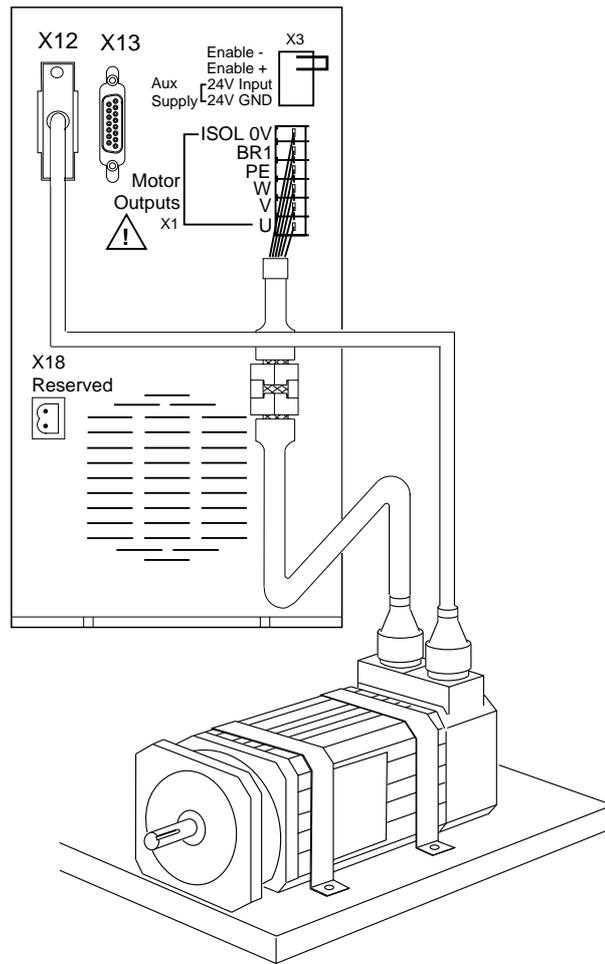


Figure 3-17. Pre-installation Test Motor Connections

Motor and brake connections are located on the base of the drive for SV4500S and SV8500S drives, as shown in Figure 3-17. The resolver connector (X12 15-way female D-type) is also located on the base and will need to be connected to the motor using a resolver cable type REK 5 for the HDX115 motor or cable type REK 14 for the HDX142 motor.

CAUTION - SUDDEN MECHANICAL MOVEMENT

The motor must be securely clamped in position before the pre-installation test is performed.

CAUTION - HIGH TEMPERATURE

The motor case can reach a temperature of greater than 100°C (212°F).

Wiring

The pre-installation test circuits should use standard motor and resolver cables (see Appendix A), appropriate for the motor/drive combination being used. AC supply wiring should be made with insulated copper conductors with a cross sectional area of at least

2.5mm² and a voltage rating of 1500V AC RMS (14 AWG tri-rated cable). Other stop, 24V and control wiring can use 16/0.2 mm (0.5 mm²) equipment wire. The protective earth conductor should be at least the same size as the supply wiring.

Testing the SV-S

Use the following procedure to test the drive:

WARNING - ELECTRIC SHOCK HAZARD

Check all connections before applying AC power to the test circuit.

1. Power up the drive whilst holding down the '-' button on the front panel. This ensures the motor will be de-energised.
2. Using the front panel buttons, press '+' to enter the parameter mode setup (a 'P' will be visible on the display), press 'enter' to select a particular parameter. Using the '+' and '-' buttons parameter numbers can be selected by ramping up and down the list of numbers available. Select parameter **P0**, press 'enter' to give it a value, and again using the '+' and '-' buttons ramp up to the value **302**, then press 'enter'. This procedure has assigned parameter **P0** the value **302** which is a password that enables you to change drive parameters.
3. The drive needs to know what type of motor it is to be used with. This is achieved by identifying the motor with a 3 digit number which is entered into parameter **P1**. A list of motor types and their associated numbers is given in Table 3-1. The appropriate number is entered into parameter **P1** using the technique described in step 2. By default, the drive will now be configured as operating in velocity mode for the entered motor type.
4. The drive automatically calculates the main servo tuning parameters to give a stable system. However, to do this you will need to input the minimum and maximum ratios of load inertia compared to motor inertia. These values are calculated as follows:

$$P81 = \frac{\text{Minimum external load inertia}}{\text{Motor inertia}} \times 10$$

$$P82 = \frac{\text{Maximum external load inertia}}{\text{Motor inertia}} \times 10$$

Example

For a minimum load equal to the motor inertia, P81=10.

For a maximum load of 5 times the motor inertia, P82=50.

The range of values which can be entered is 0 to 999, equivalent to inertia ratios up to 99.9:1. Please see Table 3-1 for motor moments of inertia. Do not include the motor inertia with the external load inertia in the calculations.

Enter the calculated values of P81 and P82 as described in step 2. In this case, with no load attached to the motor, set P81=0 and P82=10.

5. Temporarily short-circuit X8/1 and X8/2, and energise the drive by setting **P34** to **1**. The motor shaft will start rotating slowly.

6. Adjust the signal balance by setting parameter P31 to 1, to activate the auto balance adjustment. A further fine adjustment can be made by altering the value of P30.

7. Position the 10Kohm potentiometer to mid track and remove the short circuit link between X8/1 and X8/2. The basic configuration can be assumed to be working if velocity control of the motor is achieved by the adjustment of the potentiometer.

8. After the drive is fully configured. Set P0 to 270. This prevents further adjustment of any of the drive parameters - effectively locking out the front panel adjustment.

9. Having proved the drive is working correctly, you may isolate all AC supplies and remove the temporary control wiring and continue the final installation of the drive and motor.

Section 4. I/O & Control for all Drives

Drive Control and I/O Connections

Both SV-M and SV-S drives share a common control board, to which most of the signal inputs and output connections are made. The layout of these connectors is shown in Figure 4-1.

The information contained within this section, such as connector layouts and I/O circuit detail, is common to all drives. The only exception is the drive stop circuit which is looped between SV-M drives (using the ribbon wire X4 connectors), but is used to form individual drive stop circuits for the SV-S stand-alone drives.

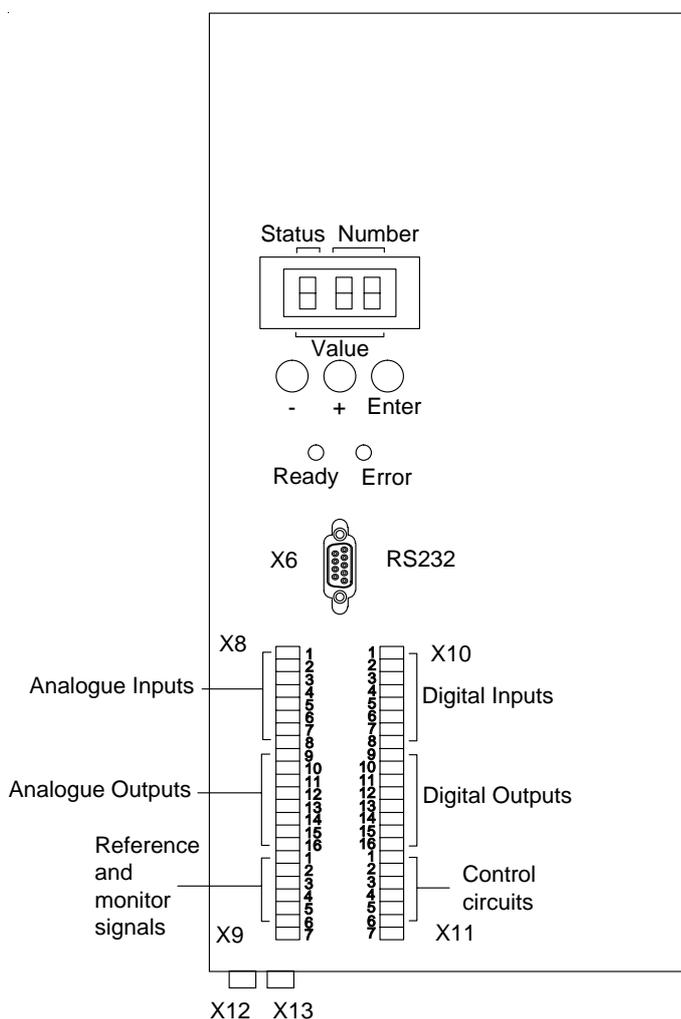


Figure 4-1. User I/O Connections

Ready and Error LEDs

The two single front panel LEDs give an immediate indication of the drive status. The green 'Ready' LED is illuminated to indicate the drive has power applied. The red 'Error' LED illuminates when a hardware or software error is detected. Error numbers are indicated on the 3 character 7 segment LED display - see **Maintenance & Troubleshooting** section for a list of error number meanings.

Control Wiring

All inputs are opto-isolated and are designed to work from 24V DC control levels. Control connections are made available via the Phoenix connectors X8, X9, X10 and X11 on the front panel of the drive.

Analogue I/O Connector X8 (16-way Phoenix)

Analogue input and output connections.

X8 pin Number	Name	Function
1	AN1+	1st differential input for speed or current reference
2	AN1-	
3	AN2+	2nd differential input for speed reference
4	AN2-	
5	N/C	Reserved
6	N/C	Reserved
7	AGND	Reference ground
8	AGND	Reference ground
9	TORQUE O/P	Torque reference output
10	SPEED O/P	Speed out
11	SCALED SPEED O/P	Scaled speed out
12	BUS VOLTS	Bus volts monitor (1V out is equivalent to 100V on the bus)
13	REF +15V	Current limited reference voltage output
14	REF -15V	
15	AGND	Reference ground
16	AGND	Reference ground

Table 4-1. X8 Connections

Speed/Current Control Inputs

When configured as a speed controller, differential inputs AN1+ and AN1- control the motor speed. The input voltage range is between -10V and +10V, the positive voltage, on AN1+, producing CW rotation and the negative voltage CCW rotation.

You configure the drive as a speed controller either by setting parameter P33=0, or by setting input E3=0 when P36=3. The speed of the motor is then controlled by the voltage applied between AN1+ and AN1- where

$$10V \text{ is equivalent to } \{\text{nominal speed}\} \times P15/100$$

With P15 set to its default value of 100% an input voltage of +10V will drive the motor at its rated speed in a CW direction.

When configured as a torque controller, differential inputs AN1+ and AN1- control the motor current, effectively controlling the torque produced by the motor. The polarity of direction remains the same as when configured as a speed controller.

You configure the drive as a torque controller either by setting parameter P33=1, or by setting input E3=1 when P36=3. The torque of the motor is then controlled by the voltage applied between AN1+ and AN1- where an input of 10V will generate the peak current of the drive being used. For example, an input voltage of 1V will generate the following drive currents per drive type:

<u>Drive Type</u>	<u>Current</u>
SVP100M	0.85A
SV0200M	0.85A
SV0500M	1.70A
SV1500M	5.00A
SV2500S	1.26A
SV4500S	1.30A
SV8500S	2.50A

Speed Output

The speed output (X8.10) produces an output voltage that is directly proportional to the speed of the motor. Scaling of this output is fixed, a voltage output of 8V being equivalent to a speed of 6000rpm.

Scaled Speed Output

The scaled speed output (X8.11) allows any selected nominal speed to generate a 0 to 10V output. The nominal speed of the motor is taken from the motor's specification, or is automatically taken from parameter P05. Scaling is controlled by parameter P15 as follows:

$$10V \text{ is equivalent to } \{\text{nominal speed}\} \times P15 / 100$$

Note: This scales both the input sensitivity and the scaled speed output. For example, for a motor with a nominal speed of 3000rpm and with P15 set to 50%, a 10V input will produce a motor speed of 1500rpm and the scaled output will generate a voltage of 10V.

Analogue Input Circuits

Analogue differential inputs can be connected as single analogue inputs, as shown in Figure 4-2, or as dual differential inputs, as shown in Figure 4-3.

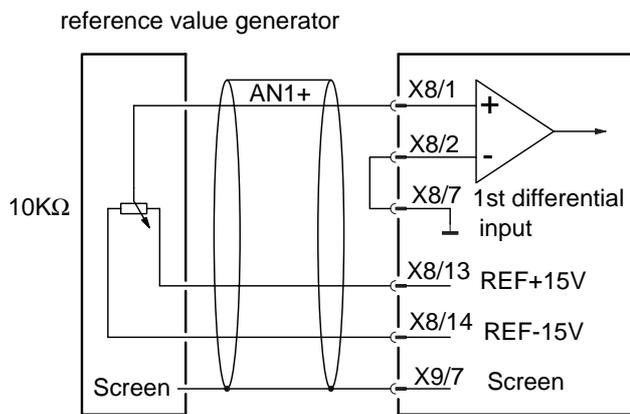


Figure 4-2. Single Differential Input

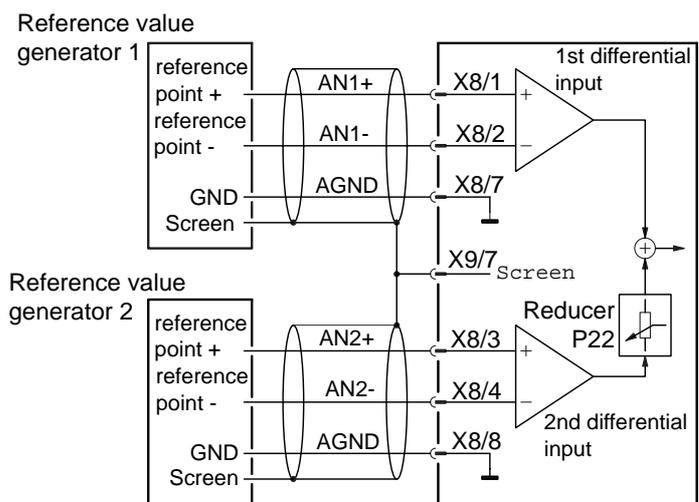


Figure 4-3. Dual Differential Inputs

Digital I/O Connector X10 (16-way Phoenix)

Digital input and output connections.

X10 pin Number	Name	Function
1	E1 ENABLE	External enable
2	E2 BRAKE	Brake control
3	E3	PLC input
4	E4	PLC input
5	N/C	Reserved
6	PLCGND	PLC ground
7	PLCGND	PLC ground
8	PLCGND	PLC ground
9	+24V	Output control voltage +24V (<0.5A)
10	24V GND	Output control voltage GND
11	N/C	Reserved
12	N/C	Reserved
13	N/C	Reserved
14	A1 +24V	Input +24V for A1 opto output
15	A1	Digital output A1 programmable via p37
16	A1 +24V GND	GND return for A1 +24V supply

Table 4-2. X10 Connections

Control Input/Output Circuits

The E1 to E4 binary inputs can be actively driven from a PLC output (see Figure 4-4) or passively controlled as shown in Figure 4-5. For the use of these inputs refer to the description of parameter P36, which controls the use of E3 and E4.

Note: only input circuit E4 is shown, the E3 input is identical.

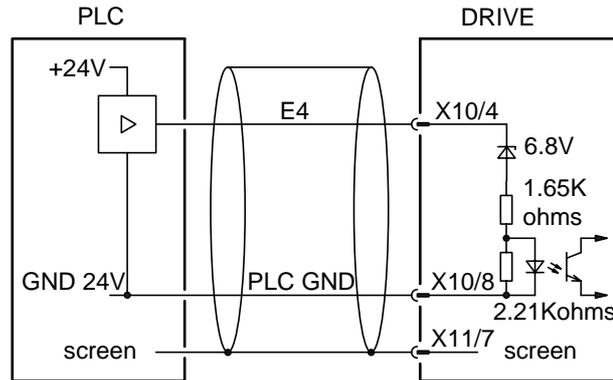


Figure 4-4. Input E4 Driven From an Active PLC Output

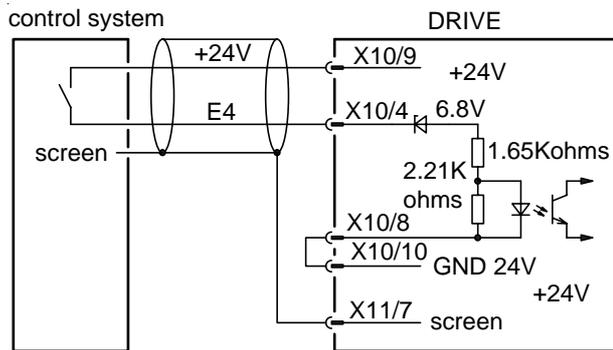


Figure 4-5. Input E4 Driven From a Passive Control Output

Output A1

The A1 output from the drive can be used to report errors or drive status conditions to the PLC. Its use is determined by the value held in parameter P37.

The output circuit consists of an opto-isolated open emitter, as shown in Figure 4-6. When used with an independent +24V supply the connections are made as shown in Figure 4-6. If you use the drive's local +24V supply you will need to link X10/16 to X10/10 i.e., the isolated output's ground connection will need to be linked to 24V ground.

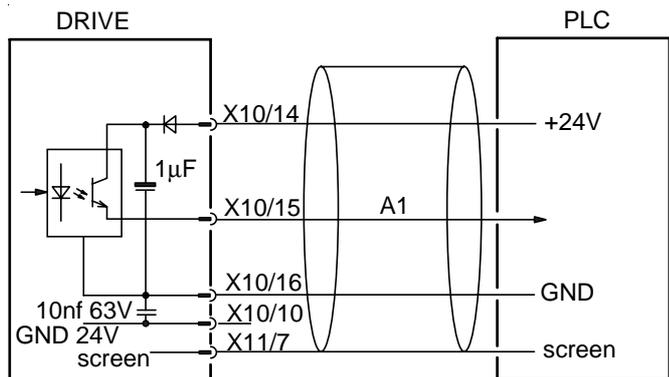


Figure 4-6. Output A1 Circuit

Drive Connector X9 (7-way Phoenix)

Analogue reference connections.

X9 pin Number	Name	Function	U & V Current monitor scaling	Current
1	REFERENCE 1	Reference point 1 output	1V=SV0200M	2A
2	REFERENCE 2	Reference point 2 output	1V=SV0500M	4A
3	CURRENT U	Current monitor phase U	1V=SV1500M	20A
4	CURRENT V	Current monitor phase V	1V=SV2500S	5A
5	CONDUCT. PHU	Phase U conduct signal	1V=SV4500S	5A
6	CONDUCT. PHV	Phase V conduct signal	1V=SV8500S	10A
7	Screen	Cable screen		

Table 4-3. X9 Connections and Output Scaling

The connections made available on X9 are for factory self test, apart from the signals on pins 5 and 6, which can be used to achieve alignment of resolver and motor. For a full description see Appendix C.

Communications and Motor Control

Other interfaces used by all drive types are:

- RS232 serial communications
- Motor resolver
- Simulated encoder feedback

RS232 Connector X6 (9-way D-type)

RS232 serial link connector.

X6 pin Number	Name	Function
1	N/C	Reserved
2	RxD	Receive data
3	TxD	Transmit data
4	DTR	Data transmit ready
5	GND	Ground
6	DSR	Data send ready
7	RTS	Request to send
8	CTS	Clear to send
9	-	Reserved

Table 4-4. X6 Connections

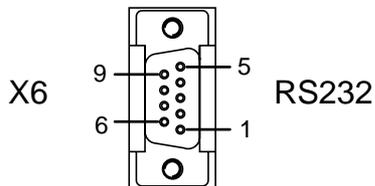


Figure 4-7. RS232 Connector

Resolver Connections to Drive

Resolver connections to the drive are made via a 15-way D-type connector (X12) located at the base of the drive. Connection details are given in Table 4-5.

Pin Number	Signal	Pin Number	Signal
1	housing	9	+5V
2	NC	10	TEMP
3	NC	11	COS-
4	REF-	12	COS+
5	SIN-	13	SIN+
6	NC	14	REF+
7	GND	15	NC
8	NC	-	-

Table 4-5. Resolver Connections

Encoder Drive Connector X13 (15-way D-type)

Simulated encoder feedback connector. All encoder signals are differential RS485 (5V) levels.

X13 pin Number	Name	Function
1	screen	Cable screen
2	Z	Output zero pulse
3	B	Output B
4	A	Output A
5	GND	Ground return for encoder outputs
6	N/C	Reserved
7	N/C	Reserved
8	N/C	Reserved
9	*Z	Output zero inverted
10	*B	Output B inverted
11	*A	Output A inverted
12	-	-
13	+5V	Input supply for RS485 driver
14	-	-
15	-	-

Table 4-6. X13 Connections

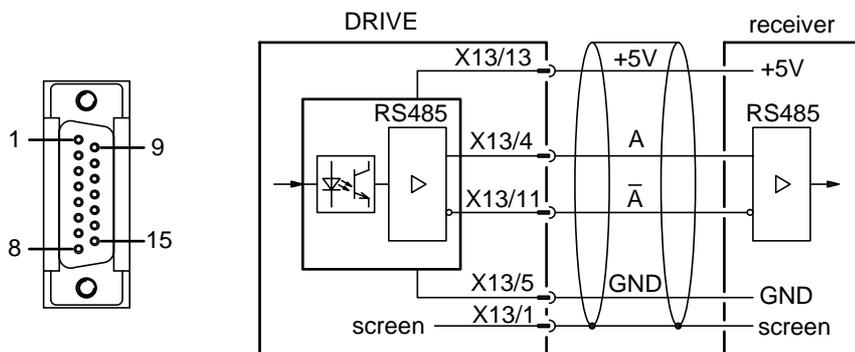


Figure 4-8 Simulated Encoder Outputs

Dynamic Braking

Please note: Part of the information contained in this sub-section has been made available by SEM Limited.

In an emergency situation, when the motor needs to be stopped following a drive fault or loss of electrical power, dynamic braking can be used.

Dynamic braking is achieved by placing a load across the motor terminals, forcing the motor to act as a generator which will produce a braking torque. Note: this highlights the weakness of dynamic braking, if the motor speed is low, or as it becomes low, dynamic braking loses its effectiveness.

For dynamic braking to be most effective it must apply the greatest torque over the maximum motor speed range i.e. it must decelerate the motor as quickly as possible. This is achieved by matching the braking load to the motor being used and the speed range over which it is operating. The motor outputs can be completely short circuited, but this will not achieve the most efficient form of braking as the maximum torque production will occur at too low a speed compared with resistive dynamic braking. In practice, a value of load resistor is selected to give the maximum torque at half the maximum operating speed. This results in a braking torque of more than 80% of the maximum over the top 75% of the motor's speed range.

Resistance Value Calculation

The required load resistance per phase to produce the most effective braking torque can be calculated using the following formula:

$$\text{Load resistance} = 0.013 \times \text{Inductance} \times \text{No of poles} \times \text{Max Speed in rpm}$$

Where Inductance is the line-to-line inductance measured in Henrys
 No of poles is equal to the number of motor poles
 Max Speed is the maximum required running speed measured in rpm
 Load resistance is the total circuit resistance including the motor
 resistance

For example, using the HDX142C6-88S motor at a maximum speed of 3,000rpm. From the motor data sheet:

$$\begin{aligned} \text{Line-to-line inductance} &= 8.9\text{mH} \text{ (phase inductance} = 4.45\text{mH)} \\ \text{Line-to-line resistance} &= 0.76 \text{ (phase resistance} = 0.38 \text{)} \\ \text{No of poles} &= 6 \end{aligned}$$

Performing the calculation will require a load resistance (per phase) of 2.1 . As the calculated load resistance includes the motor phase resistance of 0.38 , the actual external resistance required will need to have a value of $2.1 - 0.38 = 1.72$ (or the nearest preferred value of 1.8).

Resistor Power Rating

The power rating and thermal capacity of the load resistors will depend upon the total inertia of the system. To a first approximation the total power to be dissipated can be estimated by calculating the total energy in the system. For example, taking the worst case condition where the load has an inertia of ten times the inertia of the motor:

For the HDX142C6-88S the motor inertia is 0.00115 kgm²

Assuming a load inertial of 0.0115 kgm²

Total inertia = 0.0126 kgm²

Total energy stored by the system (@3,000rpm) = $0.5J\omega^2$

= 622 watt-seconds

The time taken for the motor to slow down will depend upon its maximum speed, the total inertia of the system and the braking torque applied by the resistive load.

The maximum torque at the centre speed is given by $(3 Kt^2)/(L \times \text{No poles})$

Where Kt = torque constant
 L = phase inductance
 No poles = number of motor poles

The approximate time taken to slow down to 5% of maximum speed is given by:

$$t = \frac{0.27 \times \text{Max speed in rpm} \times \text{total system inertia}}{\text{Maximum braking torque}}$$

For the HDX142C6-88S the maximum torque (at the centre speed of 1,500rpm) is 13 Nm. Using the calculated time the motor should come to rest in approximately 0.8s.

Generally, power resistors have an overload rating of five times the normal wattage rating over a period of 5 seconds. As the time taken for the motor to come to rest is less than 1 second and the total power to be dissipated is $622/5 = 125$ watts, selecting 25 watt resistors should be adequate.

Dynamic Brake Control

Dynamic braking is implemented by control of the PLC output A1, which can be used to switch a contactor used to connect the brake resistors across the motor windings (see Figure 4-9). When P37='5' (P37 controls the use of output A1) and the drive is de-energised by an error or an emergency stop, the A1 output transistor turns OFF (A1=0) and a decimal point is shown in the front panel display. This arrangement allows the drive with the error or active stop to be identified. The result of output A1 turning OFF is

to turn ON the contactor which disconnects the motor from the drive and connects it to the dynamic brake load.

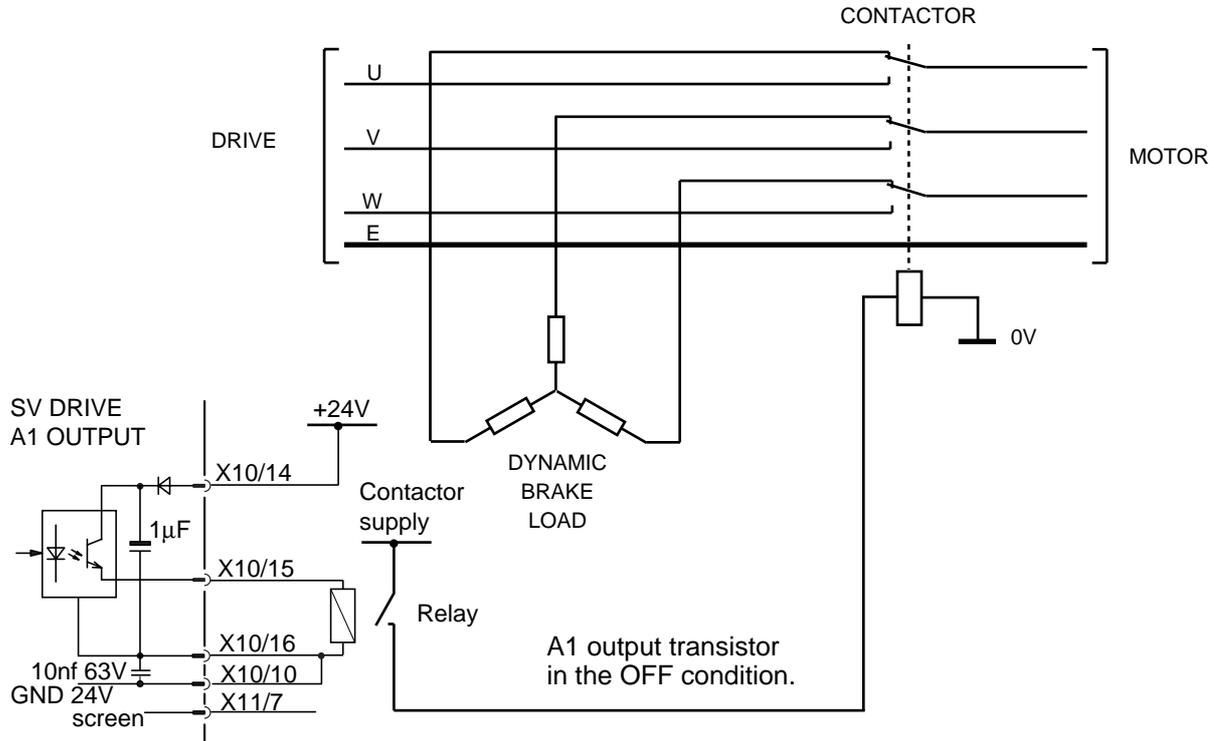


Figure 4-9. Dynamic Motor Braking Circuit

Section 5. SOFTWARE REFERENCE

Operation and Control

You can program an SV-M or SV-S drive using front panel controls or via an RS232 interface. For RS232 serial control refer to Appendix B which describes PC control and the use of the parameter editor software supplied with the drive. The use of the front panel controls is described later in this Section in the sub-section entitled **Front Panel Operation**.

Functions performed by the drive are controlled by values assigned to parameters, for example you could make simple selections, such as switching between two frequency compensation values by writing a '0' or a '1' to parameter P25. Where a fine control of parameter values is required, 3 digit integer values can be assigned and scaled to represent real values of current, voltage, torque etc.

If you need to know the current state of the drive, for example which PLC inputs are active or what motor type the drive is currently configured for, you may examine status values such as S14 or S37. Status values can be read from the front panel display or over the RS232 serial link. If an unexpected condition arises within the drive whilst you are programming it, or whilst it is operating, it will generate a coded error message which will be displayed as E<xx>, where <xx> represents the error number.

All parameter values and status values are described in this section. Error message definitions are described in the Maintenance and Troubleshooting section.

Front Panel Operation

SV-M/S front panel controls are shown in Figure 5-1. They consist of a 3 character 7 segment LED display and 3 push buttons used for scrolling through lists and for the entry of parameter values.

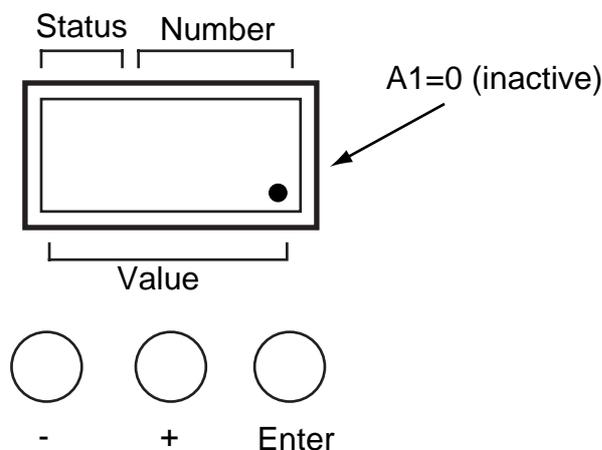


Figure 5-1. SV-M/S Front Panel Controls

The display can be used to indicate:

- Parameter values
- Status values
- Error numbers

At power up the display will indicate 'OFF' or 'RUN' depending on whether the motor is energised. An error is reported if 'E<xx>' appears in the display.

To program the drive using the front panel controls, you will need to follow the programming sequence shown in Figure 5-2. When just 'P' is showing in the display, the drive parameters can be viewed or changed. When 'S' is showing (actioned by pressing the '-' button from the parameter set-up mode), status values can be viewed.

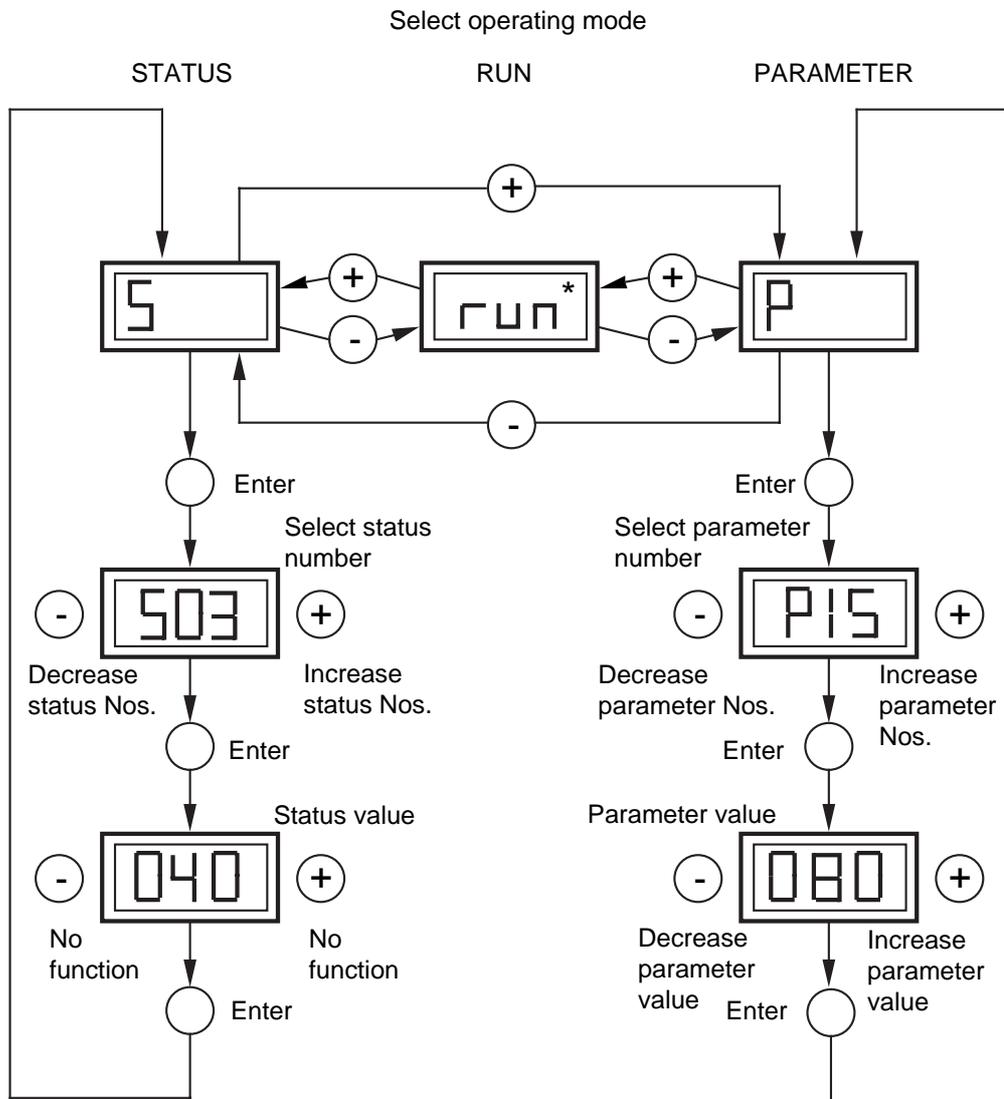


Figure 5-2. Programming the SV-M/S Drive

A particular parameter can be viewed by returning to the 'P' mode and pressing the 'Enter' button. Using the increment or decrement buttons ('+' and '-' buttons) select a particular parameter (say 'P15') and view the contents by pressing 'Enter'. At this stage the contents of the selected parameter can be changed using the '+' and '-' buttons. Once you have entered the required value press 'Enter' to return to parameter selection. Note: Parameters P1 to P9 cannot be changed using the front panel controls.

Status values can be viewed in a similar way as parameter values, but you cannot alter status values, they are read-only.

At the end of programming, the drive can be set to 'Run' by pressing '+' from parameter set-up or '-' from status read. * Run indicates the drive is energised, "off" is displayed if the drive is de-energised.

If you wish to start the drive in a de-energised state, during power on, hold down the '-' button. This action is equivalent to setting parameter P34='0', therefore the drive must be re-enabled by setting parameter P34='1' when required.

Changing Parameter Sets

The drive can store two totally independent sets of parameters in addition to the default values. This allows rapid changeover to an alternative setup or pre-configuration for two different applications. It also allows experimentation without losing the normal configuration.

The two parameter sets are referred to as set 0 and set 1. They are stored in two memories, only one of which is active (A). The second memory (B) is a back-up memory to hold the second parameter set.

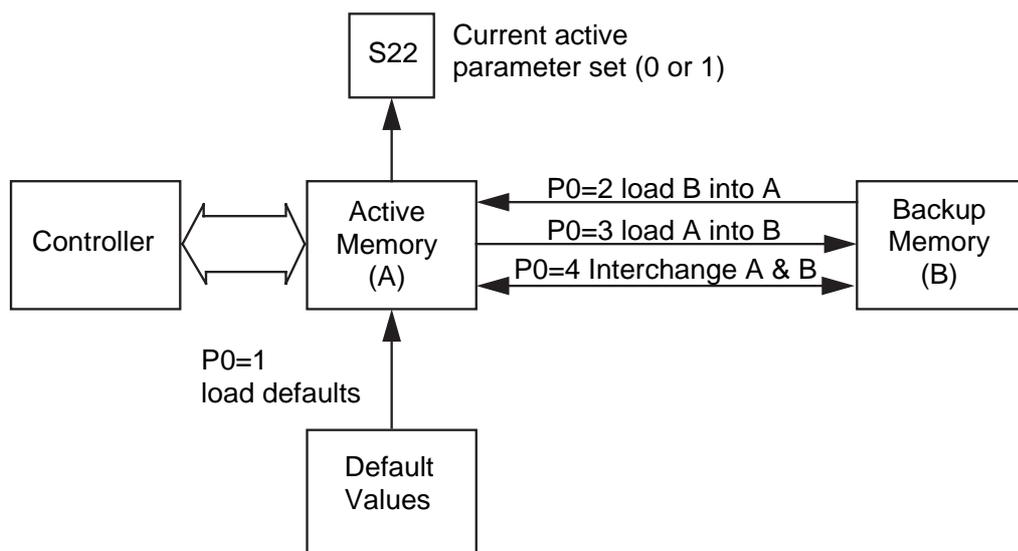


Figure 5-3. Parameter Set Storage

Only the parameter set currently in memory 'A' will control the operation of the drive. Status value S22 shows which parameter set is in memory 'A'. Parameter P0 is used to transfer parameter data between the memory areas.

P0=1 will load the default values into memory 'A'. This will return the drive to its factory settings, with the exception of the motor parameters P1 to P10.

P0=2 loads memory 'A' with the parameter set currently in memory 'B'. Both memories will now contain the same data, and the previous contents of memory 'A' will be lost. This is useful when returning to normal settings after experimenting with parameter values.

P0=3 transfers the parameter values currently in memory 'A' to memory 'B'. The previous contents of memory 'B' will be lost. Use P0=3 when making a backup parameter set or when configuring two separate parameter sets.

P0=4 interchanges the contents of 'A' and 'B'. This will switch between two parameter sets without losing any data. Use S22 to check the currently active parameter set (0 or 1).

Note: take care when using P0=2 or P0=3 since this will over write one set of values and result in both memories containing the same data.

The changeover from parameter set 0 to 1 can also be achieved using input E3. By setting P36=5, parameter set 0 will be selected with E3=0. Parameter set 1 will be selected with E3=1. **The changeover should only be performed at zero speed.**

Holding Braking Control

Motors designed to work with the SV-M/S drives may be fitted with an electrically operated holding brake. The brake is used to hold the load in a fixed position when the motor is de-energised, especially when loads are being moved in a vertical axis (z-axis).

Caution

The motor holding brake must only be switched on when the motor is stationary.

Parameter P18 is used to govern the way braking control operates, by being set to one of three values:

P18=0 the brake is controlled via external input E2

P18=1 brake not fitted or controlled externally (not controlled via drive)

P18=2 brake controlled via the drive

When P18=0 the holding brake is controlled via input E2. When E2=0 the brake is applied and with E2=1 the brake will be released. The drive will monitor the state of input E2 to ensure that the brake is released when the motor is energised and running. Once the drive is enabled and the motor energised, if the brake is not released within 0.5 seconds of the motor reaching 10% torque, an error E49 will be reported.

With parameter P18=2 (automatic brake control). The brake will be applied depending upon the states of parameters P34 (Software disable), P35 (Allow external disable) and external disable input E1. With P34=0 the brake will be applied regardless of the value of P35 or the state of input E1. When P34=1 the brake will only be applied when external disables are allowed (P35=1) and an external disable applied via E1 (E1=0).

In operation, the load is brought to rest and the holding brake is applied before the motor is de-energised. When the load is required to be moved again the motor is energised, and a short time later the holding brake is released. This brake delay during which the brake is applied and the motor is still energised is controlled by parameter P17.

Note: the drive will always take 300ms to energise the motor once it is enabled.

Applying the Holding Brake

When the drive is disabled with no brake delay the motor is de-energised and the brake is applied immediately as shown in Figure 5-4.

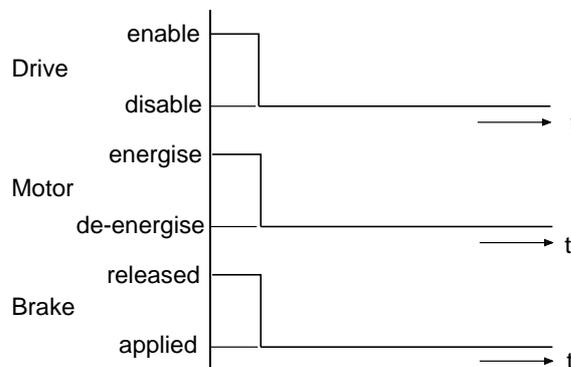


Figure 5-4. Drive disabled with P17=0

By programming a value in P17 you can delay de-energising the motor relative to the brake application as shown in Figure 5-5.

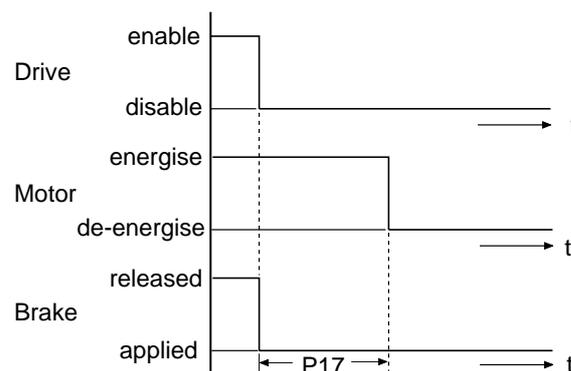


Figure 5-5. Drive disabled with P17>0

Releasing the Brake

When the drive is enabled with no brake delay the brake is released as soon as the motor is energised, as shown in Figure 5-6.

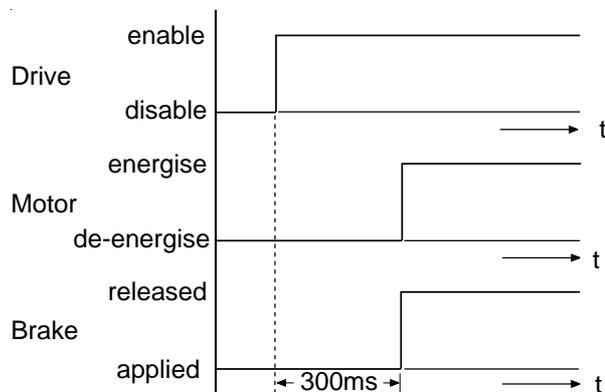


Figure 5-6. Drive enabled with P17=0

By programming a value in P17 you can delay the release of the brake relative to the motor being energised as shown in Figure 5-7.

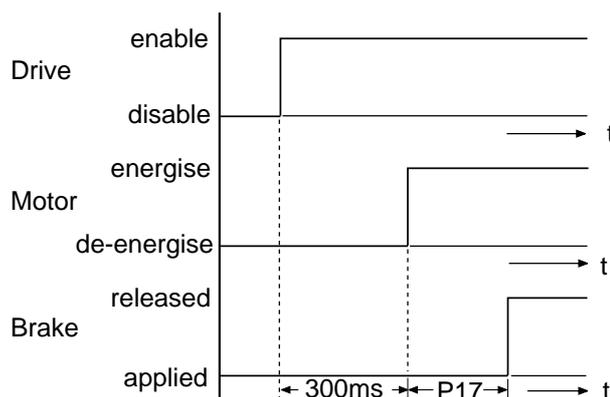


Figure 5-7. Drive enabled with P17>0

Note: holding brake control can be overridden by input E2 i.e., release of the brake with E2='1' has a higher priority.

Use of PLC Inputs and Output A1

PLC inputs E1 to E4 and output A1 allow control of the drive via a PLC or other logic controller devices. The use of the inputs and output are partly controlled by parameters.

Parameter P37 controls the use of output A1

Input E1 is used independently or in conjunction with parameters P35 & P34

Input E2 is used in conjunction with parameter P18

Parameter P36 controls the use of inputs E3 and E4

Output A1 Control

Output A1 is an opto-isolated open emitter output with an isolated ground return. When the output is active (A1=1) the output transistor is conducting, supplying current to the externally connected input. The state of output A1 can be monitored by viewing the front panel display, with A1=0 a decimal point will be displayed (see Figure 5-1).

The state of A1 can be used to signal various drive conditions depending upon the value assigned to parameter P37, which can be given values 0 to 6, or can be used to signal particular errors. The drive conditions signalled by A1 for various values of P37 are listed with the description of parameter P37.

Input E1

Input E1 can be used for enabling or disabling the drive's power output stage, or for the resetting of the drive following any error conditions. When used to control the drive's power output stage the input is enabled by parameter P35, but also requires the master software disable parameter P34 to be enabled.

Provided P34=1 the input is enabled by setting P35=1

E1=0 power output stage is disabled

E1=1 power output stage is enabled

When used to reset any drive error condition, the input is simply toggled regardless of the state of parameters P34 and P35, but if enabled this action will also reset the power output stage.

Note: the power output stage has a 300ms turn on delay time.

Input E2

Input E2 is used to control the motor's built-in holding brake, if fitted. The E2 input is enabled via parameter P18. With P18=0 the brake is controlled externally via input E2.

Provided P18=0:

E2=0 brake is applied, holding the motor shaft stationary

E2=1 brake is released, allowing the motor shaft to rotate

Inputs E3 and E4

Inputs E3 and E4 can be used to control a range of drive conditions depending upon the value assigned to parameter P36, which can be given values 0 to 5. The use of inputs E3 and E4 for various values of P36 are listed with the description of parameter P36.

Software Parameters

No.	Description	Programmable Range	Units of	Equivalent to
P0	Password/ Parameter change	000 to 999	-	-

This parameter may be used to provide password protection of parameter values or to define the storage area of parameters.

Password

With P0='270' parameters cannot be changed using the front panel keyboard.

With P0='302' parameters can be changed using the front panel keyboard.

Note parameter P0 can always be changed and will automatically return to zero after registration of a value.

Parameter change

A drive can store two separate sets of parameters in addition to the default values:

1. Primary parameters (set'0') - those normally used to control the drive.
2. Secondary parameters (set'1') - those used to quickly re-configure the drive for a different application or as a back-up set of primary parameters.

For a full explanation of changing parameters see the earlier sub-section entitled ***Changing Parameter Sets.***

No.	Description	Programmable Range	Units of	Equivalent to
P01	Motor number	000 to 999	-	-

The SV-M/S can be pre-configured for a particular motor type by entering the motor number as parameter P01.

A list of motor types is given together with their motor numbers:

HBMR55E4-44S-230V	008	HBMR70E4-44S-230V	009	HDX92C4-44S-230V	020
HDX92E4-64S-230V	021	HDX92E4-44S-230V	022	HDX115A6-64S-230V	023
HBMR55E4-44S	101	HBMR70E4-44S	106	HDX92C4-64S	120
HDX92E4-88S	122	HDX92E4-64S	121	HDX92J4-88S	220
HDX115A6-88S	221	HDX115C6-88S	222	HDX115E6-130S	223

72 SV-M & SV-S SERIES SERVO DRIVE USER GUIDE

HDX115E6-88S	320	HDX142C6-88S	321	HDX142E6-130S	322
HDX142E6-88S	420	HDX142G6-88S	421	HBMR190C6-130S	403
HDX142J6-88S	520	HBMR190E6-88S	500	HBMR190J6-130S	501

No.	Description	Programmable Range	Units of	Equivalent to
P02	Pole number	2, 4, 6 and 8	-	-

Motor parameter P02 allows the number of poles of a motor to be entered for a non specified motor type.

No.	Description	Programmable Range	Units of	Equivalent to
P03	EMF	22 - 360	1V	22 - 360V

Motor parameter P03 allows the back EMF of a motor to be defined in volts at 1000rpm for a non specified motor type.

No.	Description	Programmable Range	Units of	Equivalent to
P04	Motor moment of inertia	1 - 2000	10kg-mm ²	10 - 20000kg-mm ²

Motor parameter P04 allows the moment of inertia of the motor rotor to be entered for a non specified motor type.

Note: parameters P2 to P9 cannot be changed using the front panel controls.

No.	Description	Programmable Range	Units of	Equivalent to
P05	Nominal speed	100 - 500	10rpm	1000 - 5000rpm

Motor parameter P05 allows the entry of a nominal speed value for a non specified motor type.

No.	Description	Programmable Range	Units of	Equivalent to
P06	Nominal current	1 - 999	0.1A	0.1 - 99.9A

Motor parameter P06 allows the entry of a nominal current value for a non specified motor type.

No.	Description	Programmable Range	Units of	Equivalent to
P07	Peak current	0 - 400	%	-

Motor parameter P07 allows the peak current that can be applied to the motor to be defined as a percentage of the nominal motor current for a non specified motor type. The default value is 300%. Peak current can only be applied for a limited time defined by *Peak current duration*.

No.	Description	Programmable Range	Units of	Equivalent to
P08	Peak current duration	100 - 999	10ms	1 - 9s

Motor parameter P08 allows the peak current duration to be defined for a non specified motor type. Peak current duration is the maximum time for which peak motor current can be allowed to flow.

No.	Description	Programmable Range	Units of	Equivalent to
P09	Stator inductance	1 - 999	0.2mH	0.2 - 199.8mH

Motor parameter P09 allows the stator inductance, measured between two motor phases, to be defined for a non specified motor type.

Note: parameters P2 to P9 cannot be changed using the front panel controls.

No.	Description	Programmable Range	Units of	Equivalent to
P15	Speed scaling	20 - 150	%	-

The motor speed with a 10V reference input is set by P05 (nominal speed). This can be scaled by P15 so that a 10V input produces a speed between 20% and 150% of the nominal value. With P15=100, a 10V input gives the nominal speed set by P05.

The maximum attainable speed is 5000rpm and this cannot be exceeded by scaling the nominal speed beyond 5000rpm for 10V in. However, the lower limit of 1000rpm for P05 can be scaled down by P15. For example, with P05 set to 100 (giving 1000rpm nominal speed) and P15 set to 20, the motor will run at 200rpm for 10V in. See also P32.

No.	Description	Programmable Range	Units of	Equivalent to
P16	Maximum torque	0 - P07	%	-

The maximum torque parameter P16 sets the maximum allowable motor current as a percentage of the nominal motor current. The maximum current cannot exceed the peak current set by P7. The default setting is 200%. An alternative value for maximum torque be specified by P38. The selection of P16 or P38 is made by setting P36=3 and using input E4 (E4=0 gives P16, E4=1 gives P38).

No.	Description	Programmable Range	Units of	Equivalent to
P17	Brake delay	0 - 5	10ms	0 - 50ms

Brake delay parameter P17 enables a small delay to be introduced between the holding brake being applied and the drive being de-energised. For more information on motor braking see **Braking Control**.

Caution

The motor holding brake must only be applied when the motor is stationary.

No.	Description	Programmable Range	Units of	Equivalent to
P18	Brake control	0, 1 or 2	-	see below

P18 controls the manner in which the holding brake is used. The options are:

- P18='0' external brake control is used
- P18='1' no brake control is used
- P18='2' brake is controlled by the SV-M/S

For more information on motor braking see *Braking Control*.

No.	Description	Programmable Range	Units of	Equivalent to
P19	Baud rate of the RS232 serial interface	0 or 1	-	0=4800 baud 1=9600 baud

Parameter P19 is used to set the RS232 interface baud rate.

No.	Description	Programmable Range	Units of	Equivalent to
P20	Handshake mode	0, 1, 2, 3, 4 or 5	-	see below

XON and XOFF software handshaking and transmission errors can be reported back via the RS232 interface, depending on the state of parameter P20.

The options are:

- P20='0', '2' or '4' no software handshaking
- P20='1' software handshaking enabled and errors reported as soon as possible (depending upon SV-M/S interface activity)
- P20='3' software handshaking enabled, but no errors reported
- P20='5' software handshaking enabled with errors reported immediately

Errors will be reported as:

E_{xx}<CR><LF>

where xx is the error number.

No.	Description	Programmable Range	Units of	Equivalent to
P21	Error/stop mode	0, 1 or 2	-	see below

When an error or a stop condition occurs, requiring the motor to be stopped, parameter P21 determines the way the drive is de-energised and braking is applied. An error situation is treated in a different manner to a stop situation, consequently a stop will override error stop settings.

In a stop situation dynamic braking may be used to bring the motor to rest as quickly as possible. The dynamic brake is controlled via the standby contact (PLC O/P A1), depending upon the state of P37. When P37='5' A1 will be set to '0' by a stop condition, which can be used to apply the dynamic brake. Parameter P21 modifies the way the standby contact opens.

The possible options are described below:

To stop the motor due to certain error conditions occurring

P21='0' A1='0' immediately the error or stop condition occurs, but the drive is not de-energised

P21='1' A1='0' when the error condition occurs and the drive is de-energised

If a stop condition occurs whilst P21='1' the behaviour is modified as follows:

P21='1' A1='0' within 50ms of the stop condition occurring or at a time defined by parameter P43

P21='2' A1='0' and the drive is de-energised immediately the error or stop condition occurs

For more information on motor braking see **Braking Control**.

No.	Description	Programmable Range	Units of	Equivalent to
P22	I/P 2 sensitivity	0 or 1	-	'0'=x1 '1'=x0.1

The sensitivity of analogue input 2 can be reduced by a factor of 10 by setting parameter P22 to '1'.

No.	Description	Programmable Range	Units of	Equivalent to
P23	Stiffness	1 to 999	%	-

The stiffness setting required depends upon how quickly you need the drive to respond to programmed speed changes. The greater the stiffness of a drive the quicker and more accurate is the speed regulation. Too much stiffness will cause the closed loop control system to oscillate whilst too little will result in poor speed regulation. The default setting is 100% which should be 'tuned' to suit the target application.

No.	Description	Programmable Range	Units of	Equivalent to
P24	Damping	1 to 999	%	-

Damping determines the nature of the response to a transient speed change. Too much damping produces a sluggish response, whilst too little results in overshoot and oscillations. It is usual to adjust for 'critical damping' which gives the fastest response without overshoot. The response may be monitored using an oscilloscope connected to X8/10. The default setting is 100% which should be 'tuned' to suit the target application.

No.	Description	Programmable Range	Units of	Equivalent to
P25	Frequency compensation	0 or 1	-	'0'=450Hz '1'=150Hz

Frequency compensation is used to suppress mechanical resonance in the system. The default setting is 450Hz.

No.	Description	Programmable Range	Units of	Equivalent to
P26	Bandwidth	0 or 1	-	'0'=400Hz '1'=200Hz

Bandwidth refers to the bandwidth of the tach filter used to limit wide frequency variations in the resolver feedback signal. The default setting is 400Hz.

No.	Description	Programmable Range	Units of	Equivalent to
P28	Encoder resolution	0 or 1	-	'0'=512 pulses/rev '1'=1024 pulses/rev

Parameter P28 is used to set the simulated encoder resolution to 512 pulses or 1024 pulses per revolution (pre-quadrature).

No.	Description	Programmable Range	Units of	Equivalent to
P29	Index pulse location	0 to 360	degrees	0° - 360°

The reference index pulse, generated by the encoder simulation circuit, can be displaced from its 0° position by up to 360°. Although the displacement is specified in degrees, the resolution is approximately 1.4° (i.e. the nearest of 256 possible locations will be selected).

No.	Description	Programmable Range	Units of	Equivalent to
P30	Manual offset	1 to 199	~mV	±90mV (100 ≡ 0mV)

Manual offset is used to correct for speed controller offsets which cause the motor shaft to slowly rotate CW or CCW when the speed reference is set to zero. The parameter should be increased to correct CCW drift and decreased to correct CW drift. The default value is 100. Before making the adjustment you must ensure the drive is in the 'run' mode and that the speed reference value is zero.

No.	Description	Programmable Range	Units of	Equivalent to
P31	Auto offset	0 or 1	-	'0'=not active '1'=offset auto corrected

By setting parameter P31 to '1' the offset of the speed controller can be automatically corrected. In practice, auto offset can be used to correct large offsets, with the fine adjustment being made via parameter P30. The adjustment has auto timeout; unless the adjustment is made within 7 seconds error E5 will be reported and the drive will de-energise. Before making the adjustment you must ensure the drive is in the 'run' mode and that the speed reference value is zero.

No.	Description	Programmable Range	Units of	Equivalent to
P32	Fine scaling adjustment	90 to 110	-	see below

A fine adjustment of the actual speed of the motor for a given input voltage can be made using parameter P32. To perform this adjustment the speed of the motor will need to be monitored using an external instrument. The default value is 100.

If parameter P15 (speed limit) is changed this adjustment will need to be repeated.

No.	Description	Programmable Range	Units of	Equivalent to
P33	Velocity/Torque selection	0 or 1	-	'0'=velocity control '1'=torque control

The drive can be switched between velocity control and torque control modes by setting parameter P33 as shown above. Note: this setting can be overridden by input E3 or parameter P36.

No.	Description	Programmable Range	Units of	Equivalent to
P34	Software disable	0 or 1	-	'0'=de-energise '1'=energise

The drive may be energised or de-energised by setting parameter P34 as shown above.

No.	Description	Programmable Range	Units of	Equivalent to
P35	Allow external disable	0 or 1	-	'0'=no external disable '1'=external disable

Parameter P35 allows the external disable input E1 to enable or disable the drive as shown above.

No.	Description	Programmable Range	Units of	Equivalent to
P36	PLC digital input function control	2, 3, 4 or 5	-	see below

Parameter P36 controls the function of binary inputs E3 and E4

P36	Use of Inputs E3 and E4
0	E3 and E4 have no function.
1	E3 and E4 have no function.
2	The E3 input has the same function as E3 when P36=3, as described below. The auto offset (P31) function can be activated via input E4. E4=0 no function E4=1 auto offset routine activated The drive will respond to the leading edge of input E4 and will run the auto offset routine if the input remains active for more than 24ms with the drive in the run state.
3	Velocity/Torque selection (P33) can be made via input E3. E3=0 velocity control is selected and analogue inputs AN1 & AN2 are active E3=1 torque control is selected and only analogue input AN1 is active In the torque control mode input E4 can be used to select the torque limit. E4=0 torque output limited to the value held in P16 E4=1 torque output limited to the value held in P38
4	Inputs E3 and E4 can be used as direction dependent limit switch inputs. E3=1 CCW limit switch reached E4=1 CW limit switch reached
5	Input E3 can be used to switch between parameter sets. E3=0 parameter set 0 active E3=1 parameter set 1 is active Parameters sets can only be changed at zero speed. The time taken to change over is 200ms. E4 has no function at P36=5.
6	Inputs E3 and E4 can be used as direction dependent limit switch inputs. E3=0 CCW limit switch reached E4=0 CW limit switch reached

Table 5-1. Control of Inputs E3 & E4 by Parameter P36

No.	Description	Programmable Range	Units of	Equivalent to
P37	Output A1	0 to 6 & 1xx	-	see below

Parameter P37 controls the PLC output A1 which can be used to signal various drive error conditions or to control the dynamic braking of the motor via the standby contact.

P37	Function signalled by A1
0	A1=0
1	A1=1 active condition
2	A1=1 if errors E57, E58, E59 or P31=1 occurs - see note 1
3	A1=0 if errors E57, E58, E59 or P31=1 occurs - see note 1
4	A1=0 if errors E57, E58 or E59 occurs - see note 1
5	A1=0 When the power output stage is disabled following an error or stop A1 will be made inactive - see note 2
6	A1=0 This signals the same condition as P37=5, but the change of state of A1 will be delayed by the time assigned to parameter P43
1xx	A1=0 when an error xx occurs For example setting P37 to 147 (error number 47) will cause A1=0 when the +24V supply becomes low (the meaning of error 47)

Table 5-1. Control of Output A1 by Parameter P37

Note 1: E57 DC bus voltage is too low
E58 Temperature greater than 75°C
E59 Duty cycle of power output stage exceeds 90%
P31=1 auto offset is active

Note 2: This can be used to indicate which drive suffered an error or stop

No.	Description	Programmable Range	Units of	Equivalent to
P38	Alternative peak torque	0 to 400	%	-

Alternative peak torque parameter P38 is a second value for the maximum torque parameter P16. It sets the maximum allowable motor current as a percentage of the nominal motor current. The maximum current cannot exceed the peak current set by P7. The default setting is 200%. The selection of P16 or P38 is made by setting P36=3 and using input E4 (E4=0 gives P16, E4=1 gives P38).

No.	Description	Programmable Range	Units of	Equivalent to
P42	Braking contactor operating time	0 to 500	10ms	0 - 5s

Parameter P42 defines the time delay between the drive being de-energised and the holding brake being applied.

Note: the holding brake can only be applied once the motor has stopped.

No.	Description	Programmable Range	Units of	Equivalent to
P43	Stop delay time	0 to 900	10ms	0 - 9.00s

Parameter P43 defines the time delay between the stop becoming active and the drive becoming de-energised.

No.	Description	Programmable Range	Units of	Equivalent to
P44	Override undervoltage error during installation	0 or 1	-	'0'= not active '1'= installation operation

During installation the drive may be required to be run at a reduced voltage whilst commissioning takes place. Error E57, which normally reports a low voltage warning and de-energises the drive can be inhibited by setting P44='1' during the installation process.

Caution: Remember to disable this function once the drive is installed.

No.	Description	Programmable Range	Units of	Equivalent to
P68	Torque loop bandwidth	0 or 1	-	'0'= normal bandwidth '1'= increased bandwidth

By setting parameter P68 to '1' the torque loop bandwidth can be increased by a factor of 1.6.

No.	Description	Programmable Range	Units of	Equivalent to
P81	Minimum load inertia ratio	0 to 999	-	99.9 : 1

The drive automatically calculates the main servo tuning parameters to give a stable system. However, to do this you will need to input the minimum ratio of load inertia compared to motor inertia. This value is calculated as follows:

$$P81 = \frac{\text{Minimum external load inertia}}{\text{Motor inertia}} \times 10$$

Example

For a minimum load equal to the motor inertia, P81=10.

For a maximum load of 5 times the motor inertia, P82=50.

The range of values which can be entered is 0 to 999, equivalent to inertia ratios up to 99.9:1. Please see Table 2-1 & 3-1 for motor moments of inertia. Do not include the motor inertia with the external load inertia in these calculations.

No.	Description	Programmable Range	Units of	Equivalent to
P82	Maximum load inertia ratio	0 to 999	-	99.9 : 1

The drive automatically calculates the main servo tuning parameters to give a stable system. However, to do this you will need to input the maximum ratio of load inertia compared to motor inertia. This value is calculated as follows:

$$P82 = \frac{\text{Maximum external load inertia}}{\text{Motor inertia}} \times 10$$

See the example associated with parameter P81 description.

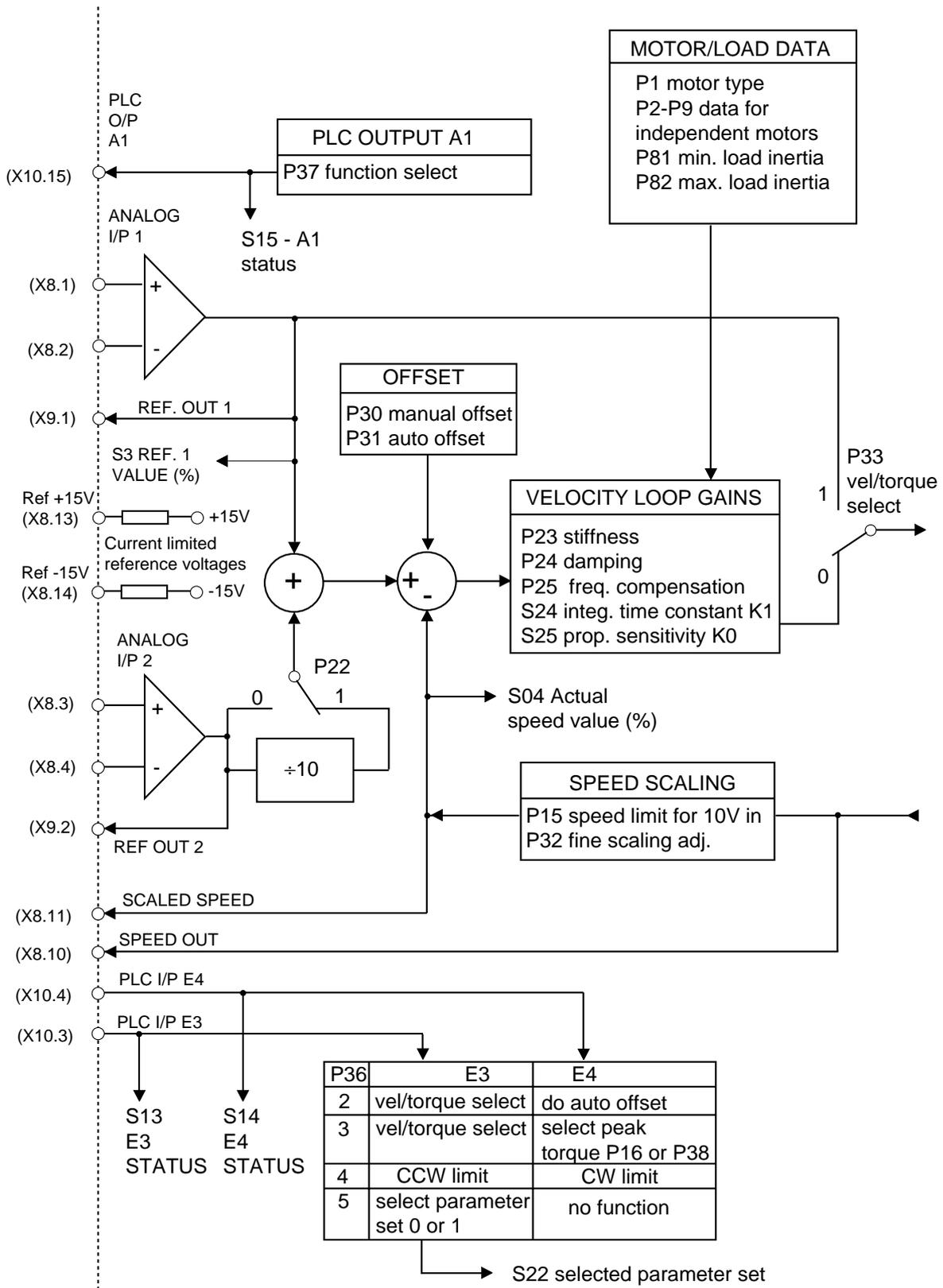


Figure 5-8. SV-M/S Functional Diagram 1

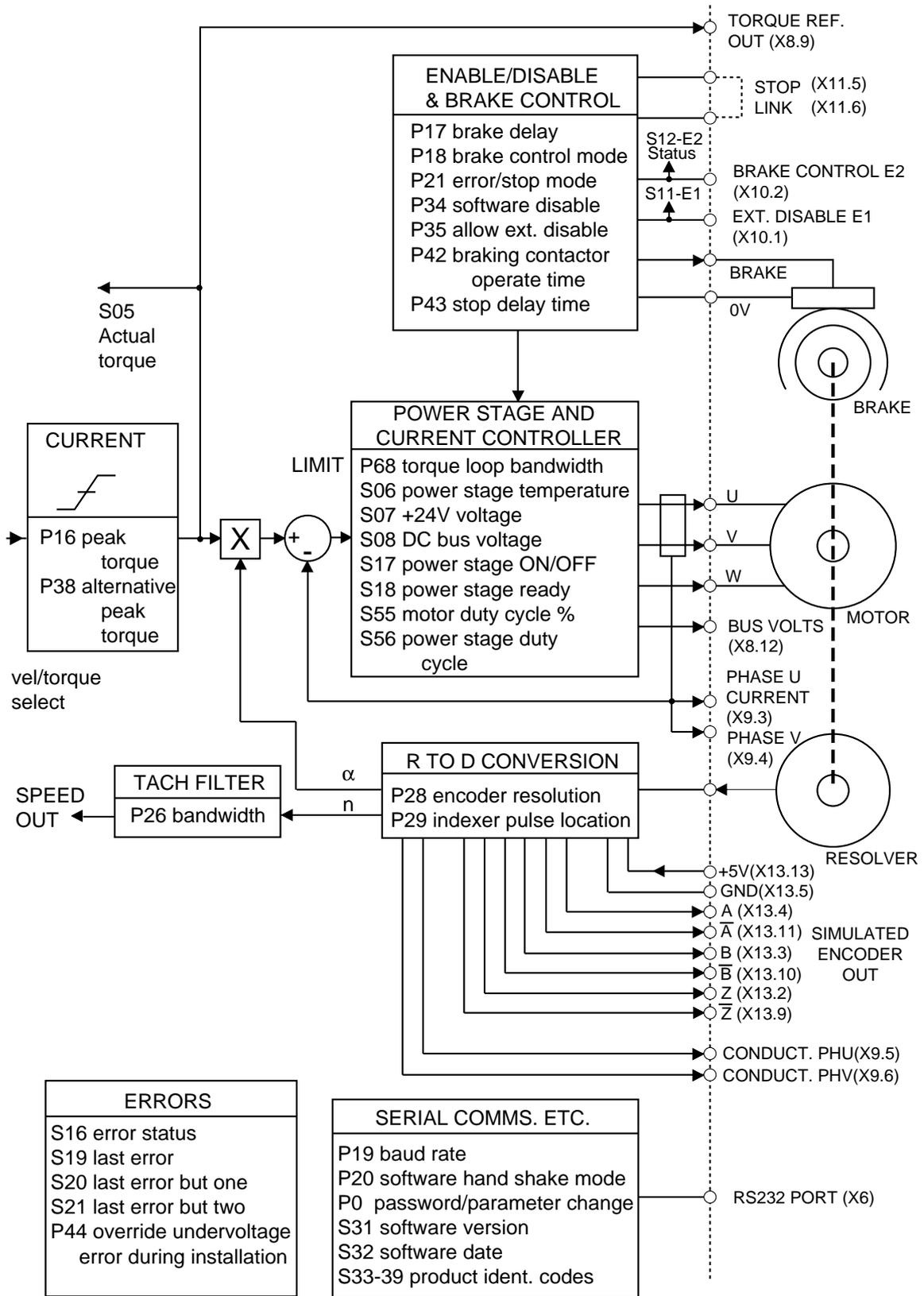


Figure 5-9. SV-M/S Functional Diagram 2

Software Parameters Listed by Function

This section groups related parameters by function and defines the default state of the parameter, where applicable.

Configuration of the controller

P0 Password/Parameter change (default - none)

Velocity/Torque selection

P33 Velocity/Torque selection (default - '0' velocity control)

Energise/De-energise

P34 Software disable (default - '1' drive enabled)

Motor parameters

- P1 Motor number (default - none)
- P2 No. motor poles (default - none)
- P3 Voltage constant @ 1000rpm (default - none)
- P4 Motor moment of inertia (default - none)
- P5 Nominal speed (default - none)
- P6 Nominal current (default - none)
- P7 Peak current (default - 300%)
- P8 Peak current duration (default - 300ms)
- P9 Stator inductance (default - none)

Moment of inertia of load

- P81 Min. load inertia (default - zero)
- P82 Max. load inertia (default - 5 x motor inertia)

Limit parameters

- P15 Speed scaling (default - 100% nominal speed)
- P16 Max. torque (default - 200% rated torque)
- P38 Alternative peak torque (default - 200% rated torque)

Performance optimisation parameters

- P23 Stiffness (default - 100%)
- P24 Damping (default - 100%)
- P25 Freq. compensation (default - '0' 450Hz)
- P26 Bandwidth (default - '0' 400Hz)
- P68 Torque loop bandwidth (default - '0' optimum)

Adjustment parameters

- P30 Manual offset (default - 100, equivalent to no offset)
- P31 Auto offset (default - '0' not active)
- P32 Fine scaling adj. (default - 100%)
- P22 I/P 2 sensitivity (default - '0' no reduction)

Installation parameter

- P44 Override undervoltage error during installation (default - '0' not active)

Encoder simulation

- P28 Encoder resolution (default - '0' 512 pulses/rev)
- P29 Indexer pulse location (default - 0° no shift)

Holding brake operation

- P17 Brake delay (default - no delay)
- P18 Brake control (default - '0' external)
- P35 Allow external disable (default - none)

Dynamic brake operation or stop operation

- P21 Error/stop mode (default - '0' controlled braking)
- P42 Braking contactor delay time (default - 100ms)
- P43 Stop delay time (default - no delay)

E3 and E4 input function

- P36 PLC function control (default - '0')

Output A1 function

- P37 Function select (default - '5')

Serial interface control

- P19 Baud rate (default - '1' 9600 baud)
- P20 Handshake mode (default - none)

Status Values

Status Number	Meaning	Comment
S03	Ref. 1 value	Reference value 1, measured in % 100% = 10V
S04	Actual speed	Actual speed value in % when P15=100 100% is equivalent to the nominal speed
S05	Actual torque	Actual torque produced as a percentage value of the rated motor torque
S06	Power stage temp.	In degrees Celsius. S06=85 or greater will report error E39
S07	+24V voltage	Reported directly in volts
S08	DC bus voltage	Reported directly in volts 70V to 999V
S11	E1 status (external disable)	'0' E1 not active '1' E1 active
S12	E2 status (brake control)	'0' E2 not active '1' E2 active
S13	E3 status	'0' E3 not active '1' E3 active
S14	E4 status	'0' E4 not active '1' E4 active
S15	O/P A1 status	'0' A1 not active '1' A1 active
S16	Error status	'0' no error '1' error
S17	Power stage ON/OFF	'0' ON '1' OFF
S18	Power stage ready	'0' not ready '1' ready
S19	Last error	-
S20	Last error but one	-
S21	Last error but two	-
S22	Selected parameter set	'0' parameters 0 selected '1' parameters 1 selected
S24	Integ. time constant K1	Displayed as ten times its actual value
S25	Proportional sensitivity K0	Displayed as ten times its actual value

Status Values Continued

S31	Software version	Version number
S32	Software date	Program date, can only be read using the parameter editor
S33	Order	Order number (6 figures)
S34	Part	Part number (4 figures)
S35	Version	-
S36	Language	'0'
S37	Controller characteristic	SVP100M: 80 SV0200M: 85 SV0500M: 170 SV1500M: 500 SV2500S: 4 SV4500S: 6 SV8500S: 5
S38	Device family	'00'
S39	Device	COMPAX E: '0' COMPAX M: '1' SV-M/S: '9'
S55	Duty cycle of motor	>90% generates error E59 >100% generates error E53
S56	Duty cycle of power output stage	>90% generates error E59 >100% generates error E53

Section 6. Maintenance & Troubleshooting

Maintenance

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

Motor

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. Do not attempt to stretch or force the cable around tight bends.

Drive

Check that the drive is free of loose particles and has a free flow of air over its heatsink. Where a fan is fitted, make sure it is operating and blowing air over the entire length of the heatsink.

Check the security of ground connections made to the drive.

Troubleshooting SV-M Drives

The SV-M has two levels of error reporting, the first level uses the green 'Ready' LED and the red 'Error' LED, mounted on the front panel of the drive's power supply. The second level uses the drive front panel three character 7-segment display to report an error number which can be decoded using the list of error codes given in Table 6-2.

Please take note of the warning given at the beginning of this User Guide. Motion control equipment is capable of making rapid unexpected movements of high force, especially during the development of controller programs and the commissioning of equipment.

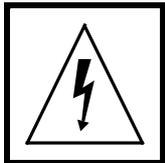
Front Panel LEDs

You can diagnose major drive problems by checking the state of the red and green front panel LEDs of the NMD power supply. Table 6-1 lists the possible errors associated with the state of the 'Error' and 'Ready' LEDs. Normal operation is indicated by the red LED being OFF and the green LED permanently ON, showing the drive is ready for operation.

LED Error Codes

Red 'Error' LED	Green 'Ready' LED	Possible Error
OFF	ON	No error
ON	OFF	24V missing or heat sink temperature too high Logic voltage error (drop in 24V supply or faulty device) Note: stop is set to off and the stand-by contact is released
ON	ON	Ballast circuit overload Undervoltage (<100V DC or <80V AC)

Table 6-1. NMD Front Panel LED Error Diagnosis



WARNING - The red LED will not illuminate if the 24V DC control voltage is not available.

Troubleshooting SV Drives

Display Errors

Errors occurring within the drive will be reported via the front panel display as 'E<xx>' numbers, where <xx> indicates the nature of the error. Refer to Table 6-2 for diagnosis of display error codes.

Note the majority of errors will de-energise the drive when they occur, but errors 'E58', 'E59' and 'E60' will be reported without causing the drive to be de-energised.

Once you have discovered why the error was reported and have taken corrective action the error may be reset by pressing the front panel 'Enter' key. Error types 'E58', 'E59' and 'E60' can be reset by pressing the front panel '+' key. Errors which cause the drive to be de-energised may also be reset by taking input E1 'high' again to re-energise the drive.

If you experience a hardware error (E35) this may only be reset by re-cycling the drive power.

If you are operating the drive via the serial interface, errors can be acknowledged by sending a 'q' character over the RS232 link.

Display Error Types

Error Number	Meaning	Corrective Action
E01	incorrect configuration	check parameters
E05	offset error	adjust offset or examine reference value
E24	speed too high	examine reference value
E25	Commanded speed is too high	Reduce commanded speed
E35	hardware error - will require a Power ON reset	check electrical connections and cable screening
E36	Hardware error, speed too high or commanded speed too high	Check speed & hardware - can only be reset by cycling the 24V supply
E38	High supply voltage	reduce mains voltage or reduce brake energy
E39	power output stage over temperature	check programmed values of acceleration time or provide extra cooling
E41	control output stage problem	check for motor/motor cable earth fault
E44	positive auxiliary voltage out of tolerance or "enable link missing at X3" *	check X8/13, "ensure Enable link is made at X3" *
E45	negative auxiliary voltage out of tolerance	check X8/14
E46	+24V supply too high	check 24V PSU
E47	+24V supply too low	check 24V PSU
E48	motor reports overtemperature condition	check motor type and motor/resolver cable
E49	drive de-energises	check torque demand or brake release time
E50	negative reference value for AN1 when P36='4' and E3='1'	reverse sign of reference value

* SV-S drives only

**Table 6-2. Front Panel Display Error Diagnosis
(Continued over the page)**

E51	positive reference value for AN1 when P36='4' and E4='1'	reverse sign of reference value
E53	motor overload	check application requirements
E54	Speed overshoot is too high	Increase damping
E55	external stop	check system, re-start
E57	DC bus voltage too low	check mains input
E58	temperature greater than 75°C - will require a +key reset	increase acceleration times or provide extra cooling
E59	duty cycle of power output stage exceeds 90% - will require a +key reset	reduce duty cycle
E60	parameter sets not changed - will require a +key reset	at P36='5' the parameter sets can only be changed with E3

Table 6-2. Front Panel Display Error Diagnosis (continued)

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, but only by prior arrangement with your supplier. Existing UK customers who purchase equipment directly from Digiplan should contact Poole for further information (contact numbers are at the front of this User Guide).

Appendix A. Motor and Resolver Cables

Introduction

Depending upon the motor being used, you will require one of the following motor and resolver cables listed in Figure A-1.

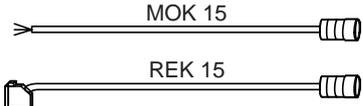
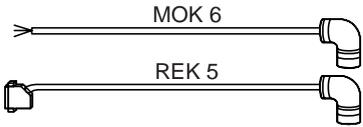
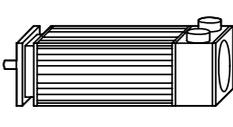
CABLE TYPES	MOTOR
 <p>MOK 15 REK 15</p>	 <p>HDX055.. HDX070..</p>
 <p>MOK 6 REK 5</p>	 <p>HDX092.. HDX115..</p>
 <p>MOK 21 REK 14</p>	 <p>HDX142.. HBMR190</p>

Figure A-1. Motor and Resolver Cables

CAUTION - HIGH TEMPERATURE

The motor case can reach a temperature of greater than 100°C (212°F).

Motor Cables

MOK 15/.. Cable

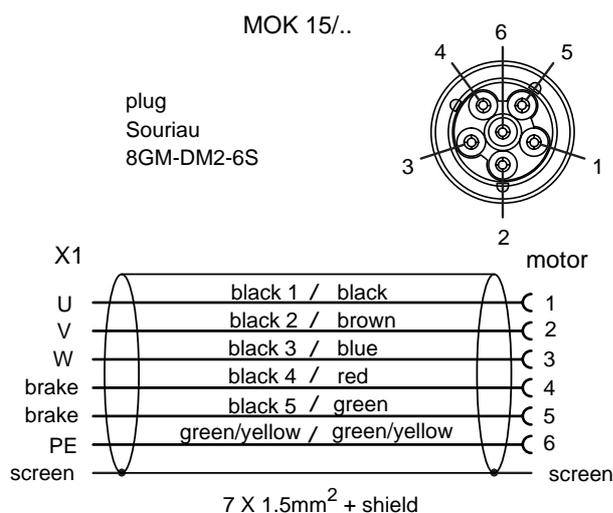


Figure A-2. MOK 15 Motor Cable

MOK 6/.. Cable

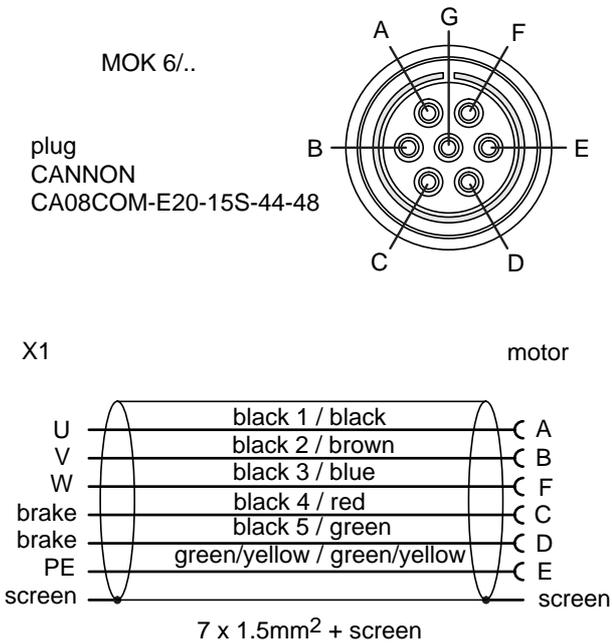


Figure A-3. MOK 6 Motor Cable

MOK 21/.. Cable

The MOK 21/.. motor cable is the same as the MOK 6/.. cable, but the conductors are increased to 7 x 2.5mm² to give a current capability of 18.9A.

Motor Connections

Motors supplied with MOK 6/.. and MOK 21/.. size cables are connected to the motor via small DIN rail connectors, mounted inside the motor's connection box. The connections required are shown in Figure A-4.

When removing the cover of the motor's connection box, take care not to disturb the thin sealing gasket.

Note: Even if a motor holding brake is not fitted the brake cables (4 & 5) must still be fitted, to prevent accidental contact with the main motor connections.

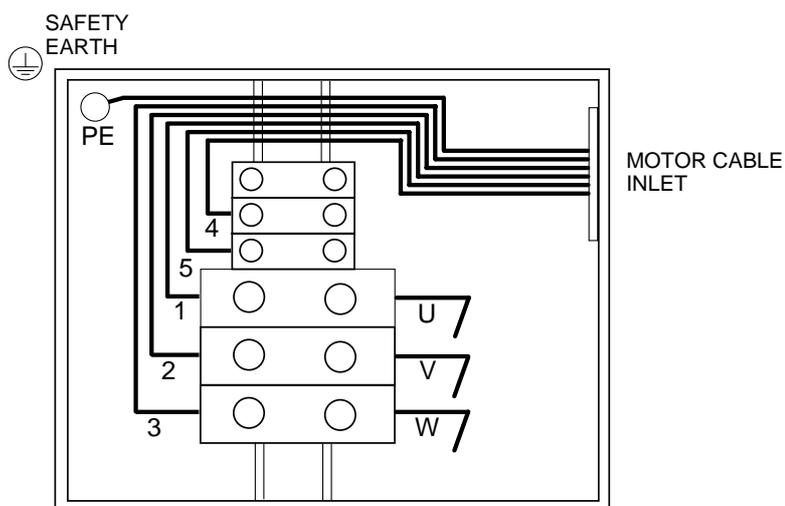


Figure A-4. Motor Connections

Gland Assembly

The MOK 6/.. and MOK 21/.. cables are supplied with a cable gland to seal the motor inlet cable when it enters the motor's connection box. It is important that you assemble this gland correctly, positioning the canted coil spring over the exposed braided screen of the cable. Figure A-5 shows an exploded view of the gland assembly.

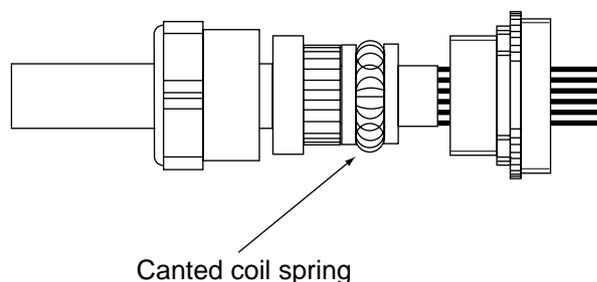


Figure A-5. Gland Assembly

Resolver Cables

REK15/.. Cable

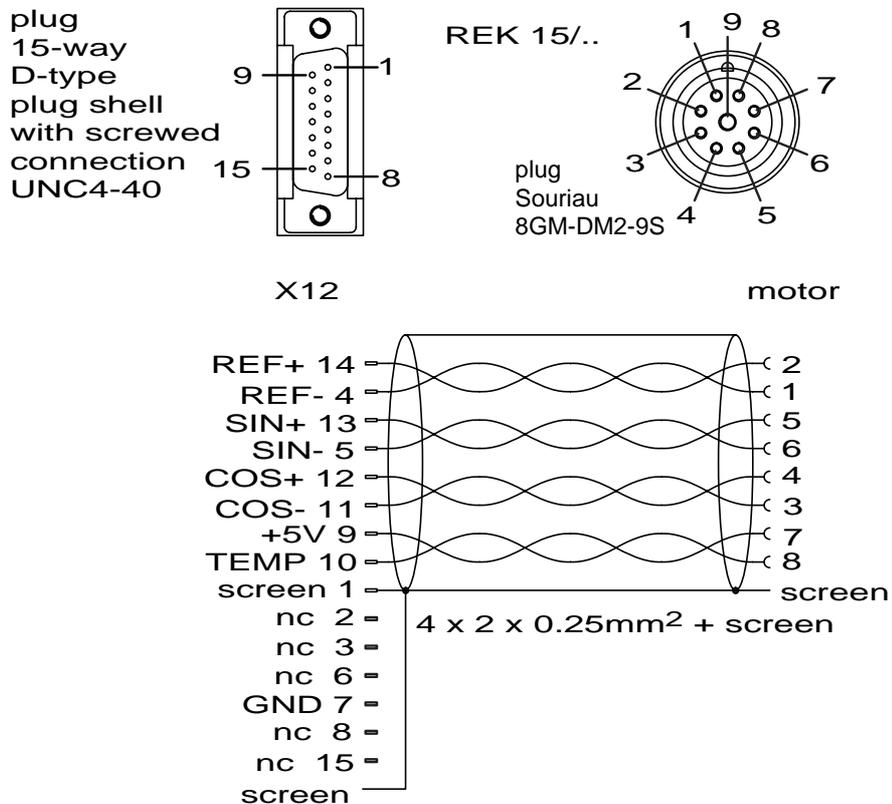


Figure A-7. REK 15 Resolver Cable

REK 5/.. Cable

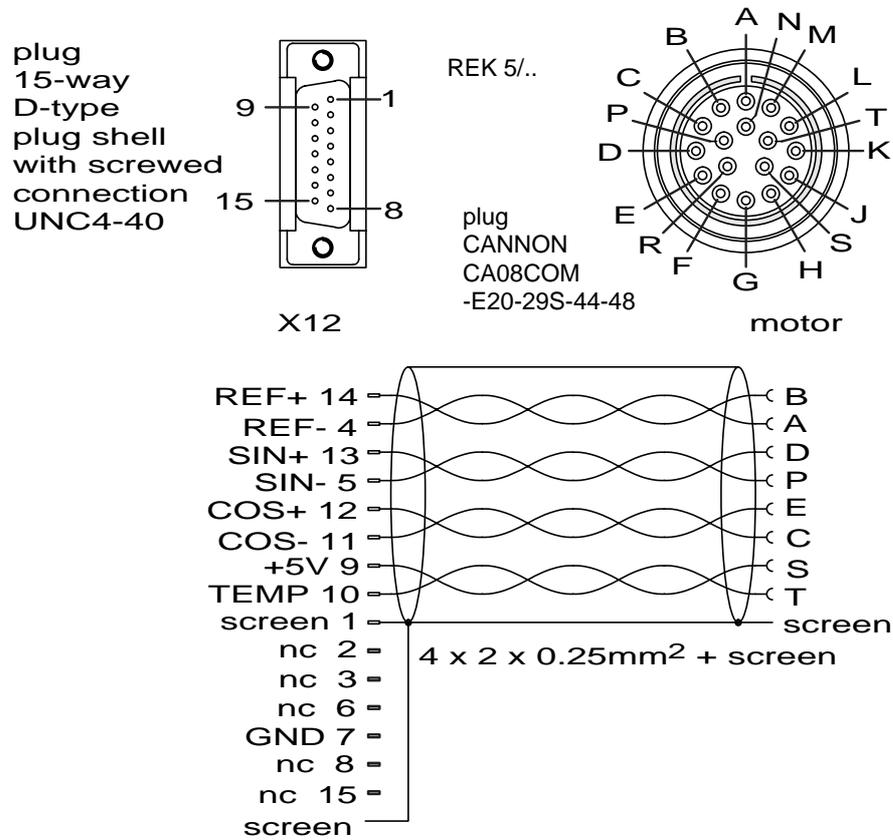


Figure A-8. REK 5 Resolver Cable

REK 14/.. Cable

Resolver cable REK 14/.. is the same as the REK 5/.. cable, but a straight-in-line plug is fitted at the motor end of the cable.

Appendix B. Use of the Parameter Editor

Introduction

Using the SV_PARA parameter editor, SV-M and SV-S parameter values can be edited on a PC. The parameter editor software also allows parameter values to be read from or written to the drive (via an RS232 link) and allows stored values to be printed.

Installation

SV_PARA is supplied on a 3.5 inch diskette and can be installed to your PC's C: drive as follows:

1. Inset the disk in the PC's A: drive and type: `install C:\{directory} /e<CR>`

Where {directory} is the required destination directory
The switch /e installs an English version or /d installs a German version

Running the Parameter Editor

To run the parameter editor software move to the disk/directory where it is loaded and type:

SV_PARA<return>

The software will generate the following menus and list of parameters:

File to process Transmit Settings Info

No	description	value		Display
SV Drive controller parameter V1.30				
22.11.96				
**** Motor data ****				
P1	: motor number	0		0
P2	: pole number	0		0
P3	: EMF[V/1000 rpm]	0	V	0
P4	: moment of inertia	0	kgmm ²	0
P5	: nominal speed	0	1/min	0
P6	: nominal current	0	mA	0
P7	: impulse current	0	%	0
P8	: impulse current time	0	ms	0
P9	: stator inductance	0	µH	0
**** main parameters ****				
p15	: speed limitation	1	1/min	100
P16	: maximum moment of inertia	200	%	200
P17	: brake delay	0		0

Controller SV Drive V1.3 Param | Motor: | SV_PARA V 1.30

Screen Description

As shown above, the display consists of an upper line called the operational field with five pull-down menus:

File
to process
Transmit
Settings
Info

The major part of the screen contains the parameter display section consisting of 4 columns.

|Parameter Number| Description| Value of parameter/Units| Front panel indicated value |

The last line consists of a status display indicating:

Controller type
Motor type
Software version number

Moving Around The Display

The SV_PARA software runs under the DOS operating system, using keyboard commands to move the cursor around the screen. Use the keyboard direction arrows to move between or up and down menus

i.e. (↑ ↓ ← →)

The arrows may also be used to move between <Help>, <OK> and <Cancel> selection buttons. Once an option is highlighted press RETURN to select.

Note: certain menu options may require ESCAPE to be pressed to return to the previous screen.

File Menu

The file menu has the following options:

- New allows you to choose a new parameter file for the entry of new parameter settings.

- Open.... allows you to load an existing parameter file. Existing parameter sets are displayed as *.rpa files which you can select and load.

- Save allows you to store the current set of parameters under the existing file name.

- Save as.... allows you to store the current set of parameters under a new file name.

- Print (Printer) - generates the printout via the computer LPT 1 port.

Print (File SV_PARA.OUT) - which is a formatted version of the 'Print File (Printer)', each page having a header with file name, date, number of pages etc. Note the print file exists in ASCII format allowing it to be exported to a standard word processing package.

End - allows you to quit the parameter editor, returning to a DOS prompt. When this option is selected a dialog box will be displayed asking if you wish to save the new parameter settings, assuming changes have been made.

To Process Menu

Parameters allows you to edit parameter values. As soon as the 'Parameters' selection is made a choice box appears allowing you to select the motor type. Once selected, parameters may be changed in the main body of the screen.

File-Info.... allows you to add text of your choice to describe the parameter list. Up to a maximum of 100 characters can be used. This information will be stored together with the edited parameter settings and can be printed out using 'Print file'. The present date and time can be inserted by pressing Ctrl+D or Ctrl+U.

Change Motor allows you to change the motor type by selecting the required motor from a multiple choice box.

Transmit Menu

Upload from Contr. is used for the transfer of parameters from the drive to the PC. If a character cannot be read, the software will make two further attempts before reporting a system error. Once all the parameters are loaded they may be edited.

Download to Contr. is used to transfer a parameter list from the PC to the active memory of the drive. All existing parameters within the active memory will be overwritten. As the download takes place each parameter will be re-read and compared with the original data. Any differences, other than rounding errors, will be reported via an error message and the transmission will be interrupted.

Note: following a download transmission error, the parameters in the drive active memory will be invalid and will need to be replaced i.e., a second download will be required.

Transmit acknowledge error - allows SV Drive errors to be acknowledged. This software acknowledgement of errors is the equivalent of pressing the front panel 'Enter' key for at least two seconds.

Transmit interface - is used to identify which PC serial port is to be used, COM1 or COM2, and what baud rate is to be used, 9600 or 4800.

Software version compatibility

If the software version of the downloaded parameter set does not match the SV Drive software, a warning dialog box will be displayed asking if the download should be abandoned.

Settings Menu

Parameter Typ... allows you to choose the version of software required and the controller type.

Release blocked fields allows certain fields in the parameter display to be unlocked e.g. P2 - P9. This option is password protected. The password is 620.

Info Menu

about SV_PARA... provides information about the SV_PARA software.

For example:

About SV_PARA

universal parameter editor

version 1.30
(c) 1996 Parker Hannifin

author: Heinz Kessler

<OK>

Editing Parameters

To change existing parameters you need to choose the 'Parameters' option in the 'To Process Menu'. Once this selection is made a dialog box will appear requesting you to choose the motor type required. Following selection of the motor type the main body of the parameter list can be edited.

The following keys can be used to move around the parameter list:

UP	to move up the list
DOWN	to move down the list
Home	to move to the beginning of the list
END	to move to the end of the list
PGUP	to move up one page of information
PGDN	to move down one page of information

The column labelled 'value' gives the physical value of a parameter. The column labelled 'display' shows the parameter as it will be displayed in the drive front panel LED display. Both columns can be edited (use TAB and SHIFT+TAB to switch between columns).

A change made in either the 'value' field or the 'display' field will update the corresponding 'value' or 'display' field entry upon leaving the changed field.

Parameter Types

Two types of parameters are used:

1. Floating point parameters are real numbers e.g. 76.46
2. Selection parameters can be allocated special discrete values i.e. 0 or 1 on the front panel display, which identify particular parameter settings i.e. P25 set to a '0' means a fixed value of 450Hz is selected for frequency compensation. When these discrete parameters are selected within the parameter editor the real values which relate to the '0' and '1' settings are displayed at the bottom of the screen and may be selected by toggling values using the space key.

Note the function of parameters that can be assigned a number of integer values (e.g. P36) are not able to be toggled in this manner. You will need to refer to the **Software Reference** section to determine the use of each number that can be assigned.

Appendix C. Motor and Resolver Alignment

Introduction

By making use of the signals appearing at pins 5 and 6 of connector X9, a resolver can be aligned with its motor. This procedure will be required if the motor or resolver are changed or if a motor/resolver combination is required other than the one normally supplied.

Initial Preparation

Before attempting to check the alignment, perform the following set-up:

1. Make sure the mains power to the drive is switched OFF.
2. Connect three 1k , 1W resistors to each motor phase winding as shown in Figure C-1.
3. Disconnect the main motor cable from the drive, but leave the resolver cable connected.
4. Provide the +24V DC supply to the drive's controller.
5. Set SV parameters P33=1 (torque control) and P44=1 (override undervoltage error during installation).
6. Provide a +5V signal across the AN1 differential input (X8 pins 1 & 2).
7. Arrange for the motor shaft to be driven at 50 rpm in either a CW (Clockwise direction) or CCW (Counter Clockwise) direction.

Procedure

This procedure allows you to check the alignment of the resolver relative to the motor. If the measurements indicate mis-alignment the angular setting of the resolver will need to be adjusted and re-checked by repeating this procedure.

1. With a +5V signal between X8/1 & X8/2 and theor turning CCW, use the oscilloscope to measure the voltage across the 'U' phase resistor (Vu). This voltage must be the same phase as the voltage appearing at the U-phase monitor ouput (X9/5). Also the voltage Vv must be the same phase as the voltage appearing at the V-phase monitor output (X9/6).

Note: What is important in this measurement is that both signals cross the 0-line at the same point i.e., both signals are in-phase.

2. The same phase relationships must be maintained when a negative 5V is applied at the input and the motor shaft is rotated in a CW direction.
3. Whilst the motor shaft is being rotated in a CW direction, check that the Tacho output voltage VT is positive with respect to ground.

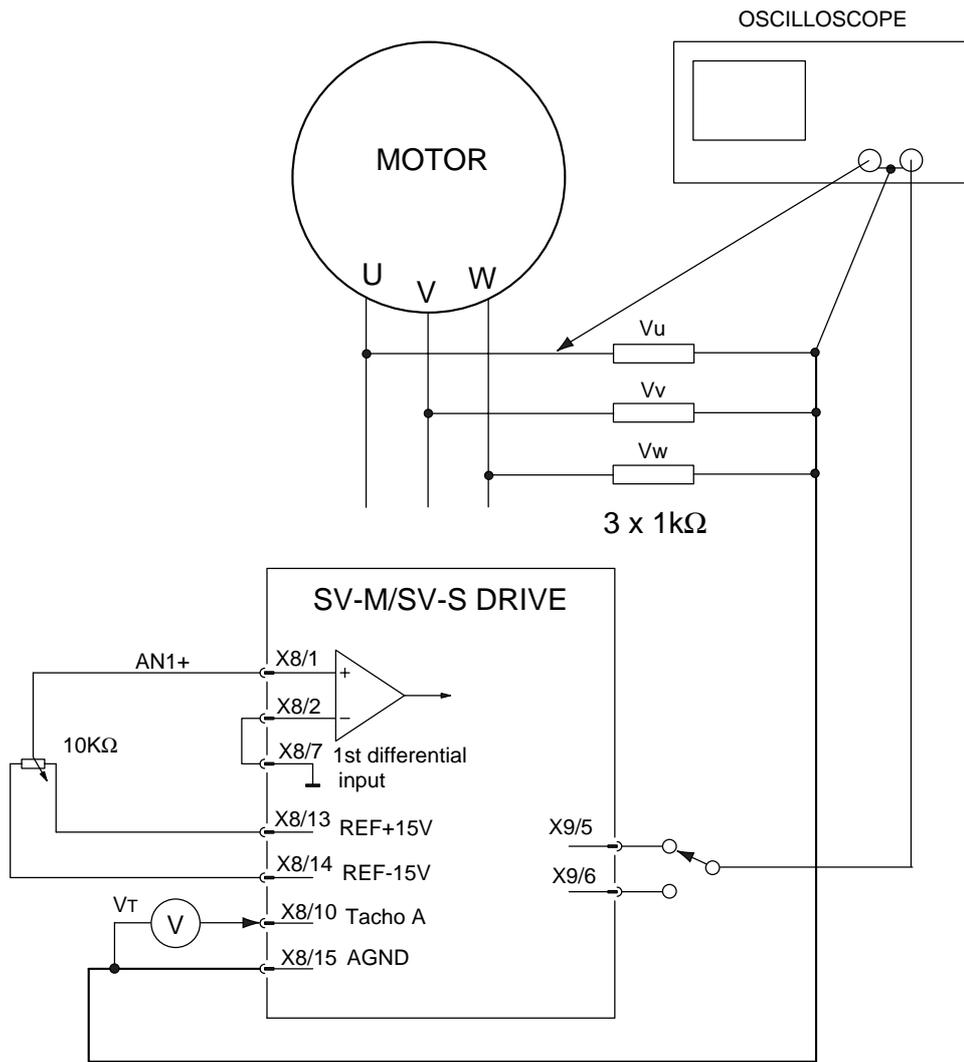


Figure C-1. Resolver Alignment Test Circuit

Index

- | | |
|--|--|
| <p style="text-align: center;">+</p> <p>+24V supply, 1</p> <p style="text-align: center;">2</p> <p>24V supply, 17
 24V supply current rating, 17
 24V supply filter, 42
 24V supply SV4500S/SV8500S,
 41</p> <p style="text-align: center;">A</p> <p>A1 output, 55
 A1 Output control, 60
 AC power connections, 2
 Allow external disable, 79
 Alternative peak torque, 82
 Analogue input circuit, 52
 Auto offset, 78
 Auxiliary supply, 41
 Auxiliary Supply Filter, 42
 Auxiliary Supply Wiring, 42</p> <p style="text-align: center;">B</p> <p>Back EMF, 72
 Backup parameter set, 66
 Ballast resistor connections for
 SV2500S, 34
 Ballast resistor connections
 NMD20, 15
 Ballast resistor dissipation NMD20,
 17
 Bandwidth, 77
 Baud rate, 75
 Brake control, 66, 75
 Brake delay, 67, 68, 74
 Brake operation, 67
 Brake release, 68
 Brake resistance calculation, 59
 Brake resistance power rating, 60
 Braking contactor operating time,
 82
 Braking time calculation, 60</p> | <p style="text-align: center;">C</p> <p>Cable gland, 99
 Cable rating, 38
 Cable size, 38
 Connectors & leads, 27
 Connectors & leads SV-M, 10
 Control board, 49
 Control bus termination, 22
 Control wiring, 50
 Current monitor scaling values, 55</p> <p style="text-align: center;">D</p> <p>Damping, 77
 De-energised startup, 24, 47, 65
 Differential input circuit, 52
 Dimensions of SV2500S, 30
 Dimensions of SV4500S &
 SV8500S, 32
 Dimensions of SV-M, 19
 Direction control, 51
 Display * symbol, 65
 Display functions, 64
 Drive Connector X10, 53
 Drive Connector X11, 43
 Drive Connector X13, 58
 Drive Connector X8, 50
 Drive Connector X9, 55
 Drive maintenance, 93
 Drive product range, 1
 Drive ratings, 4
 Dual differential input circuit, 52
 Dump circuit operating voltage, 35
 Dump connections for SV4500S &
 SV8500S, 35
 Dynamic brake control, 61
 Dynamic braking, 59</p> <p style="text-align: center;">E</p> <p>E4 input cct, 54
 Editing parameters, 107
 Editor screen, 103
 Electrical specification SV-M, 4, 21
 Electrical specification SV-S, 7
 EMC Filter 3-phase, 39</p> |
|--|--|

EMC filter installation
SV4500S/SV8500S, 37
EMC filter specification SV2500S,
36
EMC filter specification
SV4500S/SV8500S, 38
Emergency stop connections SV-
M, 14
Enable connection
SV4500S/SV8500S, 41
Encoder feedback, 58
Encoder resolution, 78
Error LED, 50
Error types list, 95
Error values, 63
Errors, 94
Exchanging parameter sets, 66
External brake control SV2500S,
40

F

Factory settings, 66
File menu, 104
Fine scaling adjustment, 79
Frequency compensation, 77
Front panel operation, 63
Fuse rating NMD10, 14
Fuse rating NMD20, 14
Fuse ratings for SV2500S, 33
Fuse ratings for SV4500S &
SV8500S, 35
Fuse requirements, 39

G

Gland assembly, 99

H

Handshake, 75
Hardware error (E35), 95
Holding brake, 67

I

I/O & control for all drives, 49
I/O Circuits, 54
I/P 2 sensitivity, 76
Index pulse location, 78
Info menu, 106
IT mains supply, 2

L

LED error codes, 94
LED operation, 93
LEDs on front panel, 50
LEDs Ready & Error, 50
Locking front panel controls, 25
Locking front panel controls SV-S,
48

M

Mains connection, 2
Mains supply fuses, 35
Maintenance, 93
Manual offset, 78
Maximum load inertia ratio, 84
Maximum torque, 74
MCB rating, 35
Minimum load inertia ratio, 83
MOK 15/ cable, 97
MOK 21/ cable, 98
MOK 6/ cable, 98
Motor & brake connections
SV2500S, 39
Motor cables, 97
Motor connections, 39, 99
Motor connections
SV4500S/SV8500S, 40
Motor connections SV-S, 45
Motor maintenance, 93
Motor parameters, 72
Motor parameters SV-S, 28
Motor type selection table SV-S,
28
Motor types, 71
Mounting of SV2500S, 29
Mounting of SV-M drives, 20

N

NMD power supplies, 12
NMD supply capacitance, 16
NMD supply characteristics, 13
Nominal current, 73
Nominal speed, 72

O

Operation and control, 63
Output A1, 81

P

Parameter descriptions, 71
 Parameter editor, 103
 Parameter set changes, 65
 Parameter set identification, 66
 Parameter sets 0 and 1, 65
 Parameter types, 107
 Parameter values display, 65
 Parameters listed by function, 88
 Password, 24, 71
 Password SV-S, 47
 Peak current, 73
 Peak current duration, 73
 PLC digital input function control, 80
 Pole count, 72
 Power cable SV-M, 13
 Power connection options, 2
 Power connections for SV2500S, 33
 Power connections for SV4500S & SV8500S, 34
 Power connections SV-M, 22
 Primary parameters, 71
 Process menu, 105
 Product description, 1
 Product range SV-M, 9
 Programming via front panel, 64
 Pull-down menus, 104
 Push-Button controls, 64

R

Readiness contact rating, 14
 Ready LED, 50
 REK 14/ cable, 101
 REK 15/ cable, 100
 REK 5/ cable, 101
 Resolver cables, 100
 Resolver connections, 57
 Returning the system, 96
 Ring terminal connections, 38
 Rotor moment of inertia, 72
 RS232 Connector X6, 56

S

Scaled speed output, 52
 Secondary parameters, 71
 Settings menu, 106
 Shipping list SV-S, 27

Simulated encoder feedback, 58
 Software compatibility, 106
 Software disable, 79
 Speed control inputs, 51
 Speed controller, 51
 Speed output, 51
 Speed scaling, 74
 Startup, 24
 Stator inductance, 73
 Status values, 63, 90
 Status values display, 65
 Stiffness, 77
 Stop delay, 82
 Stop mode, 76
 Stop wiring for NMD supplies, 15
 Stop wiring SV-M, 14
 Stop wiring SV-S, 43
 Surge protection, 39
 SV2500S drive, 29
 SV4500S drive, 31
 SV8500S drive, 31
 SV-M Installation, 9
 SV-M PSU ratings, 5
 SV-M PSU Specification, 4
 SV-M series, 1
 SV-S Drive types, 27
 SV-S drives, 29
 SV-S function diagram, 86
 SV-S installation, 27
 SV-S series, 1
 SV_PARA, 10, 28
 SV_PARA, 103
 SV_PARA installation, 103

T

Test pre-installation, 23
 Test pre-installation SV-S, 44
 Testing the SV-M, 24
 Testing the SV-S, 47
 Three phase power connections, 2
TN mains supply, 2
 Torque controller, 51
 Torque loop bandwidth, 83
 Transmit menu, 105
 Troubleshooting SV-M drives, 93

U

Undervoltage override, 82
 User guide number, 11, 28

User I/O connectors, 49

W

V

Wire size, 38

Wire voltage rating, 38

Velocity/Torque selection, 79
