



**EUROTHERM  
DRIVES**

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# 584S Frequency Inverter

## Product Manual

**COMPATIBLE WITH VERSION 6 SOFTWARE**

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## WARRANTY

Eurotherm Drives warrants the goods against defects in design, materials and workmanship for the period of 12 months from the date of delivery on the terms detailed in Eurotherm Drives Standard Conditions of Sale IA058393C.

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## INTENDED USERS

This manual is to be made available to all persons who are required to configure, install or service the equipment described herein or any other associated operation.

## Warnings and Instructions

### GENERAL WARNINGS



#### **Warning**

Only qualified personnel who thoroughly understand the operation of this equipment and any associated machinery should install, start-up or attempt maintenance of this equipment. Non-compliance with this warning may result in personal injury and/or equipment damage.

Never work on any control equipment without first isolating all power supplies from the equipment.

The drive motor must be connected to an appropriate safety earth. Failure to do so presents an electrical shock hazard.

This equipment contains high value capacitors. Allow five minutes for capacitors to discharge prior to removing equipment covers. Failure to do so presents an electrical shock hazard.



#### **Caution**

This equipment was tested before it left our factory. However, before installation and start-up, inspect all equipment for transit damage, loose parts, packing materials etc.

This product conforms to IP20 protection. Due consideration should be given to environmental conditions of installation for safe and reliable operation.

Never perform high voltage resistance checks on the wiring without first disconnecting the product from the circuit being tested.



#### **Static Sensitive**

This equipment contains electrostatic discharge (ESD) sensitive parts. Observe static control precautions when handling, installing and servicing this product.

**THESE WARNINGS AND INSTRUCTIONS ARE INCLUDED TO ENABLE THE USER TO OBTAIN THE MAXIMUM EFFECTIVENESS AND TO ALERT THE USER TO SAFETY ISSUES**

**APPLICATION AREA:** Industrial (non consumer) Motor speed control utilising AC induction or synchronous motors.

**PRODUCT MANUAL:** This manual is intended to provide a description of how the product works. It is **not** intended to describe the apparatus into which the product is installed.

This manual is to be made available to all persons who are required to design an application, install, service or come into direct contact with the product.

**APPLICATIONS ADVICE:** Applications advice and training is available from Eurotherm Drives Ltd.



**INSTALLATION:** Ensure that mechanically secure fixings are used as recommended.

Ensure that cooling and air flow around the product are as recommended.

Ensure that cables and wire terminations are as recommended and clamped to required torque.

Ensure that the installation and commissioning of this product are carried out by a competent person.

Ensure that the product rating is not exceeded.



**CAUTION:** When power is removed from the product it must not be re-applied for a period of 30 seconds to allow the inrush limit circuit to operate correctly.



**APPLICATION RISK:** The integration of this product into other apparatus or system is not the responsibility of Eurotherm Drives Ltd as to its applicability, effectiveness or safety of operation or of other apparatus or systems.

Where appropriate the user should consider some aspects of the following risk assessment.



**RISK ASSESSMENT:** Under fault conditions or conditions not intended.

1. The motor speed may be incorrect.
2. The motor speed may be excessive.
3. The direction of rotation may be incorrect.
4. The motor may be energised (unless the installation specifically prevents unexpected or unsequenced energisation of the motor).

**In all situations the user should provide sufficient guarding to prevent risk of injury and/or additional redundant monitoring and safety systems.**

NOTE: During power loss the product will not operate as specified.

**MAINTENANCE:** Maintenance and repair should only be performed by competent persons using only the recommended spares (or return to factory for repair). Use of unapproved parts may create a hazard and risk of injury.



**WHEN REPLACING A PRODUCT IT IS ESSENTIAL THAT ALL USER DEFINED PARAMETERS THAT DEFINE THE PRODUCT'S OPERATION ARE CORRECTLY INSTALLED BEFORE RETURNING TO USE. FAILURE TO DO SO MAY CREATE A HAZARD AND RISK OF INJURY.**

**PACKAGING:** The packaging is combustible and if disposed of in this manner incorrectly may lead to the generation of toxic fumes which are lethal.

**WEIGHT:** Consideration should be given to the weight of the product when handling.

**REPAIRS:** Repair reports can only be given if sufficient and accurate defect reporting is made by the user.

Remember, the product without the required precautions can represent an electrical hazard and risk of injury, and that rotating machinery is a mechanical hazard and risk of injury.

## PROTECTIVE INSULATION:

1. All exposed metal insulation is protected by basic insulation and bonding to earth i.e. Class 1.
2. NOTE: Earth bonding is the responsibility of the installer.
3. All signal terminals are SELV, i.e., protected by double insulation (Class 2). The purpose of this protection is to allow safe connection to other low voltage equipment and is not designed to allow these terminals to be connected to any unisolated potential. Ensure all wiring rated for highest system voltage.

NOTE: Thermal sensors contained within the motor are to be double insulated.

**WALL MOUNTING:** - To maintain compliance with the European Low Voltage Directive standards VDE 0160 (1994)/EN50178(1998) only units supplied and fitted with the UL Type 1 top cover are to be mounted on the wall.

**RCDs** - Compatible with Type B RCDs only.

## How to Use this Manual

This manual provides information to support the installation and operation of the 584S Frequency Inverter. A description of each of the chapters is given here to assist in locating and using the information contained within the manual.

### CHAPTER 1 - PRODUCT OVERVIEW

This chapter contains a brief description of the drive controller including a technical specification of the equipment. The purpose of this chapter is to familiarise the reader with the purpose and scope of the equipment.

### CHAPTER 2 - PRE-INSTALLATION PLANNING

This chapter contains a functional description of the equipment, wiring information and a description of the signals on the input/output terminals. The purpose of this chapter is to allow the user to understand the function of the equipment and to assist in designing a particular installation configuration.

### CHAPTER 3 - INSTALLATION PROCEDURE

This chapter contains information regarding the physical mounting arrangements, cable and fuse selection as well as information regarding good EMC installation techniques. The purpose of this chapter is to provide guidelines for the safe and efficient installation of the equipment. The theory of, and requirement for, dynamic braking is also explained within this chapter.

### CHAPTER 4 - SETTING UP AND COMMISSIONING

A description of the user adjustments to configure the drive for a particular application. The purpose of this chapter is to guide the user through pre- and post-power on checks and provide running performance adjustment procedures. Information is also provided on the function and set-up of operational parameters using the Man-Machine Interface (MMI).

### CHAPTER 5 - DIAGNOSTICS AND FAULT FINDING

A description of the procedures to diagnose and trace faults on the equipment. The purpose of this chapter is to guide the user through the on-board diagnosis and fault finding facilities, using the MMI diagnostic and alarm display.

### CHAPTER 6 - SERVICING

This chapter provides the routine maintenance and repair procedures. The purpose of this chapter is to assist returning the controller to service following a fault condition.

### CHAPTER 7 - EMC AND THE 'CE' MARK

This chapter sets out Eurotherm Drives Limited responsibility to the recent European "EMC, Low Voltage and Machinery" Directives, and explains how Eurotherm are assisting their customers in achieving conformance. The north American requirements are also discussed.

### CHAPTER 8 - APPENDICES

Appendix A contains application notes.

Appendix B contains a description of the ASCII and binary communication options.

Appendix C contains a Parameter Language translation sheet.

Appendix D contains an easy table method of calculating parabolic ramp response times.

Appendix E contains an easy table method of calculating s ramp response times.

Appendix F contains 584S Type 7 Mechanical Outline Drawings.

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## Chapter 1

### Product Overview

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# Chapter 1 Product Overview

## DESCRIPTION

The 584S range of Frequency Inverters are intended for speed control of standard 3 phase induction motors. The range covers motor power ratings from 0.75kW (1hp) to 75kW (100hp) for constant torque applications and 1.1kW (1.5hp) to 90kW (120hp) for quadratic torque applications. This dual mode feature provides the user with a cost effective solution to general industry ( Constant torque ) applications as well as the control of pumps and fans ( Quadratic torque ). All products allow either of these two modes to be selected via software. All products are designed to operate from a 3 phase mains supply with voltages of either 208V to 240V or 380V to 460V +/- 10%.

Using advanced microprocessor technology the motor is sinusoidally excited over the full speed range. Maximum frequencies of 120Hz, 240Hz and 480Hz are selectable. Voltage/frequency characteristics are widely adjustable giving optimum control of constant torque loads or efficient operation of fans and pumps.

Selectable switching frequencies and a unique "Quiet Pattern" PWM strategy are employed to minimise the audible noises from the motor. Parameters and diagnostic messages are displayed in plain multilingual text on the menu-driven display. Four push buttons provide quick access to any drive parameter and six additional keys provide the user with basic operational control of the product.

There are several levels of protection built into the drive which ensure that the drive will protect itself under abnormal conditions but will not trip unnecessarily.

Option cards can be fitted inside the drive giving serial communications, closed loop speed control and dynamic braking functions.

## PRODUCT RANGE

The 584S is available in four chassis types as follows;

CHASSIS	POWER CONSTANT TORQUE (208 to 240 volts)	POWER QUADRATIC TORQUE (208 to 240 volts)	POWER CONSTANT TORQUE (380 to 460 volts)	POWER QUADRATIC TORQUE (380 to 460 volts)
TYPE 4	0.75 - 4.0kW	1.1 - 5.5kW	0.75 - 7.5kW	1.1 - 11kW
TYPE 5	5.5 - 7.5kW	7.5 - 9kW	11.0 - 15.0kW	15 - 18kW
TYPE 6	11.0 - 18.0kW	15 - 22kW	18.0 - 37.0kW	22 - 45kW
TYPE 7	22.0 - 37.0kW	30 - 45kW	45.0 - 75.0kW	55 - 90kW

The 584S models are housed in chassis of similar appearance, refer to Figure 1.1. The chassis size increases with power rating. The models are further identified by the product code, refer to "**PRODUCT CODE**" in this chapter.

## Equipment Supplied

The following equipment is supplied as standard with the 584S Frequency Inverters:

- 1) Frequency Inverter
- 2) Product manual

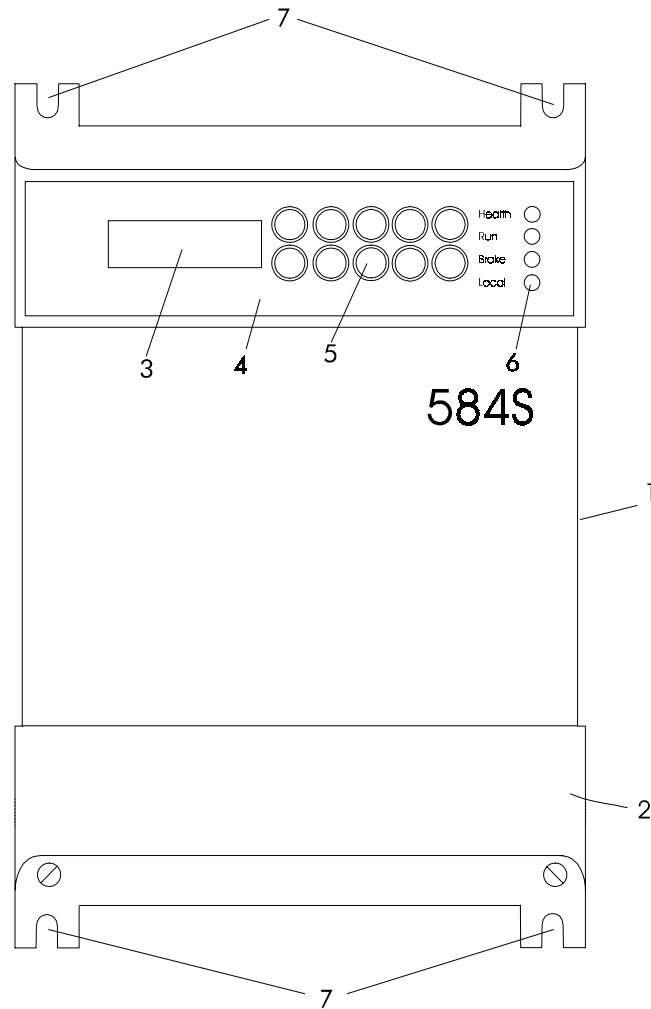
## Optional Equipment

The following equipment options are available for the 584S Frequency Inverters:

- 1) Dynamic Braking Module (fitted internally)
- 2) RS485/RS422 Serial Comms Interface
- 3) Closed Loop Speed Control by Digital Encoder.
- 4) UL Type 1 Top Cover (IP4X).
- 5) Glandbox.

## COMPONENT IDENTIFICATION

This manual refers to various connector terminals within the equipment which are accessible to the user for installation purposes. A diagram of a 584S Frequency Inverter is given in Figure 1.1.



Item	Description
1	Drive Controller
2	Terminal Cover
3	LCD
4	MMI (LCD + Buttons)
5	Function Buttons
6	Status LEDs
7	Fixing Points

Figure 1.1 - 584S Frequency Inverter

**TECHNICAL SPECIFICATION**

The following paragraphs provide technical information regarding the features and performance characteristics of the 584S Frequency Inverters.

**General**

Control:	Full control via the MMI display menus and external analogue and digital control inputs. Controls include:
	Output Frequency 0-120, 240 or 480Hz (selectable).
	Switching Frequency 3,6 or 9kHz (selectable) for power ratings up to 7.5kW. 3 or 6kHz (selectable) for power ratings from 11kW to 75kW. 3kHz only for power ratings above 75kW.
	Voltage Boost 0-25% (selectable auto or manual).
	Slip Compensation 0-Limit Frequency/24.
	Skip Frequencies 4.
	Skip Frequency width 0-Limit Frequency/12.
	Preset Speeds 8.
	Stopping Modes Ramp. Ramp and DC holding pulse. Injection braking. Coast. FRAMP - fast ramp.
	Ramps 2 independent up/down rates.
Protection:	Trip Conditions Short circuit line - line. Short circuit line - earth. Overcurrent > 220%. I x t overload 50 - 105% (adjustable). Heatsink overtemperature. Motor thermistor overtemperature. Overvoltage. Undervoltage
	Current Limits 50 - 150% adjustable. 180% shock load limit.
	Voltage/Frequency Profile Constant torque. Fan law (Base frequency adjustable).
Diagnostics/monitoring	Full diagnostics/monitoring provided by the MMI display and status LEDs.
Inputs/Outputs	Analogue Inputs Speed setpoint $\pm 10V$ or 0 - 10V plus direction. Speed trim $\pm 10V$ . Speed setpoint 4 - 20, 20 - 4, 0 - 20 or 20 - 0mA. Torque limit 0 - 10V.
	Analogue Outputs Speed 0 - 10V. Load $\pm 10V$ .
	Digital Inputs (24V DC) Run, Framp, Direction, Ext. trip, Jog, Preset 1, Preset 2, Manual / Auto.
	Digital Outputs (Relay Contact) Health Relay. 2 x Customer programmable relays. (SELV)

**Electrical Ratings - Power Circuit ( Constant torque )**

Input Voltage 380V to 460V*±10%, 50/60Hz	TYPE 4							TYPE 5		TYPE 6				TYPE 7		
Product Code Block 2	0007	0011	0015	0022	0040	0055	0075	0110	0150	0180	0220	0300	0370	0450	0550	0750
Power (kW)	0.75	1.1	1.5	2.2	4.0	5.5	7.5	11	15	18	22	30	37	45	55	75
Input Current (A)	3.0	4.5	6.0	8.0	11	15	18	25	31	40	46	61	72	91	110	150
Output Current (A)	2.3	3.3	4.5	6.3	9.4	13	16	24	30	39	46	61	72	91	110	150
Input p.f.	0.95							0.86								
Input Fuse/(Circuit Breaker) (A)	10				20			40 <sup>1</sup>	40 <sup>1</sup>	50 <sup>1</sup>	63 <sup>1</sup>	100 <sup>1</sup>		125 <sup>1</sup>	160 <sup>1</sup>	200 <sup>1</sup>
Approx. loss @ 6kHz (W)	60	70	85	110	150	200	250	350	400	550	630	820	1050	1300	1600	2200
Switching Frequency.	3kHz/6kHz/9kHz							3kHz/6kHz								

\* Suitable for earth referenced (TN) and non earth referenced (IT) supplies.

Input Voltage 208V to 240V*±10%, 50/60Hz	TYPE 4					TYPE 5		TYPE 6			TYPE 7				
Product Code Block 2	0007	0011	0015	0022	0040	0055	0075	0110	0150	0180	0220	0300	0370		
Power (kW)	0.75	1.1	1.5	2.2	4.0	5.5	7.5	11	15	18	22	30	37		
Input Current (A)	5.5	7.5	9.5	12	19	25	31	46	61	72	86	120	145		
Output Current (A)	4.3	6	8	10.5	17	24	30	46	61	72	86	120	145		
Input p.f.	0.95					0.86									
Input Fuse/(Circuit Breaker) (A)	10			15		20		40 <sup>1</sup>	40 <sup>1</sup>	63 <sup>1</sup>	100 <sup>1</sup>		125 <sup>1</sup>	160 <sup>1</sup>	200 <sup>1</sup>
Approx. loss @ 6kHz (W)	70	90	100	130	210	270	360	510	680	830	980	1300	1600		
Switching Frequency	3kHz/6kHz/9kHz					3kHz/6kHz									

Common	TYPE 4	TYPE 5	TYPE 6	TYPE 7
Output Voltage (max)	Input Voltage			
Output Overload	150% for 60s			
Output Frequency	0 to 120Hz/240Hz/480Hz			
Temperature Range	0 to 50°C (0 to 40°C for 2.2 kW 380 - 460V)			0 - 50°C @ 3kHz 0 - 45°C @ 6kHz
UL Type 1	0 to 40°C			
Earth Leakage Current	> 50mA AC. Permanent Protective Earthing Required			

Note :-

- For installations requiring UL compliance, short circuit protection Semiconductor Fuses should be installed in the 3-phase supply to the 584S products. These fuses are suitable for branch circuit short-circuit protection of the solid-state motor controllers only. For installations NOT requiring UL compliance, use class "T" fuses or a circuit breaker.

### Electrical Ratings - Power Circuit ( Quadratic torque )

Input Voltage 380V to 460V*±10%, 50/60Hz	TYPE 4							TYPE 5		TYPE 6				TYPE 7		
Product Code Block 2	0007	0011	0015	0022	0040	0055	0075	0110	0150	0180	0220	0300	0370	0450	0550	0750
Power (kW)	1.1	1.5	2.2	3.0	5.5	7.5	11	15	18	22	30	37	45	55	75	90
Input Current (A)	4.4	5.8	7.0	9.5	14.5	18	24	31	38	47	61	74	91	115	156	182
Output Current (A)	3.2	4.0	5.4	7.1	13	16	22	29	36	45	59	72	86	107	145	176
Input p.f.	0.95							0.86								
Input Fuse/(Circuit Breaker) (A)	10				20		32	40 <sup>1</sup>	50 <sup>1</sup>	63 <sup>1</sup>	100 <sup>1</sup>	100 <sup>1</sup>	125 <sup>1</sup>	160 <sup>1</sup>	200 <sup>1</sup>	200 <sup>1</sup>
Approx. loss @ 3kHz (W)	60	70	85	110	150	200	250	350	400	550	630	820	1050	1300	1600	2200
Switching Frequency.	3kHz							3kHz								

\* Suitable for earth referenced (TN) and non earth referenced (IT) supplies.

Input Voltage 208V to 240V*±10%, 50/60Hz	TYPE 4					TYPE 5		TYPE 6			TYPE 7		
Product Code Block 2	0007	0011	0015	0022	0040	0055	0075	0110	0150	0180	0220	0300	0370
Power (kW)	1.1	1.5	2.2	3.0	5.5	7.5	9.0	15	18	22	30	37	45
Input Current (A)	7.5	8.5	12	15	24	32	38	60	73	87	107	145	176
Output Current (A)	6.0	7.2	10.5	13	22	30	36	59	72	86	107	145	176
Input p.f.	0.95					0.86							
Input Fuse/(Circuit Breaker) (A)	10		15	20	32	40 <sup>1</sup>	50 <sup>1</sup>	100 <sup>1</sup>		125 <sup>1</sup>	160 <sup>1</sup>	200 <sup>1</sup>	200 <sup>1</sup>
Approx. loss @ 3kHz (W)	70	90	100	130	210	270	360	510	680	830	980	1300	1600
Switching Frequency	3kHz					3kHz							

Common	TYPE 4	TYPE 5	TYPE 6	TYPE 7
Output Voltage (max)	Input Voltage			
Output Overload	110% for 10s			
Output Frequency	0 to 120Hz/240Hz/480Hz			
Temperature Range	0 to 40°C			
UL Type 1	0 to 35°C			
Output Frequency	0 to 120Hz/240Hz/480Hz			
Earth Leakage Current	> 50mA AC. Permanent Protective Earthing Required			

Note :-

- For installations requiring UL compliance, short circuit protection Semiconductor Fuses should be installed in the 3-phase supply to the 584S products. These fuses are suitable for branch circuit short-circuit protection of the solid-state motor controllers only. For installations NOT requiring UL compliance, use class "T" fuses or a circuit breaker.

## Electrical Ratings - Control Circuit

The following ratings relate to 584S products.

### Supplies

Reference Supplies ( for all analogue inputs )	+10V $\pm$ 0.1V, 10mA max - 10V $\pm$ 0.1V, 10mA max
Reference Supply ( for all digital inputs )	+24V $\pm$ 10%, 200mA max.

### Analogue I/O

	INPUT	OUTPUT
Impedance	94k $\Omega$ (terminal 3, 235 $\Omega$ )	100 $\Omega$
Range	$\pm$ 10V	$\pm$ 10V
Resolution	10 bit (1 in 1024)	8 bit (1 in 256)
Sample Rate	20ms	20ms
Current (max.)	1mA (terminal 3, 20mA)	5mA

### Digital Inputs

Input voltage	Min. -30V DC	Nominal 24V DC	Max. 30V DC
Input Impedance	4k7 $\Omega$		
Sample Rate	20ms		
Threshold	Vin low <6V DC	Typical 12V DC	Vin high >18V DC

### Digital Outputs

Volt Free Relay Contacts	
Maximum voltage	220V AC (USA), 25V AC 60V DC (EUROPE)
Maximum current	3A resistive load

Table 1.1 - Control Terminal Specifications

## Mechanical Details

### 584S ( TYPE 4 )

AIR FLOW CLEARANCE	Refer to figure 3.1		
MOUNTING ORIENTATION	Vertical		
WEIGHT	2.2 kW (400V)	1.1 kW (230V)	7 kg
	4.0 kW (400V)	2.2 kW (230V)	7 kg
	5.5 kW (400V)		8.5kg
	7.5 kW (400V)	4.0 kW (230V)	9.3kg
DIMENSIONS	Refer to figure 3.1		
POWER TERMINATIONS	M5 tapped bushes with slotted screws., tightening torque 2.5Nm, 22.1lb-in (1.8lb-ft).		
EARTH (GROUND) TERMINATIONS	<i>Gland box not fitted:</i> 2 x M4 bolt and washer, tightening torque 1.3Nm (11.5lb-in, 0.9lb-ft) and M5 slotted screw and washer, tightening torque 2.5Nm (22.1lb-in, 1.8lb-ft) <i>Gland box fitted:</i> 2 x M5 stud, nut and washer, tightening torque 2.5Nm (22.1lb-in, 1.8lb-ft) and M5 slotted screw and washer, tightening torque 2.5Nm (22.1lb-in, 1.8lb-ft)		
CONTROL TERMINATIONS	Removable screw connectors for 0.75mm <sup>2</sup> wire. Terminals will accept up to 3.3mm <sup>2</sup> wire (12 AWG). Tightening torque 0.56 - 0.79Nm, 5-7lb-in (0.42 - 0.58lb-ft)		

### 584S ( TYPE 5 )


AIR FLOW CLEARANCE	Refer to figure 3.1		
MOUNTING ORIENTATION	Vertical		
WEIGHT	11 kW (400V)	5.5 kW (230V)	12 kg
	15 kW (400V)	7.5 kW (230V)	12 kg
POWER TERMINATIONS	M5 tapped bushes with slotted screws, tightening torque 2.5Nm, 22.1lb-in (1.8lb-ft)		
EARTH (GROUND) TERMINATIONS	<i>Gland box not fitted:</i> 2 x M5 stud, nut and washer, tightening torque 2.5Nm, 22.1lb-in (1.8 lb-ft) <i>Gland box fitted:</i> 2 x M5 stud, nut and washer, tightening torque 2.5Nm, 22.1lb-in (1.8 lb-ft)		
DIMENSIONS	Refer to figure 3.1		
CONTROL TERMINATIONS	Removable screw connectors for 0.75mm <sup>2</sup> wire. Terminals will accept up to 3.3mm <sup>2</sup> wire (12 AWG). Tightening torque 0.56 - 0.79Nm, 5-7lb-in (0.42 - 0.58lb-ft)		

**584S ( TYPE 6 )**

AIR FLOW CLEARANCE	Refer to figure 3.1		
MOUNTING ORIENTATION	Vertical		
WEIGHT	18 kW (400V)		28 kg
	22 kW (400V)	11 kW (230V)	29 kg
	30 kW (400V)	15 kW (230V)	30 kg
	37 kW (400V)	18 kW (230V)	34 kg
DIMENSIONS	Refer to figure 3.1		
POWER AND EARTH (GROUND) TERMINATIONS	Compact high current terminal blocks. Terminals accommodate wire range 0.8 - 53.5mm <sup>2</sup> (18 - 1/0 AWG) Tightening torque 3.4 - 5.6Nm, 30 - 50lb-in (2.5 - 4.2lb-ft).		
CONTROL TERMINATIONS	Removable screw connectors for 0.75mm <sup>2</sup> wire. Terminals will accept up to 3.3mm <sup>2</sup> wire (12 AWG). Tightening torque 0.56 - 0.79Nm, 5 - 7lb-in (0.42 - 0.58lb-ft)		



## 584S ( TYPE 7 )

AIR FLOW CLEARANCE	Refer to figure 3.1									
MOUNTING ORIENTATION	Vertical									
WEIGHT	<table> <tr> <td>45 kW (400V)</td> <td>22 kW (230V)</td> <td>76 kg</td> </tr> <tr> <td>55 kW (400V)</td> <td>30 kW (230V)</td> <td>80 kg</td> </tr> <tr> <td>75 kW (400V)</td> <td>37 kW (230V)</td> <td>84 kg</td> </tr> </table>	45 kW (400V)	22 kW (230V)	76 kg	55 kW (400V)	30 kW (230V)	80 kg	75 kW (400V)	37 kW (230V)	84 kg
45 kW (400V)	22 kW (230V)	76 kg								
55 kW (400V)	30 kW (230V)	80 kg								
75 kW (400V)	37 kW (230V)	84 kg								
DIMENSIONS	Refer to figure 3.1									
POWER AND EARTH (GROUND) TERMINATIONS	<p>(a) Supply (L1-3), Motor (M1/U-M3/W), Brake (DBR1-2) Terminals:  Compact high current terminal blocks.  Terminals accommodate wire range 33.6 - 107.2mm<sup>2</sup> (2 - 4/0 AWG).  Tightening torque 20Nm, 175lb-in (14.6lb-ft).</p> <p>(b) D.C. interconnection terminals (DC+, DC-):  Compact high current terminal blocks.  Terminals accommodate wire range 33.6 - 152mm<sup>2</sup> (2AWG - 300kcmil (MCM)).  Tightening torque 30.5Nm, 270lb-in (22.5lb-ft).</p> <p>(c) Earth (ground)  :  Compact high current terminal blocks.  Terminals accommodate wire range 33.6 - 107.2mm<sup>2</sup> (2 - 4/0 AWG).  Tightening torque 22.6Nm, 200lb-in (16.7lb-ft).</p>									
CONTROL TERMINATIONS	Removable screw connectors for 0.75mm <sup>2</sup> wire. Terminals will accept up to 3.3mm <sup>2</sup> wire (12 AWG). Tightening torque 0.56 - 0.79Nm, 5 - 7lb-in (0.42 - 0.58lb-ft)									

## ENCLOSURE

IP20 (as standard), to be built into a suitable cubicle.

IP40 (with UL Type 1 top cover) Type 4, 5, 6 and 7 only, suitable for wall mounting in Europe.

## EMC Specification

For EMC Specification refer to Chapter 7 The European Directives and the 'CE' Mark

## Special Considerations for Installations Requiring Compliance with UL Standards

### Motor Overload Protection

An external motor overload protective device must be provided by the installer.

OR

Motor overload protection is provided in the controller by means of the thermal device in the motor winding. This protection cannot be evaluated by UL hence it is the responsibility of the installer and/or the local inspector to determine whether the overload protection is in compliance with the National Electrical Code or Local Code requirements.

### Branch Circuit/Short Circuit Protection Requirements

Model 584S Type 4 Series

UL Listed (JDDZ) non-renewable cartridge fuses or UL listed (JDRX) renewable cartridge fuses, rated 300Vac or 600Vac as appropriate (depending on the rated input voltage of the drive), must be installed upstream of the drive. For fuse current ratings, see Chapter 1 “Electrical Ratings - Power Circuit”.

Model 584S Type 5 and 6 Series

UL Recognized Component (JFHR2) semiconductor fuses must be installed upstream of the drive. For fuse current ratings, see Chapter 1 “Electrical Ratings - Power Circuit”. Refer to Table 1.2 below for recommended semiconductor fuse manufacturer and model numbers.

Fuse Current Rating	Bussmann Model No.
40A	170M3808
50A	170M3809
63A	170M3810
100A	170M3812
125A	170M3813

Table 1.2 Bussmann International Fuses (Rated 660Vac)

Model 584S Type 7 Series

These devices are provided with solid state short circuit (output) protection. Branch circuit protection should be provided as specified in the National Electrical Code, NEC/NFPA-70.

### Short Circuit Ratings

Model 584S Type 4, 5, 6 Series.

Suitable for use on a circuit capable of delivering not more than 5000 RMS Symmetrical Amperes, 240/460V maximum.

Model 584S Type 7 Series

Suitable for use on a circuit capable of delivering not more than (the value shown in Table 1.3 or Table 1.4) RMS Symmetrical Amperes, (the value of rated voltage shown in Table 1.3 or Table 1.4) V maximum.

Output Rating kW	Rated Voltage V	Short Circuit Rating RMS Symmetrical Amperes
22 - 37	208 - 240	5,000
45 - 75	380 - 460	10,000

Table 1.3: Constant Torque (Industrial) Ratings

Output Rating kW	Rated Voltage V	Short Circuit Rating RMS Symmetrical Amperes
30 - 37	208 - 240	5,000
45	208 - 240	10,000
55 - 90	380 - 460	10,000

Table 1.4: Quadratic Torque (HVAC) Ratings

#### Field Wiring Temperature Rating

Model 584S Type 4, 5, 6 Series.

Use 60°C copper conductors only.

Model 584S Type 7 Series.

Use 75°C copper conductors only.

#### Motor Base Frequency

The motor base frequency rating is 480Hz maximum.

#### Operating Ambient Temperature

For operating ambient temperature range, see Chapter 1 “Electrical Ratings - Power Circuit”.

#### Environmental Rating

Model 584S Type 4, 5, 6, 7 Series with a product code block IV designation xx2x are suitable for direct wall mounting applications as they have a “Type 1 enclosure” rating.

In order to preserve this enclosure rating, it is important to maintain the environmental integrity of the enclosure. The installer must provide correct Type 1 enclosures for all unused clearance/knockout holes within the drive glandbox.

Additionally, in order to preserve the “Type 1 enclosure” rating for 584S Type 7 models, the installer must ensure that the blanking plates are fitted to the ventilation apertures provided within the glandbox.

### Environmental Requirements

Humidity (max.)	85% relative humidity at 40°C non-condensing
Altitude	Above 1000m derate 1% per 100m,
Atmosphere	Non flammable, non corrosive and dust free
Operating temperature range	0°C to 50°C (Constant torque mode) 0°C to 40°C (Quadratic torque mode) 0°C to 40°C UL Type 1 option fitted (Constant torque) 0°C to 35°C UL Type 1 option fitted (Quadratic torque)
Storage temperature	Minimum -25°C to maximum +55°C
Transport temperature	Minimum -25°C to maximum +70°C
Enclosure	IP20 (direct conduit connection and UL Type 1 options)
Climatic Conditions	Class 3k3 as defined by EN50178 (1998)
Pollution Degree	2
Installation / Overvoltage Category	3

## PRODUCT CODE

All 584S units are fully identified using an eleven block alphanumeric code. This code details the drive calibration and settings on despatch from the factory. The product code appears as the "Model No." on the rating label at the side of the unit. Details of each block of the product code are given in Table 1.5.

Table 1.5 - Product Code Block Descriptions

Block No.	Variable	Description
1	584S	Generic product
2	XXXX	Four numbers specifying the <b>constant torque</b> power rating kW. (For <b>quadratic torque</b> see Electrical Ratings - Power Circuit (Quadratic torque) table on page 1.5)  0007=0.75kW 0011=1.1 0015=1.5 0022=2.2 0040=4.0 0055=5.5 0075=7.5 0110=11 0150=15 0180=18 0220=22 0300=30 0370=37 0450=45 (380-460V only) 0550=55 (380-460V only) 0750=75 (380-460V only)
3	XXX	Three numbers specifying the nominal input voltage rating: 230 208 to 240V (±10%) 50/60Hz 400 380 to 460V (±10%) 50/60Hz

Block No.	Variable	Description
4	XXXX	<p>Four digits specifying the mechanical package including livery and mechanical package style:</p> <p>First two digits Livery</p> <p>00 Standard Eurotherm Drives livery</p> <p>01-99 Defined customer liveries</p> <p>Third digit Mechanical packaging style</p> <p>1 Standard (IP20), protected panel mounting</p> <p>2 IP20 and falling dirt protection, (UL Type 1) with glandplate cable entry</p> <p>3 Enclosed (IP20), through panel mounting</p> <p>5 IP20 with falling dirt protection (UL Type 1) only</p> <p>6 IP20 with glandcable entry only</p> <p>Note: Option 3 applies to Type 7 power ratings only.</p> <p>Fourth digit Operator Station</p> <p>0 Standard product (must be 0) - Operator station fitted</p>
5	XX	<p>Two characters specifying the user interface language.</p> <p>These characters are the same as used for computer keyboard specifications:</p> <p>A1 Code</p> <p>FR French</p> <p>GR German</p> <p>UK English</p> <p>US United States (English and 60Hz)</p>
6	XXX	<p>Three characters specifying any feedback option installed over and above the standard features of the product:</p> <p>000 No additional option fitted</p> <p>ENW Encoder (Wire-ended)</p> <p>ENG Encoder (Fibre Optic - Glass)</p>
7	XXXX	<p>Four characters specifying the communications protocol and its hardware implementation method:</p> <p>0000 No communications options fitted</p> <p>E100 EI ASCII/Bisync with hardware implementation 1 (RS485/422)</p>
8	XXX	<p>Three characters specifying any optional loaded software:</p> <p>000 No software options loaded</p>

Block No.	Variable	Description
9	XX	Two characters specifying the braking option: 00 Brake power switch not fitted B0 Brake power switch fitted - no braking resistors supplied Note: Braking resistors should be specified and ordered separately.
10	XXX	Three characters specifying aux supply required: 000 No aux supply fitted
11	XXX	3 digits specifying engineering special options: 000 No special option

### Example Codes:

#### Industrial Rating

Block 1	Generic product	=	584S	<b>584S/</b>
Block 2	Required power	=	75kW	<b>584S/0750/</b>
Block 3	Voltage (nominal)	=	400V	<b>584S/0750/400/</b>
Block 4	Livery	=	Eurotherm (IP20)	<b>584S/0750/400/0010/</b>
Block 5	Language	=	UK	<b>584S/0750/400/0010/UK/</b>
Block 6	Feedback option	=	Encoder (glass)	<b>584S/0750/400/0010/UK/ENG/</b>
Block 7	Communications	=	EI ASCII	<b>584S/0750/400/0010/UK/ENG/E100/</b>
Block 8	Special Software	=	None	<b>584S/0750/400/0010/UK/ENG/E100/000/</b>
Block 9	Brake Option	=	None	<b>584S/0750/400/0010/UK/ENG/E100/000/00/</b>
Block 10	Aux Supply	=	None	<b>584S/0750/400/0010/UK/ENG/E100/000/00/000/</b>
Block 11	Special options	=	None	<b>584S/0740/400/0010/UK/ENG/E100/000/00/000/000</b>

**Full Product Code - 584S/0750/400/0010/UK/ENG/E100/000/00/000/000**

#### Quadratic Rating

Block 1	Generic product	=	584S	<b>584S/</b>
Block 2	Required power	=	11kW *	<b>584S/0075/</b>
Block 3	Voltage (nominal)	=	400V	<b>584S/0075/400/</b>
Block 4	Livery	=	Eurotherm (IP20)	<b>584S/0075/400/0010/</b>
Block 5	Language	=	UK	<b>584S/0075/400/0010/UK/</b>
Block 6	Feedback option	=	None	<b>584S/0075/400/0010/UK/000/</b>
Block 7	Communications	=	None	<b>584S/0075/400/0010/UK/000/0000/</b>
Block 8	Special Software	=	None	<b>584S/0075/400/0010/UK/000/0000/000/</b>
Block 9	Brake Option	=	None	<b>584S/0075/400/0010/UK/000/0000/000/00/</b>
Block 10	Aux Supply	=	None	<b>584S/0075/400/0010/UK/000/0000/000/00/000/</b>
Block 11	Special options	=	None	<b>584S/0075/400/0010/UK/000/0000/000/00/000/000</b>

**Full Product Code - 584S/0075/400/0010/UK/000/0000/000/00/000/000**

\* NOTE:- See Electrical Ratings - Power Circuit (Quadratic torque) on page 1.5 for correct block 2 code

## Chapter 2

### PRE-INSTALLATION PLANNING

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## Chapter 2 PRE-INSTALLATION PLANNING

### FUNCTIONAL OVERVIEW

#### Principles of Operation

584S Frequency Inverters are microprocessor based 3-phase inverters used to control the speed of standard 3-phase induction motors. An extensive range of configuration options are available to the user. A menu structure controlled using the man-machine interface (MMI) allows access to various options and adjustable parameters.

A simplified block diagram of a 584S is presented in Figure 2.1. This shows the basic internal arrangement of the drive with the circuitry split between the control circuits, and the power circuits. The functions of the control circuits are further expanded in Figure 2.2.

#### Power Circuits

The 3-phase supply is input on terminals L1, L2 and L3 and is rectified to give a DC output to the inverter circuits. The connection between the rectifier and inverter is called the DC link and comprises a positive and negative DC connection with an in-line choke.

#### Dynamic Braking

The in-line choke and DC link capacitors, smooth the DC voltage prior to input to the inverter power stage. During motor deceleration or at other times when the motor acts as a generator, energy flows from the motor into the DC link capacitors and causes the DC link voltage to rise. The drive trips if the DC link voltage rises above the over voltage trip level. If the dynamic braking option is used, an external brake resistor is switched to be in parallel with the capacitors and absorbs the energy when the DC link voltage rises to the braking level. Voltage detection is performed by the control circuits and the switching is performed by the optional dynamic brake circuit. Refer to Chapter 3 for further details of the dynamic braking option.

#### Motor Drive Output

The inverter circuits convert the DC input to the 3 phase output used to drive the motor. The GATE DRIVE signals generated by the control circuits control the inverter circuits to reproduce the 3-phase MOTOR DRIVE OUTPUTS. The frequency and amplitude are determined by the control inputs and by the parameters set up via the MMI.

#### Control Circuits and Software

The control circuits and software block in Figure 2.1 are expanded in the functional block diagram Figure 2.2. This diagram shows software configuration options. It is not representative of the hardware since most of the functions are performed entirely by software.

Inputs to the control circuit are provided by physical connections to the control board terminals (identified on the left and right hand edges of the block diagram) and by parameters set via the MMI display (as explained in the "KEY" of Figure 2.2).

#### Parameters

Parameters are values or options that are programmed via the Setup Parameters and System menus within the MMI structure. These are usually set up during installation and commissioning and are not changed during normal operation.

Number parameters assign a value to a variable, eg. **PRESET SPEED 1** which determines the motor speed if **PRESET SPEED 1** is selected.

Logic parameters are used to control switching functions, eg. **AUTO SETPOINT SELECT** which controls a software switch to select one of a number of sources of the auto setpoint.

Refer to Chapter 4 for further information on the MMI and parameter descriptions.

#### Diagnostics

Number and logic diagnostics are values and settings that can be displayed via the diagnostic menu within the MMI. These values are read-only and are provided for the user to determine operating or fault conditions. Refer to Chapter 5 for further information and descriptions of the diagnostics.



## Analogue Inputs/Outputs

Analogue inputs to the control board have a range as indicated in the associated function block, eg. 0V to +10V. The range of values represented by analogue outputs can be selected or adjusted as indicated by their associated function blocks in Figure 2.2.

## Digital Inputs/Outputs

Digital inputs to the control board are usually provided by external switch contacts. 0V and +24V outputs (not shown) are provided for reference purposes. Digital outputs are provided by the three relay contact pairs, two of which are programmable. Refer to Table 2.5 for further information on all control board input and outputs.

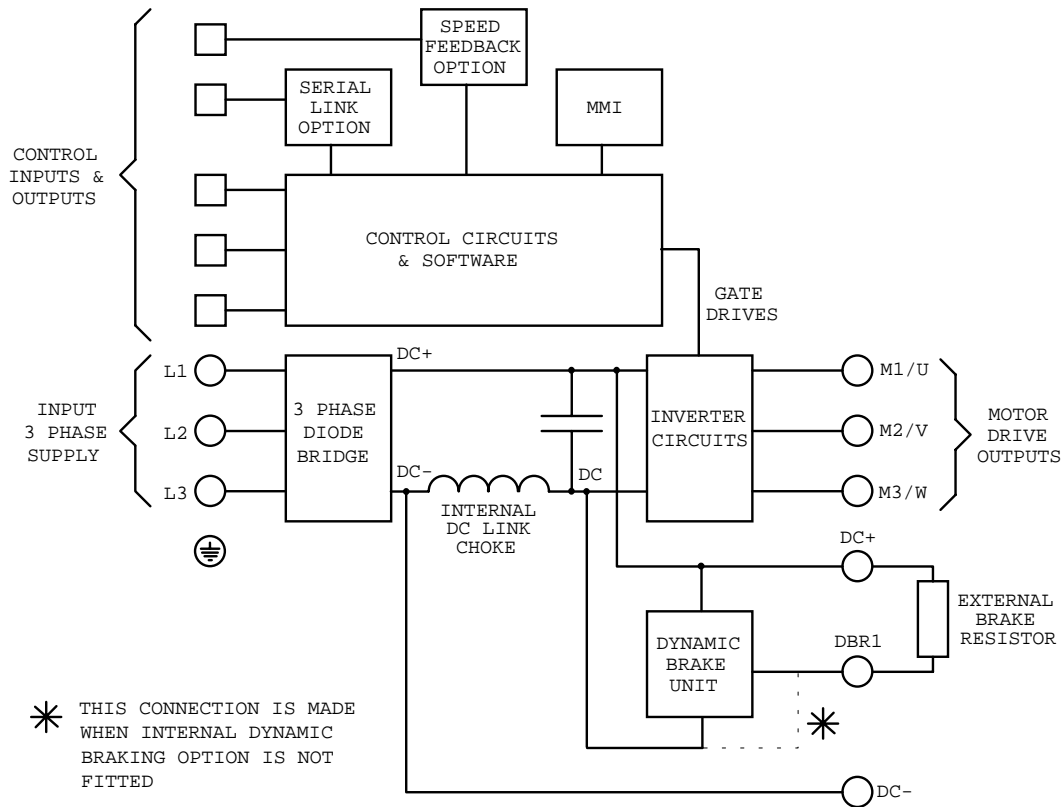


Figure 2.1A - Simplified Block Diagram (584S Type 4)

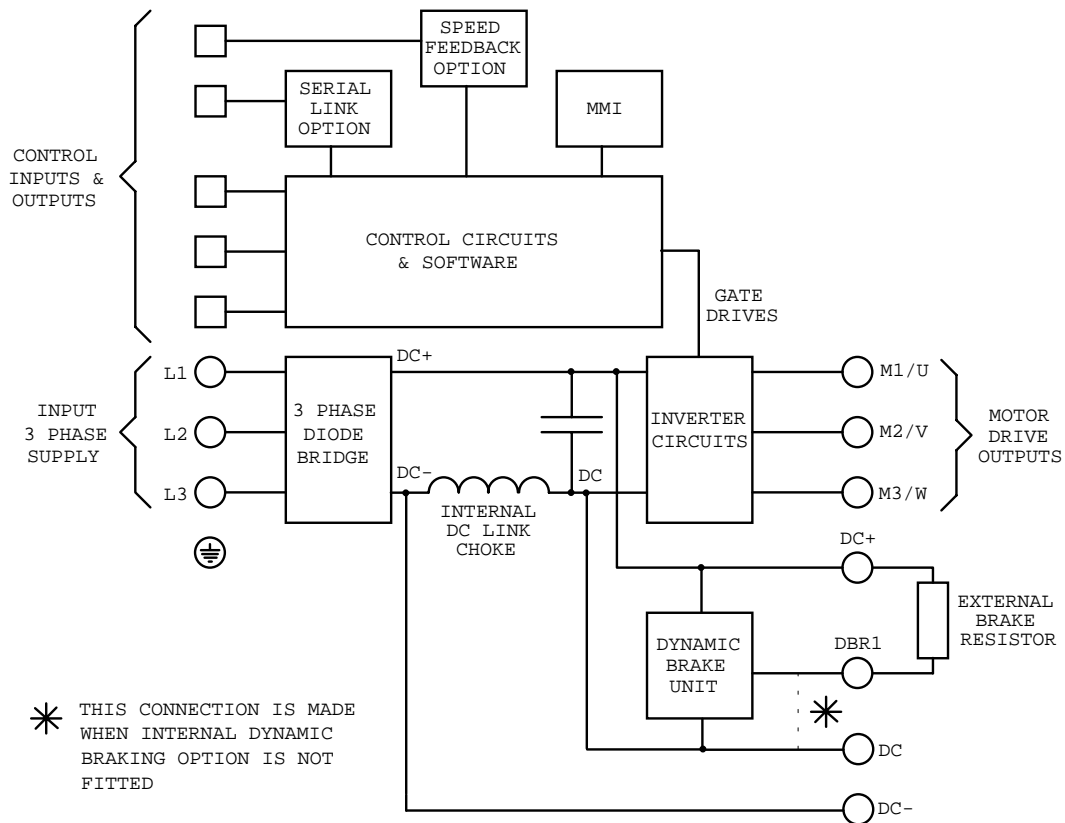


Figure 2.1B - Simplified Block Diagram (584S Type 5)

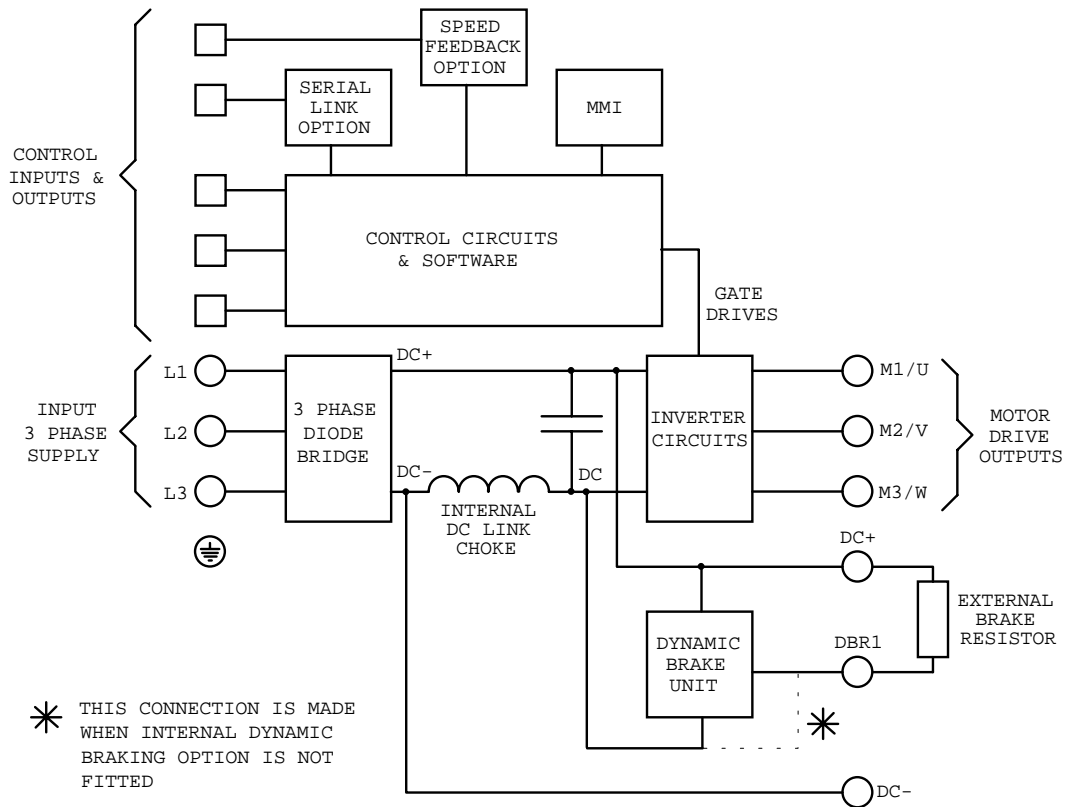


Figure 2.1C - Simplified Block Diagram (584S Type 6)

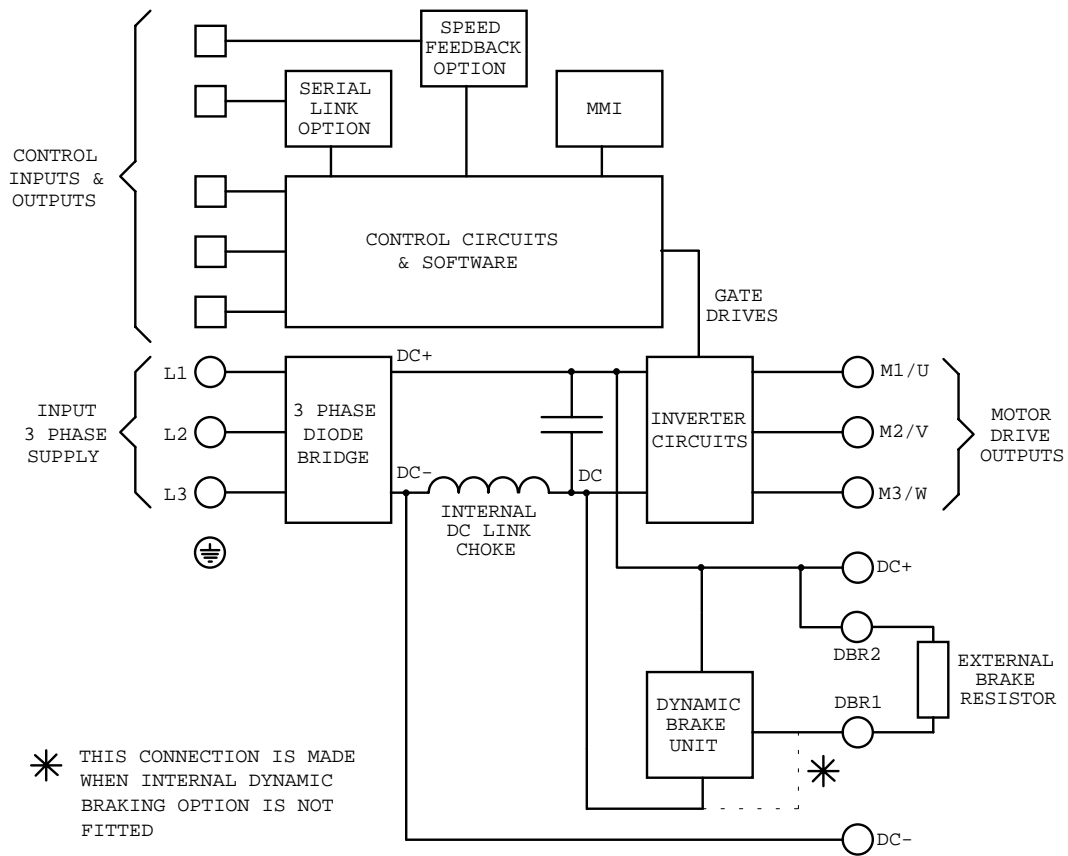


Figure 2.1D - Simplified Block Diagram (584S Type 7)

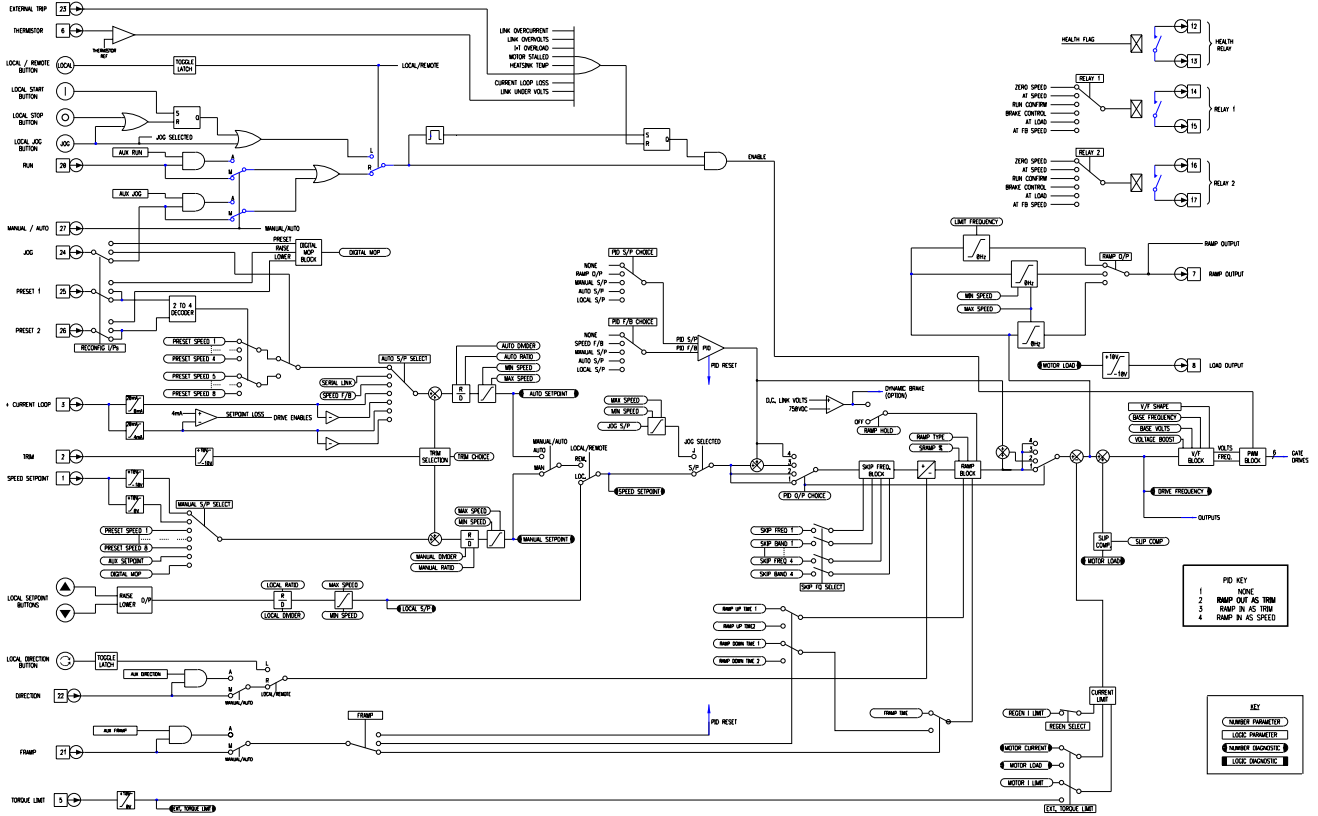


Figure 2-2 Functional Block Diagram

## BASIC WIRING DIAGRAMS

General wiring diagrams are provided for the 584S types 4, 5, 6 & 7 in Figures 2.3 to 2.6 respectively. A minimum connection diagram is shown in Appendix A, Figure A.1 .

### 584S Type 4

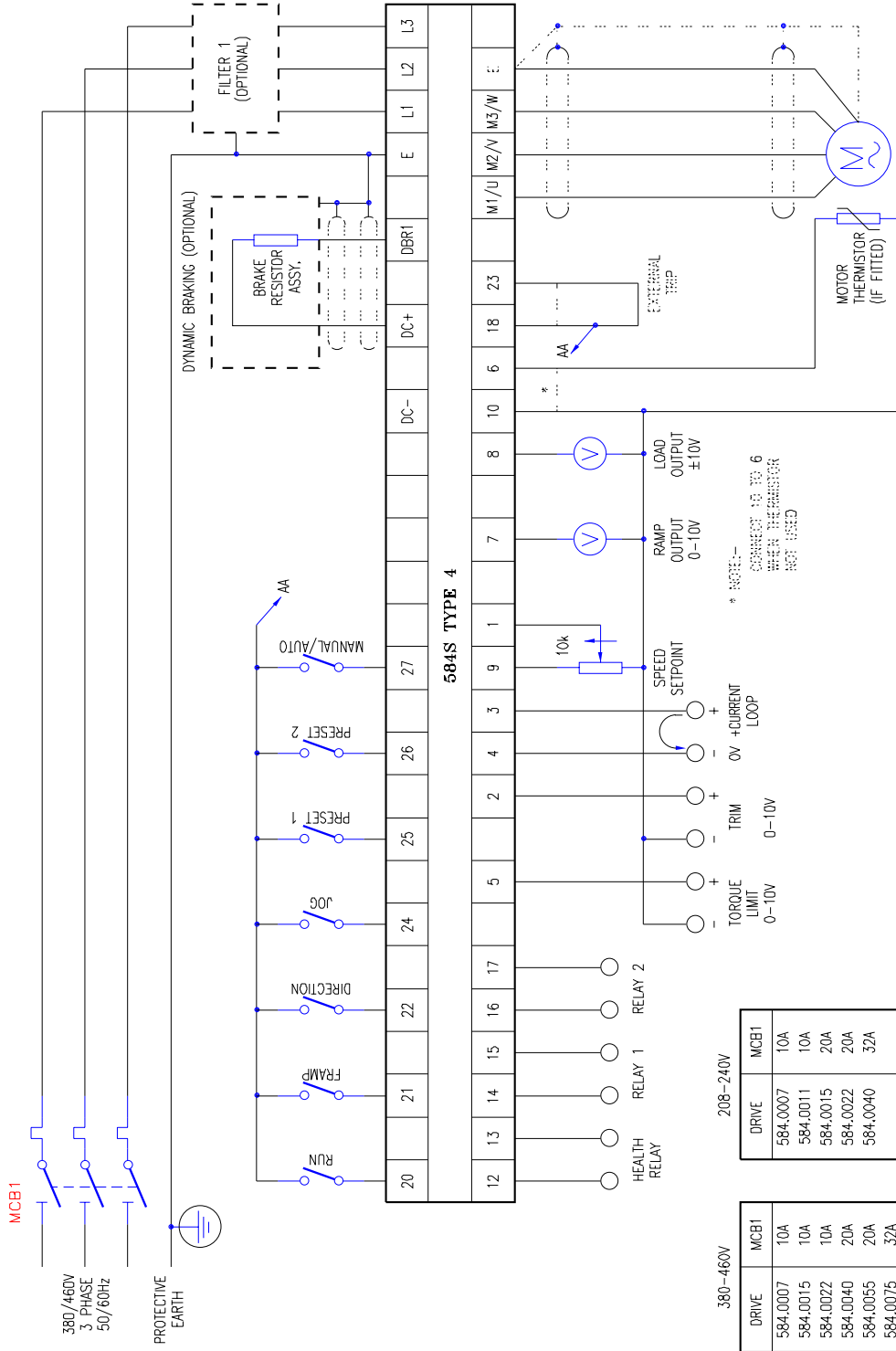


Figure 2.3 - General Wiring Diagram ( 584S type 4 )

### 584S Type 5

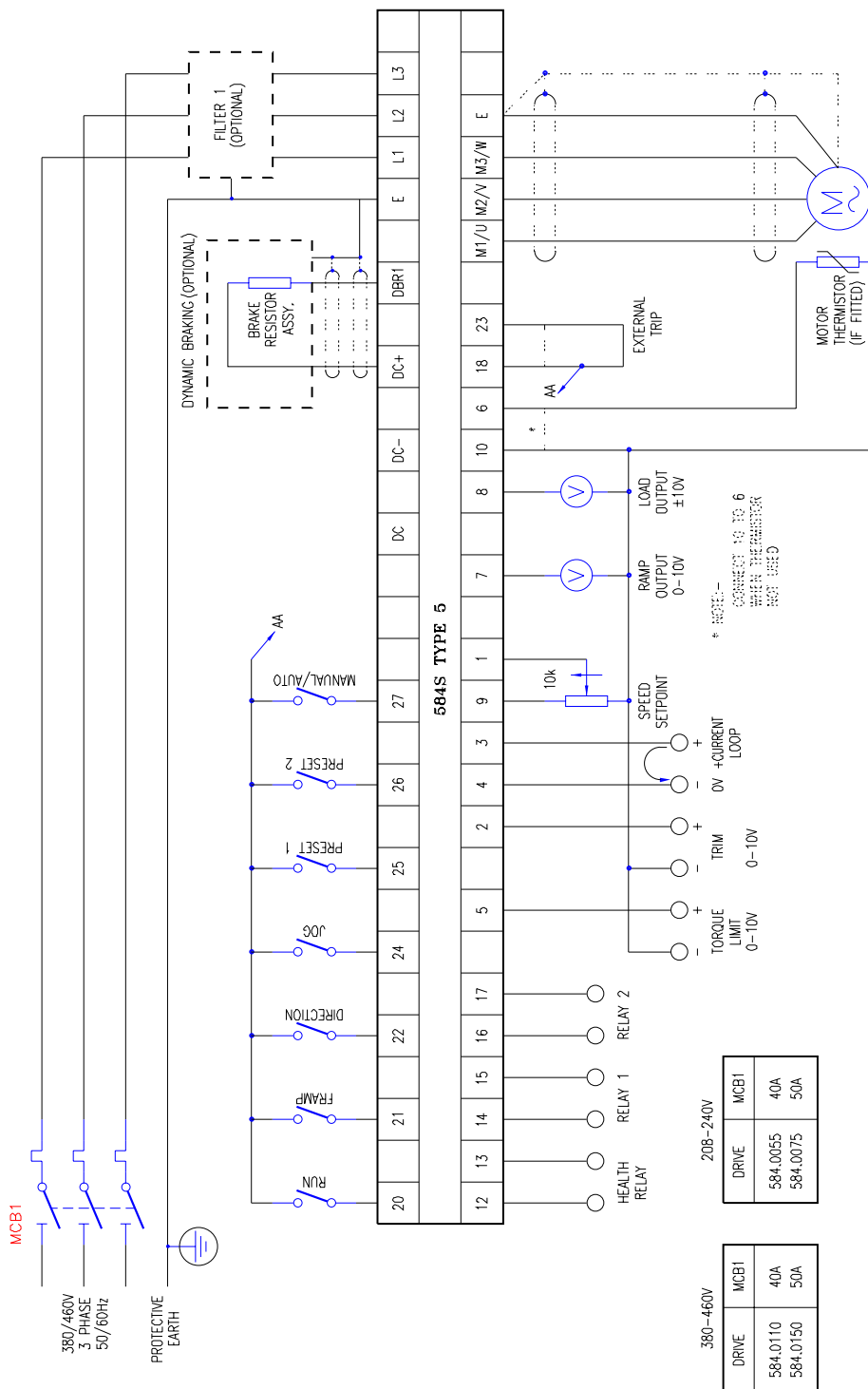


Figure 2.4 - General Wiring Diagram ( 584S type 5)

# 584S Type 6

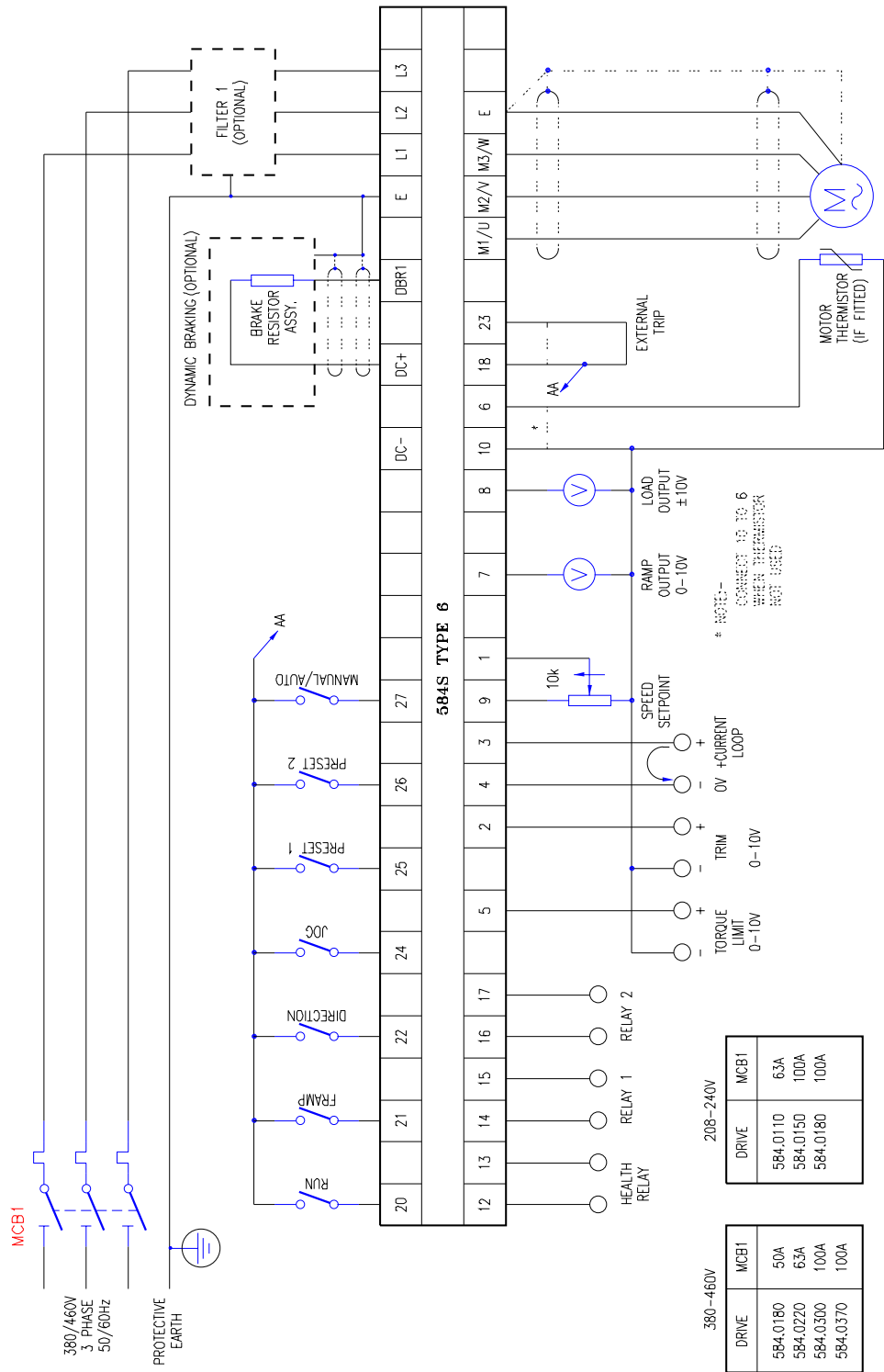


Figure 2.5 - General Wiring Diagram ( 584S type 6 )

### 584S Type 7

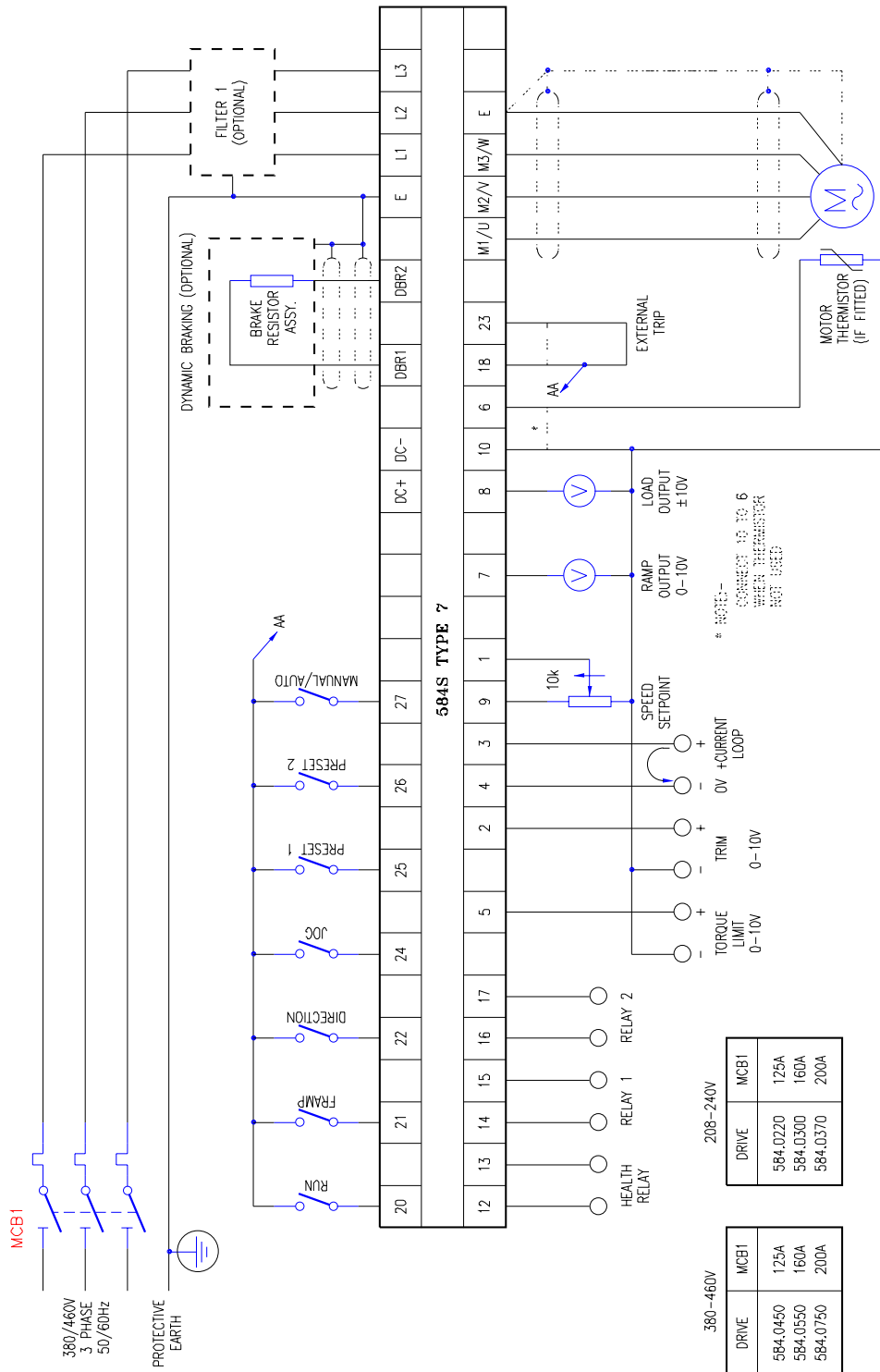


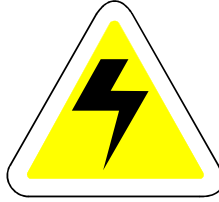
Figure 2.6 - General Wiring Diagram ( 584S type 7 )



## TERMINAL DESCRIPTIONS

Terminals are provided for both the power connections and the control connections to allow reliable interface connections with external devices. The function of these terminals is described in tables 2.1-2.4.

### Power Terminals



**WARNING!**

THE POWER TERMINALS CARRY ELECTRICAL POWER WHICH CAN BE LETHAL.  
 NEVER WORK ON ANY CONTROL EQUIPMENT OR MOTORS WITHOUT FIRST  
 REMOVING ALL POWER SUPPLIES FROM THE EQUIPMENT.

#### 584S Type 4



Terminal	Terminal Description
M1/U, M2/V, M3/W	Power outputs forming the 3-phase supply connection for the motor.
DC-	Power input/output. This terminal is used in conjunction with the DC+ terminal only when two or more controllers are coupled together. It carries a negative DC link voltage.
DC+	Power input/output. This terminal is used for connection to a braking resistor. It is also used in conjunction with the DC- terminal when two or more controllers are coupled together. It carries a positive DC link voltage (typically 600V referred to terminal DC-).
DBR1	Power input/output for the connection of a dynamic braking resistor. Refer to " <b>DYNAMIC BRAKING</b> " for further details. This terminal is connected to the negative side of the link capacitor when the brake option is not fitted.
L1, L2, L3	Power inputs. These terminals are the 3-phase mains supply input, 380 - 460V ± 10% or 208 - 240V ± 10% AC line-to-line.
PE / 	Power earth. These terminals must be connected to a permanent protective earth (ground).
	Motor earth connection. This terminal may be used for the protective earth connection to the motor.

Table 2.1 - 584S ( TYPE 4 ) - Power Terminals

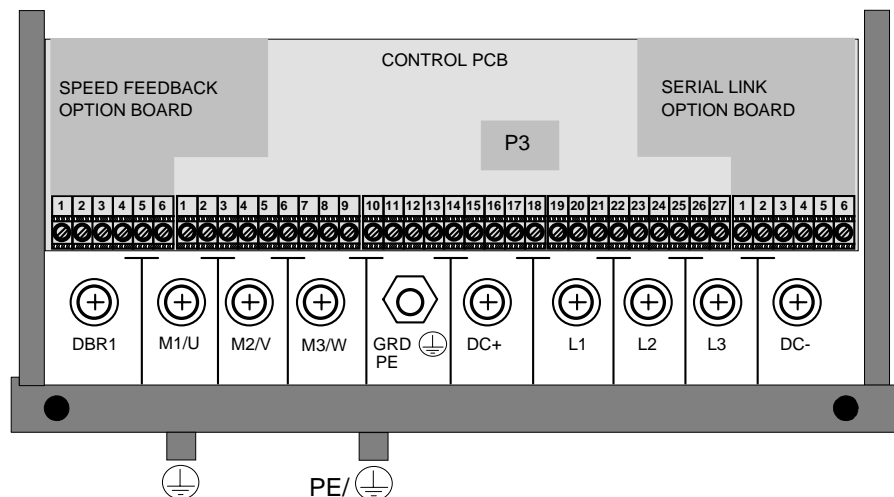


Figure 2.7 - 584S ( TYPE 4 ) - Power Terminals

584S Type 5



Terminal	Terminal Description
M1/U, M2/V, M3/W	Power outputs forming the 3-phase supply connection for the motor.
DC-	Power input/output. This terminal is used in conjunction with the DC+ terminal when two or more controllers are coupled together. It carries a negative DC link voltage.
DC+	Power input/output. This terminal is used for connection to a braking resistor. It is also used in conjunction with the DC- terminal when two or more controllers are coupled together. It carries a positive DC link voltage (typically 600V referred to terminal DC-).
DC	Power input/output. This terminal is connected to the negative side of the d.c. link capacitor. <b>No customer connection must be made to this terminal.</b>
DBR1	Power input/output for the connection of a dynamic braking resistor. Refer to "DYNAMIC BRAKING" for further details. This terminal is connected to the negative side of the link capacitor when the brake option is not fitted.
L1, L2, L3	Power inputs. These terminals are the 3-phase mains supply input, 380 - 460V ± 10% or 208 - 240V ± 10% AC line-to-line.
PE / 	Power earth. This terminal must be connected to a permanent protective earth (ground).
	Motor earth connection. This terminal may be used for the protective earth connection to the motor.

Table 2.2 - 584S ( TYPE 5 ) - Power Terminals

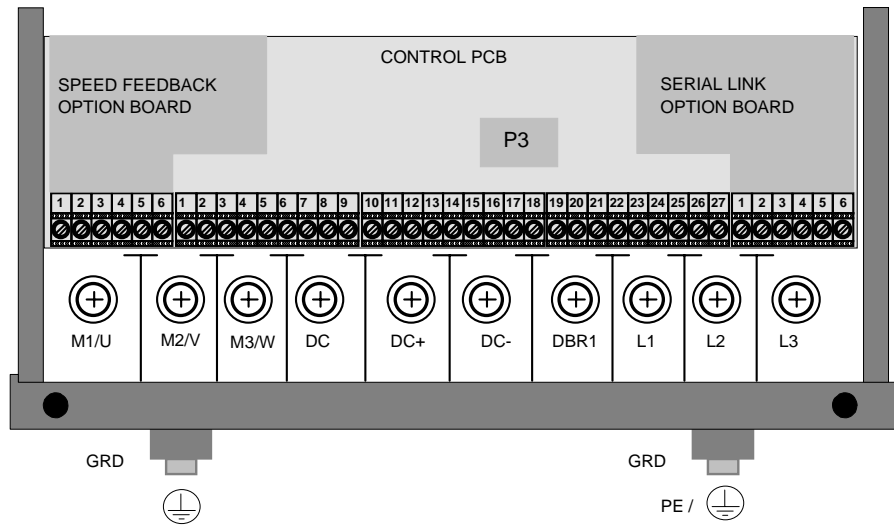


Figure 2.8 - 584S ( TYPE 5 ) - Power Terminals

584S Type 6



Terminal	Terminal Description
M1/U, M2/V, M3/W	Power outputs forming the 3-phase supply connection for the motor.
DC-	Power input/output. This terminal is used in conjunction with the DC+ terminal when two or more controllers are coupled together. It carries a negative DC link voltage.
DC+	Power input/output. This terminal is used for connection to a braking resistor. It is also used in conjunction with the DC- terminal when two or more controllers are coupled together. It carries a positive DC link voltage (typically 600V referred to terminal DC-).
DBR1	Power input/output for the connection of a dynamic braking resistor. Refer to " <b>DYNAMIC BRAKING</b> " for further details. This terminal is connected to the negative side of the link capacitor when the brake option is not fitted.
L1, L2, L3	Power inputs. These terminals are the 3-phase mains supply input, 380 - 460V ± 10% or 208 - 240V ± 10% AC line-to-line.
PE / 	Power earth. This terminal must be connected to a permanent protective earth (ground).
	Motor earth connection. This terminal may be used for the protective earth connection to the motor.

Table 2.3 - 584S ( TYPE 6 ) - Power Terminals

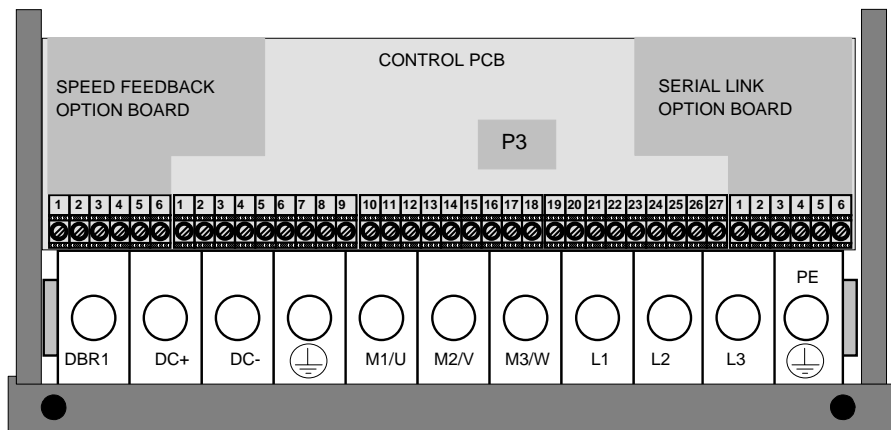


Figure 2.9 - 584S ( TYPE 6 ) - Power Terminals

584S Type 7



Terminal	Terminal Description
M1/U, M2/V, M3/W	Power outputs forming the 3-phase supply connection for the motor.
DC-	Power input/output. This terminal is used in conjunction with the DC+ terminal when two or more controllers are coupled together. It carries a negative DC link voltage.
DC+	Power input/output. This terminal is used in conjunction with the DC- terminal only when two or more controllers are coupled together. It carries a positive DC link voltage (typically 600V referred to terminal DC-).
DBR1	Power output. This terminal is used for connection to a braking resistor. Refer to " <b>DYNAMIC BRAKING</b> " for further details. This terminal is connected to the negative side of the link capacitor when the brake option is not fitted.
DBR2	Power output. This terminal is used for connection to a braking resistor.
L1, L2, L3	Power inputs. These terminals are the 3-phase mains supply input, 380 - 460V ± 10% or 208 - 240V ± 10% AC line-to-line.
PE / 	Power earth. This terminal must be connected to a permanent protective earth (ground).
	Motor earth connection. This terminal may be used for the protective earth connection to the motor.

Table 2.4 - 584S ( TYPE 7 ) - Power Terminals

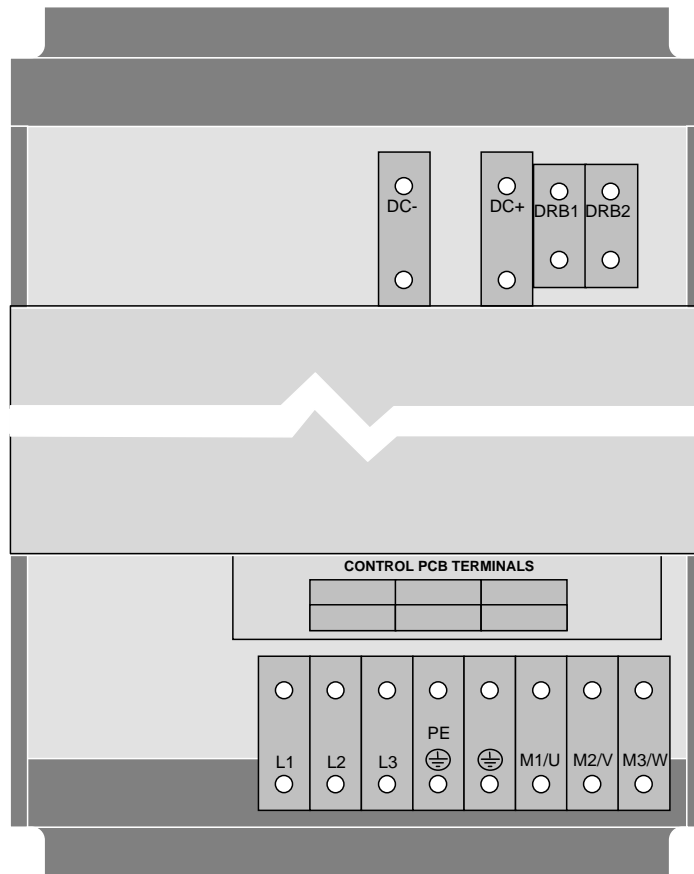


Figure 2.10 - 584S ( TYPE 7 ) - Power Terminals

## Control Terminals

The control terminals are identical for all variants of the 584S Frequency Inverter. The functions of the control board terminals are described in Table 2.5. See Chapter 1 "**ELECTRICAL RATINGS**", Table 1.1 for control terminal specification.

NOTE: In Table 2.5 the names of the parameters are presented in a different font, eg. **MAX SPEED**, to indicate that they may be adjusted using the MMI (see Chapter 4).

Table 2.5 - Control Board Terminal Descriptions

Terminal Number	Terminal Description
1	<p>SPEED SETPOINT. Analogue Input</p> <p>An input in the range 0 to 10V, or <math>\pm 10V</math>, selectable from the MMI. This signal sets the motor speed in the range:</p> <p>+10V = <b>MAX SPEED</b> forward  0V = <b>MIN SPEED</b>  -10V = <b>MAX SPEED</b> reverse</p> <p>Where <b>MAX</b> and <b>MIN SPEEDS</b> are set from the MMI</p> <p>Input impedance = 94k<math>\Omega</math>.</p>
2	<p>TRIM. Analogue Input</p> <p>An input in the range <math>\pm 10V</math>. This signal adjusts the motor speed as follows:-</p> <p>(a) When trim is acting on an analog type main setpoint i.e., 0 <math>\rightarrow</math> 10V or 0 <math>\rightarrow</math> 20mA, then:</p> <p>+10V = <b>MAX SPEED</b> forward  0V = <b>MIN SPEED</b>  -10V = <b>MAX SPEED</b> reverse</p> <p>Where <b>MAX</b> and <b>MIN SPEEDS</b> are set from the MMI.</p> <p>(b) When trim is acting on a digital type main setpoint i.e., preset speed or serial link setpoint, then:</p> <p>+10V = <b>LIMIT FREQUENCY</b> forward  0V = 0Hz  -10V = <b>LIMIT FREQUENCY</b> Reverse</p> <p>Where limit frequency is set from MMI.</p> <p>Note:- Regardless of trim scaling, all setpoints are ultimately clamped between <b>MAX SPEED</b> and <b>MIN SPEED</b>.</p> <p>Input impedance = 94k<math>\Omega</math>.</p>
3	<p>+ CURRENT LOOP. Analogue current loop input (connect return to terminal 4)</p> <p>A current loop input in the range 0 - 20mA, 20 - 0mA, 4 - 20mA or 20mA - 4mA as selected from the MMI. This input allows automatic adjustment of motor speed. For example, with 4 - 20mA selected:</p> <p>4mA = <b>MIN SPEED</b>  20mA = <b>MAX SPEED</b></p> <p>Where <b>MAX</b> and <b>MIN SPEEDS</b> are set from the MMI.</p> <p>Input impedance = 235<math>\Omega</math>.</p>
4	<p>0V. Reference</p> <p>This terminal provides a zero volt reference for analogue signals only or current loop connection.</p>

Table 2.5 - Control Board Terminal Descriptions (Continued)

Terminal Number	Terminal Description
5	<p>TORQUE LIMIT. Analogue Input</p> <p>An input in the range 0 to +10V. When enabled from the MMI, this terminal sets the maximum motor output torque.</p> <p>+10V = 150% output torque            0V = 0% output torque</p>
6	<p>THERMISTOR. Analogue Input</p> <p>Analogue input for motor thermistor. The second lead of the thermistor is connected to terminal 10 (0V). If no thermistor fitted, connect to terminal 10 (0V).</p> <p>Trip at 3k<math>\Omega</math>, reset at 1.8k<math>\Omega</math>.</p>
7	<p>RAMP OUTPUT. Analogue Output</p> <p>An output in the range 0V to +10V (5mA max) representing drive output frequency. Scaling is set using the <b>RAMP OUTPUT</b> parameter. For example:</p> <p>+10V = <b>MAX SPEED</b>            0V = <b>MIN SPEED</b>            or            +10V = <b>LIMIT FREQUENCY</b>            0V = 0Hz            or            +10V = <b>MAX SPEED</b>            0V = 0Hz</p>
8	<p>LOAD OUTPUT. Analogue Output</p> <p>An output in the range <math>\pm</math> 10V (5mA max) representing estimated motor load (torque).</p> <p>+10V = 150% load motoring            0V = 0% load            -10V = 150% load regenerating</p>
9	<p>+10V. Reference</p> <p>Internally generated +10V supply for analogue inputs. Maximum load is 5mA.</p>
10	<p>0V. Reference</p> <p>This terminal provides a zero volt reference for analogue signals only.</p>
11	<p>-10V. Reference</p> <p>Internally generated -10V supply for analogue inputs. Maximum load is 5mA.</p>
12 13	<p>HEALTH RELAY            HEALTH RELAY. Relay Contacts</p> <p>These terminals are the contacts of the internal 'health' relay. The contacts close to indicate that the drive is powered up and no alarms are present.</p>
14 15	<p>RELAY 1            RELAY 1. Relay Contacts</p> <p>These terminals are the contacts of internal Relay '1' the function of which is configurable from the MMI.</p>

Table 2.5 - Control Board Terminal Descriptions (Continued)

Terminal Number	Terminal Description
16 17	RELAY 2 RELAY 2. Relay Contacts  These terminals are the contacts of internal Relay '2' the function of which is configurable from the MMI.
18	+24V.  24V supply for use with digital inputs. Max. load 200mA.
19	0V.  0V for digital inputs.
20	RUN. Digital Input  The digital input used to run and stop the drive.  +24V = run 0V = stop
21	FRAMP. Digital Input (Configurable)  This digital input can be used to select an alternative ramp rate, an alternative ramp <b>down</b> rate during stopping or a PID reset. Refer to chapter 4 "Reconfigure inputs" <b>FRAMP</b> .  +24V = function selected 0V = function deselected
22	DIRECTION. Digital Input  This digital input can be used to control the direction of the motor.  +24V = reverse 0V = forward
23	EXTERNAL TRIP. Digital Input  This digital input can be used to trip the drive. The motor will coast until the trip is reset. If no external trip used, connect to terminal 18 (+24V).  +24V = no trip 0V = trip
24	JOG. Digital Input (Configurable)  This digital input can be used to implement the jog function. The <b>JOG SPEED</b> is set from the MMI. Refer to Table 2.6 for further optional uses of this terminal.

Table 2.5 - Control Board Terminal Descriptions (Continued)

Terminal Number	Terminal Description															
25 26	<p>PRESET 1, PRESET 2. Digital Inputs (Configurable)</p> <p>These digital inputs can be used to select 1 of 4 preset speeds as shown below:</p> <table border="0"> <tr> <td>PRESET 2 state</td> <td>PRESET 1 state</td> <td>Preset selection</td> </tr> <tr> <td>0V</td> <td>0V</td> <td><b>PRESET SPEED 1</b> selected</td> </tr> <tr> <td>0V</td> <td>+24V</td> <td><b>PRESET SPEED 2</b> selected</td> </tr> <tr> <td>+24V</td> <td>0V</td> <td><b>PRESET SPEED 3</b> selected</td> </tr> <tr> <td>+24V</td> <td>+24V</td> <td><b>PRESET SPEED 4</b> selected</td> </tr> </table> <p>The preset speeds parameters are set using the MMI. In order to select preset speeds using the PRESET 1 and PRESET 2 terminals, the <b>AUTO SETPOINT</b> parameter needs to be set to <b>DIGITAL PRESET</b>, and the MANUAL/AUTO terminal needs to be connected to +24V.</p> <p>Refer to Table 2.6 for further uses of these terminals.</p>	PRESET 2 state	PRESET 1 state	Preset selection	0V	0V	<b>PRESET SPEED 1</b> selected	0V	+24V	<b>PRESET SPEED 2</b> selected	+24V	0V	<b>PRESET SPEED 3</b> selected	+24V	+24V	<b>PRESET SPEED 4</b> selected
PRESET 2 state	PRESET 1 state	Preset selection														
0V	0V	<b>PRESET SPEED 1</b> selected														
0V	+24V	<b>PRESET SPEED 2</b> selected														
+24V	0V	<b>PRESET SPEED 3</b> selected														
+24V	+24V	<b>PRESET SPEED 4</b> selected														
27	<p>MANUAL/AUTO.</p> <p>+24V = auto setpoint control                      0V = manual setpoint control</p>															

### Configurable Digital Inputs

The control board terminals 24, 25 and 26 can be configured (Chapter 4, "**RECONFIGURE INPUTS**") to perform alternative functions to those described in Table 2.5. The alternative functions are described in Table 2.6.

Table 2.6 Configurable Digital Inputs

Terminal Number	Terminal Description																																				
24 25 26	<p>SELECT PRESET 1 PRESET 2</p> <p>These digital inputs are used to select 1 of 8 preset speeds as shown below:</p> <table border="0"> <tr> <td>SELECT</td> <td>PRESET 2</td> <td>PRESET 1</td> <td>Preset Selection</td> </tr> <tr> <td>0V</td> <td>0V</td> <td>0V</td> <td><b>PRESET SPEED 1</b> selected</td> </tr> <tr> <td>0V</td> <td>0V</td> <td>+24V</td> <td><b>PRESET SPEED 2</b> selected</td> </tr> <tr> <td>0V</td> <td>+24V</td> <td>0V</td> <td><b>PRESET SPEED 3</b> selected</td> </tr> <tr> <td>0V</td> <td>+24V</td> <td>+24V</td> <td><b>PRESET SPEED 4</b> selected</td> </tr> <tr> <td>+24V</td> <td>0V</td> <td>0V</td> <td><b>PRESET SPEED 5</b> selected</td> </tr> <tr> <td>+24V</td> <td>0V</td> <td>+24V</td> <td><b>PRESET SPEED 6</b> selected</td> </tr> <tr> <td>+24V</td> <td>+24V</td> <td>0V</td> <td><b>PRESET SPEED 7</b> selected</td> </tr> <tr> <td>+24V</td> <td>+24V</td> <td>+24V</td> <td><b>PRESET SPEED 8</b> selected</td> </tr> </table> <p>The preset speeds are set using the MMI. Again the <b>AUTO SETPOINT</b> parameter needs to be set to <b>DIGITAL PRESET</b>, and the MANUAL/AUTO terminal needs to be connected to +24V.</p>	SELECT	PRESET 2	PRESET 1	Preset Selection	0V	0V	0V	<b>PRESET SPEED 1</b> selected	0V	0V	+24V	<b>PRESET SPEED 2</b> selected	0V	+24V	0V	<b>PRESET SPEED 3</b> selected	0V	+24V	+24V	<b>PRESET SPEED 4</b> selected	+24V	0V	0V	<b>PRESET SPEED 5</b> selected	+24V	0V	+24V	<b>PRESET SPEED 6</b> selected	+24V	+24V	0V	<b>PRESET SPEED 7</b> selected	+24V	+24V	+24V	<b>PRESET SPEED 8</b> selected
SELECT	PRESET 2	PRESET 1	Preset Selection																																		
0V	0V	0V	<b>PRESET SPEED 1</b> selected																																		
0V	0V	+24V	<b>PRESET SPEED 2</b> selected																																		
0V	+24V	0V	<b>PRESET SPEED 3</b> selected																																		
0V	+24V	+24V	<b>PRESET SPEED 4</b> selected																																		
+24V	0V	0V	<b>PRESET SPEED 5</b> selected																																		
+24V	0V	+24V	<b>PRESET SPEED 6</b> selected																																		
+24V	+24V	0V	<b>PRESET SPEED 7</b> selected																																		
+24V	+24V	+24V	<b>PRESET SPEED 8</b> selected																																		
24 25 26	<p>MOP PRESET, RAISE, LOWER.</p> <p>These digital inputs allow the drive to be used in raise speed/lower speed mode in conjunction with raise/lower pushbuttons. The ramp can be reset, by +24V on the MOP PRESET input. The <b>MOP PRESET SPEED</b> value can be programmed via the MMI ( See Chapter 4 ). To use the digital MOP, the <b>MANUAL SETPOINT</b> parameters needs to be set to <b>DIGITAL MOP</b>, and the MANUAL/AUTO terminal needs to be connected to 0V.</p>																																				



## Speed Feedback Options

An additional card is necessary to implement speed feedback from a Microtach (ENG block 6 of Product Code). For specification and connection information refer to 5901 Microtach Product Manual, drawing number HA387484. The maximum speed that the 584S will accept from a Microtach depends on its resolution (number of lines per revolution). The limit, in RPM is:

$$\frac{3 \times 10^6}{\text{resolution}} \quad \text{with an overriding limit of 24000 RPM.}$$

An additional card is necessary to implement speed feedback from an Encoder (ENW block 6 of Product Code). For specification and connection information refer to Electrical Encoder Receiver Card manual drawing number HA388867. For more information on compatible encoders and line drives see 5902 Electrical Encoder Product Manual, drawing number HA385749. The maximum speed that the 584S will accept from an encoder depends on its resolution (number of lines per revolution). The limit, in RPM is:

$$\frac{6 \times 10^6}{\text{resolution}} \quad \text{with an overriding limit of 24000 RPM.}$$

## Serial Link Options

An additional card is necessary to implement isolated serial communications. For specification and connection information refer to Appendix B.

## TERMINATIONS

UL Compression Lug Kits are available for the inverters which provide sets of lugs suitable for the following ratings. These lugs must be applied with the correct tooling as described in the Installation Instructions provided with each Lug Kit.

The following terminal kits are available for the connection of Power Cabling.

Product	Supply Voltage	Constant Torque	Quadratic Torque	Kit No.	Lug Size	Amp Part No.
584S	380 - 460V	11kW	15kW	LA389585	#8 AWG	52263-1
	208 - 240V	5.5kW	7.5kW			
584S	380 - 460V	15kW	18kW	LA389586	#6 AWG	52265
	208 - 240V	7.5kW	9kW			

## EMC

Refer to Chapter 3 for EMC installation guidelines

## Chapter 3

### INSTALLATION PROCEDURE

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## Chapter 3 INSTALLATION PROCEDURE

### INSTALLATION PRECAUTIONS



#### Caution

This product conforms to IP20 protection. Due consideration should be given to environmental conditions of installation for safe and reliable operation.

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When installing the 584S Vector Drive ensure that the following precautions are observed:

- 1) Mechanically secure fixings are used, as recommended in "**MOUNTING**".
- 2) The enclosure into which this product is mounted is suitable for the working environment.
- 3) The cooling and airflow around this product are as recommended in "**VENTILATION**".
- 4) The cables and wire terminations are as recommended and securely clamped.
- 5) The installation and commissioning of this equipment is carried out only by competent personnel in accordance with safe working practices.

### MECHANICAL INSTALLATION

#### Mounting

The 584S should be mounted vertically on a solid flat vertical surface. It is fixed using 4 bolts or screws through fixing points provided at each corner at the rear of the unit. The fixing points are in the form of keyholes and slots to simplify fastening or removal. The overall dimensions of the unit and the positions of the fixing points are given in Figure 3.1 for all chassis types.

#### Ventilation

In normal operation the drive dissipates heat and must be mounted to allow the free flow of air vertically through the circuit board area over the fuses and heatsink. Care should be taken to ensure that the mounting surface is also cool and that any heat generated by adjacent equipment is not transmitted to the 584S.

For adequate natural ventilation of the Drive Controller, minimum clearance as defined in Figure 3.1 must be maintained. Side-by-side mounting of two or more Drive Controllers is permissible providing the ambient operating temperature is not exceeded.

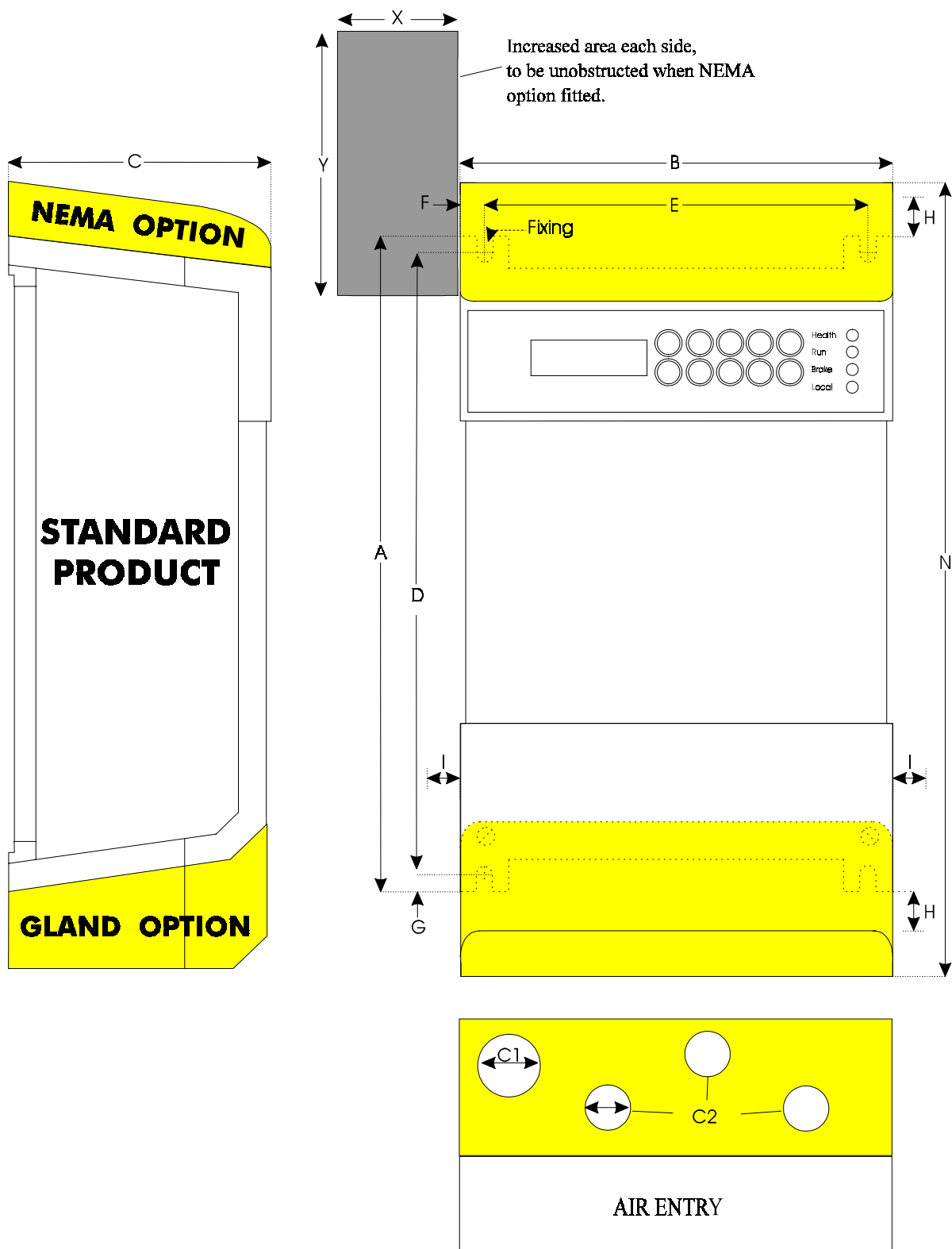


Figure 3.1 - 584S Mounting Arrangements

Model	Outside Dimensions (mm)			Fixing Centres (mm)				Fixing Size	Cooling air clearance (mm)		OPTIONS				
											Overall height (mm)	Exit air clearance (mm)		Conduit hole size (mm)	
	A	B	C	D	E	F	G		H	I	N	X	Y	C1	C2
Type 4	318	228	157	300	200	14	9	M6	80	10	385	40	130	32	20-32
Type 5	468	228	157	450	200	14	9	M6	80	10	535	40	130	32	20-32
Type 6	672	234	298	650	200	17	11	M8	100	40	775	40	130	20-40	32-40
Type 7*	838	398	336	800	370	14	19	M10	250	50	1125	120	300	-	44-76

Table 3.1 - 584S Mechanical Mounting Details

\* Full mechanical details of type 7 including through panel mounting is provided in Appendix F Chapter 7.

Further mechanical details are also available from Eurotherm Drives Engineering department.

## ELECTRICAL INSTALLATION

The following instructions describe the wiring requirements for operation of the 584S as basic speed controllers. The variety of specific drive applications precludes the inclusion of diagrams showing all wiring options.

### Power Wiring



#### Caution

Never perform high voltage resistance checks on the wiring without first disconnecting the drive from the circuit being tested.

All relevant national standards and local electricity board regulations must be observed at installation.

Power cables must have a minimum rating of 1.1 x full load current.

Power cables (particularly 3-phase motor cables) must be routed well away from cables carrying setpoints or feedback signals, screened motor feedback cables, and cables from other electronic equipment in the same plant.

The main power supply should be 3-phase and within the voltage tolerances specified in "**ELECTRICAL RATINGS - Power Circuit**" in Chapter 1 of this manual. The supply should be connected to power board terminals L1, L2 and L3 of the 584S.

Access to the power terminals is obtained by removing terminal cover with a screwdriver, then prising off terminal strip.

## Protection

The incoming mains supply should be protected as shown below:

Controller Rating 380 - 460 Volts	Controller Rating 208 - 240 Volts	Fuse or Circuit Breaker (Amps) Constant Torque/ Quadratic Torque	Cable Diameter (mm <sup>2</sup> )	
			MIN	NORMAL
0.75	-	10	1.5	1.5
1.1	-	10	1.5	1.5
1.5	0.75	10	1.5	1.5
2.2	1.1	10	1.5	1.5
4.0	1.5	20	3.5	4
5.5	2.2	20	3.5	4
7.5	4.0	20/32	3.5	4
11	5.5	32/40	5.5	6
15	7.5	40/50	8.5	10
18	-	50/63	12.5	16
22	11	63/100	18	16
30	15	100	37	35
37	18	100/125	37	35
45	22	125/160	50	50
55	30	160/200	65	70
75	37	200	85	95

\* - Cable diameters listed assume the conductors are in free air. Fuses are standard type with slow-blow characteristic or a circuit breaker. NOTE: These are typical values only. If in doubt please observe your national standards or local electricity supply regulations. For installations requiring compliance with UL standards, refer to **Special Considerations** and **Electrical Ratings - Power Circuit** in chapter 1.

## Earthing



THE MOTOR MUST BE CONNECTED TO AN APPROPRIATE SAFETY EARTH. FAILURE TO DO SO CONSTITUTES AN ELECTRICAL SHOCK HAZARD.

### ALL FREQUENCY CONVERTERS MUST BE PERMANENTLY EARTHED

In accordance with the European Low Voltage Directive standards VDE 0160 (1994)/prEN50178 (1995) permanent earthing requires either:-

- i) The cross section of the protective conductor should be at least 10mm<sup>2</sup> (copper). (Note this minimum cross section was determined with regard to mechanical strength).
- ii) Laying of a second conductor through separate terminals and electrically parallel to the protective conductor. Earth conductor shall individually satisfy the requirements for a protective conductor (Note this ensures the equipment is still protectively earthed if one conductor is damaged).

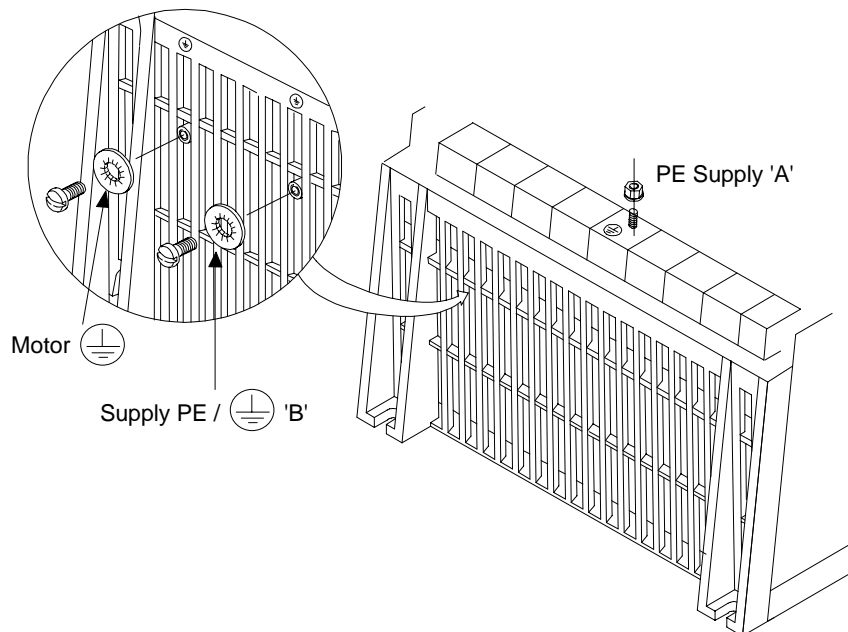
**For normal installation the Type 4 series will require two individual incoming protective earth conductors (<10mm<sup>2</sup> cross section) and the Type 5, 6 and 7 one (•10mm<sup>2</sup> cross section).**

### MODEL 584S TYPE 4 AND TYPE 5 SERIES

#### Cubicle-Mounted (IP20) Models

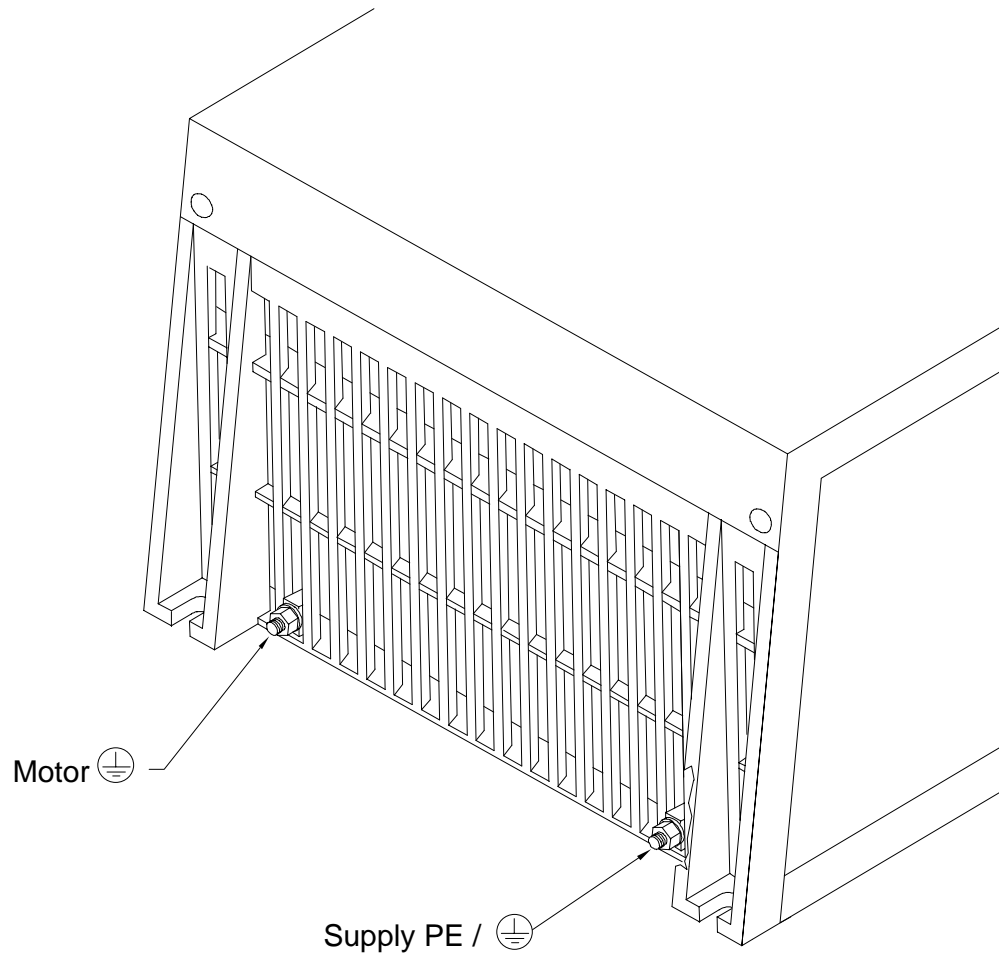
##### Model 584S Type 4 Series

Protective earthing arrangements for these models are provided by a single-size M4 diameter earth terminal located at the centre of the power terminal array, together with two further earth terminals consisting of size M4 diameter slot-head screws and washers located on the lower face of the drive, as shown in the drawing below. In all cases, the terminals are identified with the symbol  $\oplus$  (IEC 417, Symbol 5019) and are intended to be used with protective conductors terminated with compression terminations sized to accept the M4 diameter bolt fitted and the conductor size selected. In Europe two incoming protective conductors shall be used for permanent earthing, one connected to each of the terminals marked "PE" ('A' and 'B') whilst the motor protective conductor shall be connected to the remaining earth terminal located on the lower face of the drive identified with the symbol  $\oplus$  only.



### Model 584S Type 5 Series

Protective earthing arrangements for these models are provided by two size M5 diameter terminals located on the lower face of the drive, as shown in the drawing below. The terminals are identified with the symbol  $\oplus$  (IEC 417, Symbol 5019) and are intended to be used with protective conductors terminated with compression terminations sized to accept the M5 diameter bolt fitted and the conductor size selected. The single incoming protective conductor shall be of 10mm<sup>2</sup> cross sections minimum (permanent earthing in Europe) and be connected to the terminal marked "PE", as shown in the drawing below, whilst the motor protective conductor shall be connected to the remaining earth terminal located on the lower face of the drive.

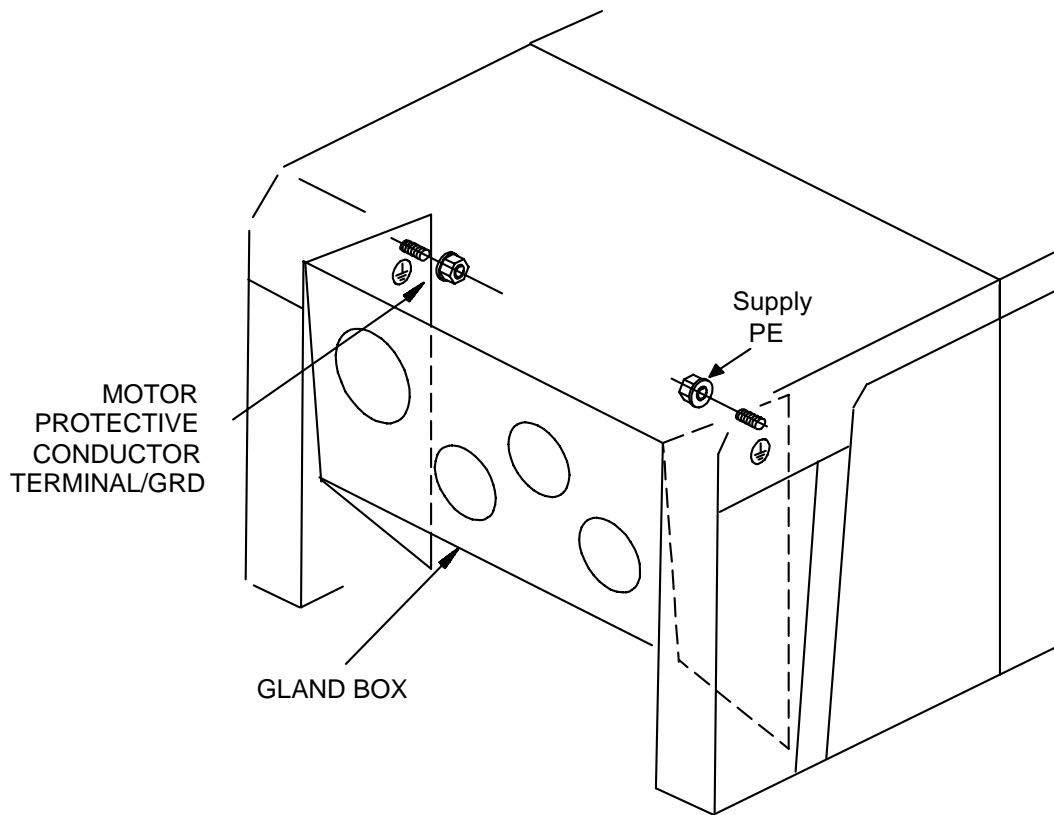




### Direct Wall-Mounted Models

#### Model 584S Type 4 and Type 5 Series

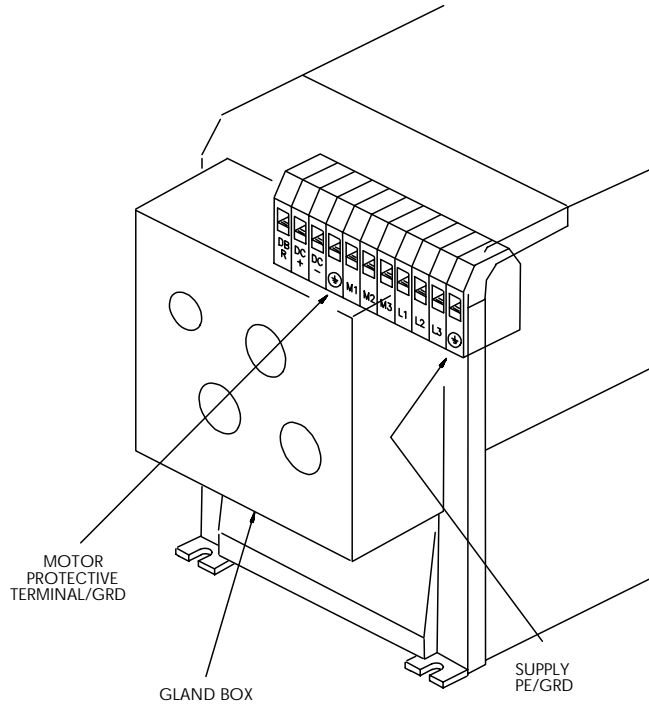
Protective earthing arrangements for wall-mounted models are provided by two size M5 diameter terminals mounted on either side of the internal faces of the sideplates of the conduit gland box as shown in the accompanying drawing. Both terminals are identified with the symbol  $\oplus$  (IEC 417, Symbol 5019) and are intended to be used with protective conductors terminated with compression terminations sized to accept the M5 diameter bolt fitted and the conductor size selected. The single incoming protective conductor shall be of 10mm<sup>2</sup> cross section minimum (for permanent earthing in Europe) connected to the terminal marked "PE", as shown in the drawing below, whilst the motor protective conductor shall be connected to the remaining earth terminal within the gland box.



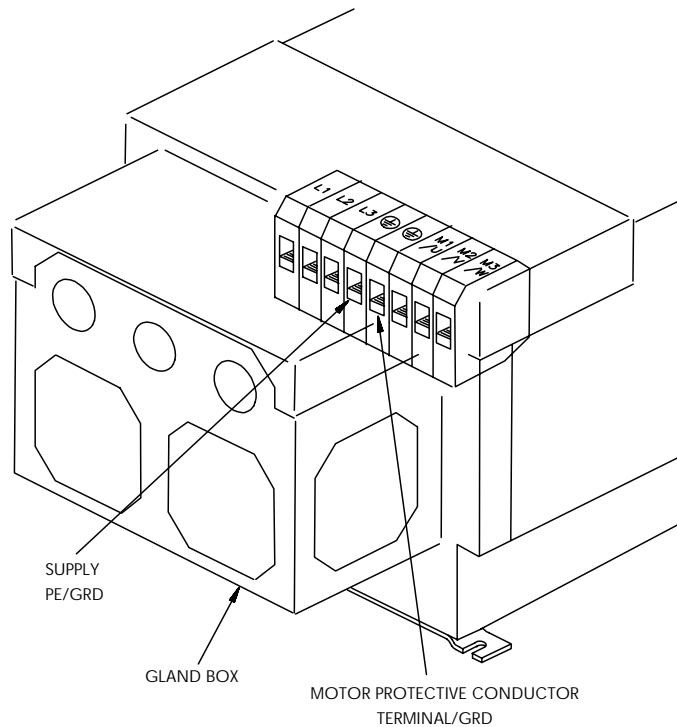
WALL MOUNTING PE/GRD CONNECTIONS  
584S TYPES 4 and 5

### MODEL 584S TYPE 6 AND TYPE 7 SERIES

The protective earthing arrangements for these models consist of two green-yellow coloured terminal blocks located as part of the power terminal array, as shown in the accompanying drawings. The incoming protective conductor of suitable size shall be connected to the terminal marked "PE" as shown in the drawing below, whilst an adequately rated motor protective conductor shall be connected to the remaining earth terminal block. The incoming protective earth conductor will be  $>10\text{mm}^2$  in cross section as so the drives will be permanently earthed for Europe.



CUBICLE AND WALL MOUNTING PE/GRD CONNECTIONS  
584S TYPE 7



CUBICLE AND WALL MOUNTING PE/GRD CONNECTIONS  
584S TYPE 7

## Control Wiring

General wiring diagrams for the 584S are provided in Chapter 2 Figures 2.3 to 2.6.

For normal speed control operation, the speed demand signals are connected to the speed inputs provided (control board terminals 1, 2 and 3) as required. Terminal 4 or 10 may be used for the 0V connection associated with the SPEED SETPOINT, +CURRENT LOOP and TRIM signals. The maximum speed, and other associated parameters, are set from the MMI.

The RUN signal to the 584S is provided by connecting a single holding contact between control board terminal 20 (RUN) and terminal 18 (+24V) - open contact to stop, close contact to run.

A relay contact indicating drive healthy is provided on control board terminals 12 and 13 of the 584S drive. Any alarm which causes the drive healthy relay to de-activate is internally latched by the drive - the cause of the alarm is displayed by the MMI. Once latched, such an alarm can be cleared only by removing and re-applying the main supply to the drive, or removing and re-applying the RUN signal (terminal 20).

Control cables should be 0.75mm<sup>2</sup> (18AWG) minimum. It is recommended that screened cable be used, with the screen connected at the drive end only. Control wiring should be kept separate from power and motor wiring.

## DYNAMIC BRAKING

### Introduction

During deceleration, or with an overhauling load, the motor acts as a generator. Energy flows back from the motor into the DC link capacitors within the drive. This causes the DC link voltage to rise. If the DC link voltage exceeds 810V for the 400V build (or 420V for the 230V build) then the drive will trip to protect the capacitors and the inverter power devices. The amount of energy that can be absorbed in the capacitors is relatively small; typically more than 20% braking torque will cause the drive to trip on overvoltage. Dynamic braking increases the braking capability of the drive by dissipating the excess energy in a high power resistor connected across the DC link (refer to Figure 3.2).

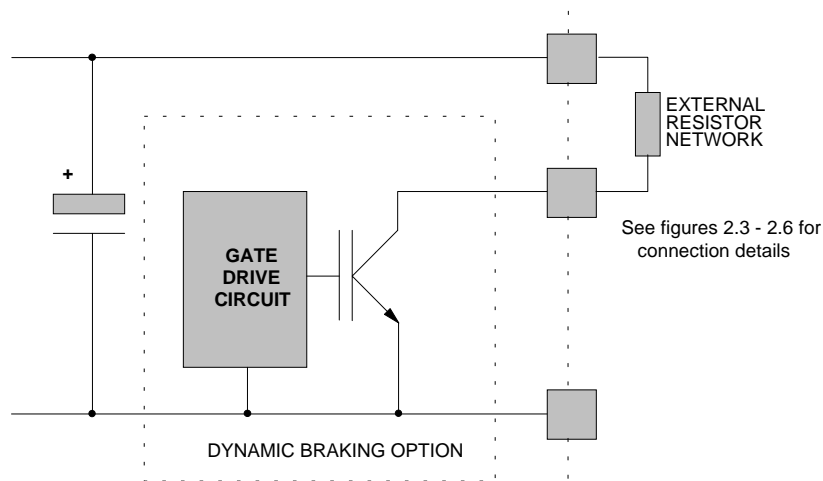


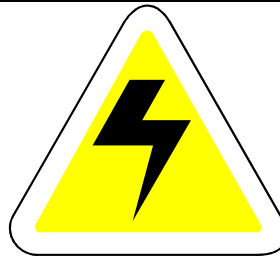
Figure 3.2 - The Dynamic Braking Option

The dynamic braking option is a PCB with an extra IGBT power device fitted. This is fitted inside the drive package and is connected to the negative side of the DC link as shown in Figure 3.7.

When the DC link voltage rises above 750V for the 400V build (385V for the 230V build), the brake unit switches the external resistor network across the DC link. The brake unit switches off again when the DC link voltage falls below the threshold level. The amount of energy produced by the motor during regeneration depends upon the RAMP DOWN TIME parameter and the inertia of the load.

Note: The dynamic braking option is designed to cope with short term stopping or braking only. It is not rated for a continuously overhauling load.

All 584S units are supplied without braking resistors. The following paragraphs should be used as a guide to calculate the braking requirements of the system.



**WARNING!**

**Connecting a brake resistor to a drive not fitted with brake option ( see product code ) will result in damage to this unit. In the case when an internal brake option is not present the DBR1 terminal may be used to connect an external braking unit**

### Brake Resistor Selection

Brake resistor assemblies must be rated to absorb both peak braking power during deceleration and the average power over the complete cycle.

$$\text{Peak braking power} = \frac{0.0055J \times (n_1^2 - n_2^2)}{t_b} \quad (\text{W})$$

$$\text{Average braking power } P_{av} = \frac{P_{pk}}{t_c} \times t_b$$

- J - total inertia (kgm<sup>2</sup>)
- n<sub>1</sub> - initial speed (rpm)
- n<sub>2</sub> - final speed (rpm)
- t<sub>b</sub> - braking time (s)
- t<sub>c</sub> - cycle time (s)

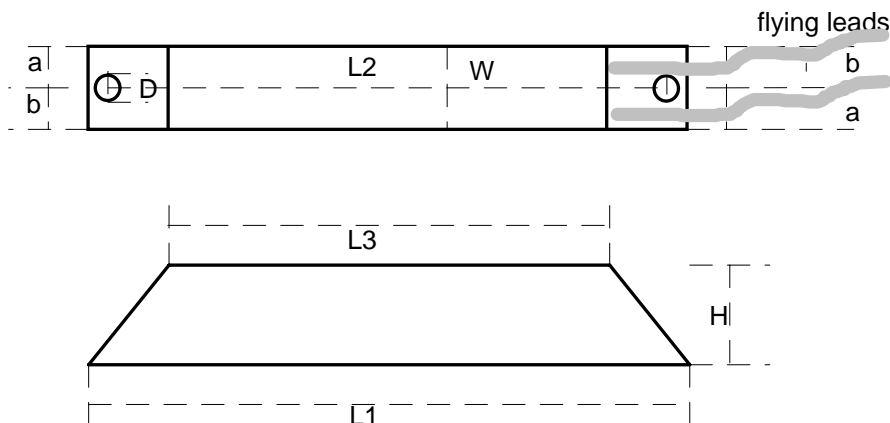
Information on the peak power rating and the average power rating of the resistors must be obtained from the resistor manufacturer. Alternatively if this information is not available then a large safety margin must be incorporated to ensure that the resistors are not overloaded. Eurotherm Drives can supply suitable brake resistor assemblies as detailed over.

By connecting these resistors in series and in parallel the braking capacity can be selected for the application.

The minimum resistance of the combination should not be less than that specified in table 3.3.

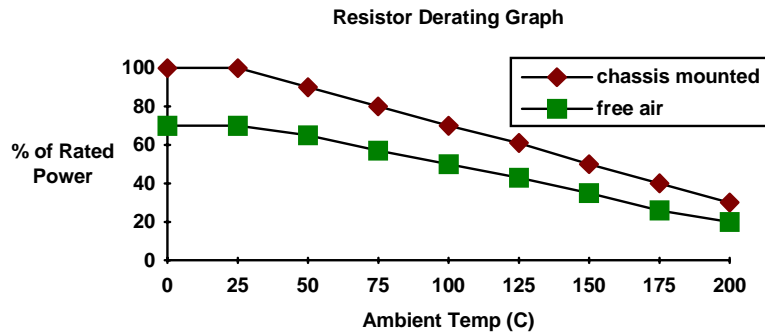
The resistor(s) must be specified to the maximum DC link voltage (810V for the 400V build, 420V for the 230V build).

### Brake Resistor Specification



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Part number	CZ463068	CZ388396
Resistance	56ohms	36ohms
Max Wattage	200W	500W
5 second rating	500%	500%
3 second rating	833%	833%
1 second rating	2500%	2500%
Dimensions L1 (mm)	165	335
L2 (mm)	146	316
L3 (mm)	125	295
W (mm)	30	30
H (mm)	60	60
D (mm)	5.3	5.3
a (mm)	13	13
b (mm)	17	17
Flying lead length (mm)	500	500
Electrical Connection	M5 spade	M5 ring



These resistors should be mounted on a heatsink (back panel) and covered to prevent injury from burning.

**Specification of the Dynamic Braking Switch**

Chassis type 4		
Typical motor rating	(380 - 460 Volts)	0.75kW to 7.5kW
Typical motor rating	(208 - 240 Volts)	0.75kW to 4.0kW
Current rating	(20s max)	15A
Max duty cycle		30%
Min resistor value	(380 - 460 Volts)	50Ω
Min resistor value	(208 - 240 Volts)	25Ω

Chassis type 5		
Typical motor rating	(380 - 460 Volts)	11kW to 15kW
Typical motor rating	(208 - 240 Volts)	5.5kW to 7.5kW
Current rating	(20s max)	30A
Max duty cycle		30%
Min resistor value	(380 - 460 Volts)	25Ω
Min resistor value	(208 - 240 Volts)	12.5Ω

Chassis type 6					
Typical motor rating	(380 - 460 Volts)	18kW	22kW	30kW	37kW
Typical motor rating	(208 - 240 Volts)	-	11kW	15Kw	18kW
Current rating	(20s max)	45A	45A	65A	75A
Max duty cycle		30%	30%	30%	30%
Min resistor value	(380 - 460 Volts)	17Ω	17Ω	11.5Ω	10Ω
Min resistor value	(208 - 240 Volts)	-	8.5Ω	6Ω	5Ω

Chassis type 7				
Typical motor rating	(380 - 460 Volts)	45kW	55kW	75kW
Typical motor rating	(208 - 240 Volts)	22kW	30kW	37kW
Current rating	(20s max)	90A	110A	150A
Max duty cycle		30%	30%	30%
Min resistor value	(380 - 460 Volts)	8.3Ω	6.9Ω	5.0Ω
Min resistor value	(208 - 240 Volts)	4.2Ω	3.5Ω	2.6Ω

Table 3.3 Dynamic Braking Switch Ratings

## EMC INSTALLATION GUIDELINES

### Introduction

This section provides installation guidelines for drive modules and systems to maximise their 'Electro Magnetic Compatibility' (EMC) in their intended operating environment. All installers must read this section and apply the advice which is relevant to their application. **Pass on this information to others as is appropriate.**

All power drive systems have the potential to produce electrical emissions, both radiated and conducted back into the AC supply. This is due to the inherent operation of all drives by switching large voltages and currents rapidly in order to control the motor. Because the drives internal control electronics operates continuously in very close proximity to the electrically noisy power switching elements, drives are inherently immune to any additional external electrical noise.

Great care has been taken in the design and selection of suitable EMC filters to provide the correct level of interface suppression, ease of installation and to ensure that electrical safety is not compromised. The EMC performance can only be guaranteed to be within the limits specified when the 584S/620 drive modules are installed together with the recommended EMC filters in accordance with the following instructions.

The subject of EMC is explored in more detail in a separate Eurotherm Application Manual entitled "EMC Installation Guidelines for modules and systems", part number HA388879, available from your local Eurotherm office.

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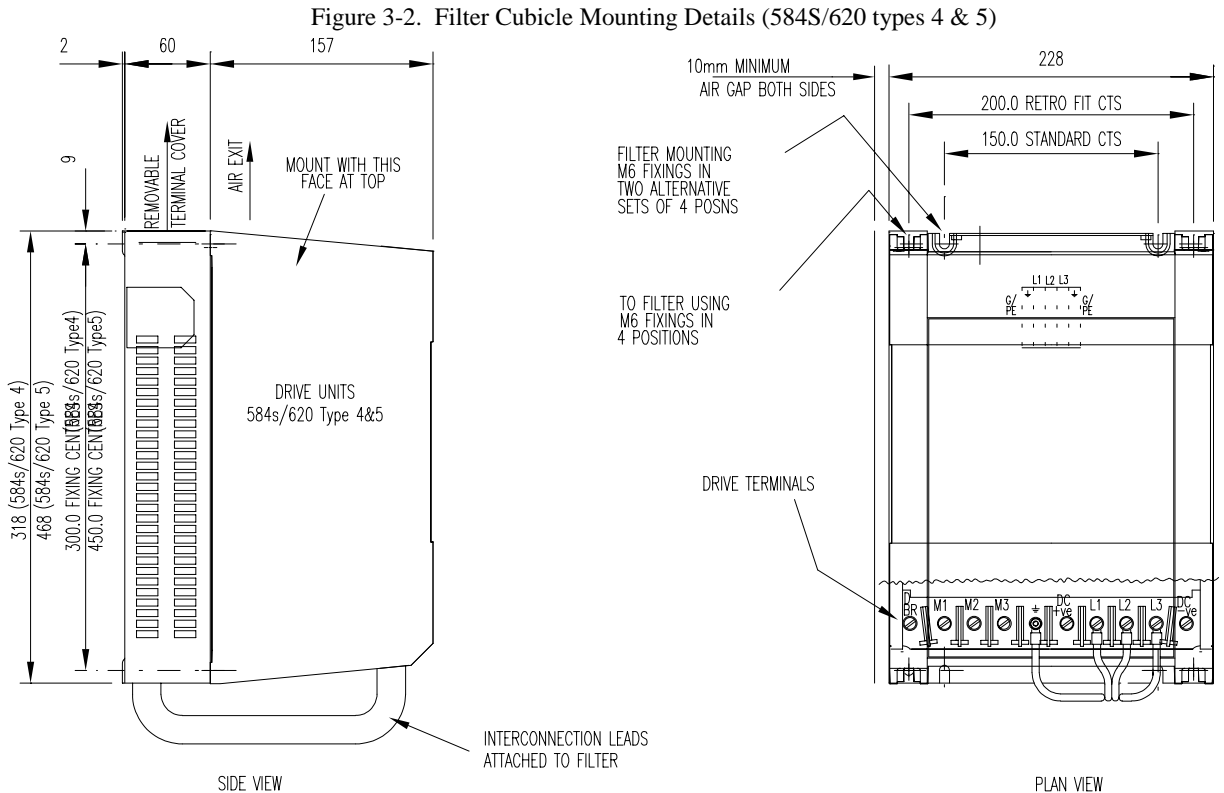
**EMC Filters to Reduce Line Conducted Noise**

An EMC supply filter may be used with each 584S/620 drive module to reduce the line conducted noise. The recommended filters are listed in table 3.4 below.

Table 3.4 AC Supply Filter Part Numbers for Conformance with EN55011 Class B (suitable for both generic environments)

Eurotherm Product	Rating	Watt Loss	Eurotherm Filter Part Number
584S Type 4	0.75kW - 5.5kW (380V to 460V) & 0.75kW - 2.2kW (208V to 240V) constant torque	20W	CO388966U021
584S Type 4	7.5kW (380V to 460V) & 4kW (208V to 240V) constant torque	35W	CO388966U035
584S Type 5	All	25W	CO388966U045
584S Type 6	All	75W	CO464053U095
584S Type 7	All	158W	CO464053U200

The recommended EMC filters for the type 4 and 5 584S/620 are to be mounted behind the drive module (underfloor mounting) and share the same footprint. They are suitable as standard for cubicle mount applications, as shown in figure 3-2. For wall mounting a purpose designed pressed steel conduit (Part No. BA388844) is supplied with the gland box, for mounting between the filter body and gland box is shown in the mechanical mounting drawing figures 3-3.



FILTER (CUBICLE) MOUNTING DETAIL

- FILTERS:- CO388966U021 (18amp FOR 584s/620 Type 4)
- CO388966U035 (24amp FOR 584s/620 Type 4)
- CO388966U045 (38amp FOR 584s/620 Type 5)

Figure 3-3. Filter Wall Mounting Details (584S/620 types 4 & 5).

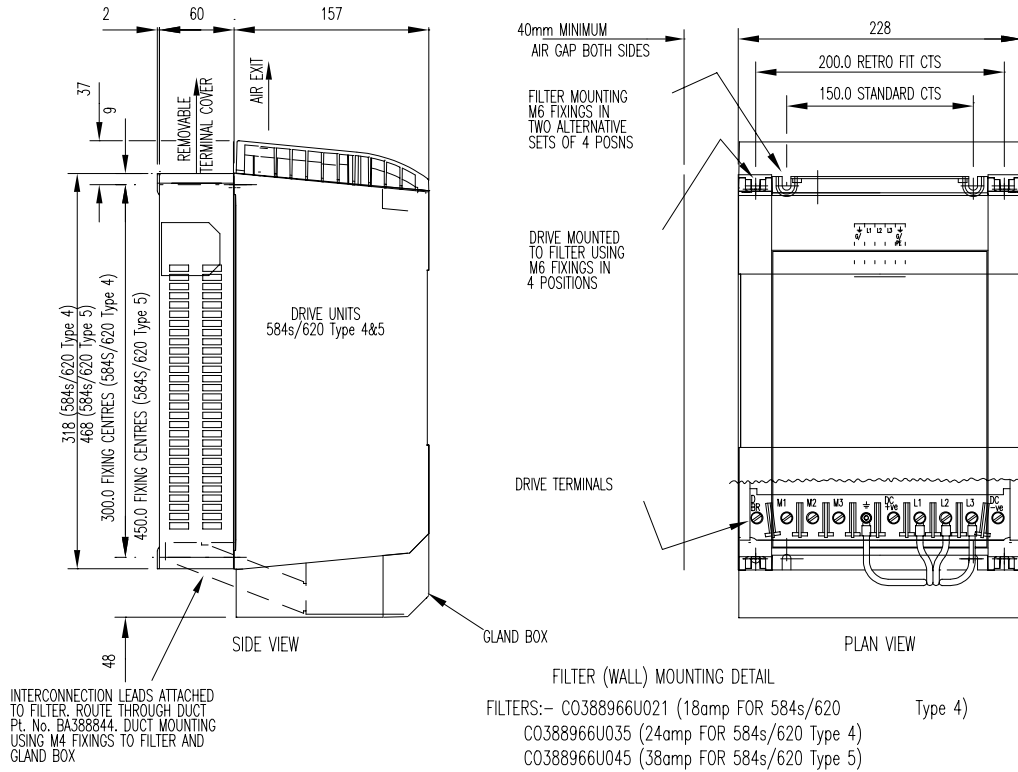
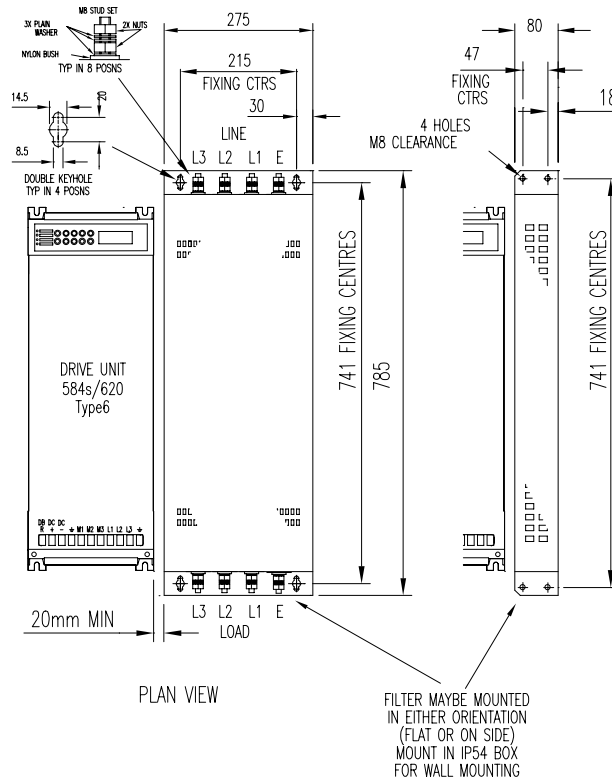


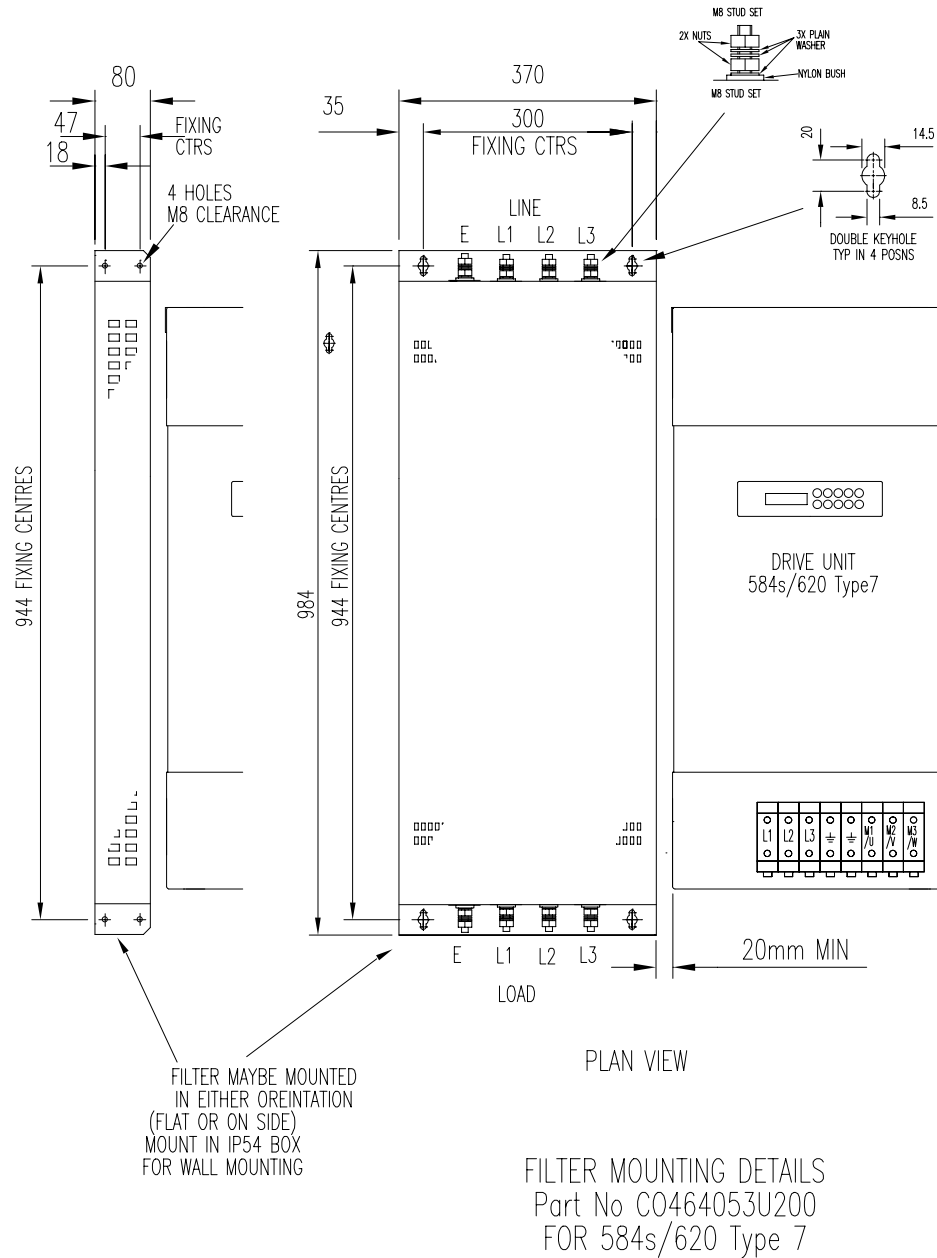
Figure 3-4. Filter Mounting Details (584S/620 Type 6).



FILTER MOUNTING DETAILS  
 Part No C0464053U095  
 FOR 584s/620 Type 6



Figure 3-5. Filter Mounting Details (584S/620 Type 7).



The type 6 and 7 584S/620 filters are not of the footprint mounting design. These filters may be mounted to the left, right, above, below or spaced behind the product, but can be mounted in two orientations i) flat against the wall or ii) projecting over from the wall, mounting arrangements are shown in figures 3-4 and 3-5. Wallmount application require the EMC filter to be mounted in a separate suitable enclosure, and the gland box to be fitted to the 584S/620.

The EMC filter should be mounted as close to the 584S/620 drive module as possible. The connection between the 584S/620 and filter must always be as short as possible taking care not to obstruct any ventilation spacing and **be segregated from all other cables**. If this cable/busbar exceeds 0.3m in length then it must be replaced with a screened/armoured cable, with the screen/armour earthed at both the filter and inverter ends with large-area contact surfaces, preferably with metal cable glands. The connection between the 584S/620 drive module and the motor must be installed away from all other cables or wires. Ideally the filter will be mounted onto the same metallic panel as the drive. The RF connection between the inverter, filter and panel should be enhanced as follows:

- Remove any paint/insulation between the mounting points of the EMC filter, 584S/620 drive module and panel.
- Liberally apply petroleum jelly over the mounting points and securing threads to prevent corrosion. Alternatively conducting paint could be used on mounting panels.

- If the proceeding is not possible, then the RF earth bond between the filter and 584S/620 drive module is usefully improved by making an additional RF earth connection using wire braid of at least 10 mm<sup>2</sup> cross sectional area (due to skin effect).
- For wall mount application, ensure that the cable between the EMC filter and the 584S/620 drive module cable is passed through conduit mounted between the filter and the Gland Box. This cable must be as short as possible and segregated from all other cables. The conduit must be electrically connected to the filter and drive module gland box.

**NOTE:** Metal surfaces such as eloxized or yellow chromed e.g. with cable mounting or 35 mm DIN rails, screws and bolts have a high RF impedance which can be very detrimental for EMC performance.

Care should be taken to ensure that the protective earth (PE) conductor exiting from the filter is connected to the protective earth connection of the 584S/620 drive module. Any additional RF earth such as a cable screen **is not a protective earth**. The EMC filter must be **permanently earthed** to prevent the risk of electric shock under abnormal operating instances (such as the loss of one phase of the AC supply). Permanent earthing can be achieved by either:

- Using a copper protective earth conductor of at least 10 mm<sup>2</sup> or
- Installing a second conductor in parallel connection with the protective conductor to a separate protective earth terminal.

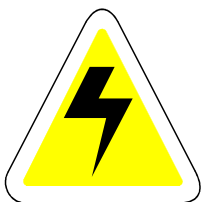
Each conductor shall on its own meet the requirements for a protective earth conductor. On all recommended underfloor EMC filters two protective earth connections are provided for permanent earthing.

The recommended EMC filters are designed to operate from normal three-phases supplies which are balanced with respect to earth (earth referenced supplies). This minimises the earth leakage current due to the filter capacitors between phase and earth. On some specific customer sites the supply may not be balanced with respect to earth (non-earth referenced supplies). The earth leakage currents would increase and interfere with the operation of any earth-fault monitoring equipment. In addition the EMC performance of the filter will be degraded. Eurotherm Drives do not recommend the use of AC supply filters on non earth-referenced supplies.

**With all AC and servo drives conducted and radiated interference increases with the inverter switching frequency. The emissions can therefore be reduced by selecting the lowest acceptable switching frequency. (584S switchable option only). Thermal conformance of the recommended filters is only guaranteed up to a given switching frequency. For the 584S types 4, 5, 6 and 7 this is 6kHz, all with a maximum equivalent cable length of 150m.**

**As with all power electronic drives the conducted emissions increase with motor cable length. EMC conformance to the stringent limits is only guaranteed up to a cable length of 50 m (types 4, 5, 6 and 7). This length can be increased. Refer to section entitled Motor Cable-length Limitations in this chapter.**

If **one EMC filter** is to be used in an enclosure, then this filter should be mounted as close to the incoming AC supply to the enclosure as possible.



### IMPORTANT WARNINGS !

The recommended EMC filters are designed to work with supplies which are balanced with respect to earth (i.e. earthed referenced supplies). On some specific customer sites the supply may not be balanced with respect to earth. The recommended standard EMC filters are not recommended be used on such supplies. Refer to Eurotherm Drives for more information.

The EMC filters contain capacitors phase-to-phase and phase-to-earth. Discharge resistors are fitted, but the filters, terminals and wiring must not be touched for a period of 5 minutes after the removal of the AC supply. **Not adhering to this warning can result in electric shock.**

The EMC filter must only be used with a **permanent earth** connection using one of the following alternatives:

- Using a copper protective earth conductor of at least 10 mm<sup>2</sup> or
- Installing a second conductor in parallel with the protective conductor to a separate protective earth terminal on the filter or inverter. The conductor on its own shall meet the requirements for a protective earth conductor.

Thermal performance of the EMC filter is only guaranteed up to a switching frequency of 6 kHz (type 4, 5, 6 and 7), and a maximum equivalent cable length of 150 m.

Refer to the following section regarding safety considerations with earth-fault detection systems.

## Interaction With Earth-fault Monitoring Systems and Safety Considerations

Due to the EMC filter internal capacitors between phase and earth, on initial connection of the AC supply a pulse of current will flow in the earth. This has been minimised in the recommended EMC filters, but may still trip out any RCD (Residual Current Detector) in the earth system. In addition high frequency and DC components of earth leakage currents will flow under normal operating conditions. Under certain fault conditions, larger DC protective earth currents may flow. The protective function of some RCDs cannot be guaranteed under such operating conditions. Eurotherm Drives do not recommend the use of RCDs, but where their use is mandatory, they should be capable of correct operation with DC and AC protective earth currents (such as type B RCDs as in amendment 2 of IEC755) and have adjustable trip amplitude and time characteristics, to prevent nuisance tripping on initial power connection. RCDs used with 584S/620 drive modules and other similar equipment are **not suitable for personnel protection**. Another means of providing personal safety must be provided for, see prEN50178/VDE0160.

## Minimising Radiated Emissions

All 584S/620 drive modules can be made to comply with the most stringent radiated emission limits of EN55011 (1991) Class B by simply mounting inside an enclosure with 10 dB attenuation between 30 and 100 MHz (which would typically be the attenuation provided by a metal cabinet with no aperture greater than 0.15m) and screening any control and signal cabling outside of the enclosure. The control and signal cables should be terminated at the entrance to the enclosure. Outside of an enclosure (wall mount) all 584S/620 drive modules will meet the Class A requirements with screening of the signal and control cables. Inside the enclosure the radiated magnetic and electric fields will be high, due to proximity, and any components fitted inside the enclosure must be sufficiently immune. Remember that the EN55011 radiated emission measurements are made between 30 MHz and 1 GHz in the far field, at a distance of between 10m and 30 m. No limits are specified lower than 30 MHz, or in close proximity. Emissions from individual components tend to be additive.

The cable between the enclosure and the motor must be screened or armoured and also contains the motor protective earth connection. The screen/armour must be earthed at both ends by connecting it to both the motor frame and the entrance to the cubicle (or gland box for wall mount), ideally in 360° termination's via cable glands (to meet the most stringent emission requirements). Screen to earth connections via 360° bonding is 75% more effective than earthing via pigtailed (Note some motor gland boxes and conduit glands are made of plastic, if this is the case then braid must be connected between the screen and the chassis, in addition at the motor end ensure that the screen is electrically connected to the motor frame since some terminal boxes are insulated from the frame by gasket/paint). Often the screens are terminated on a power screen rail at the entrance to the enclosure using 'u' clips to achieve a near 360° screen band. The integrity of the screen must be maintained over the entire length of the cable between the enclosure and motor. If the cable is broken to insert terminals, contactors, chokes, fuses etc., then the screen must be connected over the shortest possible distance. Note some hazardous area installations may preclude direct earthing at both ends of the screen, in this case earth the other end via a 1 µF, 50VAC capacitor. The motor protective earth should be connected to the drive module motor protective earth connection.

If a shielded cable is not available, lay unshielded motor cables in a metal conduit which will act as a shield. The conduit must be continuous with a direct electrical contact to the drive module and motor housing. If links are necessary, use braid with a minimum cross sectional area of 10 mm<sup>2</sup>.

### **Safety earthing always takes precedence over EMC earthing.**

The use of screened cable without an EMC filter is not recommended, as line-conducted interference will increase substantially and the capacitive coupling of the output cable to earth will result in high earth-leakage currents.

To ensure the correct operation of the 584S/620 drive module, some control and signal cables (encoder, all analogue inputs and communications) have to be screened back to the inverter terminals. The screen integrity must be continuous right back to the drive if not connected to the cubicle. Always minimise the length of screen stripped back to make this connection. The screen should only be connected at the drive end. If high frequency noise is still a problem, earth at the non drive end via a 0.1 µF capacitor.

## Screening and Earthing When Mounted in an Enclosure

Make sure the requirements of EN60204 are adhered to with electrical equipment for machines. Satisfactory EMC performance is only achievable when the 584S/620 drive module, filter and associated equipment is mounted on a conducting metal mounting panel. Beware of constructions using insulating mounting panels or undefined mounting structures. A single point earthing strategy should be followed for a single drive module mounted in an enclosure as shown in figure 3-6. The protective earth connection (PE) to the motor must run inside the screened cable between the motor and 584S/620 drive module, where it is to be connected to the motor protective earth terminal on the drive module. (Note in accordance with EN60204 only one protective earth conductor is permitted at each earth terminal contacting point). Local wiring regulations may require the protective-earth connection of the motor to be connected

locally but this will not cause shielding problems due to the relatively high RF impedance of the local earth connection.

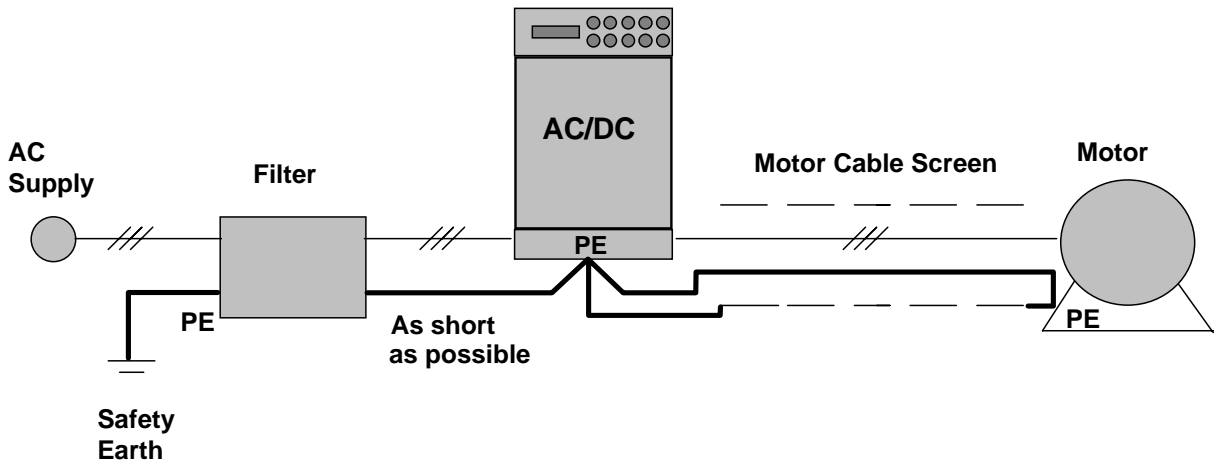


Figure 3-6: Screening and earthing of a single 584S/620 drive module.

When more than one piece of electrical equipment is fitted inside an enclosure, care must be taken to ensure that noise flowing in the earth connection does not couple into other equipment. A star-point earthing policy separating noisy from quiet earths is strongly recommended. Five separate earths branches should be provided for:

- ◆ Clean earth busbar                      The Clean earth busbar is used as a reference point for all signal and control cabling. This may be further subdivided into an analogue and a digital reference busbar, each separately connected to the star earthing point. The digital reference is also used for any 24V control.
- ◆ Dirty earth busbar                      The dirty earth busbar is used for all power earths (i.e. protective earth connections)
- ◆ Enclosure metalwork busbar            The enclosure metalwork busbar is used for all parts of the cubicle including panels, doors and back plate. It is also used as a reference for any 110 or 220V control used and for the control transformer screen.
- ◆ Power screen busbar                    The power screen busbar is only for power screened cables which **do not** have to go directly to the 584S/620 drive module (such as motor cables, braking choppers and their resistors) or to other drive modules (refer to appropriate Product Manual to identify these). Noise coupled onto the incoming screens must flow to earth directly so as not to contaminate the rest of the cubicle. Hence the power screen busbar should be placed as close to the point of cable entry as possible.
- ◆ Signal/control screen busbar            The signal/control screen busbar is to be used for signal/control screened cables which do not have to go directly to the 584S/620 drive module. This busbar should also be placed as close as to the point of cable entry as possible.

For optimum EMC performance, copper rails with a substantial cross-section should be used for the busbar. Screened cables are best 'u' clamped to the busbars to ensure an optimum HF connection.

The five separate earth busbars should be insulated from the mounting panel and connected to a single earth point (star point) near the PE or PEN terminal of the main supply. Flexible large cross-section cable to ensure a low HF impedance should be used. The arrangement of the busbars should be such that the connection to the single earth point are as short as possible. Figure 3-7 shows an implementation of a star-point earthing policy.

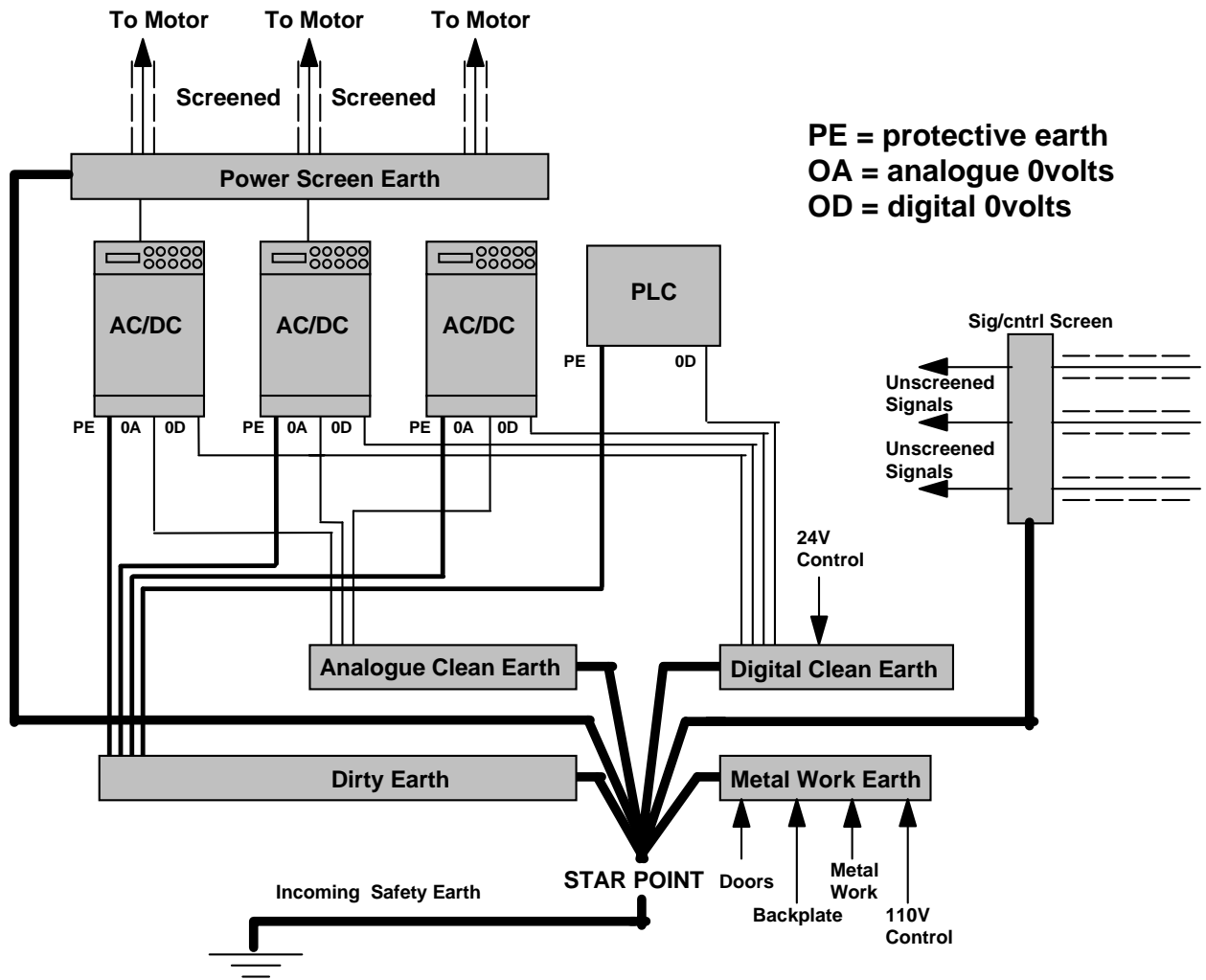


Figure 3-7: Implementation of star-point earthing policy for multi-drive installation

## Screening and Earthing When Wall Mounted

To provide for good EMC performance the recommended EMC filter must be fitted and the cables between the wall-mount 584S/620 drive module and the motor screened or armoured. Also screening of control and signal cables may be required. Refer to the previous instructions on minimising radiated emission. In addition any connections to the DC link must also be screened/armoured, with the screen connected at both ends (e.g. to the protective earth of the dynamic brake resistor).

All 584S/620 drive modules comply with the radiated emission limits of EN55011 (1991) Class A when wall mounted to these instructions, using the recommended EMC filter and screened motor control and signal cabling. Products which meet the limits of Class A can be made to meet the more stringent limits of Class B by mounting inside an enclosure with 10 dB attenuation between 30 and 100 MHz (which would typically be the attenuation provided by a metal cabinet with no aperture at a dimension greater than 0.15m) and screening any control and signal cabling outside of the cubicle. Minimise the length of unshielded cable inside the cubicle to prevent increased radiated emission.

A single-point earthing policy as shown in Figure 3-6 is required.

The protective earth connection (PE) to the motor must run inside the screened cable between the motor and 584S/620 drive module where it is to be connected to the protective earth terminal in the gland box or on the drive module (note, in accordance with EN60204 only one protective earth conductor is permitted at each earth terminal contacting point). Local wiring regulations may require the protective-earth connection of the motor to be connected locally but this will not cause shielding problems due to relatively high RF impedance of the local earth connection.

The EMC filter must be permanently earthed in accordance with recommendations and warnings in the section “**EMC Filters to Reduce Line Conducted Noise**”.

## Motor Cable-length Limitations

Screened/armoured cable has significant capacitance between the conductors and the screen which increases linearly with cable length. Typically this is 200 pF per metre but this will vary with cable type and current rating. Long cable lengths may have the following undesirable effects:

- Tripping on 'over current' as the cable capacitance is charged and discharged at the switching frequency,
- Producing increased conducted emissions which degrade the performance of the EMC filter due to saturation. EMC compliance is only guaranteed up to a maximum cable length of 50m (type 4, 5, 6 and 7).
- Causes RCDs (Residential Current Detection) to trip out due to increased high frequency earth current.
- Produces increased heating inside the EMC AC supply filter from the increased conducted emissions. Eurotherm Drives only guarantee the thermal performance of the filters up to a specified cable length of 150m with screened cable.

These effects can be overcome by adding chokes at the output of the 584S/620 drive module. In applications where multiple motors are connected to a single drive, minimise the length of screened/armoured cable connected to the drive by using a single length of cable to a star junction point, from where all the other motor cables are attached. Maintain the integrity of the shield. If the cable is interrupted to insert contactors or other components, the screen must be connected over the shortest possible route. Table A1 in the appendix gives information on the recommended output chokes for use with long cables, cables connected in parallel, or when EMC output filters are used with cables greater than that specified for EMC compliance.

Output filters can also be used to achieve EMC and filter thermal conformance with longer cable lengths than that specified. These output filters also ensure a long motor life by reducing the high dV/dt and over voltage stresses applied to the motor windings by inverters. These filters should be mounted as close to the 584S/620 drive module as possible. Refer to Eurotherm Drives for the selection of suitable filters.

## Other Layout Considerations

The proximity between the source and victim circuit has a large effect on radiated coupling. The electromagnetic fields produced by drive modules falls off rapidly with distance from the cabling/enclosure. It should be remembered that the radiated fields from EMC compliant drive systems are measured at least 10m from the equipment over the frequency band 30 to 1000 MHz (as required by EN55011, referenced by the generics and the drive product specific standard). Any equipment placed closer to the drive system than this will see larger magnitude fields, particularly very close to the drive. No magnetic/electric field sensitive equipment should be placed within 0.25m of the following parts of a drive system:

- 584S/620 Drive module
- EMC output filters
- Input or output chokes/transformers
- Cable between 584S/620 Frequency Inverter and Motor (even when screened/armoured)
- Connections to external braking chopper and resistor (even when screened/armoured)
- AC/DC brushed motors (due to commutation)
- DC link connections (even when screened/armoured)
- Relays and contactors (even if they are suppressed)

Often the coupling between electrically 'noisy' and 'sensitive' cables is a problem. This can be minimised by separating parallel runs by at least 0.25m, and minimising the length of parallel runs. For long parallel runs (>10 m) the separation should be increased proportionally. For example if the parallel runs were 50 m then the separation would be  $(50/10) \times 0.25 \text{ m} = 1.25 \text{ m}$ .

In addition the coupling between two cables which must cross is minimised if they cross over at 90°. Hence sensitive cables should cross the cables to the motor, DC link and braking chopper circuit at 90°, and should never be run close to them or in parallel for any great length.

Never run supply, DC link or motor cables in the same bundle as the signal/control and feedback cables, even if they are screened.

From experience the following equipment is defined as particularly sensitive and care must be taken in the installation:

- Any transducers which produce low level analogue outputs (<1 volt) e.g. load cells, strain gauges, thermocouples, piezoelectric transducers, anometers, LVDT's

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- A.M. radios (long and medium wave only)
- Video cameras and closed circuit TV
- Office personal computers
- Capacitive devices such as proximity sensors and level transducers
- Mains borne communication systems
- Equipment not suitable for operation in the intended EMC environment i.e. with insufficient immunity to new EMC standards

## Chapter 4

### SETTING-UP AND COMMISSIONING

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## Chapter 4 SETTING-UP AND COMMISSIONING

### DESCRIPTION

The 584S Frequency Inverters feature a Man-Machine Interface (MMI) panel, shown in Figure 4.1, comprising a 2x16 character liquid crystal display (LCD), ten function keys and four status LEDs. The LCD and function keys provide a means of tailoring the drive for individual application requirements, monitoring performance and basic operation of the drive. The status LEDs show the condition of the drive.



Figure 4.1 Man-Machine Interface

### MAN-MACHINE INTERFACE

Since the setting up and commissioning procedures rely on the use of the MMI, its operation is described in the following sub-paragraphs. Users familiar with the MMI may proceed directly to "**SETTING-UP PROCEDURE**".

### Display and Menu

The MMI display comprises two lines of plain text information to provide access to the various menu options and parameters. The top line contains the title of the current menu or parameter and the second contains either one of the options within the menu, or the value or status of the parameter. The basic operation of the MMI display and function keys is described in Figure 4.2.

### Parameters and Diagnostics

In this chapter the names of parameters and diagnostics are presented in a different font to indicate that they appear on the MMI display, for example **MOTOR I LIMIT**.

### User Reset

If during commissioning or at any time you wish to return the drive parameters to a known factory default, then follow this set sequence.

1. Remove power from the drive.
2. Wait till display disappears.
3. Reapply power with both the up arrow and down arrow key depressed.

## Function Keys

The ten function keys allow the user to move around the menu structure on the display, alter parameters or manually control the drive. Each key is identified by a legend and is described in the following section:



### MENU

The MENU select key allows the user to access the menu level or function indicated on the bottom line of the display. This key does not alter any of the stored drive parameters. This key will also allow the user to observe the actual frequency diagnostic while in LOCAL MODE. This diagnostic is only present while the key is depressed.



### ESCAPE

The ESCAPE key allows the user to select the preceding menu level. It does not alter any of the stored drive parameters. The ESCAPE key always takes you back to the last point at which you were working.



### UP

The UP key provides forward movement to explore the options available under any selected menu level. The selected menu is always given on the top line of the display. When a modifiable parameter is shown on the top line of the display the UP key will increment its value. In LOCAL MODE this key will increment the local setpoint unless its value is already MAX SPEED.



### DOWN

The DOWN key provides backward movement to explore the options available under any selected menu level. The selected menu is always given on the top line of the display. When a modifiable parameter is shown on the top line of the display the DOWN key will decrement its value. In LOCAL MODE this key will decrement the local setpoint unless its value is already MIN SPEED.



### LOCAL/REMOTE

This key will toggle between the normal operating mode (remote) and the local control mode (this can only happen when the drive is stopped). Control functionality is now with the operator station i.e. START, STOP, JOG and speed setpoint (REF). Pressing the local button will place the LCD in a new separate MMI tree entry. Pressing the local/remote button to put the drive back into remote mode will place the LCD back at the original position in the standard tree (again only when the drive is stopped).



### PROG

This button toggles between the local mode MMI display (if the local mode has been selected) and the normal MMI tree. This will allow the user to change parameters etc. while the drive is operating in this local mode. The toggle will always be between the last normal MMI entry and the new local MMI entry.



### FORWARD/REVERSE

The FORWARD/REVERSE button will change the direction of motor rotation. The display will also change to indicate which direction is selected.

Note: Some models in this range will cause counter clockwise motor shaft rotation when Forward is selected. This can be corrected by reversing two motor phases e.g., M1/U and M2/V see page 4.8 paragraph 4).



#### JOG

This button will run the drive at a speed determined by the JOG SPEED parameter and in the direction determined by the FORWARD/REVERSE selection. This function is only active while the button is depressed. After operating JOG the drive will be placed in a stopped mode.



#### START

This button will enable the drive in a similar manner to placing 24V on terminal 20 (note this action is latched). This button will only perform this function if the local mode has been selected.



#### STOP

This button will disable the drive in a similar manner to removing the 24V from terminal 20 (note this action is latched). This button will only perform this function if the local mode has been selected. Setpoint values will be maintained during stop.

### Status LEDs

The status LEDs give instant diagnostic information on the condition of the drive. When the LEDs are lit they indicate:

HEALTH	The drive is powered up and there are no alarms present.
RUN	The run digital input is active and there are no alarms present. A flashing RUN LED indicates that the output current has exceeded the selected I*T threshold. The drive will trip if this condition persists. "I*T ALARM" in this chapter describes the I*T function in more detail.
BRAKE	The DC link voltage inside the drive has risen above the dynamic braking threshold. Chapter 3 "DYNAMIC BRAKING" describes this in more detail.
LOCAL	The drive is in local mode when illuminated.

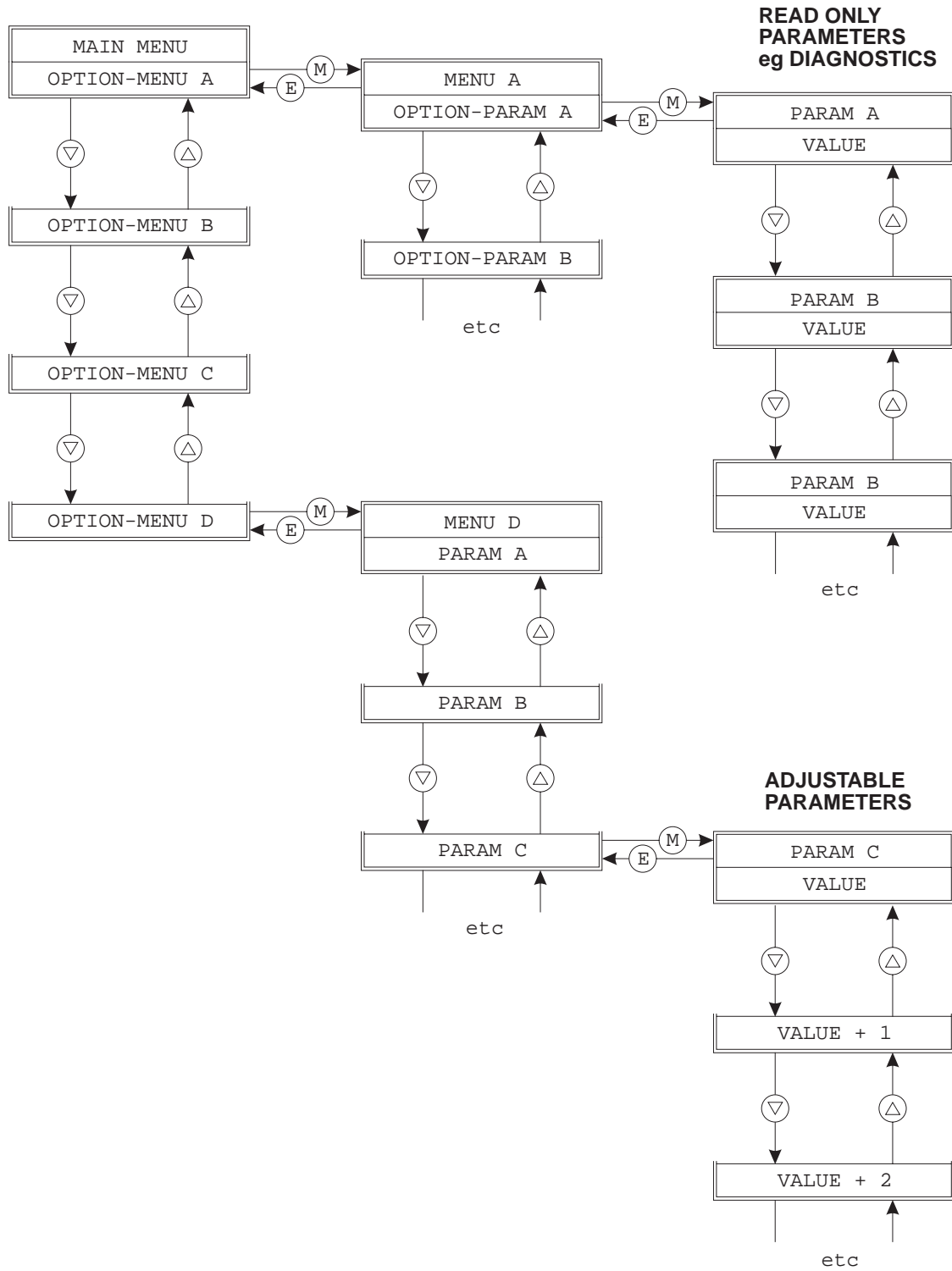


Figure 4.2 - Using the MMI

## Menu Structure

The options available to the user from the main menu are given in Figure 4.3. These options are briefly described in the following paragraphs which include references for further details.

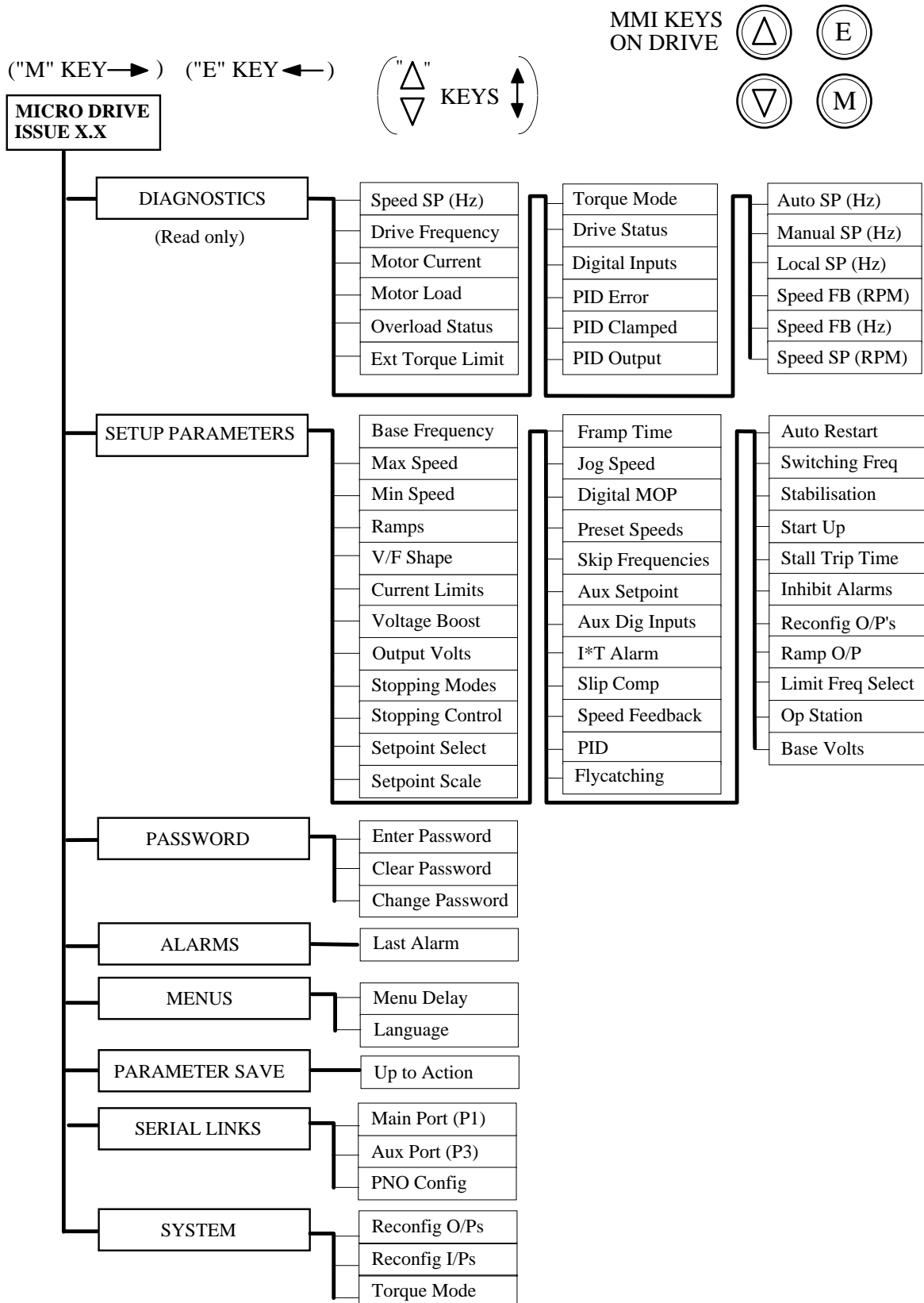


Figure 4.3 - Main Menu Options

## Diagnostics

The DIAGNOSTIC option provides the user with access to read-only displays of various drive status parameters. Refer to Chapter 5 for further details.

## Setup Parameters

The SETUP PARAMETERS option provides the user with the facility to adjust and set a large number of drive parameters. Refer to "**SETUP PARAMETERS**" in this chapter for further details.

## Password

The PASSWORD option allows the user to protect the setup parameters from being changed by an unauthorised user. Procedures for setting and changing passwords are included in "**PASSWORD**" in this chapter.

## Alarms

The ALARMS option provides the user with access to the last alarm message. If the drive trips, the MMI display immediately shows an alarm message indicating the reason for the trip. This message can be cleared using the ESCAPE (E) key, but can be redisplayed via the ALARMS menu. Possible alarm messages are explained in Chapter 5.

## Menus

The MENUS option allows the user to select the language in which the text appears.

## Parameter Save

The PARAMETER SAVE option enables the user to store the setup parameters after adjustment.

## Serial Links

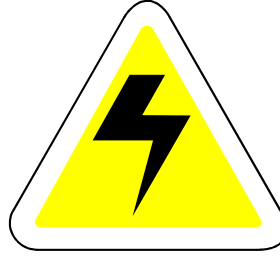
The SERIAL LINKS option allows access to the serial link setup parameters which are used to configure the RS232 port: AUX PORT P3 (fitted as standard), and the RS422/485 port: MAIN PORT P1 (fitted as an option). Further details are contained in Appendix B.

## System

The SYSTEM option enables the user to set reconfigurable input and output control board connections as well as setting the torque mode. Refer to "**SYSTEM**" for further details.

## SETTING-UP PROCEDURE

---



### WARNING!

**WAIT 5 MINUTES AFTER POWER IS DISCONNECTED BEFORE WORKING ON ANY PART OF THE SYSTEM OR REMOVING THE TERMINAL COVER FROM THE DRIVE**

---

Before power is applied to the system the following items should be checked:

- 1) Mains power supply voltage is correct.
- 2) Motor is of correct voltage rating and is connected in either star or delta as appropriate.
- 3) All external wiring circuits; Power connections, Control connections, Motor connections, Earth connections.

NOTE: Completely disconnect the drive before point to point checking with a buzzer or when checking insulation with a Meggar.

- 4) Check for damage to equipment.
- 5) Check for loose ends, clippings, drilling swarf, etc., lodged in the drive or ancillary equipment.
- 6) If possible check that the motor can be turned freely and that the cooling fan is intact and free of obstructions.

Next ensure the safety of the complete system when the drive is energised. In particular ensure:

- 1) That rotation of the motor in either direction will not cause damage.
- 2) That nobody else is working on another part of the equipment which will be affected by powering up.
- 3) That other equipment will not be adversely affected by powering up.

Prepare to energise the drive and system as follows:

- 1) Prevent application of the main power supply by removal of the supply fuses or isolate via supply circuit breaker.
- 2) Disconnect the load from the motor shaft, if possible.
- 3) If any of the drive control terminals are not being used then refer to Chapter 2, Table 2.5 to check whether these unused terminals need to be tied high or low.
- 4) Check external run contacts are open.
- 5) Check external speed setpoints are all zero.
- 6) The drive setup parameters, such as min/max speed, ramp times etc., all have factory default values. These values should be adequate for many applications, however it may be necessary to change some of the parameters to suit individual applications.



The most important parameters and their default values are listed in Table 4.1. Check that these are appropriate for your application before proceeding. If any changes are required to these parameters then this should be done when the drive has been powered up, but before the drive is enabled (ie. before the RUN input switch contacts are closed). Refer to "**SETUP PARAMETERS**" for a description of these parameters.

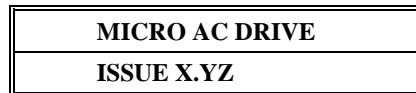
Table 4.1 - Important Setup Parameters and their Default Values

PARAMETER	DEFAULT	BRIEF DESCRIPTION
<b>LIMIT FRQ SELECT</b>	120Hz	Highest possible drive output frequency
<b>BASE FREQUENCY</b>	50Hz	Frequency at which drive gives max output volts
<b>MIN SPEED</b>	0Hz	Min motor speed
<b>MAX SPEED</b>	50Hz	Max motor speed
<b>MOTOR I LIMIT</b>	100%	Output current limit as % of drive rated current
<b>OP CURRENT CAL</b>	100%	Calibrates motor rated current to drive rated current
<b>RAMP UP TIME 1</b>	10.0s	Acceleration time from 0Hz to limit frequency
<b>RAMP DOWN TIME 1</b>	10.0s	Deceleration time from limit frequency to 0Hz
<b>FIXED BOOST</b>	0.0%	Boosts the starting torque by adding volts at low drive output frequencies
<b>STOPPING MODE</b>	RAMP	Ramp to standstill when RUN signal removed

## POWER ON

Once all the preceding steps are completed and understood the supply fuses or circuit breaker may be replaced and power applied to the drive. Although fairly general, the following assumes a single drive and motor configuration.

- 1) At switch on the diagnostic "HEALTH" LED should light. The remaining 3 LEDs should be off and the power-up message should appear on the MMI display as follows:



- 2) If any of the basic drive parameters need to be changed then this should be done now. See "**MAN-MACHINE INTERFACE**" for a full explanation of how to use the MMI, and "**SET-UP PARAMETERS**" onwards for specific parameters.
- 3) Close the RUN contact and give the drive a small speed demand. The motor should rotate slowly.
- 4) **If the motor rotates in the wrong direction either** (a) swap two of the output phases M1/U, M2/V, M3/W or (b) operate the DIRECTION digital input terminal 22.
- 5) In applications where a high starting torque is required an increase in the **FIXED BOOST** parameter may be necessary. This parameter is described in "**SET-UP PARAMETERS**". Excessive boost may cause the drive to trip on overcurrent. Always use the minimum level of boost that allows the motor to start reliably.
- 6) If the motor current rating is smaller than the drive current rating then the **OP CURRENT CAL** parameter should be reduced to match the motor rating.
- 7) If several motors are connected to a single inverter then each motor should be protected with an appropriate overload device.



### Caution

When power is removed from the product it must not be re-applied for a period of 30 seconds to allow the inrush limit circuit to operate correctly.

## SETUP PARAMETERS

The **SETUP PARAMETERS** menu is entered in order to change default parameters and in order to make running performance adjustments. All the parameters are described in the following subparagraphs, although the order of presentation on the actual MMI may differ.

---



### Caution

If your application requires operation above 120Hz with a special high speed motor then the **LIMIT FREQUENCY** parameter should be adjusted before any other parameters are changed. This is because **LIMIT FREQUENCY** affects the scaling of all frequency related parameters (**MIN SPEED**, **MAX SPEED**, **BASE FREQUENCY** etc). The default value for **LIMIT FREQUENCY** is 120Hz which covers the majority of applications for standard induction motors. This parameter is described in "**LIMIT FREQUENCY**".

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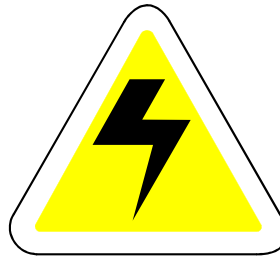
Note: Users must remember to save parameters after any changes are made. See "**PARAMETER SAVE**" later in this chapter.

## Base Frequency

The **BASE FREQUENCY** is the frequency at which the inverter produces maximum output voltage. This would be set at 50Hz or 60Hz for a standard motor. The range and default values are:

Range: **LIMIT FREQUENCY/16 to LIMIT FREQUENCY**  
Default: 50Hz

---



### WARNING!

The inverter output frequency can exceed the **MAX SPEED** parameter setting when using slip compensation feature or when using the PID output to trim the ramp output. This speed is clamped at 105% of the **MAX SPEED** parameter

---

## Maximum and Minimum Speeds

**MAX SPEED** is the motor speed corresponding to maximum setpoint input. The maximum speed range and default values are:

Range: **MIN SPEED to LIMIT FREQUENCY**  
Default: 50Hz

**MIN SPEED** is the motor speed corresponding to zero setpoint input. Range and default values are:

Range: 0Hz to **MAX SPEED**  
Default: 0Hz

NOTE: The **MAX SPEED** and **MIN SPEED** parameters can affect the scaling of the analogue speed setpoint inputs (SPEED SETPOINT, + CURRENT LOOP and TRIM). Refer to Chapter 2, Table 2.5.

## Ramps

The **RAMPS** option provides access to a number of ramp related parameters which control acceleration and deceleration characteristics. Ramp 2 times are only active if **FRAMP** parameter is configured as **2ND RAMP RATES** (see **RECONFIG I/Ps** parameter in the System menu) and terminal 21 is high. Parameter options include:

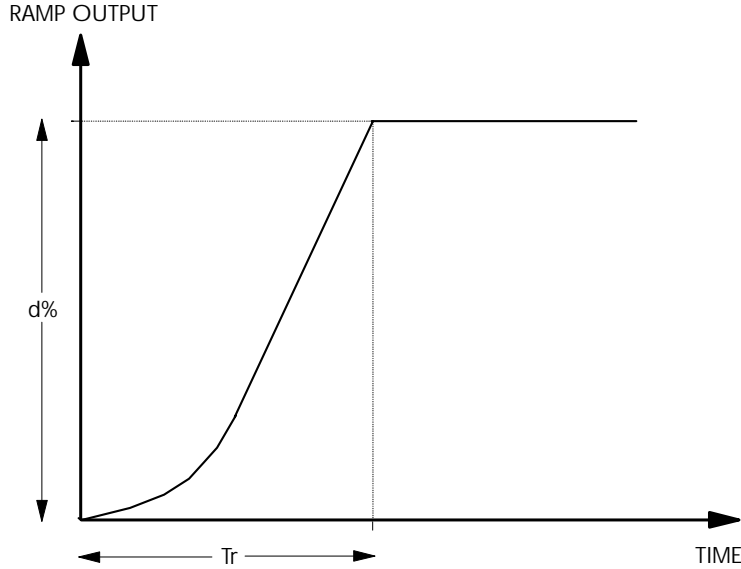
<b>RAMP UP TIME 1</b>	This is the time taken for the drive to ramp the frequency from 0Hz to <b>LIMIT FREQUENCY</b> . Range: 0.1 to 3000 seconds. Default: 10.0 seconds (up to 75kW) - 50.0 seconds (greater than 75kW).
<b>RAMP DOWN TIME 1</b>	This is the time taken for the drive to ramp the frequency from <b>LIMIT FREQUENCY</b> to 0Hz. Range: 0.1 to 3000 seconds. Default: 10.0 seconds (up to 75kW) - 50.0 seconds (greater than 75kW).
<b>RAMP UP TIME 2</b>	This is the time taken for the drive to ramp the frequency from 0Hz to <b>LIMIT FREQUENCY</b> . Range: 0.1 to 3000 seconds. Default: 10.0 seconds (up to 75kW) - 50.0 seconds (greater than 75kW).
<b>RAMP DOWN TIME 2</b>	This is the time taken for the drive to ramp the frequency from <b>LIMIT FREQUENCY</b> to 0Hz. Range: 0.1 to 3000 seconds. Default: 10.0 seconds (up to 75kW) - 50.0 seconds (greater than 75kW).
<b>RAMP HOLD</b>	This can prevent the drive from tripping on overvolts when decelerating large inertia loads without a dynamic braking unit. The deceleration ramp is stopped when the DC link volts rises above the braking level. It is only restarted when the link voltage falls below this threshold level. The effect is to increase the overall deceleration time. Range: <b>DISABLED</b> or <b>ENABLED</b> Default: <b>DISABLED</b>

NOTE: Do not enable the ramp hold feature when using injection braking. This will increase the risk of overvolt tripping on stopping.

<b>RAMP TYPE</b>	This option allows the user to choose between three types of ramp characteristics: <b>LINEAR RAMP</b> provides a linear increase in motor speed with time. <b>PARABOLIC RAMP</b> provides a soft start characteristic. <b>S RAMP</b> provides both soft start at the beginning and soft finish at the end. Default: <b>LINEAR RAMP</b> .
<b>S RAMP %</b>	This dictates the degree of soft start and soft finish experienced when using the <b>PARABOLIC RAMP</b> or <b>S RAMP</b> . <b>S RAMP %</b> has no effect when using <b>LINEAR RAMP</b> . An <b>S RAMP %</b> value of 0% causes the <b>PARABOLIC RAMP</b> or <b>S RAMP</b> to act as a <b>LINEAR RAMP</b> . Range: 0 to 100%. Default: 100%.

NOTE: When using PARABOLIC RAMP or S RAMP, the time taken for the motor speed to reach the speed setpoint will be dependent on the ramp time, the size of the speed setpoint and the value of the **S RAMP %** parameter. Refer to the following sub-paragraphs for further details regarding PARABOLIC RAMP or S RAMP characteristics.

**PARABOLIC RAMP:**



The PARABOLIC RAMP response time for a given setpoint step size,  $d\%$ , and **S RAMP %** can be calculated as follows:

$$\text{If } \sqrt{2 \times \frac{d\%}{100\%} \times \frac{\text{SRAMP}\%}{200\% - \text{SRAMP}\%}} \leq \frac{\text{SRAMP}\%}{200\% - \text{SRAMP}\%}$$

Then the PARABOLIC RAMP contains pure acceleration only. Thus, the response time,  $T_r$ , can be calculated using:

$$T_r = \text{RAMPTIME} \times \sqrt{2 \times \frac{d\%}{100\%} \times \frac{\text{SRAMP}\%}{200\% - \text{SRAMP}\%}}$$

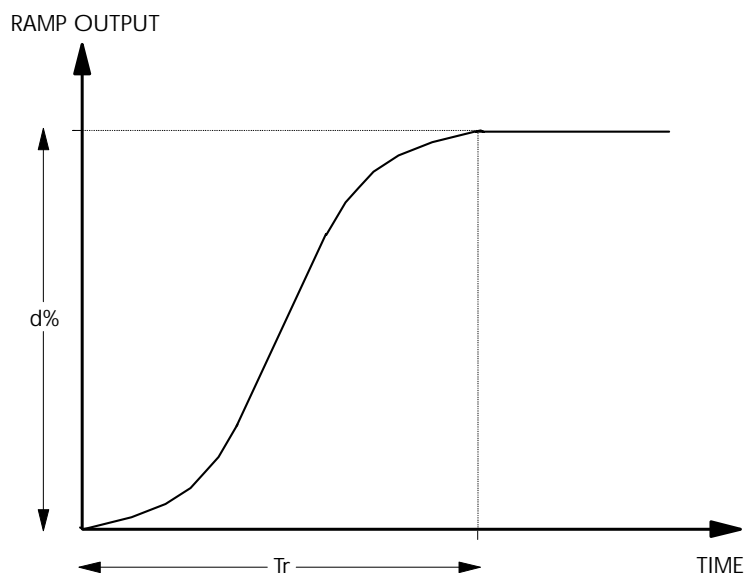
Else, the PARABOLIC RAMP contains acceleration and linear sections to its response. Thus, the response time,  $T_r$ , can be calculated using:

$$T_r = \text{RAMPTIME} \times \left[ \frac{d\%}{100\%} + \frac{1}{2} \times \frac{\text{SRAMP}\%}{200\% - \text{SRAMP}\%} \right]$$

NOTE:- 100% is assumed to be equal to the **LIMIT FREQUENCY**.

The S applies to the start of the acceleration and the start of the deceleration

**S RAMP:**



The S RAMP response time for a given setpoint step size, d%, and **R RAMP %** can be calculated as follows:

If 
$$\sqrt{\frac{d\%}{100\%} \times \frac{SRAMP\%}{200\% - SRAMP\%}} \leq \frac{SRAMP\%}{200\% - SRAMP\%}$$

Then the S RAMP contains pure acceleration and deceleration only. Thus, the response time, Tr, can be calculated using:

$$Tr = RAMPTIME \times 2 \times \sqrt{\frac{d\%}{100\%} \times \frac{SRAMP\%}{200\% - SRAMP\%}}$$

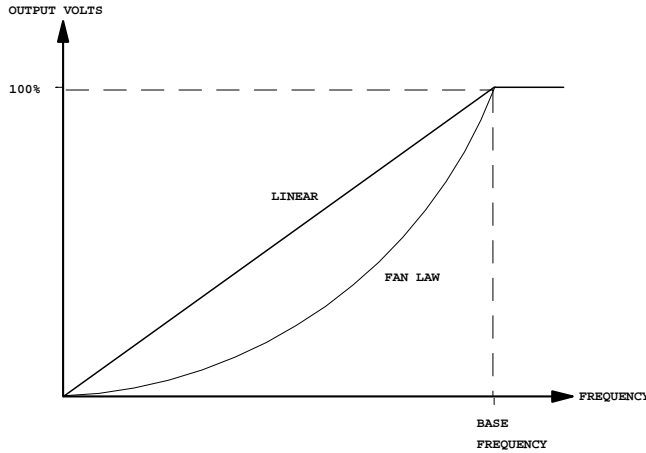
Else, the S RAMP contains acceleration, linear and deceleration sections to its response. Thus, the response time, Tr, can be calculated using:

$$Tr = RAMPTIME \times \frac{d\%}{100\%} \times \frac{200\%}{200\% - SRAMP\%}$$

NOTE:- 100% is assumed to be equal to the **LIMIT FREQUENCY**.

## Voltage/Frequency Shape

The **V/F SHAPE** option enables one of two voltage/frequency characteristics to be selected



### **LINEAR**

This gives a constant torque characteristic up to the **BASE FREQUENCY**

### **FAN LAW**

This gives a quadratic torque characteristic up to the **BASE FREQUENCY**. This matches the load requirement for fan and pump applications.

Range:           **LINEAR**  
                      **FAN LAW**  
Default:          **LINEAR**

## Current Limits

This option provides access to a number of current limit parameters.

### **MOTOR I LIMIT**

This sets the maximum motoring current for the drive. If the drive output current exceeds this value then the drive will attempt to reduce the motoring load by reducing the motor frequency.

Range:           50 to 150%.  
Default:          100%.

### **REGEN I LIMIT**

This sets the maximum regenerating current for the drive. If the drive output current exceeds this value then the drive will attempt to reduce the regenerating load by increasing the motor frequency.

Range:           -50 to -150%.  
Default           -100%.

### **REGEN LIM SELECT**

This enables or disables the **REGEN I LIMIT** function.

Default:          **ENABLED.**

### **EXT TORQUE LIM**

This parameter enables or disables the **EXTERNAL TORQUE LIMIT** analogue input on terminal 5. When enabled, the drive takes its load limit setting from terminal 5 rather than from the **MOTOR I LIMIT** parameter. In this mode, the drive will adjust the motor frequency to control the motor load rather than motor current.

Default:          **DISABLED.**

### **OP CURRENT CAL**

This parameter can be used to scale the drive output current to match the actual motor current as follows:

$$\text{OP CURRENT CAL} = \frac{\text{MOTOR FLC}}{\text{DRIVE FLC}} \times 100\%$$

For example, if the drive full load current is 16A and the motor full load current is 14.8A then:

$$\text{OP CURRENT CAL} = \frac{14.8}{16} \times 100\% = 92.5\%$$

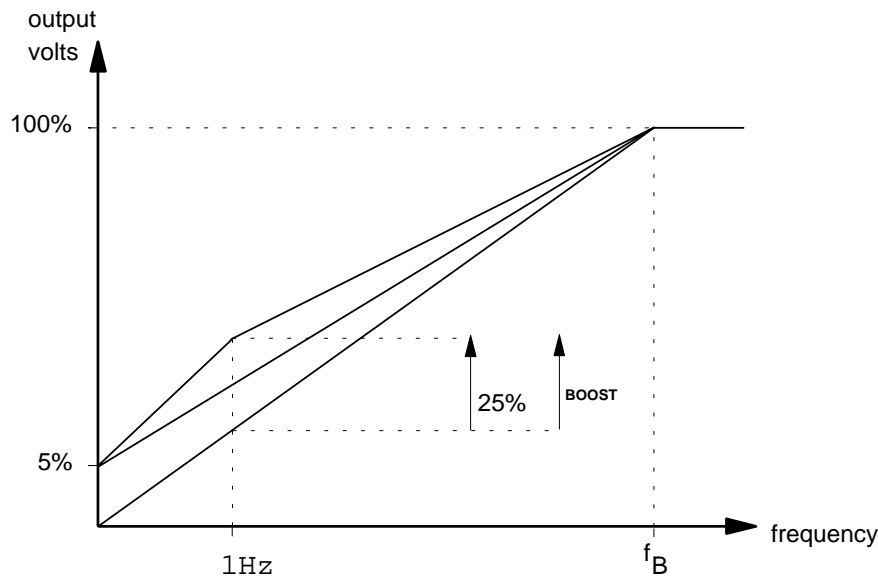
All current related diagnostics and parameters can now be read as a % of the motor rated current.

Range: 10 to 100%.  
Default: 100%.

## Voltage Boost

This is used to correctly flux the motor at low speeds. This allows the drive to produce greater starting torque for high friction loads. Voltage boost increases the motor volts above the selected V/F characteristic at the lower end of the speed range.

For applications requiring very high motor starting torque, consult Chapter 8 Appendix A for guidance on optimal settings for the voltage boost parameters.



f<sub>B</sub> = BASE  
FREQUENCY

Two options are available:

### FIXED BOOST

This parameter determines the level of extra volts applied to the motor at low speeds.

Range 0 to 25% of the rated output voltage.  
clamped internally to 5% in types 8, 9 and 10 inverters  
(greater than 75kW).

Default 0%.

Note:- 6% fixed boost is sufficient for most applications, excessive boost will cause the motor not to start as well as cause motor overheating.

<b>AUTO BOOST</b>	The <b>AUTO BOOST</b> parameter determines whether the applied voltage boost is a fixed value or varies linearly with motor load. With the <b>AUTO BOOST</b> parameter enabled the applied boost is 0% at no load, but equal to the <b>FIXED BOOST</b> parameter at 100% load. <b>AUTO BOOST</b> is especially suited to applications where high motor torque is initially required to overcome stiction. Range                   ENABLED or DISABLED Default                 DISABLED
-------------------	--

NOTE: The **AUTO BOOST** feature requires a value of **FIXED BOOST** to be set by the user. Zero **FIXED BOOST** will result in zero **AUTO BOOST**.

$$BOOSTLEVEL = FIXEDBOOST \times \frac{MEASUREDLOAD}{100\%}$$

NOTE: Setting the **FIXED BOOST** parameter too high with **AUTO BOOST** enabled, can cause the drive to enter current limit. If this happens, the drive will be unable to ramp up in speed. Simply reducing the setting of the **FIXED BOOST** parameter will eliminate this problem.

## Voltage Control

This option determines how the inverter output volts change as a result of variations of DC link volts.

<b>VOLTAGE MODE</b>	Two control modes are available:-  FIXED                   The product of modulation depth and link volts is constant. The <b>OUTPUT VOLTS</b> at nominal supply voltage may be adjusted between 208.0 and 460.0 volts.  AUTOMATIC           The product of modulation depth and link volts is initially kept constant following a change in link volts, but slowly reverts to the demanded level of modulation depth.  Default:               Automatic.
<b>OUTPUT VOLTS</b>	This parameter determines the desired level of maximum motor volts (i.e., the motor volts expected at base frequency).  Range:                 208V to 460V. Default:               Either 230V or 400V dependent of drive nameplate voltage rating.

## Stopping Mode

One of four stopping modes is available:

<b>COAST</b>	The motor is allowed to freewheel to a standstill.
<b>RAMP</b>	The motor speed is controlled down to zero at a rate set by the <b>RAMP DOWN TIME</b> parameter.
<b>INJECTION</b>	On a stop command the motor volts are rapidly reduced at constant frequency to deflux the motor. If injection braking begins from a speed greater than 20% of <b>BASE FREQUENCY</b> , a low frequency braking current is applied until the motor speed is almost zero. This is followed by a timed 2.0s DC pulse to hold the motor shaft. The DC pulse amplitude is set by the voltage boost. Braking current during low frequency injection braking is controlled by the <b>MOTOR I LIMIT</b> parameter. If injection braking begins from a speed below 20% of <b>BASE FREQUENCY</b> , a d.c. pulse is applied to the motor. The duration of the d.c. holding pulse is governed by the active <b>RAMP DOWN TIME</b> parameter.

NOTE: **AUTO BOOST** should be disabled when using injection braking. Enabling the auto boost feature will make the DC holding pulse amplitude related to estimated motor load. Since load is small during injection braking, the DC holding pulse will also be small. **FIXED BOOST** only provides better motor holding performance.



## RAMP + INJECTION

The motor speed is controlled down to zero at a rate set by the **RAMP DOWN TIME** parameter. A timed DC pulse is then applied to hold the shaft. The DC pulse amplitude is set by the voltage boost.

Default **RAMP**

## Stopping Control

The stopping control menu contains parameters associated with the stopping modes.

### DC PULSE TIME.

This parameter governs the duration of the d.c holding pulse applied to the motor at the end of a **RAMP + INJECTION** or **FRAMP** stopping sequence. The amplitude of the d.c. holding pulse is governed by **VOLTAGE BOOST** setting.

Range: 0.1s to 20.0s

Default: 2.0s

### INJ TIMEOUT

This parameter governs the maximum allowed duration of low frequency injection braking. If low frequency injection braking persists for longer than the **INJ TIMEOUT** duration, injection braking is terminated and a 2.0s d.c. holding pulse is forced.

Range: 0.1s to 600.0s

Default: 120.0s

## Setpoint Select

This option enables the user to configure the manual and auto setpoints. The **MANUAL/AUTO** digital input (terminal 27) can be used to switch between manual and auto setpoints.

### MANUAL SETPOINT

There are 12 possible sources for the **MANUAL SETPOINT**

1. analogue input terminal 1, **0V TO +10V**
2. analogue input terminal 1, **-10V TO +10V**
3. **AUX SETPOINT** parameter
4. **PRESET SPEED 1** parameter
5. **PRESET SPEED 2** parameter
6. **PRESET SPEED 3** parameter
7. **PRESET SPEED 4** parameter
8. **PRESET SPEED 5** parameter
9. **PRESET SPEED 6** parameter
10. **PRESET SPEED 7** parameter
11. **PRESET SPEED 8** parameter
12. **DIGITAL MOP** parameter

Default **0V TO +10V**

### AUTO SETPOINT

There are 7 possible sources for the **AUTO SETPOINT**

1. analogue input terminal 3, **I LOOP 0-20mA**
2. analogue input terminal 3, **I LOOP 20-0mA**
3. analogue input terminal 3, **I LOOP 4-20mA**
4. analogue input terminal 3, **I LOOP 20-4mA**
5. **SERIAL LINK**, serial link setpoint parameter
6. **DIGITAL PRESET**, preset speed selected by digital input terminals 25, 26 and 24
7. **SPEED FEEDBACK**, measured speed of a different motor as a setpoint.

Default **I LOOP 0-20mA**

### TRIM CHOICE

The bipolar, -10V to +10V, speed trim, terminal 2, can be selected to operate with manual setpoints only, auto setpoints only or with manual and auto setpoints simultaneously. The Default is **MANUAL & AUTO**.

## Setpoint Scale

This option provides setpoint ratio functions for the local operator station and both remote setpoints, manual and auto. The manual and auto setpoints are summed with the trim before being scaled by a **RATIO** and a **DIVIDER** and clamped between **MIN SPEED** and **MAX SPEED**.

<b>LOCAL RATIO</b>	The local ratio is the factor which the local setpoint is multiplied by. Range -3.0000 to +3.0000 Default 1.0000
<b>LOCAL DIVIDER</b>	The local divider is the factor by which the local setpoint is divided by. Range -3.0000 to +3.0000 Default 1.0000
<b>MANUAL RATIO</b>	The manual ratio is the factor which the manual setpoint is multiplied by. Range -3.0000 to +3.0000 Default 1.0000
<b>MANUAL DIVIDER</b>	The manual divider is the factor by which the manual setpoint is divided by. Range -3.0000 to +3.0000 Default 1.0000
<b>AUTO RATIO</b>	The auto ratio is the factor which the auto setpoint is multiplied by. Range -3.0000 to +3.0000 Default 1.0000
<b>AUTO DIVIDER</b>	The auto divider is the factor by which the auto setpoint is divided by. Range -3.0000 to +3.0000 Default 1.0000

## Framp Time

This is the time taken for the drive to ramp the frequency from **LIMIT FREQUENCY** to 0Hz, when the **FRAMP** parameter is configured as **FRAMP** (see **RECONFIG I/Ps** parameter in the System menu ) and terminal 21 is high, and the RUN signal is removed. The **FRAMP** is followed by a DC holding pulse with duration determined by the **DC PULSE TIME**. The range and default values are:

Range : 0 to 3000s  
Default : 1.0s

NOTE: The FRAMP digital input is used only to select the **FRAMP TIME**. The RUN signal must always be removed to initiate the stop sequence.

## Jog Speed

The **JOG SPEED** parameter determines the speed that the drive will run at when the JOG terminal, 24, is raised to +24V (terminal 18) or the JOG button to the MMI is depressed ( depending which is active ) The **JOG SPEED** parameter can only be altered when the **RECONFIG I/Ps** parameter in the "SYSTEM" menu is set to 4 PRESETS & JOG.

Range : - **LIMIT FREQUENCY** to +**LIMIT FREQUENCY**  
Default : 5.0Hz

NOTE: JOG has priority over RUN

## Digital MOP

The **DIGITAL MOP** provides the feature of an internal motorised potentiometer (MOP). The setpoint can be changed by an increase / decrease function. In order for the **DIGITAL MOP** to operate, the **RECONFIG I/Ps** parameter in the "SYSTEM" menu must be set to DIGITAL MOP & PRESET. Once configured, terminal 25, acts as setpoint RAISE, while terminal 26, acts as setpoint LOWER. The JOG, terminal 24, is reconfigured to provide a

MOP PRESET command. The **DIGITAL MOP** setpoint is not saved by the parameter save operation. Parameters accessed via the **DIGITAL MOP** menu are as follows:

**MAX MOP SPEED** This is the target **DIGITAL MOP** speed setpoint while RAISE is active.  
Range : **-LIMIT FREQUENCY** to **+LIMIT FREQUENCY**  
Default : **+LIMIT FREQUENCY**

**MIN MOP SPEED** This is the target **DIGITAL MOP** speed setpoint while LOWER is active.  
Range : **-LIMIT FREQUENCY** to **+LIMIT FREQUENCY**  
Default : **-LIMIT FREQUENCY**

**MOP PRESET SPEED** This is the **DIGITAL MOP** preset speed setpoint.  
Range : **-LIMIT FREQUENCY** to **+LIMIT FREQUENCY**  
Default : 0

**INCREASE RATE** This is the time taken to ramp from 0 to **+LIMIT FREQUENCY** or from 0 to **-LIMIT FREQUENCY**.  
Range : 0.1 to 3000.0s  
Default : 10.0s

**DECREASE RATE** This is the time taken to ramp from **+LIMIT FREQUENCY** to 0 or from **-LIMIT FREQUENCY** to 0.  
Range : 0.1 to 3000.0s  
Default : 10.0s

NOTE: The **DIGITAL MOP** will fail to operate when **S RAMP** has been selected. This is because unlike linear or parabolic ramps, s-ramps cannot be instantly stopped without destroying the s characteristic.

## Preset Speeds

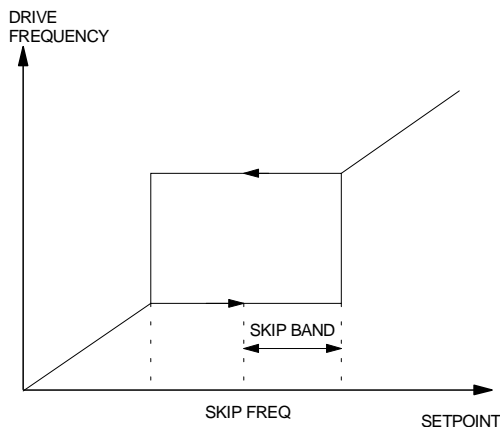
There are two banks of 4 preset speeds available to the user. All 8 presets can be selected locally using the **MANUAL SETPOINT** select parameter.

The first bank of 4 presets can be selected remotely using the two digital inputs, terminals 25 and 26, when the **RECONFIG I/Ps** parameter in the System menu (see "SYSTEM") is set to 4 PRESETS & JOG.

The second bank of 4 presets is only active when the **RECONFIG I/Ps** parameter in the "SYSTEM" menu is set to 8 PRESETS. Once the values have been programmed, this second bank of presets can be selected remotely via the two digital inputs, terminals 25 and 26, while the terminal 24, is held at +24V (terminal 18). The first bank of presets (preset speeds 1 to 4) can still be selected remotely using terminals 25 and 26, while terminal 24 is held at 0V (terminal 19).

## Skip Frequencies

Four programmable skip frequencies are available to avoid resonances within the mechanical system. Enter the value of drive frequency that causes the resonance using the **SKP FRQ** parameter and then programme the width of the skip band using the **SKP FRQ BAND** parameter. The drive will then avoid sustained operation within the forbidden band as shown in the diagram.



<b>SKP FQ SELECTION</b>	This option enables the user to enable or disable each of the 4 skip frequencies. Default <b>DISABLED.</b>
<b>SKP FRQ 1 to 4</b>	These parameters contain the centre frequency of each skip band. Range: 0Hz to <b>LIMIT FREQUENCY</b> Default: 0Hz
<b>SKP FRQ 1 to 4 BAND</b>	These parameters contain the width of each skip band. Range: 0Hz to <b>LIMIT FREQUENCY/12</b> Default: 0Hz

## Aux Setpoint

This parameter allows a setpoint value to be entered directly via the MMI. The **MANUAL SETPOINT** select menu must first be used to enable the **AUX SETPOINT** to allow the motor speed to be controlled from the drive keypad.

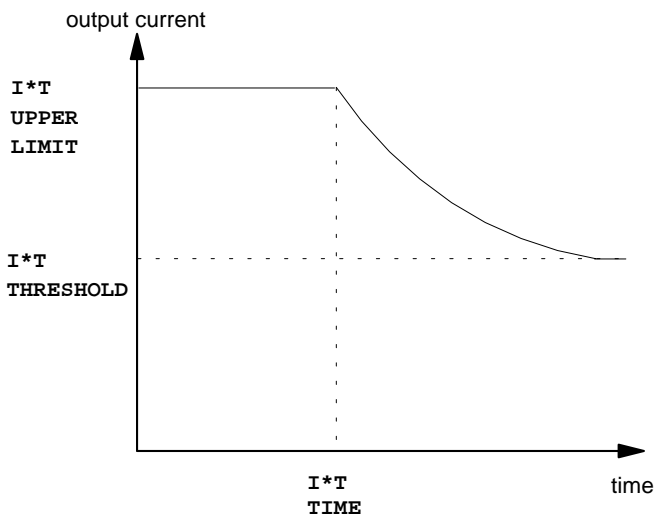
Range: **-LIMIT FREQUENCY to +LIMIT FREQUENCY**  
 Default: 0Hz

## Aux Digital Inputs

**AUX DIG INPUTS** are used by the serial link to control **AUX JOG**, **AUX RUN**, **AUX FRAMP** and **AUX DIRECTION** parameters. The functionality of these inputs is shown in Chapter 2 Figure 2-2.

## I\*T Alarm

The **I\*T ALARM** parameters allow the overload characteristics of the drive to be programmed to match the application.



If the drive output current exceeds the **I\*T THRESHOLD** then the drive will trip after a certain time given by:

$$I * T \text{ TRIP TIME} = \frac{(I * T \text{ UPPER LIMIT} - I * T \text{ THRESHOLD}) \times I * T \text{ TIME}}{\text{OUTPUT CURRENT} - I * T \text{ THRESHOLD}}$$

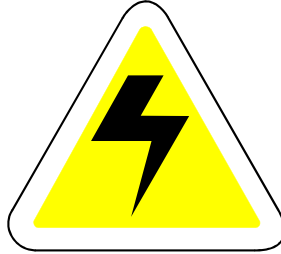
<b>I*T THRESHOLD</b>	Adjustment of the long term continuous rating. This parameter should be set to match the current rating of the motor being used. Range 50% to 105% of drive rating. Default 105%
<b>I*T UPPER LIMIT</b>	Adjustment of the maximum overload permissible Range 50% to 150% of drive rating. Default 150%.

---

<b>I*T TIME</b>	Adjustment of the maximum time the maximum overload can be sustained.
Range	5 to 60 seconds
Default	60 seconds

## Slip Compensation

Slip compensation increases the inverter output frequency as a function of load. This is an open loop compensation for the slip characteristic of the induction motor.



### WARNING!

The inverter output frequency can exceed the **MAX SPEED** parameter setting when using slip compensation feature by 5%.

---

<b>COMP LEVEL</b>	Gives the frequency value which will be added to the output frequency at 100% drive load.
Range	0 to <b>LIMIT FREQUENCY</b> / 24 Hz
Default	0 Hz

The procedure for adjusting **SLIP COMP** is as follows:

1. Run the drive at the desired speed on no load.
2. Measure the actual motor speed using a hand tacho or other suitable device.
3. Run the drive at the desired speed on full load
4. Measure the actual motor speed and increase the **SLIP COMP** parameter until the no-load speed (synchronous speed) is attained.

<b>REGEN SLIP COMP</b>	This parameter determines whether slip compensation will be active during regenerative operation.
Range	Enable / Disable
Default	Disable

NOTE:- Slip compensation is disabled when the output frequency is below 0.5 Hz

## Speed Feedback

The **SPEED FEEDBACK** parameters are used to calibrate the speed feedback measurement. The Speed Feedback Option Board needs to be fitted to the drive and connected to a suitable encoder before the speed feedback measurement will operate. Parameters accessed via the **SPEED FEEDBACK** menu are as follows:

<b>FEEDBACK SOURCE</b>	Used to enable the speed measurement function from an encoder.
<b>ENCODER SIGN</b>	Used to invert the sign of the measured speed where necessary.
<b>ENCODER LINES</b>	The resolution must be set to match the type of encoder being used. Incorrect setting of this parameter will result in an erroneous speed measurement.
Range	1 to 10000.
Default	1000.

**POLE PAIRS**

This parameter must correspond to the number of pole-pairs for the AC motor being used. The most common form of AC motor has 4 poles or 2 pole-pairs. If you are in doubt as to the correct number of pole-pairs your motor possesses, please contact your motor supplier. Incorrect setting of this parameter will result in an erroneous speed measurement.

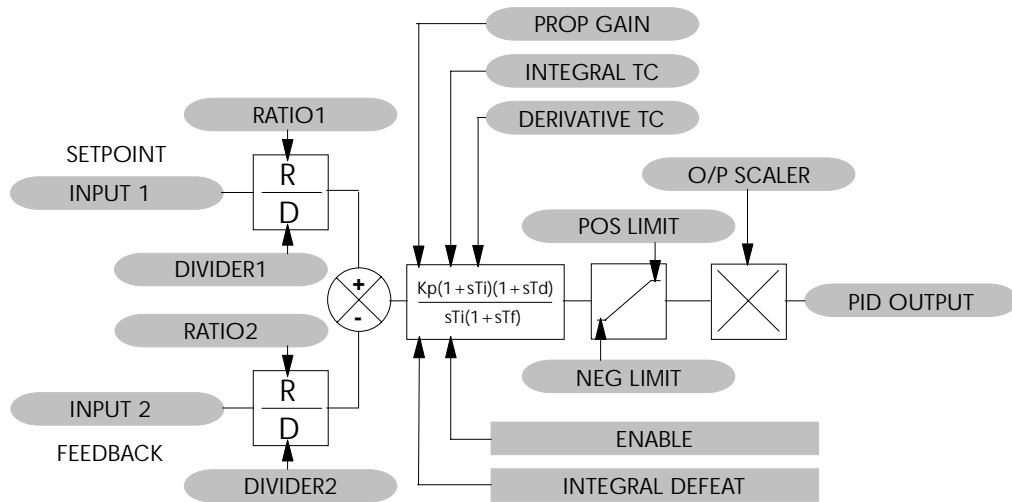
NOTE: The motor synchronous speed can be calculated from the motor supply frequency and the pole-pairs using the following :

$$N_{sync}(rpm) = 60 \times \frac{\text{Freq(Hz)}}{\text{pole - pairs}}$$

eg. a 4 pole motor (2 pole-pairs) with a base speed of 50Hz will have a synchronous speed of 1500rpm.

**PID**

Current software provides the user with a general purpose PID controller block internal to the drive. The PID can be used either in conjunction with speed feedback to provided closed-loop speed control, or with other external setpoints and feedbacks for closed-loop process control.



**PROP GAIN**

This parameter is the true proportional gain of the PID controller. With a **PROP GAIN** of zero, the PID output would become zero. Range: 0.0 to 100.0. Default: 1.0.

**INTEGRAL TC**

This parameter is the integral time constant of the PID controller. Range: 0.01 to 100.00s. Default: 1.00s.

**DERIVATIVE TC**

This parameter is the derivative time constant of the PID controller. Range: 0.000 to 10.000s. Default: 0.000s. With the **DERIVATIVE TC** set to zero, the PID becomes a P+I controller.

**FILTER TC**

In order to help attenuate high frequency noise on the PID output, a first order lag output filter has been provided. The **FILTER TC** parameter determines the output filter time constant. Range: 0.000 to 10.000s. Default: 2.000s.

**POSITIVE LIMIT**

This parameter determines the maximum positive excursion of the PID output. Range: 0.00 to 105.00%. Default: 100%. PID output corresponds to the **LIMIT FREQUENCY**.

**NEGATIVE LIMIT** This parameter determines the maximum negative excursion of the PID output. Range: -105.00 to 0.00%. Default: -100.00%. 100% PID output corresponds to the **LIMIT FREQUENCY**.

**O/P SCALER (TRIM)** This parameter represents an overall PID output scaling function which is applied after the PID **POSITIVE LIMIT** and **NEGATIVE LIMIT** clamps. Range: -3.0000 to +3.0000. Default: 0.0417.

NOTE:-With 100% **POSITIVE LIMIT** and **NEGATIVE LIMIT** clamps, the default **O/P SCALER (TRIM)** value of 0.0417 represents a maximum PID output of 5Hz with a 120Hz **LIMIT FREQUENCY**.

**ENABLE** This parameter globally resets the PID output and integral term when **DISABLED**. This parameter must be **ENABLED** in order for the PID to operate. Default: **DISABLED**.

NOTE: The PID is automatically disabled when the drive is in the stopped state (not running), or the **FRAMP** parameter is configured to **PID RESET** and terminal 21 is active.

**INTEGRAL DEFEAT** This parameter resets the PID integral term when **ON**. Range: **ON** or **OFF**. Default: **OFF**.

**INPUT 1** This parameter represents the value of the PID setpoint. 100% corresponds to the value of the **LIMIT FREQUENCY**. Range: -300.00 to +300.00%. Default: 0.00%.

**RATIO 1** This represents the PID setpoint ratio parameter. Range: -3.0000 to +3.0000. Default: 1.0000.

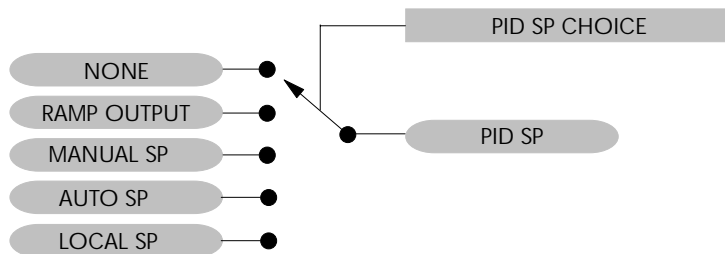
**DIVIDER 1** This represents the PID setpoint divider parameter. Range: -3.0000 to +3.0000. Default: 1.0000.

**INPUT 2** This parameter represents the value of the PID feedback. 100% corresponds to the value of the **LIMIT FREQUENCY**. Range: -300.00 to +300.00%. Default: 0.00%.

**RATIO 2** This represents the PID feedback ratio parameter. Range: -3.0000 to +3.0000. Default: 1.0000.

**DIVIDER 2** This represents the PID feedback divider parameter. Range: -3.0000 to +3.0000. Default: 1.0000.

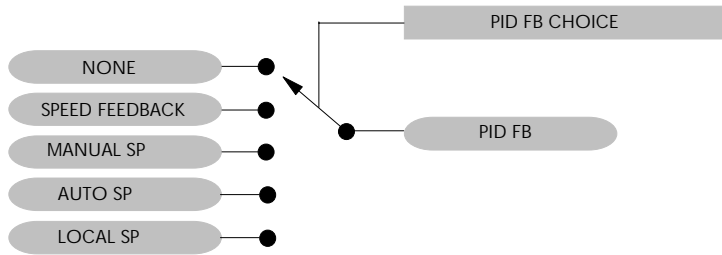
**PID SP CHOICE** This parameter determines the source of the PID setpoint. Range: **NONE**, **RAMP OUTPUT**, **MANUAL SP**, **AUTO SP** or **LOCAL SP**. Default: **NONE**.



NOTE:-With the **PID SP CHOICE** parameter set to **NONE**, a fixed value of the PID setpoint can be set directly into the **INPUT 1** parameter.

**PID FB CHOICE**

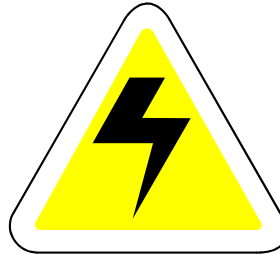
This parameter determines the source of the PID feedback. Range: NONE, SPEED FEEDBACK, MANUAL SETPOINT AUTO SETPOINT or LOCAL SETPOINT  
Default: NONE.



NOTE:-With the **PID FB CHOICE** parameter set to **NONE**, a fixed value of the PID feedback can be set directly into the **INPUT 2** parameter.

**PID OP**

This option provides access to two further parameter options, **PID OP CHOICE** and **PID OP MODE**.

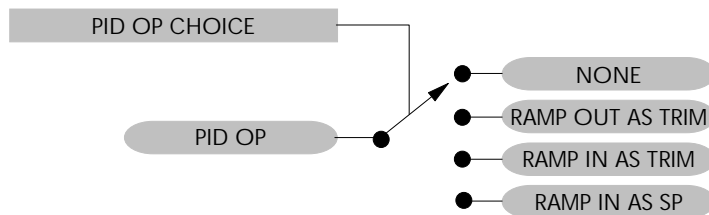


**WARNING!**

The inverter output frequency can exceed the **MAX SPEED** parameter setting when using the PID output to trim the ramp output by 5%.

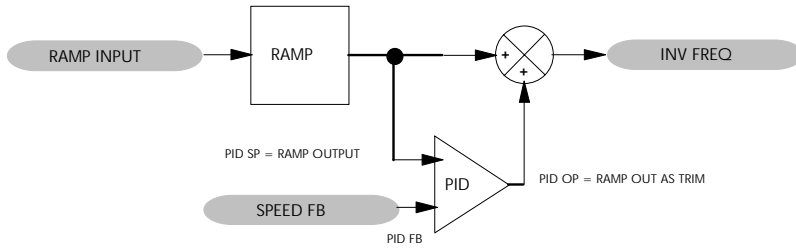
**PID OP CHOICE**

This parameter determines the application of the PID output. Range: NONE, RAMP OUT AS TRIM, RAMP IN AS TRIM or RAMP IN AS SP. Default: NONE.

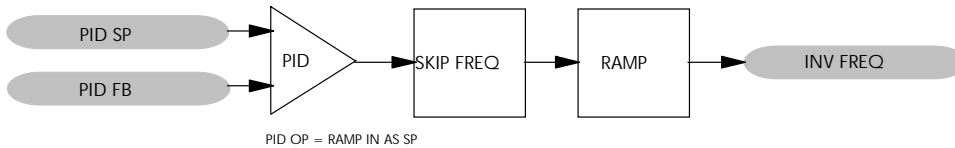
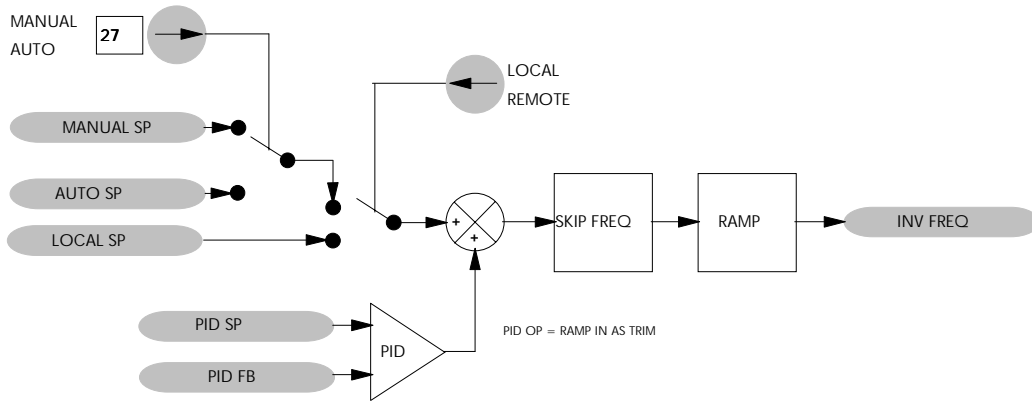


For closed-loop speed control, **PID OP CHOICE** should be set to **RAMP OUT AS TRIM** and **O/P SCALER (TRIM)** should be chosen such that maximum PID output corresponds to full load motor slip frequency. In this way, the ramp output can be trimmed by the PID to compensate for motor speed variations due to load.





For closed-loop process control applications, **PID OP CHOICE**, can be set either such that the PID output trims the ramp input, RAMP IN AS TRIM, or so that the PID output acts as the ramp input, RAMP IN AS SP



**PID OP MODE**

This parameter determines the type of control the PID is allowed to exhibit for closed-loop process control applications (**PID OP CHOICE** set to either RAMP IN AS TRIM or RAMP IN AS SP). Range: UNIPOLAR or BIPOLAR. Default: UNIPOLAR.

In UNIPOLAR mode, the PID output cannot cause the inverter output frequency to be of an opposite sign to the setpoint.

In BIPOLAR mode, the PID output is allowed to cause the inverter output frequency to an opposite direction to the setpoint.

NOTE: In closed-loop speed control with **PID OP CHOICE** set to RAMP OUT AS TRIM, the PID is never allowed to drag the inverter output frequency in an opposite direction to the setpoint.

## Flycatching

The **FLYCATCHING** function enables the drive to be restarted smoothly into an spinning motor.

### **ENABLE**

The **ENABLE** parameter globally enables the flycatching feature. With the feature **ENABLED** when the drive is re-enabled from a stopped condition, the drive performs a speed search sequence. Once the motor speed has been identified, the drive begins to smoothly ramp to the speed setpoint from the discovered motor speed.

Default: Disabled

### **SEARCH MODE**

The **SEARCH MODE** parameter determines which of the 3 types of speed search sequence performed by the drive when the flycatching mode is engaged.

Default: Bidirectional

The **UNIDIRECTIONAL** speed search sequence only searches for the motor speed in the direction of the speed setpoint.

The **BIDIRECTIONAL** speed search sequence, initially searches for the motor speed in the direction of the speed setpoint. If the drive fails to identify the motor speed in this direction, a second speed search is performed in the reverse direction.

The **REFLUX AT SP** sequence simply performs a soft-start at the speed setpoint. This mode can be used in situations where the motor speed is known not to have deviated much from the speed setpoint. In situations where this is not the case, **UNIDIRECTIONAL** or **BIDIRECTIONAL** flycatching is preferred. This mode is not available in types 8, 9 and 10 inverters (greater than 75kW).

### **REFLUX TIME**

The **REFLUX TIME** parameter determines the time taken to ramp up the inverter output volts from the **SEARCH VOLTS** level to the normal operating level once the motor speed has been successfully identified.

Range: 0.1 to 10.0 seconds

Default: 2.0 seconds

Note:- Refluxing the motor too quickly can cause the drive to trip on either overvoltage or overcurrent. In either case increasing this parameter will reduce the risk of tripping.

### **SEARCH TIME**

The **SEARCH TIME** parameter governs the rate at which the flycatching speed search is performed. Once flycatching is initiated, the spinning motor is refluxed to the **SEARCH VOLTS** level with the inverter output frequency fixed at the **MAX SPEED** parameter. The inverter output frequency is then ramped down towards the **MIN SEARCH SPEED** level at a ramp rate governed by the **SEARCH TIME** parameter.

Range: 0.1 to 60.0 seconds

Default: 15 seconds

Note:- Performing the flycatching speed search too quickly can cause the drive to inaccurately identify the motor speed. Refluxing at an inaccurate motor speed can cause the drive to trip on overvoltage. If this occurs, increasing this parameter will reduce the risk of tripping.

### **SEARCH VOLTS**

The **SEARCH VOLTS** parameter determines the percentage of the full motor volts applied during the flycatching speed search sequence.

Range: 0.0% to 100.0%

Default: 15.0%

Note:- Increasing the **SEARCH VOLTS** level improves the accuracy of the discovered motor speed but increases the braking influence of the speed search on the rotating motor.

### **MIN SEARCH SPEED**

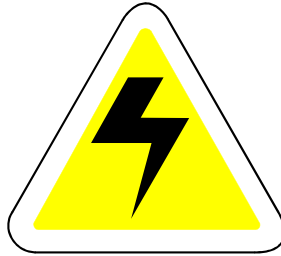
The **MIN SEARCH SPEED** parameter determines the lower limit of the **UNIDIRECTIONAL** and **BIDIRECTIONAL** speed search sequences. If while

performing the speed search, the inverter frequency falls below this level, flycatching is deemed to have failed. The drive will then restart from zero speed.

Range: 0.0Hz to 120.0Hz  
Default: 10.0Hz

## Auto Restart

The **AUTO RESTART** function allows the drive a limited number of self restarts after a trip has occurred. **AUTO RESTART** is only recommended for remote drive applications where manual clearing of drive fault conditions is impractical.



### WARNING!

When using **AUTO RESTART** the drive will restart automatically. It is the user's responsibility to ensure that unexpected drive restarts do not cause injury to people or damage to equipment.

The following **AUTO RESTART** parameters are provided:

<b>ENABLE</b>	This parameter globally enables the <b>AUTO RESTART</b> function. Default: Disabled
<b>ATTEMPT DELAY</b>	This determines the delay between <b>AUTO RESTART</b> attempts. Range: 0.5 to 600.0 seconds Default: 10.0 seconds
<b>ATTEMPTS</b>	This parameter governs the number of restarts the drive will try before requiring a manual fault reset. Range: 1 to 10 Default: 5
<b>ATTEMPTS LEFT</b>	This is a read-only diagnostic indicating the number of restart attempts left before a manual fault reset is required.
<b>TRIP MASK</b>	This parameter permits the user to perform <b>AUTO RESTART</b> only on selected trip conditions. The <b>TRIP MASK</b> is a 16 bit hexadecimal number each bit of which is logically ANDed with the corresponding bit of the 16 bit <b>DRIVE STATUS</b> diagnostic word (chapter 5). When the drive trips, a unique bit in the <b>DRIVE STATUS</b> diagnostic word is set. This bit identifies the type of trip that has occurred. If the corresponding bit in the <b>TRIP MASK</b> word is also set, and <b>AUTO RESTART</b> is ENABLED, an <b>AUTO RESTART</b> attempt will be made. If the corresponding bit in the <b>TRIP MASK</b> word is not set, no <b>AUTO RESTART</b> attempt is made (and the fault condition will require a manual reset). Range: 0x0000 to 0xFFFF Default: 0x1F00

NOTE: The default value for the **TRIP MASK** word is 0x1F00. Thus, with the **AUTO RESTART** feature ENABLED, the drive will only attempt to restart after the following trips:

DC Link Overvoltage Trip  
DC Link Undervoltage Trip  
Overcurrent Trip  
I\*T Trip  
Stall Trip

**AR CANCEL TIME**

This sets the required period of drive operation after a successful **AUTO RESTART** before the **ATTEMPTS LEFT** diagnostic is reset to the **ATTEMPTS** parameter.

Range: 0.1 to 600.0 seconds  
Default: 300.0 seconds

## Switching Frequency

This controls the drive switching frequency of the inverter

**SWITCHING FREQ**

Higher switching frequencies produce lower audible noise from the motor, but increase overall inverter losses. Lower switching frequencies improve motor operation at low speed and result in lower overall inverter losses.

Range: 3kHz, 6kHz or 9kHz available in certain conditions ( See Technical Specification )

Default: 3kHz

## Stabilisation

This helps to stabilise larger motors running on light load

**STABILISATION**

Larger motors can sometimes exhibit instability at certain speeds under light load. If oscillations are apparent in the motor speed or current, increase the **STABILISATION** parameter until stable operation is achieved. A typical setting for this parameter would be between 0.5Hz and 1.0Hz. Note that too high a value will tend to make the motor more unstable. The range and default values are:

Range: 0Hz to **LIMIT FREQUENCY/24**  
Default: **LIMIT FREQUENCY/200**

## Start up

Select default control mode and default MMI position on power-up.

**CONTROL MODE**

This parameter selects whether the terminals or the MMI controls the drive.

**REMOTE** selects the terminal as the control source. **LOCAL** selects the operator station as the control source and places the display in the local mode.

Default: **REMOTE**

**MENU POSITION**

This parameter selects which diagnostic menu to be displayed after power-up. These can be chosen from the following:

Range: **MICRO AC DRIVE, SPEED SP(Hz), DRIVE FREQUENCY, MOTOR CURRENT, MOTOR LOAD, EXT TORQUE LIMIT, DRIVE STATUS, DIGITAL INPUTS, TORQUE MODE, PID ERROR, PID CLAMPED, PID OUTPUT, SPEED FB(RPM), SPEED FB(HZ), SPEED SP(RPM), MANUAL SP(HZ), AUTO SP(HZ)**

Default: **MICRO AC DRIVE**

## Stall Trip Time

A motor stall timer.

<b>STALL TRIP TIME</b>	If the drive operates continuously in current limit for longer than the <b>STALL TRIP TIME</b> then a MOTOR STALLED alarm will occur. Range: 0.1 to 3000 seconds Default: 600 seconds
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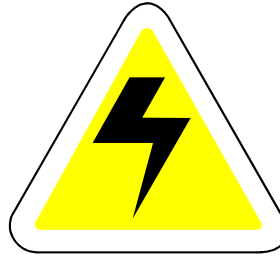
## Inhibit Alarms

This menu allows certain alarm conditions to be disabled. For example, the **STALL ALARM** must be disabled in applications where the drive operates continuously in current limit.

## Reconfigure Outputs

The Setup Parameters **RECONFIG O/Ps** menu contains parameters that govern the operation of the reconfigurable relay outputs RELAY1 and RELAY2. (These relays are configured using the **RECONFIG O/Ps** menu which is under **SYSTEM**) The following **RECONFIG O/Ps** parameters are provided:

<b>AT SPEED THRESH</b>	The relay contacts close when the drive output frequency falls within the speed setpoint $\pm$ the <b>AT SPEED THRESH</b> parameter. The relay contacts subsequently open when the drive output frequency differs from the speed setpoint by more than $\pm$ the <b>AT SPEED THRESH</b> parameter. Range: 0 to <b>+LIMIT FREQUENCY</b> . Default: <b>LIMIT FREQUENCY/120</b> .
<b>0 SPEED THRESH</b>	The relay contacts close when the drive output frequency is within the $\pm$ <b>0 SPEED THRESH</b> parameter of 0Hz. The relay contacts subsequently open when the drive output frequency rises out of the $\pm$ <b>0 SPEED THRESH</b> parameter frequency band. Range: 0 to <b>+LIMIT FREQUENCY</b> . Default: <b>LIMIT FREQUENCY/120</b> .
<b>LOAD THRESH</b>	This parameter determines the measured motor load at which the AT LOAD relay will operate (change state). Range: 0 to 150%. Default: 50%
<b>FB SPEED THRESH</b>	The relay contacts will close when the measured motor speed is greater than the <b>FB SPEED THRESH</b> parameter. The relay contacts close when the measured motor speed is below the <b>FB SPEED THRESH</b> parameter. Range: 0 to <b>+LIMIT FREQUENCY</b> . Default: <b>LIMIT FREQUENCY/12</b> .



**WARNING!**

The **BRAKE CONTROL** logic will fail to operate correctly where there is a missing motor phase. In this situation the drive will incorrectly estimate the motor load. As a consequence the brake logic will release the motor brake while the motor is not producing torque. In this situation the motor has no control over the load. It is the responsibility of the user, by the use of external equipment, to detect missing motor phases and to prevent the **BRAKE CONTROL** logic from either releasing or maintaining open the motor brake in these circumstances.

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<b>BRAKE CONTROL</b>	This mode is intended to control external electro-mechanical motor brakes in lift and hoist applications. There are 3 parameters associated with this mode. The relay contacts close when drive frequency > <b>ON FREQ LEVEL</b> AND motor load > <b>ON LOAD LEVEL</b> . The relay contacts open when drive frequency < <b>OFF FREQ LEVEL</b> .
<b>ON LOAD LEVEL</b>	Load level at which the external motor brake is to be released. Range: 0 to 150%. Default: 50%.
<b>ON FREQ LEVEL</b>	Frequency at which the external motor brake is to be released. Range: 0Hz to <b>LIMIT FREQUENCY</b> . Default: <b>LIMIT FREQUENCY/24</b>
<b>OFF FREQ LEVEL</b>	Frequency at which the external motor brake is to be applied. Range: 0Hz to <b>LIMIT FREQUENCY</b> . Default: <b>LIMIT FREQUENCY/40</b> .

## Ramp Output

This parameter sets the scaling of the RAMP OUTPUT analogue output, terminal 7. Three ranges are possible:

<b>MIN TO MAX</b>	This gives 0V at <b>MIN SPEED</b> and +10V at <b>MAX SPEED</b> .
<b>0 TO LIMIT FREQ</b>	This gives 0V at 0Hz and +10V at the <b>LIMIT FREQUENCY</b> .
<b>0 TO MAX</b>	This gives 0V at 0Hz and +10V at <b>MAX SPEED</b> . Default: <b>MIN TO MAX</b>

## Limit Frequency

The limit frequency is the highest possible value of drive output frequency. There are 3 choices of limit frequency, 120Hz, 240Hz and 480Hz. This is determined by the **LIMIT FRQ SELECT** parameter. The default value for **LIMIT FRQ SELECT** is 120Hz. The setpoint frequency resolution of the drive is the **LIMIT FREQ SELECT/10,000**.

## Op Station

These parameters are associated with the control and configuration of the operator station on the front of the drive.

<b>INITIAL SETUP</b>	<b>INITIAL SETUP</b> is the menu which contains the power-up parameters for the operator station.
<b>DIRECTION</b>	<b>DIRECTION</b> sets the preferred direction on power up and when <b>LOCAL</b> mode is selected. Range: Forward / Reverse. Default: Forward.
<b>AUTO START</b>	<b>AUTO START</b> sets whether the drive will run immediately on power-up if the <b>CONTROL MODE</b> is set to <b>LOCAL</b> . If the <b>CONTROL MODE</b> parameter is set to <b>REMOTE</b> then this parameter will have no effect. Range: Enabled/Disabled. Default: Disabled.
<b>SPEED SETPOINT</b>	<b>SPEED SETPOINT</b> sets the initial setpoint for the operator station which is invoked on power up and when <b>CONTROL MODE</b> is set to <b>LOCAL</b> . Range: 0 to <b>LIMIT FREQUENCY</b> Default: 0 Hz.
<b>KEY INHIBITS</b>	<b>KEY INHIBITS</b> provides the user with a means to disable any or all of the operator station keys.
<b>START</b>	<b>START</b> sets whether the start button on the operator station is enabled or disabled. Default: Enabled.
<b>STOP</b>	<b>STOP</b> sets whether the stop button on the operator station is enabled or disabled. Default: Enabled.
<b>JOG</b>	<b>JOG</b> sets whether the jog button on the operator station is enabled or disabled. Default: Enabled.
<b>SPEED SETPOINT</b>	<b>SPEED SETPOINT</b> sets whether the up and down buttons on the operator station are enabled or disabled. Default: Enabled.
<b>DIRECTION</b>	<b>DIRECTION</b> sets whether the direction button on the operator station is enabled or disabled. Default: Enabled.
<b>LOCAL/REMOTE</b>	<b>LOCAL/REMOTE</b> sets whether the local button on the operator station is enabled or disabled. Default: Enabled.

## Base Volts

<b>BASE VOLTS</b>	<b>BASE VOLTS</b> is the output voltage produced at the <b>BASE FREQUENCY</b> , as a % of the input voltage. This is the maximum output voltage the drive will produce. Range: 0% to 115.4%. Default: 100%
-------------------	--

NOTE: Setting the **BASE VOLTS** parameters greater than 100% increases the amplitude of the output voltage fundamental component, but only at the expense of increased high frequency harmonics.

## PASSWORD

The 584S Frequency Inverters have a password system which can be used to prevent unauthorised access to the setup parameters. Once the user has programmed in a password then the setup parameters become read-only. In order to change the parameter values the correct password must first be entered.

All drives shipped from the factory have a default password value of 0000.

The **PASSWORD** submenu has 3 entries as follows:

- |                        |  |
|------------------------|--|
| <b>ENTER PASSWORD</b>  | This option is used to enter the password to regain access to the setup parameters. The password value entered must match the value previously set up in the <b>CHANGE PASSWORD</b> menu.  |
| <b>CHANGE PASSWORD</b> | This option is used to change the password or to initially programme a user password. When a password has been set up, the <b>PARAMETER SAVE</b> menu should be used to save the password in non-volatile memory.  |
| <b>CLEAR PASSWORD</b>  | This option is used to clear the password value displayed under the <b>ENTER PASSWORD</b> menu. When this menu is accessed the <b>ENTER PASSWORD</b> value is cleared to "0000". If the <b>CHANGE PASSWORD</b> value is non-zero then the setup parameters will be locked. |

### Example 1: Initial programming of password

- 1) Access the **CHANGE PASSWORD** menu. The display will show:

<b>CHANGE PASSWORD</b>
<b>0X0000</b>

- 2) Using the up and down arrow keys, set the password value required as a 4 digit hexadecimal number. The display will show, for example:

<b>CHANGE PASSWORD</b>
<b>0X1234</b>

**When you are happy with the password make a note of the value and keep it in a safe place!**

- 3) Press the 'E' key to take you out of the **CHANGE PASSWORD** menu. The display will show:

<b>REMEMBER PASSWORD</b>
<b>0X1234</b>

Press the 'E' key again and the display will show:

<b>NOW SAVE PARAMS</b>
<b>0X1234</b>

This is to remind you to save the password along with the other parameters before you remove power from the drive. Press the 'E' key again to exit the **CHANGE PASSWORD** menu.

- 4) Access the **CLEAR PASSWORD** menu and press the 'M' key. The display will show:

<b>CLEAR PASSWORD</b>
<b>PASSWORD CLEARED</b>

This indicates that the password value entered above has been locked into the system. Using **CLEAR PASSWORD** sets the value in the **ENTER PASSWORD** menu to 0x0000, otherwise the password would still be displayed.

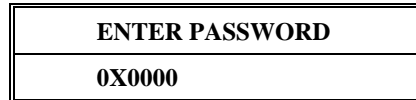


- 5) The setup parameters are now locked. Remember to use **PARAMETER SAVE** to put the password value in non-volatile memory. If you now go back to the **CHANGE PASSWORD** menu the password value is hidden and the display will show:



**Example 2: Accessing setup parameters when the password is set.**

- 1) Access the **ENTER PASSWORD** menu. The display will show:



- 2) Use the up and down arrow keys to select your password.
- 3) Press the 'E' key to exit the **ENTER PASSWORD** menu.
- 4) Access the **SETUP PARAMETERS** menu to make any necessary changes.
- 5) When all parameter changes have been made come back to the **CLEAR PASSWORD** menu to hide the password value and lock the setup parameters again.

**Example 3: Changing a previously set password**

- 1) Access the **ENTER PASSWORD** menu.
- 2) Use the up and down arrow keys to enter the existing password value.
- 3) Leave the **ENTER PASSWORD** menu and access the **CHANGE PASSWORD** menu.
- 4) Use the up and down arrow keys to select a new password value.
- 5) Leave the **CHANGE PASSWORD** menu and access the **CLEAR PASSWORD** menu.
- 6) Press the 'M' key to clear the password value and lock the setup parameters.
- 7) Remember to use **SAVE PARAMETERS** to save the new password value in non-volatile memory.

## PARAMETERS SAVE

This menu is used to save all of the drive parameters in the non-volatile memory. Press the UP arrow as instructed on the second line of the MMI display (UP TO ACTION) to save the drive parameters.

NOTE:- Parameters cannot be saved when the drive is unhealthy or braking (stopping). Toggle run signal to clear alarm or wait for drive to stop before saving.

## SYSTEM

Options within the System menu are described in the following paragraphs:

### Reconfig O/Ps

This menu controls the function of the two user-configurable relay outputs, RELAY 1, and RELAY 2. For each relay the following options are available:

**ZERO SPEED**

The relay contacts close when the drive output frequency is at  $0\text{Hz} \pm 0$  **SPEED THRESH** parameter.

<b>AT SPEED</b>	The relay contacts close when the drive output frequency reaches the speed setpoint $\pm$ <b>AT SPEED THRESH</b> .
<b>RUN CONFIRM</b>	Relay contacts are closed when the drive is running. Relay contacts are open when the drive is not running.
<b>BRAKE CONTROL</b>	This mode is intended to control external electro-mechanical motor brakes in lift and hoist applications. There are 3 parameters associated with this mode. These are under the <b>BRAKE CONTROL</b> parameter. The relay contacts close when drive frequency > <b>ON FREQ LEVEL</b> and motor load > <b>ON LOAD LEVEL</b> . The relay contacts open when drive frequency < <b>OFF FREQ LEVEL</b> .
<b>AT LOAD</b>	The relay contacts close when the measured motor load exceeds the <b>LOAD THRESH</b> parameter. The relay contacts will open when the measured motor load falls below the <b>LOAD THRESH</b> parameter.
<b>AT FB SPEED</b>	The relay contacts will close when the measured motor speed is greater than the <b>FB SPEED THRESH</b> parameter. The relay contacts close when the measured motor speed is below the <b>FB SPEED THRESH</b> parameter.

NOTE: For the **AT FB SPEED** relay to operate correctly the drive requires speed feedback information from an encoder via the speed feedback option board. In addition the data concerning the number of encoder lines and motor pole-pairs needs to have been correctly entered in the set up parameters menu.

## Reconfig I/Ps

This parameter determines the functionality of the FRAMP, JOG, PRESET1 & PRESET2 control terminals (terminals 21, 24, 25 and 26 respectively). The following options are provided:

### **PRESETS & JOG**

Within this menu we can choose from the options:-

**4 PRESETS & JOG** With this option selected, raising the JOG terminal to +24V causes the drive to run at the jog speed setpoint. The digital inputs PRESET1 and PRESET2 remotely select 1 of 4 preset speed setpoints.

**8 PRESETS** With this option selected, the JOG digital input is now re-configured to select a second bank of preset speed (preset speeds 5 to 8).

**DIGITAL MOP & PRESET** With this selected, the functionality of the JOG, PRESET1 & PRESET 2 terminals are again reconfigured to act as a digital motorised potentiometer. PRESET1 becomes RAISE, PRESET 2 becomes LOWER and JOG becomes MOP PRESET.

### **FRAMP**

Within this menu we can choose the function of the FRAMP terminal from the options:-

**FRAMP** with this option selected, raising the FRAMP terminal to +24V and removing the RUN signal causes the drive to ramp down with the FRAMP TIME selected.

**PID RESET** with this option selected, raising the FRAMP terminal to +24V causes the internal PID to be held in a reset state.

**2ND RAMP RATES** with this option selected, raising the FRAMP terminal to +24V causes the **RAMP UP TIME2** and **RAMP DOWN TIME2** to be selected as the main ramp times.

**TRIP RESET** with this option selected, raising the **FRAMP** terminal to +24V, and the RUN is input inactive, the drive will attempt to reset any trips.

## Torque Mode

This parameter selects the power mode of the product. The following options are provided.

<b>CONSTANT TORQUE</b>	This mode allows a 50% overload for 60 seconds, ( see ELECTRICAL RATINGS CONSTANT TORQUE ). This mode would be used in general industrial application.
<b>QUADRATIC TORQUE</b>	This mode allows a 10% overload for 10 seconds, ( see ELECTRICAL RATINGS QUADRATIC TORQUE ) but has a higher continuous current rating than . <b>CONSTANT TORQUE</b> . This mode would be used for most pump and fan applications where the torque required is a square of speed.

## SERIAL LINK

The 584 Series Drives support 2 serial links. Fitted as standard is an RS232 port, called the AUX PORT, P3. This is intended for connection to a personal computer to allow drive configuration and storing of parameters. The second serial port, called MAIN PORT P1, is fitted as an option. It is an opto-isolated RS422/485 port allowing full remote control of the drive from a host supervisory computer. This port also acts as an interface to Field Bus options ( currently only PROFIBUS DP ). Both serial ports use the industry standard EI BISYNC protocol. Each port has a number of setup parameters which are described below. Further information regarding the Serial Communications Option is included in Appendix B.

## Main Port P1

Parameters available from the Main Port P1 menu are as follows:

<b>SRL LINK ENABLE</b>	Enables serial port operation. Note that this parameter must be enabled before serial communications can take place.
<b>PROTOCOL</b>	There are three types of message format (protocol), <b>EI ASCII</b> , <b>EI INARY</b> or <b>OPTION</b> ( used for FIELD BUS options ). This parameter selects which format is to be used. Default: <b>EI ASCII</b> .
<b>GROUP ID (GID)</b>	Eurotherm protocol group identity address. Range: 0 to 7. Default: 0.
<b>UNIT ID (UID)</b>	Eurotherm protocol unit identity address. Range: 0 to 15. Default: 0.
<b>OPTION ADDRESS</b>	This parameter is used to set a "network" address to the option card. Range: 0 to 32767 Default: 0.
<b>BAUD RATE</b>	Baud rate is the serial communications bit rate. Range: 300 to 9600. Default: 9600.
<b>ESP SUP(ASCII)</b>	See Appendix B for a description of ESP support.
<b>CHANGE BAND(BIN)</b>	Enquiry poll changeband. See Appendix B Block 0, PNO.4 for a description of Changeband. Range: 0.0% to 327.6%. Default: 0.0%.

**ERROR REPORT**

This is a read only diagnostic showing communication errors as follows:

ERROR REPORT	MEANING
00C0	No errors
01C7	Unknown mnemonic
02C2	Block check character fail
03C1	Parity error on received data
03C2	Framing or overrun error
05C8	Attempt to write to a read-only mnemonic
07C7	Invalid message format
08C8	Value in selection message out of range

**PNO.7** Control word for multi-parameter polling. See Appendix B Block 0, PNO.7 for a description. Range: 0x0000 to 0xFFFF. Default: 0xFFFF.

**PARITY** Select odd or even parity (Main Port P1 only). Eurotherm BISYNC protocol requires even parity, however odd parity may be selected for other applications. Default: EVEN.

**OPTION VERSION** The **OPTION VERSION** diagnostic indicates the software/firmware version of the field bus options.

### AUX Port P3

Parameters available from the AUX Port P3 menu are as follows:

**SRL LINK ENABLE** Enables serial port operation. Note that this parameter must be enabled before serial communications can take place.

**GROUP ID (GID)** Eurotherm protocol group identity address. Range: 0 to 7. Default: 0.

**UNIT ID (UID)** Eurotherm protocol unit identity address. Range: 0 to 15. Default: 0.

**PROTOCOL** There are two types of message format (protocol), **EI ASCII** and **EI BINARY**. This parameter selects which format is to be used. Default: **EI ASCII**.

**BAUD RATE** Baud rate is the serial communications bit rate. Range: 300 to 9600. Default: 9600.

**ESP SUP(ASCII)** See Appendix B for a description of ESP support.

**CHANGEBAND(BIN)** Enquiry poll changeband. See Appendix B Block 0, PNO.4 for a description of Changeband. Range: 0.0% to 327.6%. Default: 0.0%.

**ERROR REPORT**

This is a read only diagnostic showing communication errors as follows:

ERROR REPORT	MEANING
00C0	No errors
01C7	Unknown mnemonic
02C2	Block check character fail
03C1	Parity error on received data
03C2	Framing or overrun error
05C8	Attempt to write to a read-only mnemonic
07C7	Invalid message format
08C8	Value in selection message out of range

**PNO . 7** Control word for multi-parameter polling. See Appendix B Block 0, PNO.7 for a description. Range: 0x0000 to 0xFFFF. Default: 0xFFFF.

## PNO Config

The parameter number (PNO) configuration menu allows the serial link to be set up to access drive parameters and diagnostics indirectly. This is achieved using the configurable serial link mnemonic parameters as described in Appendix B Blocks 14 & 15. The configurable mnemonics are parameter numbers (PNOs) 112 to 127. These correspond to ASCII comms mnemonics 70 to 7F. Simply entering a drive parameter tag number into the MMI parameter associated with a configurable mnemonic, allows that parameter to be accessed indirectly by reading or writing to the configurable mnemonic via the serial link. A full list of drive parameters and their associated tag numbers is given in Appendix B.

For example, the tag number for the **RAMP UP TIME** parameter is 14. Setting the **PNO 112** parameter to 14, will allow the **RAMP UP TIME** parameter to be accessed when reading or writing to PNO 112 (ASCII mnemonic 70) via the serial link.

**PNO 112** Contains the tag number of the drive parameter which will be accessed when reading or writing to parameter number 112 (PNO 112) via the serial link.  
 Range 0 to 255  
 Default 0

**PNO 113** Contains the tag number of the drive parameter which will be accessed when reading or writing to parameter number 113 (PNO 113) via the serial link.  
 Range 0 to 255  
 Default 0

**PNO 114** Contains the tag number of the drive parameter which will be accessed when reading or writing to parameter number 114 (PNO 114) via the serial link.  
 Range 0 to 255  
 Default 0

**PNO 115** Contains the tag number of the drive parameter which will be accessed when reading or writing to parameter number 115 (PNO 115) via the serial link.  
 Range 0 to 255  
 Default 0

**PNO 116** Contains the tag number of the drive parameter which will be accessed when reading or writing to parameter number 116 (PNO 116) via the serial link.  
 Range 0 to 255  
 Default 0

<b>PNO 117</b>	Contains the tag number of the drive parameter which will be accessed when reading or writing to parameter number 117 (PNO 117) via the serial link. Range 0 to 255 Default 0
<b>PNO 118</b>	Contains the tag number of the drive parameter which will be accessed when reading or writing to parameter number 118 (PNO 118) via the serial link. Range 0 to 255 Default 0
<b>PNO 119</b>	Contains the tag number of the drive parameter which will be accessed when reading or writing to parameter number 119 (PNO 119) via the serial link. Range 0 to 255 Default 0
<b>PNO 120</b>	Contains the tag number of the drive parameter which will be accessed when reading or writing to parameter number 120 (PNO 120) via the serial link. Range 0 to 255 Default 0
<b>PNO 121</b>	Contains the tag number of the drive parameter which will be accessed when reading or writing to parameter number 121 (PNO 121) via the serial link. Range 0 to 255 Default 0
<b>PNO 122</b>	Contains the tag number of the drive parameter which will be accessed when reading or writing to parameter number 122 (PNO 122) via the serial link. Range 0 to 255 Default 0
<b>PNO 123</b>	Contains the tag number of the drive parameter which will be accessed when reading or writing to parameter number 123 (PNO 123) via the serial link. Range 0 to 255 Default 0
<b>PNO 124</b>	Contains the tag number of the drive parameter which will be accessed when reading or writing to parameter number 124 (PNO 124) via the serial link. Range 0 to 255 Default 0
<b>PNO 125</b>	Contains the tag number of the drive parameter which will be accessed when reading or writing to parameter number 125 (PNO 125) via the serial link. Range 0 to 255 Default 0
<b>PNO 126</b>	Contains the tag number of the drive parameter which will be accessed when reading or writing to parameter number 126 (PNO 126) via the serial link. Range 0 to 255 Default 0
<b>PNO 127</b>	Contains the tag number of the drive parameter which will be accessed when reading or writing to parameter number 127 (PNO 127) via the serial link. Range 0 to 255 Default 0

## MENUS

### **MENU DELAY**

This parameter controls the speed of response of the display to key presses. Increasing the **MENU DELAY** slows down the display.

Range: 10 to 200

Default: 20

### **LANGUAGE**

This menu changes the displayed text to the selected language. Use the 'UP' and 'DOWN' keys to select the appropriate language. The language name will be displayed in the appropriate language chosen. i.e. English - **ENGLISH**, German - **DEUTSCH**, Parameter - **P LANGUAGE**. or French **FRANCAIS**. Selecting Parameter will display menu options as parameter codes. This is to be used in conjunction with the translation table in Appendix C, where the code is given with the English language equivalent, with space for translation to an otherwise unsupported language.

Note: When selecting a different language, the language will automatically be set to the language name selected. After changing the language parameter, it is important to perform a parameter save. In this way, the desired language setting will not be lost when power is removed from the product.

Range: English/German/Parameter/French

Default: English

## Chapter 5

### DIAGNOSTICS AND FAULT FINDING

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## Chapter 5 DIAGNOSTICS AND FAULT FINDING

### INTRODUCTION

The 584S Frequency Inverters provide comprehensive diagnostic, alarm and trip facilities. These facilities minimise the possibility of damage to the drive, motor and associated components under unusual or fault conditions. The diagnostics and alarm information, available at the MMI display, enables ready identification of these conditions. In the event that a fault is traced to the drive, the drive should be returned to the manufacturer - no corrective maintenance should be attempted.

### DIAGNOSTICS

The Diagnostics menu allows the user to monitor the operation of the drive. Diagnostics that can be monitored are described in the following paragraphs. These diagnostics are read-only.

#### Speed Setpoints

There are two total speed setpoint diagnostics available in the Diagnostics menu:

<b>SPEED SP (Hz)</b>	This displays the speed setpoint in Hz.
<b>SPEED SP (RPM)</b>	This displays the speed setpoint in RPM. In order for this diagnostic to operate correctly, information concerning the number of motor pole-pairs has to be entered in the <b>SETUP PARAMETERS</b> menu (see <b>SPEED FEEDBACK</b> chapter 4).

The manual and auto setpoints are also available:

<b>AUTO SP (Hz)</b>	This displays the auto setpoint in Hz. When the MANUAL/AUTO digital input (terminal 27) is connected to +24V (terminal 18), the total speed setpoint becomes equal to the auto setpoint.
<b>MANUAL SP (Hz)</b>	This displays the manual setpoint in Hz. When the MANUAL/AUTO digital input (terminal 27) is connected to 0V (terminal 19), the total speed setpoint becomes equal to the manual setpoint.
<b>LOCAL SP (Hz)</b>	This displays the local setpoint in Hz. When the local mode is selected the total speed setpoint becomes equal to the local setpoint.

#### Drive Frequency

The output **DRIVE FREQUENCY** is displayed in Hz.

#### Motor Current

**MOTOR CURRENT** is displayed as a percentage of the drive output current. This can be scaled to read as a percentage of the motor rated current using the **OP CURRENT CAL** parameter described in Chapter 4.

NOTE: The **MOTOR CURRENT** diagnostic may show a different value to the **MOTOR LOAD** diagnostic, especially on light loads. This is because even on no-load the motor draws typically 30% magnetising current.

#### Motor Load

The estimated **MOTOR LOAD** (torque) is displayed as a percentage of the drive output current. It is assumed that 100% load corresponds to 100% output current. This can be scaled to read as a percentage of the motor rated current using the **OP CURRENT CAL** parameter described in Chapter 4.

#### Overload Status

The **OVERLOAD STATUS** indicates to the user whether the current limit is active or not.

**NORMAL** indicates that the current limit is **not** active. **OVERLOAD** indicates that the current limit **is** active.

## Ext Torque Limit

The setting of the torque limit analogue input (terminal 5) is displayed as a percentage of the drive output current. This can be scaled to read as a percentage of the motor rated current using the **OP CURRENT CAL** parameter described in Chapter 4.

## PID Diagnostics

The PID diagnostics available from the DIAGNOSTICS menu are as follows:

<b>PID ERROR</b>	This is displayed as percentage of the <b>LIMIT FREQUENCY</b> parameter. Note that the default value of the <b>LIMIT FREQUENCY</b> is 120Hz.
<b>PID CLAMPED</b>	This indicates whether the output of the internal PID has saturated.
<b>PID OUTPUT</b>	This output of the internal PID is displayed in Hz.

## Speed Feedback

There are two speed feedback diagnostics available in the DIAGNOSTICS menu:

<b>SPEED FB (Hz)</b>	This displays the speed feedback in Hz.
<b>SPEED FB (RPM)</b>	This displays the speed feedback in RPM.

NOTE: In order for these diagnostics to operate correctly, the drive must be connected to an encoder via the speed feedback option card. The speed feedback must be enabled and the correct number of encoder lines entered in the **SETUP PARAMETERS** menu. Information concerning the number of motor pole-pairs must also be correctly entered.

## Torque Mode

The **TORQUE MODE** diagnostic indicates whether the drive is rated for **CONST TORQUE** applications (100% continuous rating with 150% overload for 60s) or **QUADRATIC TORQUE** applications (higher continuous rating with less overload capability).

## Drive Status

**DRIVE STATUS** is a 16 bit hexadecimal number representing the status of the drive as follows:

Bit No.	Function	Hex. Value
0	Drive stopped	0x0001
1	Drive running	0x0002
2	Drive at zero speed	0x0004
3	Drive at speed setpoint	0x0008
4	Drive running with I*t warning	0x0010
5	Not Used	0x0020
6	Not used	0x0040
7	External trip	0x0080
8	DC link overvoltage trip	0x0100
9	DC link undervoltage trip	0x0200
10	Overcurrent trip	0x0400
11	I*t trip	0x0800
12	Stall trip	0x1000
13	4-20mA control trip	0x2000
14	Heatsink overtemperature trip	0x4000
15	Motor overtemperature trip	0x8000

### Example 1

<b>DRIVE STATUS</b>
<b>0x000A</b>

This indicates that the drive is running at the speed setpoint since 0x0008 hex + 0x0002 hex = 0x000A hex.

### Example 2

<b>DRIVE STATUS</b>
<b>0x8001</b>

This indicates that the drive has stopped with a motor overtemperature trip since 0x8000 hex + 0x0001 hex = 0x8001hex.

NOTE: It is not necessary to look at **DRIVE STATUS** if a trip occurs since the drive will always display an alarm message in plain text. Further information on alarm messages can be found in "ALARMS" in this chapter.

## Digital Inputs

The status of the digital inputs is represented as an 16 bit hexadecimal number as follows:

Bit No.	Digital Input	Hex. Value
0	Run	0x0001
1	Framp	0x0002
2	Direction	0x0004
3	External Trip	0x0008
4	Jog	0x0010
5	Preset 1	0x0020
6	Preset 2	0x0040
7	Manual/Auto	0x0080
8	Local	0x0100
9	Prog	0x0200
10	Direction	0x0400
11	Jog	0x0800
12	Stop	0x1000
13	Start	0x2000
14	Reserved	0x4000
15	Not used	0x8000

Bits 0-7 are active high

Bits 8-15 are active low

### Example 1

<b>DIGITAL STATUS</b>
<b>0xFF21</b>

This indicates that the drive is running and preset speed 1 is selected.

## ALARMS

If the drive trips then the display immediately shows a message indicating the reason for the trip. Alarm conditions are reset by removing and re-applying the RUN signal on terminal 20. The alarm message can be cleared from the display by pressing the "E" key. However the message will be stored in the drive's non-volatile memory. It can be retrieved by using the **LAST ALARM** menu.

The error message contained in the **LAST ALARM** menu can be cleared by simply pressing the down arrow key while viewing this parameter. This operation also clears the alarm message from the drive's non volatile memory.

The possible alarm messages are:

- |                         |   |
|-------------------------|---|
| <b>LINK UNDERVOLTS</b>  | The DC link voltage is too low. Possible reasons for this alarm message are: <ul style="list-style-type: none"><li>(a) The mains voltage is too low;</li><li>(b) The mains supply has been lost;</li><li>(c) One of the three phases of the supply is missing.</li></ul>  |
| <b>LINK OVERVOLTAGE</b> | The DC link voltage is too high. Possible reasons for this alarm message are: <ul style="list-style-type: none"><li>(a) The mains voltage is too high;</li><li>(b) Trying to decelerate a large inertia load too quickly.</li></ul>   |
| <b>LINK OVERCURRENT</b> | The DC link current is too high. Possible reasons for this alarm message are: <ul style="list-style-type: none"><li>(a) Trying to accelerate a large inertia load too quickly;</li><li>(b) Trying to decelerate a large inertia load too quickly;</li><li>(c) Application of shock load;</li><li>(d) Short circuit between motor phases;</li><li>(e) Short circuit between motor phase and earth;</li><li>(f) Too long output cables or too many parallel motors;</li><li>(g) Voltage boost set too high.</li></ul> |
| <b>HEATSINK TEMP</b>    | The drive heatsink temperature is too high. Possible reasons for this alarm message are: <ul style="list-style-type: none"><li>(a) The ambient air temperature is too high;</li><li>(b) A drive cooling fan has failed.:</li><li>(c) Poor ventilation.</li></ul>  |
| <b>MOTOR TEMP</b>       | The motor temperature is too high. Possible reasons for this alarm message are: <ul style="list-style-type: none"><li>(a) Prolonged operation of the motor at low speed without forced cooling;</li><li>(b) Excessive load;</li><li>(c) Motor voltage rating incorrect:</li><li>(d) Voltage boost set too high.</li></ul>   |

<b>MOTOR STALLED</b>	The motor has stalled. Possible reasons for this alarm message are: <ul style="list-style-type: none"><li>(a) Motor loading too great;</li><li>(b) <b>MOTOR I LIMIT</b> parameter set too low;</li><li>(c) <b>STALL TRIP TIME</b> parameter too low;</li><li>(d) Voltage boost set too high.</li></ul>
<b>CURRENT LOOP LOSS</b>	The current loop setpoint signal has been lost. This alarm is activated if the auto setpoint has been configured as 4/20mA or 20/4mA and the current falls below 3mA.
<b>EXTERNAL TRIP</b>	24V not present on Ext. Trip (Terminal 23).
<b>FAULT OR BRAKING</b>	Parameters cannot be saved when the drive is unhealthy or braking (stopping). Toggle run signal to clear alarm.
<b>CHECKSUM FAILED</b>	Hardware error.
<b>EE VERSION ERROR</b>	Hardware error.
<b>EE WRITE ERROR</b>	Hardware error.

## Chapter 6

### SERVICING

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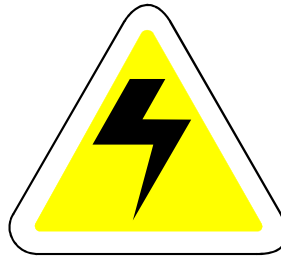
## Chapter 6 SERVICING

### ROUTINE MAINTENANCE

Routine maintenance of the 584S Frequency Inverters comprises a periodic inspection to check for a build-up of dust or other obstructions that may affect the ventilation of the unit. Obstructions should be removed and any dust must be cleared using dry air.

### REPAIR

The 584S Frequency Inverters must not be repaired by the user. If repair is necessary return the unit to Eurotherm Drives, refer to "SALES AND SERVICE" in this chapter.



#### WARNINGS!

BEFORE DISCONNECTING THIS UNIT, ENSURE ISOLATION OF THE MAIN SUPPLY TO TERMINALS L1, L2 AND L3.

WAIT FOR AT LEAST 5 MINUTES FOR THE DC LINK TERMINALS (DC+ & DC-) TO DISCHARGE TO SAFE VOLTAGE LEVELS (<50V), FAILURE TO DO SO CONSTITUTES AN ELECTRICAL SHOCK HAZARD.

---

### RETURNED MATERIAL

The following procedures are recommended in the unlikely event of a fault which necessitates return of a controller (or part) to Eurotherm Drives.

- a) Contact your nearest Eurotherm Drives service centre to arrange return of the controller, if necessary. (Refer to the list of Eurotherm Drives service centres at the end of this Chapter). Eurotherm Drives will request the model number and serial number of the controller, please have this information to hand prior to making contact.
- b) On contacting your local Eurotherm Drives service centre, a Returned Material Authorisation (RMA) code will be issued, if necessary, which must be used as a reference on paperwork returned with the controller.
- c) Package and despatch the controller.

NOTE: In the unlikely event that a 584S is to be returned to Eurotherm Drives, it must be suitably packaged. If Styrofilä chips, or equivalent, are being used as a packing material then the controller must first be sealed in a polythene bag or similar, to prevent ingress of the packing material.



## DISPOSAL

This product contains materials which are consignable waste under the Special Waste Regulations 1996 which complies with the EC Hazardous Waste Directive - Directive 91/689/EEC.

We recommend you dispose of the appropriate materials in accordance with the valid environmental control laws. The following table shows which materials can be recycled and which have to be disposed of in a special way

Material	Recycle	Disposal
metal	yes	no
plastics material	yes	no
printed circuit board	no	yes

The printed circuit board should be disposed of in one of two ways:

1. High temperature incineration (minimum temperature 1200°C) by an incinerator authorised under parts A or B of the Environmental Protection Act
2. Disposal in an engineered land fill site that is licensed to take aluminium electrolytic capacitors. Do not dispose of in a land fill site set aside for domestic waste.

## Packaging

During transport our products are protected by suitable packaging. This is entirely environmentally compatible and should be taken for central disposal as secondary raw material.

## Chapter 7

### The European Directives and the 'CE' Mark

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## Chapter 7 The European Directives and the 'CE' Mark

### CEMEP

Until recently each European drives manufacturer and importer has been interpreting the EMC directive and 'CE' marking requirements differently. This has led to considerable confusion and frustration in the market place. To provide a unified approach, the European machines and drives manufactures, via their national trade associations have formed the 'European Committee of Manufacturers of Electrical Machines and Power Electronics', termed CEMEP. This committee has produced a document entitled "Recommendations for Application of Power Drive Systems (PDS), European Council Directives - CE Marking and Technical Standardisation", which will be followed by all major European Drives manufacturer. A copy is available from your local trade association or from your local Eurotherm Drives office.

### EMC DIRECTIVE

#### 'CE' EMC responsibility

The subject of CE marking and EMC is explored in more detail in a separate Eurotherm Application manual entitled 'EMC Installation Guidelines for modules and systems', part number HA388879, available from your local Eurotherm Drives office. The following sections are the minimum necessary for basic understanding.

Eurotherm Drives are adhering to the CEMEP recommendations on 'CE' marking for EMC. According to SI No. 2372, implementing the EMC directive into UK law, the requirement to CE mark for EMC, applies only to **relevant apparatus** that has '**intrinsic function**' to the **end user** and which is placed on the market (**supplied**). The majority of drive modules/systems sold by Eurotherm Drives will be incorporated into a higher system/apparatus or machine which includes (at least) the motor, cable and a driven load before providing intrinsic function to the end user. As such the majority of Eurotherm Drives products are categorised as **components** (CEMEP validity field 2) and it would be incorrect for Eurotherm Drives to apply the CE mark or produce an EC Declaration of Conformity in respect of EMC. It is the manufacturer/supplier/installer of the relevant apparatus (with the intrinsic function to the end user) who must demonstrate conformance to the EMC directive

However, in a minority of cases, single drives may have intrinsic function to the end user. An example is that of '**add on**' intrinsic function, where an existing fixed speed motor application (such as a fan or a pump) is converted to variable speed with an **add on** drive module (CEMEP validity field 1). In this application Eurotherm Drives CE mark its drive module and issue an EC declaration of conformity. Because the validity of the 'CE' mark for EMC is not known when the product is manufactured, the 'CE' mark will be applied via the product manual, and will not be on the product label. From 1997, when the 'CE' mark for the Low Voltage Directive becomes mandatory, the CE mark will appear on the product label, but its validity for EMC can only be identified from the product manual.

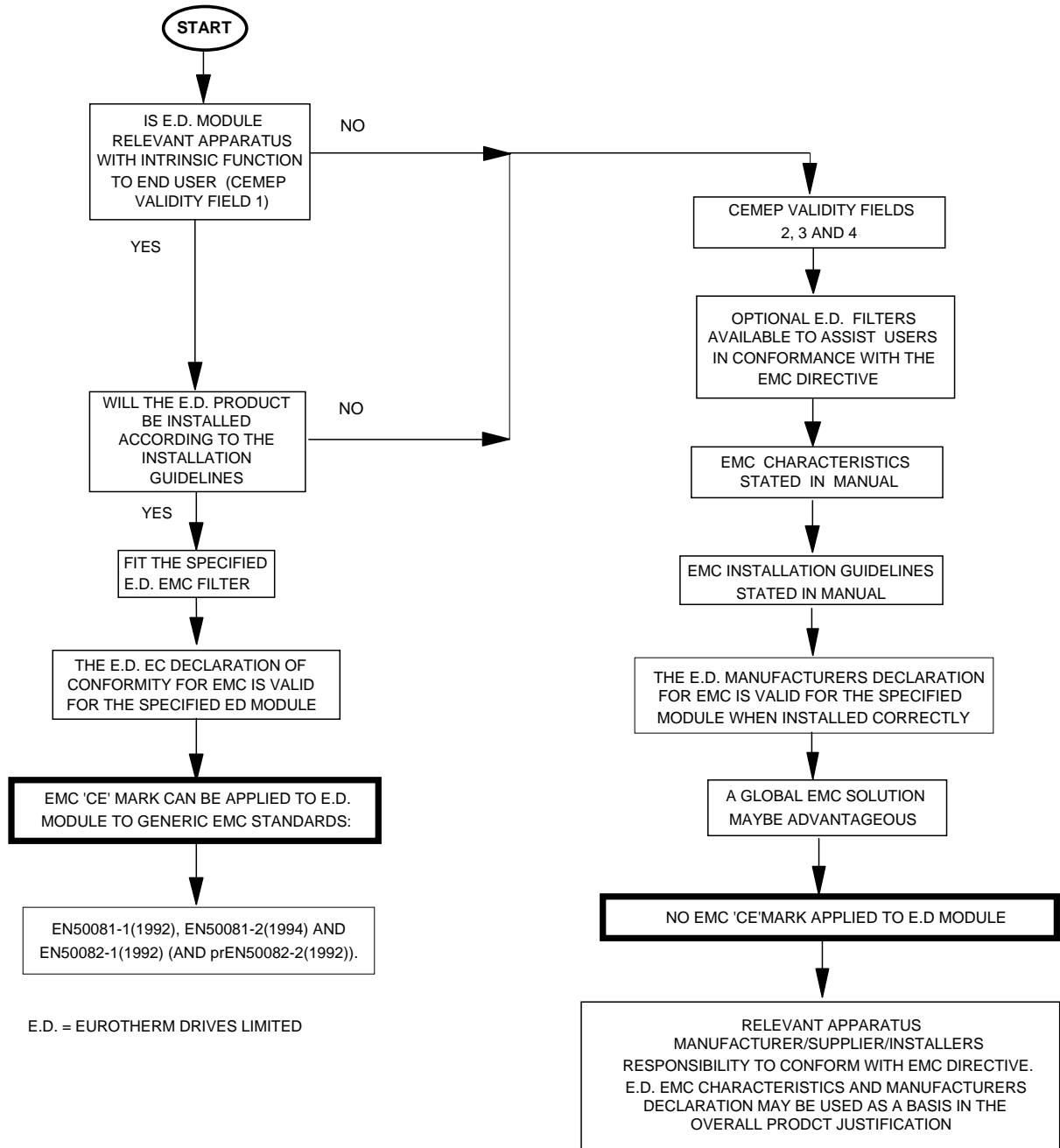
The validity of the 'CE' mark can be identified from the flowchart in figure 7.1, refer to SI No. 2372 for clarification of relevant apparatus.

To assist manufacturers/suppliers/installers of relevant apparatus, Eurotherms 584S/620 drive modules are EMC compliant to EN50081-1 (1992), EN50082-1 (1992), EN50081-2 (1994) and prEN50082-2 (1992), when fitted with the specified filter and installed according to these instructions, (as confirmed by the Manufacturers EMC declaration to be found at the end of this chapter).

Manufacturers/suppliers/installers of relevant apparatus (CEMEP validity fields 3 & 4) may use this compliance as a basis for their own justification of overall compliance with the EMC Directive.




It must be clearly understood by the customer before installation commences who is legally responsible for conformance with the EMC Directive. Misappropriation of the CE mark is a criminal offence.

Figure 7.1 Eurotherm EMC 'CE' Mark Validity Chart



**CONSIDERATION OF EMC ENVIRONMENT**

When considering the relevant EMC emission and immunity standards it is important to distinguish between the following classes of EMC environments:

	Residential, supplied directly from public electricity supply 		Commercial and light industry, supplied directly from public electricity supply 		Industrial installation with a separate transformer station 	
	RF emission	Immunity	RF emission	Immunity	RF emission	Immunity
<b>Basic and Generic Standards</b>	EN55011 (Class B) or EN50081-1(1992)	EN50082-1(1992) see below for referenced standards	EN55011 (Class B) or EN50081-1(1992)	EN50082-1(1992) see below for referenced standards	EN55011 (Class A) or EN50081-2(1994)	EN50082-2 (1992) see below for referenced standards
<b>New EMC Product Standard (draft) for Power Drive Systems</b>  IEC-22G/31/FDIS <sup>+</sup> (will become EN 61800-3)	Unrestricted distribution (CEMEP-1): < 25 A Class B > 25 A Class A  Restricted distribution (CEMEP-2) Class A	see below  ↓	EMC measures do not have to be implemented  If interference in a neighbouring installation occurs, the operator is responsible for taking measures to prevent interference. In this case the required emission levels must be adhered to at the point of supply to the effected neighbouring installation.	see below  ↓	EMC measures do not have to be implemented  If interference in a neighbouring installation occurs, the operator is responsible for taking measures to prevent interference. In this case the required emission levels must be adhered to at the point of supply to the effected neighbouring installation.	see below  ↓
<sup>+</sup> This new Product Standard Draft has not yet been finally passed and more important, is not EC approved. An EC Declaration of Conformity for EMC can only be issued with the approval of a "Competent Body". It is anticipated this standard will be officially released during Q 3/4 1996.  * New standards to be introduced in the near future		Standards for immunity: IEC801-2 (IEC1000-4-2*): Electrostatic discharge (e.g. from electrostatically charged persons)  IEC801-3 (IEC1000-4-3/6*): Electromagnetic fields (e.g. from portable telephones)  IEC801-4 (IEC1000-4-4*): Fast electrical transients (burst) (e.g. from opening contacts in inductive circuits)  IEC801-5 (IEC1000-4-5): Voltage surges (e.g. on local lightning strikes).				

**Fig. 7-2: EMC Emission and Immunity Standards applicable to 584S/620 drive modules and similar equipment**

When using the generic EMC standards, the 'Residential, commercial and light industry' emission limits (Class B) are more stringent than the 'Industrial' (class A) limits, and so equipment which meets EN50081-1(1992) automatically meets EN50081-2(1994). Similarly, the 'Industrial' immunity requirements are more stringent than the 'Residential, commercial and light industry' requirements, and equipment which meets prEN50082-2(1992) automatically meets EN50082-1(1992).

More and more Product Specific standards are being released with less onerous EMC requirements than the Generic Standards. When the new EMC Drive Product Standard for Power Drive System (EN61800-3) becomes available (Q 3/4 1996), EMC filters will only be **mandatory** in 'residential' type EMC environments (if this is the most appropriate standard to use for demonstrating conformance of the relevant apparatus). EMC competent bodies are today using the draft EMC Drive Product Standard to demonstrate conformance using the technical construction file route. The EMC Drive Product Standard as CEMEP is discussed in more detail in the Eurotherm Application manual entitled 'EMC Installation Guidelines for modules and systems', part number HA388879, available from your local Eurotherm Drives office.

It is important for the customer to identify what EMC standards are to be applied to the final machine/system and in what EMC environment it will operate, so that any additional compliance costs can be minimised. It should be remembered that when two or more EMC compliant components are combined to form the final machine/system, the resulting machine/system may not be compliant. Emissions from combined components tend to be additive, whilst the immunity remains constant.

## FILTER SELECTION

584S/620 drive modules can be 'CE' marked (as in CEMEP validity field 1) when used with the specified specially designed EMC filters to comply with the mains terminal limits of EN55011 Class B (or EN50081-1) as indicated previously, and when installed in accordance with the **EMC installation instructions** in this Product Manual (chapter 3). The Class B limit is the most stringent limit applied in Europe to date, and allows product to be used in either the 'residential, commercial and light industrial' or 'industrial' EMC environments. Refer to **Consideration of EMC environments**, in this chapter for more details. The specified EMC filters for the 584S/620 drive modules are summarised in table 3-4 in Chapter 3. The fitment of the specified EMC filter is **mandatory** where 'CE' marking is applied.

If the customer is treating the 584S/620 drive module as a **component for supply to EMC competent professional assemblers** (CEMEP validity field 2) and is taking the EMC responsibility, then the filters are optional and may assist the customer in achieving EMC compliance. In this situation the customer may also achieve compliance by less expensive more global measures depending on the limits to be achieved, such as the use of a combination of global or local filtering and screening methods, natural mitigation through distance or use of distributed parasitic elements of the existing installation.

## FILTER INSTALLATION

The required EMC emission and immunity performance, and 'CE' marking of 584S/620 drive modules can only be achieved when the **EMC installation instructions** in Chapter 3 are adhered to.

## SPECIFICATION OF ACHIEVABLE EMC EMISSION AND IMMUNITY

584S/620 drive modules with the option to be 'CE' marked meet the following EMC emission limits provided they are installed with the specified EMC filters for 'CE' marking in accordance with the EMC installation instructions.

Port	Phenomenon	Basic standard	Level	Generic standard
Enclosure Port	radiated	EN55011 (1991)	Class B (cubicle mount)	EN50081-1 (1992)
			Class A (wall mount)	EN50081-2 (1994)
AC Power Port	conducted (with specified filter)	EN55011 (1991)	Class B #	EN50081-1 (1992)
AC Power Port	conducted ( <b>no filter</b> )	EN55011 (1991)	130dBOV @ 150kHz* (common mode) 130dBOV @ 150kHz* (differential mode) Reducing with frequency by 20dB/decade	

\* 6kHz switching frequency, 50 metres screened motor cable.

# Up to 50 metres screened motor cable maximum.

All 584S/620 drive modules meet the following EMC immunity performance criteria as defined in prEN50082-2 (1992) when installed and used as recommended.

Port	Phenomenon	Test Standard	Level	Acceptance Criterion	Generic Standard
Enclosure Port	ESD	IEC 801-2	4 kV CD, 8 kV AD	self recovery	EN50082-1 (1992)  Draft prEN50082-2 (1992)
	RF Field	IEC 801-3	10 V/m, 1 kHz AM	no change	
Power Ports	Fast Transient	IEC 801-4,	2 kV	self recovery	
	Burst, Surge	IEC 801-5	1 kV (P-P), 2 kV (P-E)	self recovery	
Signal & Control	Fast Transient Burst	IEC 801-4	2 kV	self recovery	
Power Interfaces	Fast Transient Burst	IEC 801-4	2 kV	self recovery	

The EMC filters for 584S/620 drive modules may be flash tested in circuit up to DC 2850 V for 1 min Ensure all other equipment that may be damaged by such flash testing has been suitably isolated/removed/short circuited as applicable. Due to the internal capacitors between phase and earth, the DC voltage should be wound up slowly, to prevent excessive earth current. For similar reasons AC flash testing cannot be performed due to the excessive earth leakage current. Repeated flash testing is not recommended as it may degrade the insulation.

### EMC RESPONSIBILITY OF MANUFACTURERS/SUPPLIERS/INSTALLERS

For end users of 584S/620 drive modules, a correctly installed power drive system (PDS) created from the supplied 584S/620 will be compliant with the generic emission standards EN50081-1(1992) & EN50081-2(1994) and for immunity EN50082-1(1992) & prEN50082-2(1992) as previously indicated. Manufacturers/suppliers/installers of relevant apparatus may use this compliance as a basis for their own justification of overall compliance with the EMC Directive.

If it is the responsibility of the manufacturer/supplier/installer to establish EMC conformity and to 'CE' mark. There are three methods of demonstrating conformity:

- 1) Self certification to a relevant standard
- 2) Third party testing to a relevant standard
- 3) Writing a technical construction file stating the technical rationale as to why the relevant apparatus is compliant. An EMC "competent body" must then assess this and issue a technical report or certificate to demonstrate compliance.

Upon demonstrating EMC compliance an EC-Declaration of Conformity for the apparatus or machine may be issued and a 'CE' mark applied.

**Professional end users with EMC expertise who are using drive modules and cubicle systems defined as components who supply, place on the market or install the relevant apparatus must take responsibility for demonstrating EMC conformance and applying the 'CE' mark and issuing an EC Declaration of Conformity.**

### Eurotherm Guide

More information is available in a separate Eurotherm Guide entitled "Short Form Overview of European Directives for Variable Speed Drives and Applications" part number HA389770 available from your local Eurotherm Drives office.



## EC Declaration of Conformity for EMC

Issued for compliance with the EMC Directive when the unit is used as *relevant apparatus*.

This is provided to aid your justification for EMC compliance when the unit is used as a component.

The drive is CE marked in accordance with the low voltage directive for electrical equipment and appliances in the voltage range when installed correctly.

Since the potential hazards are mainly electrical rather than mechanical, the drive does not fall under the machinery directive. However, we do supply a manufacturer's declaration for when the drive is used (as a component) in machinery.

584S (T4/5/6/7)				
<div style="display: flex; justify-content: space-between; align-items: center;"> <div style="font-size: 2em; font-weight: bold;">CE</div> <div style="text-align: center;"> <h3>EC DECLARATIONS OF CONFORMITY</h3> <p>Date CE marked first applied: 06/12/96</p> </div> </div>				
<p style="text-align: center; background-color: black; color: white; margin: 0;"><b>EMC Directive</b></p> <p>In accordance with the EEC Directive 89/336/EEC and amended by 92/31/EEC and 93/68/EEC, Article 10 and Annex 1, (EMC DIRECTIVE)</p> <p>We Eurotherm Drives Limited, address as below, declare under our sole responsibility that the above Electronic Products when installed and operated with reference to the instructions in the Product Manual (provided with each piece of equipment) is in accordance with the relevant clauses from the following standards:-</p> <p style="text-align: center;">BSEN50081-2 (1994), BSEN50082-2# (1995).</p>	<p style="text-align: center; background-color: black; color: white; margin: 0;"><b>Low Voltage Directive</b></p> <p>In accordance with the EEC Directive 73/23/EEC and amended by 93/68/EEC, Article 13 and Annex III, (LOW VOLTAGE DIRECTIVE)</p> <p>We Eurotherm Drives Limited, address as below, declare under our sole responsibility that the above Electronic Products when installed and operated with reference to the instructions in the Product Manual (provided with each piece of equipment), is in accordance with the following standard :-</p> <p style="text-align: center;">EN50178 (1998)</p>			
<h3>MANUFACTURERS DECLARATIONS</h3>				
<p style="text-align: center; background-color: black; color: white; margin: 0;"><b>EMC Declaration</b></p> <p>We Eurotherm Drives Limited, address as below, declare under our sole responsibility that the above Electronic Products when installed and operated with reference to the instructions in the Product Manual (provided with each piece of equipment) is in accordance with the relevant clauses from the following standards:-</p> <p style="text-align: center;">BSEN50081-2 (1994), BSEN50082-2# (1995)</p>	<p style="text-align: center; background-color: black; color: white; margin: 0;"><b>Machinery Directive</b></p> <p>The above Electronic Products are components to be incorporated into machinery and may not be operated alone. The complete machinery or installation using this equipment may only be put into service when the safety considerations of the Directive 89/392/EEC are fully adhered to. Particular reference should be made to EN60204-1 (Safety of Machinery - Electrical Equipment of Machines). All instructions, warnings and safety information of the Product Manual must be adhered to.</p>			
 _____ Dr Martin Payn (Conformance Officer)				
<p><i>For information only.</i></p> <p># Compliant with these immunity standards without specified EMC filters.</p>				
<p><b>EUROTHERM DRIVES LIMITED</b> <span style="float: right;">An Invensys Company</span></p> <p>NEW COURTWICK LANE, LITTLEHAMPTON, WEST SUSSEX BN17 7RZ</p> <p>TELEPHONE: +44(0)1903 737000 FAX: +44(0)1903 737100</p> <p><small>Registered Number: 1159876 England. Registered Office: Southdownview Way, Worthing, West Sussex BN14 8NN</small></p>				
<p style="font-size: 0.8em;">File Name: I:\Manuals\584S Controller\HA389756 Issue 7\7.wrd <span style="float: right;">© 1999 EUROTHERM DRIVES LIMITED</span></p>				
ISS:	DATE	DRN: MP	CHKD: JMc	DRAWING NUMBER: HK389949.919
A	06/12/96	 <b>EUROTHERM DRIVES</b>		TITLE:  Declarations of Conformity
				SHT 6 OF 2 SHTS



## Chapter 8

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## Chapter 8 Appendices

### APPENDIX A - APPLICATION NOTES

#### General

Always use gold flash relays, or others designed for low current operation (5mA), on all control wiring.

All power factor correction equipment must be removed from the motor side of the inverter before an inverter can be used.

Motors with low efficiency and small  $\cos \phi$  (power factor) should be avoided since they require a larger kVA rated inverter to produce the correct shaft kW.

#### Minimum Connection Requirements.

The diagram below shows the minimum connection requirements in order to operate the drive.

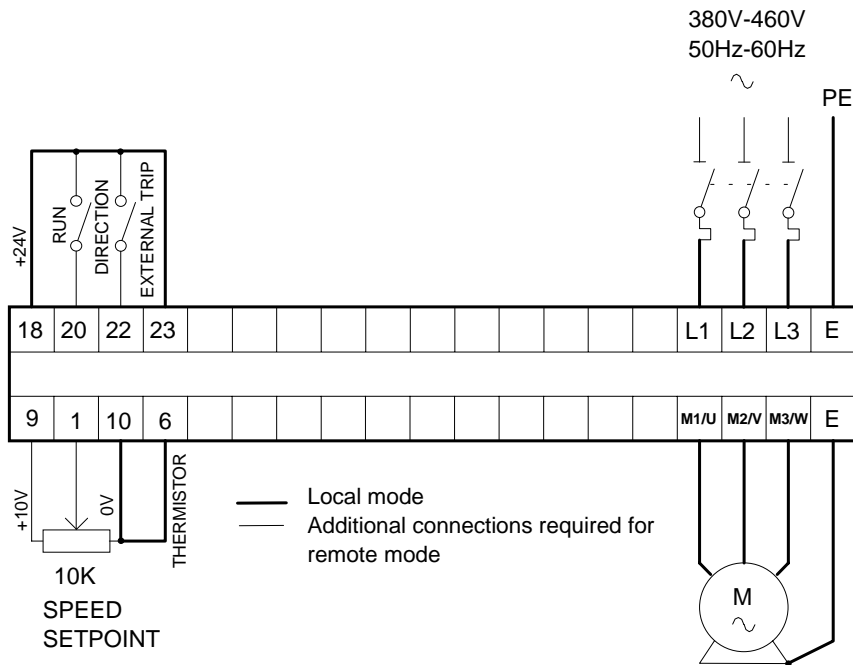


Figure A.1 - Minimum Connection Requirements

## Synchronous Motors

Although intended primarily for use with induction (asynchronous) motors, inverters can also be used for speed control of synchronous motors. Synchronous motors can offer economic solutions in applications where tight control of speed is required together with the low maintenance characteristics of an AC motor.

The two most common types of synchronous AC motor are permanent magnet and wound rotor. In contrast to induction motors, synchronous motors run at synchronous speed whether on no load or full load. Synchronous speed is set by the frequency of the supply applied to the stator. The stator flux can be kept constant by keeping the stator volts/frequency ratio constant as with an induction motor.

Torque is produced in the motor by a increase in load angle between the stator and rotor fluxes. Maximum torque occurs when the load angle approaches 90°. If the load angle exceeds this value then torque drops and the motor will stall. Systems involving synchronous motors need careful design to ensure that the motor can accelerate the load and handle transient load changes without stalling.

## Brake Motors

Brake motors are used in applications requiring a mechanical brake for safety or other operational reasons. The motor can be a standard induction motor fitted with an electromechanical brake or it could be a special conical rotor machine. In the case of a conical rotor machine the spring-loaded brake is controlled by the motor terminal voltage as follows:

- a) At rest the motor is braked;
- b) When the motor is energised an axial component of the magnetic field, due to the conical air-gap, overcomes the force of the brake spring and draws the rotor into the stator. This axial displacement releases the brake and allows the motor to accelerate like a normal induction motor;
- c) When the motor is de-energised the magnetic field collapses and the brake spring displaces the rotor, pushing the brake disc against the braking surface.
- d) Inverters can be used to control the speed of conical rotor brake motors since the linear V/F characteristic maintains the motor magnetic field constant over the speed range. It will be necessary to set the **FIXED BOOST** parameter to overcome motor losses at low speed.

## Using Line Chokes

Line chokes are not required to limit input current to Eurotherm Drives inverters. Controllers from 5.5kW ( 400v) or 2.2kW ( 230v) upwards are fitted with DC link chokes to limit the ripple current seen by the DC link capacitors and thus prolong their life.

Line chokes may be used to reduce the harmonic content of the supply current where this a particular requirement of the application or where greater protection from mains borne transients is required.

## Using Output Contactors

The use of output contactors is permitted. It is recommended that this type of operation be limited to emergency use only or in a system where the drive can be inhibited before closing or opening this contactor.

## Using Motor Chokes

Installations with motor cable runs in excess of 50m may suffer from nuisance overcurrent trips. This is due to the capacitance of the cable causing current spikes to be drawn from the inverter output. A choke may be fitted in the inverter output which limits the capacitive current. Screened cable has a higher capacitance and may cause problems in shorter runs. The recommended choke values are shown in Table A.1.

Table A.1 - Recommended Choke Values For Cables Up To 300m

Drive kW	Choke Inductance	RMS Current Rating	Eurotherm Part No.
0.75	2mH	7.5A	CO055931
1.1			
1.5			
2.2			
4.0	0.9mH	22A	CO057283
5.5			
7.5			
11	0.45mH	33A	CO057284
15			
18	0.3mH	44A	CO057285
22	50uH	70A	CO055193
30			
37	50uH	99A	CO055253
45	50uH	99A	CO055253
55	25uH	120A	-
75	25uH	160A	-
90	25uH	200A	-

## Using Multiple Motors On A Single Drive

It is possible to use a single large inverter to supply several smaller motors provided that each individual motor has overload protection.

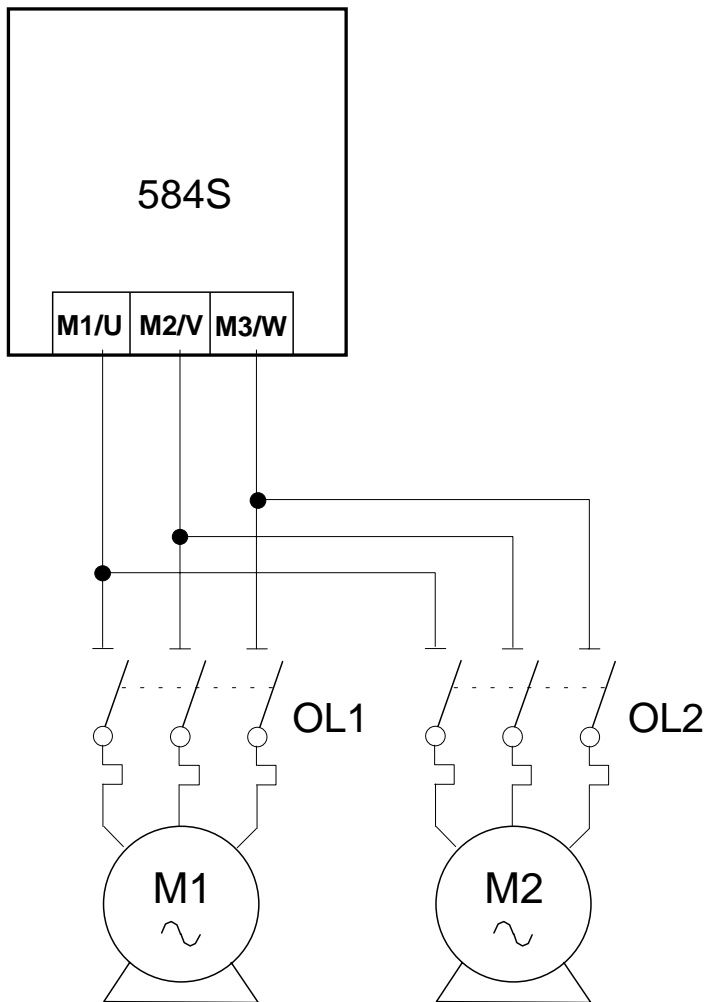


Fig. A.2 - Multiple Motors on a Single Drive

The drive must be rated to supply the **total motor current**. It is not sufficient to simply sum the power ratings of the motors, since the drive has also to supply the magnetising current for each motor.

Note that the overload device will not prevent the motor overheating due to inadequate cooling at low speed. Force vented motors may be required; consult your motor supplier.



Caution

MULTIPLE MOTOR INSTALLATIONS SHOULD RESTRICT THE TOTAL CABLE LENGTH AS FOLLOWS:

50M WITH NO OUTPUT CHOKE FITTED

300M WITH CHOKE AS RECOMMENDED IN TABLE A.1.

## High Starting Torque

Applications requiring high motor starting torque (greater than 100% of rated torque) need careful set up of the drive voltage boost feature. For most motors a **FIXED BOOST** parameter setting of 6.0% is usually adequate. Setting the **FIXED BOOST** parameter level too high can cause the drive current limit feature to operate. If this occurs, the drive will be unable to ramp up in frequency. The **OVERLOAD STATUS** diagnostic will indicate **OVERLOAD** when the current limit feature is operating. Simply reducing the level of the **FIXED BOOST** parameter will remove this problem. It is important to use the minimum level of **FIXED BOOST** necessary to accelerate the load. Using a level of **FIXED BOOST** higher than necessary will lead to increased motor heating and increased risk of drive overload.

It should be noted that motor torques greater than 100% require high currents to be drawn from the drive. Thus, the **MOTOR I LIMIT** parameter will have to be set accordingly such that the drive current limit feature will not activate when accelerating the load.

The best motor starting performance can be achieved by setting up the drive **SLIP COMP** parameter. The procedure for setting the **SLIP COMP** parameter is outlined in chapter 4. Also setting the **BASE VOLTS** parameter to 115.4% and the **SWITCHING FREQ** parameter to 3kHz, can help to start difficult loads in the most extreme cases.

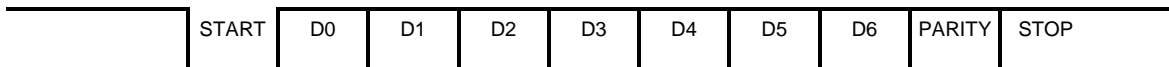
## APPENDIX B - SERIAL COMMUNICATIONS OPTION

This option provides an opto-isolated RS422/485 serial data port to allow an intelligent device to monitor or update the parameters of a network of drives. The option takes the form of a PCB which is plugged into the drive control board at the bottom right-hand side (refer to Figure B.1). The option board carries 6 screw terminals for the serial link connections.

The 584S supports both ASCII and Binary communication modes. ASCII is more commonly used so this section concentrates mainly on ASCII communications. Binary communications is explained later in this chapter.

### Specification

Transmission Standard	:	RS485 (RS422) (bi-directional)
Protocol	:	ANSI-X3.28-2.5-B1
Data Rates	:	300,600,1200,2400,4800 or 9600 baud
Character Format (300 to 9600 baud)	:	ASCII + 1 start, 1 parity and 1 stop bit [10 BIT]
Parity	:	Defaults to Even



	RS422	RS485
Electrical Connections	4-wire differential	4-wire differential
No. of drivers and receivers allowed per line	1 driver 16 receivers	32 drivers 32 receivers
Maximum cable length	4000ft/1200 metres	

NOTE: RS485 supports multiple drivers however EI (Eurotherm International) protocol supports one driver.

### Terminal Connections

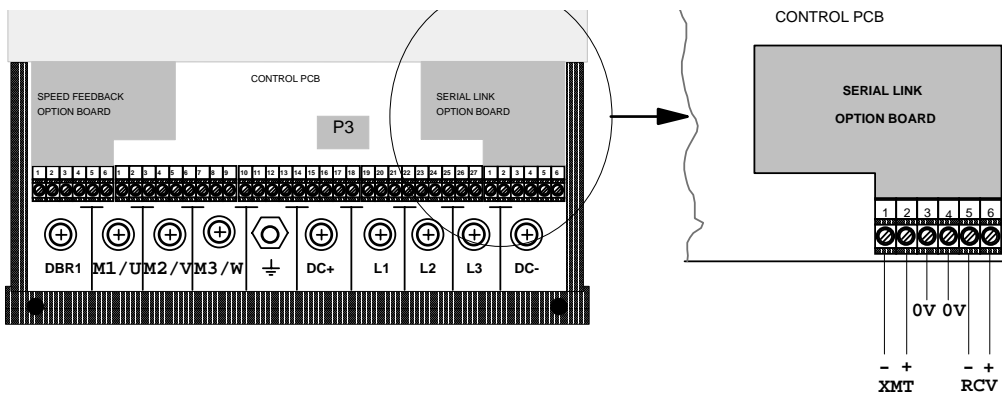


Figure B.1 - Serial Link Option Board



## ASCII Communications

### Reading Data

#### Control Characters

Control Characters are ASCII binary codes which define actions rather than information. The six ASCII codes used are defined in Table B.1.

Table B.1 - Control Character Definitions

ASCII-HEX	Mnemonic	Definition
02	(STX)	Start of Text
03	(ETX)	End of Text
04	(EOT)	End of Transmission
05	(ENQ)	Enquiry
06	(ACK)	Positive Acknowledge
15	(NAK)	Negative Acknowledge

#### Enquiry

The computer initially has master status with the 584S in slave status. The computer begins communication by transmitting a message, known as the "establish connection" message, which is represented by the following format:-

(EOT) (GID) (GID) (UID) (UID) (C1) (C2) (ENQ)

These symbols are defined as follows:

- (EOT) This control character resets all instruments on the link and causes them to examine the next four transmitted characters to see if they correspond with their group/unit address identifiers.
- (GID) These characters represent the group address identifier, repeated for security.
- (UID) These characters represent the required unit address identifier, repeated for security. (Together GID and UID define the address of a particular instrument). If, for example, GID = 3 and UID = 4, then the instrument to be addressed is number 34.
- (C1)(C2) These characters specify the parameter by mnemonic.
- (ENQ) This character indicates the end of the message, and that it is an enquiry.

The transmission of this message initiates a response procedure from the 584S.

### Valid Response of the 584S to this Message

After the message has been sent, the computer adopts slave status and expects to receive a reply from the 584S. In so doing, the 584S assumes Master status and, providing the 584S has successfully received the message in full, it responds in the following form:

(STX) (C1) (C2) (D1) (D2) (D3) (Dn) (ETX) (BCC)

which constitutes a message defined as:

(STX) Start of text.

(C1)(C2) Parameter specified by mnemonic.

(D1 to Dn) Value of the requested parameter (string may be of any length as determined by the data). The 584S responds with the shortest message which represents the data value. If the data value is an integer then it does not send a decimal point. Trailing zeros in the decimal part are not sent.

(ETX) End of text.

(BCC) Block check character which is the character generated by taking the exclusive OR of the ASCII values of all the characters transmitted after and excluding (STX) up to and including (ETX).

e.g. if a message with (D1 - Dn) is 5 characters (BCC) = (C1) EOR (C2) EOR (D1) EOR (D2) EOR (D3) EOR (D4) EOR (D5) EOR (ETX)

where EOR = Exclusive OR

The computer must check this (BCC) before accepting this reply as valid. Also the software must be able to extract the number from the data string taking into account the protocol of the data transmission.

NOTE: If the 584S receives the message but does not recognise the mnemonic it will respond with (EOT). The (EOT) hands back control to the computer.

### Further Enquiry and Termination

The computer then assumes master status again and three options are available:

1. Repeat Parameter Facility (NAK). If the computer transmits a (NAK) after the valid reply, it causes the 584S to repeat the parameter that was just received. This allows continuous monitoring of the same parameter without having to re-establish the connection.
2. Scroll Mode Facility (ACK). If the computer transmits an (ACK) after a valid 'reply', it causes the 584S to fetch the next parameter from the parameter list. This facility enables the computer to sequence continuously through all the parameters of the 584S.
3. Terminate Communication (EOT). The termination procedure is entered when the selection of a particular instrument is no longer required or when a 584S does not respond to a message or replies with an (EOT) character. The computer assumes Master status and transmits an (EOT) character to enable all the instruments on the data link to respond to the next GID-UID address parameter.

### No Response

Under certain circumstances the computer may not receive a response from the 584S. This could be due to any of the following reasons:

1. Group/Unit address identifiers not recognised.
2. An error (e.g. parity) is found in one or more of the characters up to and including ENQ.
3. Communications loop failure, perhaps due to noise or wrong baud rate being selected.
4. Hardware failure.

In these cases the computer should be programmed to "time-out", i.e. wait for a response for a short time (160ms minimum) before trying again.

The sequence diagram for the data read function is given in Figure B.2.

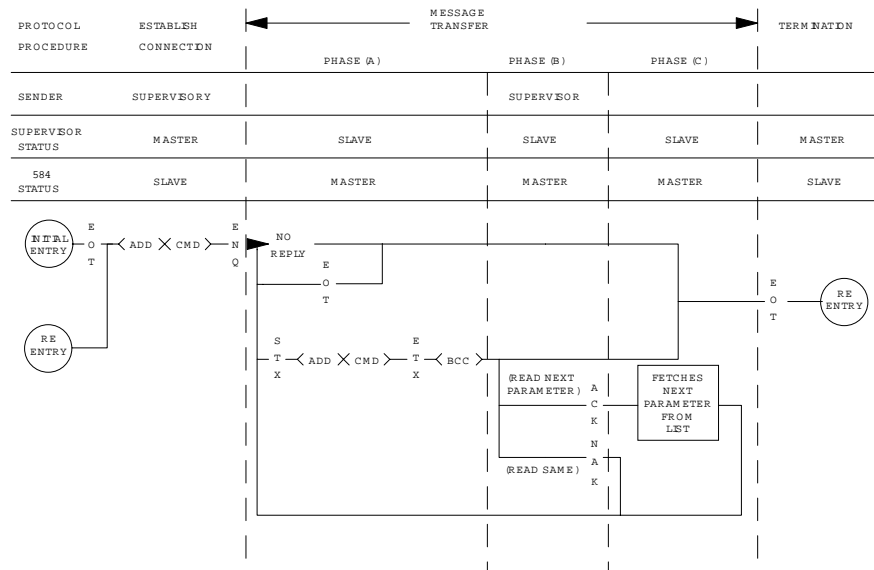


Figure B.2 - Reading Data From The 584S

### Sending Data

#### Establish Connection

Connection is established with a particular 584S by sending:

(EOT) (GID) (GID) (UID) (UID)

followed immediately by the data transfer:

(STX) (C1) (C2) (D1) (D2) (D3) (DN) (ETX) (BCC)

(Note that the data transfer message is identical to that transmitted by a 584S when giving a "valid reply").

The symbols of this message are defined as follows:

(STX)	start of text character
(C1)(C2)	parameter specified by mnemonic
(D1 to DN)	parameter value
(ETX)	end of text character
(BCC)	Block Check Character (verification check digit which is again the exclusive OR of (C1) to (ETX) inclusive and must be calculated by the computer before transmission)

## Responses

After transmission of the whole message, the 584S responds to it by sending (ACK), (NAK) or by giving no reply.

### 1. Positive acknowledgement (ACK)

When the 584S has received the message, it performs the following tasks:

- Checks for any parity errors in the message.
- verifies that the (BCC) character corresponds to the data pattern received.
- verifies that the (C1), (C2) command characters are a valid mnemonic that may be written to.
- verifies that the data (D1 to DN) is valid and not out-of-range\*.
- updates the selected parameter with the new value contained in the message.

Only when all these tasks have been successfully completed does the 584S send the (ACK) response to the computer. This signifies that the message was correctly received and implemented.

### 2. Negative acknowledgement (NAK)

If the message fails any of the above checks, the 584S sends (NAK) response to the computer. This signifies that the message received by the 584S contained an error and accordingly it has not updated the selected parameter. One possible reason is the incorrect calculation of (BCC). At this point, the selected command may be repeated by sending the data transfer string without re-establishing connection, until the (ACK) response is received by the computer.

\* Data out-of-range returns NAK and is discarded.

### 3. No Reply

Under certain circumstances, the computer may not receive a response from the 584S. This could be due to any of the following reasons:

- Unit address identifiers not recognised.
- An error (e.g. parity) is found in one or more of the characters up to and including (BCC).
- Communications loop failure perhaps due to noise or wrong baud rate selected.
- Hardware failure.

In these cases the computer should be programmed to 'time-out', i.e. wait for a response for a short time (160ms minimum) before trying again.

The sequence diagram for the data send function is given in Figure B.3.

## Termination

The termination procedure is used if the computer wishes to stop selecting a particular 584S and establish connection with another. This is achieved by sending the 'establish connection' sequence. The computer retains Master status and transmits an (EOT) character to reset all instruments on the data link to be responsive to the next GID-UID address parameter.

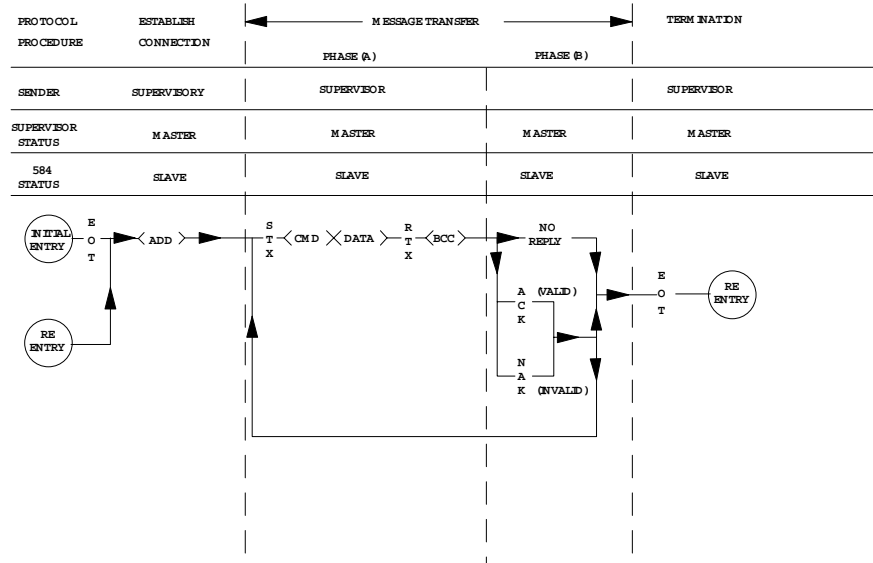


Figure B.3 - Sending Data to the 584S

## Binary Communications

This mode has many similarities with the ASCII mode. This document mainly concentrates on presenting those parts which are different from the ASCII mode.

### Specifications

#### Character Format

Each data-word is transmitted as 11 bits rather than adapting the 10-bit format used by the ASCII mode. This is because a control bit is used which is cleared in control characters and set in data characters. The format is as follows:

- 1 Start bit (lo)
- 7 Data bits (LSB first)
- 1 Control bit\*
- 1 Even parity bit
- 1 Stop bit (hi)

- \* Logic 0 = Control character
- \* Logic 1 = Data character

### The Message

The message received from the supervisor can be in any of several types. They can be divided into two categories:

- a) "main messages"
- b) "continuation messages"

Before presenting the format of these messages, the following gives the symbols they use. These symbols used in the messages are divided into two types; "control characters" and "data characters".

### Control Characters

(EOT)	Indicates the end of transmission. It therefore clears the line and is sent by the Master at the start of a new message.
(STX)	This is the start of text character.
(ENQ)	This is the enquiry character. It is sent by the Master as the last character of any type of polling message.
(ETX)	This is the end of text character. It is followed by another character containing the checksum.
(ETB)	This is the end of block character. It is sent by the 584S instead of the (ETX) when it wishes to reply to a multi parameter enquiry. The (ETB) indicates the end of a block, but not the end of a message. Each block contains information on up to eight parameters. The (ETB) is used to reply to enquiry polling and multi-parameter polling (these are explained in " <b>TYPES OF MESSAGES</b> ").
(ACK)	This is the positive acknowledgement character.
(NAK)	This is the negative acknowledgement character.

### Data Characters

(INO)	This is the instrument number. It contains the address of the slave drive and is equivalent to the combination of the GID, UID characters of the ASCII mode.
(PNO)	This is the parameter number. It is equivalent to the combination of the C1 and C2 characters of the ASCII mode and is sent as a hexadecimal number rather than two ASCII characters.
(D1), (D2) and (D3)	These three characters contain both the value and the mode number. The format is explained in " <b>DATA FORMAT</b> ".
(CCC)	This is the connection check control character. It contains the checksum of all the characters following the (EOT) character in the message.
(BCC)	Block check character which is generated by taking the Exclusive OR of the ASCII values of all character transmitted after and excluding (STX) up to and including (ETX)

## Types of Messages

As described above there are two types of message:

### Main Messages

The main messages are in four types:

1. Selection

The supervisor writes to one parameter.

(EOT) (INO) (CCC) (STX) (PNO) (D1) (D2) (D3) (ETX) (BCC)

where the (BCC) character contains the checksum of all characters following the (STX).

2. Polling

The supervisor requests to read the value of one parameter.

(EOT) (INO) (PNO) (CCC) (ENQ)

3. Enquiry Polling

The supervisor requests to read all those parameters in block 1 that have changed since the last read by an amount greater than or equal to changeband (PNO 4).

(EOT) (INO) (CCC) (ENQ)

4. Multi-parameter polling

The supervisor requests to read a given number of parameters. That number is referred to as the count number ("CNO"), it is included in the request message and the reply will be sent by the drive in blocks of up to 8 parameters.

(EOT) (INO) (PNO) (CNO) (CCC) (ENQ)

NOTE: The CCC is the checksum of the characters following an (EOT) and is therefore equal to (INO) in selection and enquiry-polling messages.

If PNO is the first in a block (i.e. 0, 8, 16, etc.) and CNO = 8, then a pseudo - enquiry poll is performed on the block, controlled by PNO 7. Further details are given in the 'Serial Link' menu option described in Chapter 4.

### Continuation messages:

In addition to the above, there are two types of continuation message (sent by the supervisor).

1. Next : (send next item from a list)  
Only valid if sent following a multi-parameter poll.  
(ACK)
2. Repeat : (repeat last reply)  
Only valid if sent following any type of poll. It requests a repetition of the previous reply. (NAK)

## Data Format

Data values are presented in three consecutive characters, D1, D2 and D3. These characters include the mode name as well as the value read from, or to be written to, one of the parameters. A data character is represented by setting its MSB (bit 7). The contents of these characters are as follows:

D1 :	bits 2 to 6 :	mode number Number format is: 0 = XXXX 1 = XXX.X 2 = XX.XX 3 = X.XXX 4 = .XXXX
	bits 0 and 1 :	bits 14 and 15 of the value.
D2 :	bits 0 to 6 :	bits 7 to 13 of the value.
D3 :	bits 0 to 6 :	bits 0 to 6 of the value.

## Baud Rate:

This can be any one of 6 values: 300, 600, 1200, 2400, 4800 or 9600 baud

## Serial Transmission

During serial communications, the 584S acts as a slave and replies to messages sent from a supervisor. It responds by transmitting a reply which can be one of two types:

- a. one character

It can be one of the following:

1. (ACK) : sent after the correct reception of a selection message.
2. (NAK) or (EOT) : in the case of detecting a fault.

- b. more than one character

This is the case when sending a reply to any type of a polling message. The reply is in the form:

(STX) (PNO) (D1) (D2) (D3) (ETX) (BCC)

In the case of multi-parameter polling, the reply can consist of more than one message. Such a reply is divided into a group of messages (blocks). The (ETX) character is only sent at the end of the last message. In other messages, the (ETX) is replaced by an (ETB) to indicate an end of a block rather than the end of reply, as explained earlier.



## Serial Link Mnemonics And Parameter Number Allocation

### Eurotherm Group Standard Parameters

Each of the Eurotherm Group instruments which support ASCII protocol contains a minimum set of parameters. These are known as the Prime Set and allow access to the following:

Mnemonic	Description	Access	Function
BL	Buffer length	R/O	Returns $4646_{16}$ indicating that both transmit and receive buffers are $46_{16}$ bytes long.
CI	Configuration Information	R/O	Returns $4CCC_{16}$ indicating that the drive supports both fixed and variable length data formats, and that the drive is a single-function device.
EE	Error report	R/W	Returns one of the following to indicate the status of serial link transmissions : 00C0 No errors 01C7 Unknown mnemonic 02C2 Block check character fail 03C1 Parity error on received data 03C2 Framing or overrun error 05C8 Attempt to write to a read-only mnemonic 07C7 Invalid message format 08C8 Value in selection message out of range Writing any value to mnemonic EE resets it to 00C0.
II	Instrument	R/W	Returns the value of a parameter, the default value of which is $5840_{16}$ .
MN	Mode Number	R/O	Returns a fixed value 08C1 (the full Eurotherm standard is not supported).
VO	Version Number	R/O	Returns the issue number in the upper two characters, and the release number in the lower two characters. For example issue 2.1 returns 0201.

In addition to the Prime Set, each drive or instrument supports an application set of parameters to allow fast access to commonly required variables such as:

- a. Process variables.
- b. Setpoints.
- c. PI gains.

All parameters can be found by polling the instrument identifier parameter and then sequentially polling until the instrument identifier parameter is repeated. This will result in a circular list that contains all supported by the instrument.

## PNO Allocation

### Block 0: (Binary Protocol Only)

PNO	Access	Description						
0	R/O	Instrument Identifier. Same as ASCII mnemonic II.						
1	R/W	Error report. Same as ASCII mnemonic EE						
2		Reserved						
3	R/O	Option Version of field bus option.						
4	R/W	Changeband. In an enquiry poll or pseudo-enquiry poll R/W (see PNO 7), a value must have changed by an amount equal to or greater than the hysteresis before it will be reported. Hysteresis is measured in the smallest units applicable to each parameter. For example, if hysteresis = 10, then a parameter with one decimal point must change by 1.0, and a parameter with two decimal points must change by 0.10 before they will be reported						
5	R/O	Serial link configuration.						
		<table border="1"> <thead> <tr> <th>Bit nos.</th> <th>Description</th> </tr> </thead> <tbody> <tr> <td>0 - 3</td> <td>                     Baud rate                      0 = 300                      1 = 600                      2 = 1200                      3 = 2400                      4 = 4800                      5 = 9600 (default)                 </td> </tr> <tr> <td>4 - 15</td> <td>Reserved</td> </tr> </tbody> </table>	Bit nos.	Description	0 - 3	Baud rate 0 = 300 1 = 600 2 = 1200 3 = 2400 4 = 4800 5 = 9600 (default)	4 - 15	Reserved
		Bit nos.	Description					
0 - 3	Baud rate 0 = 300 1 = 600 2 = 1200 3 = 2400 4 = 4800 5 = 9600 (default)							
4 - 15	Reserved							
4 - 15	Reserved							
6	R/O	Field Bus option "network" address.						
7	R/W	<p>Control word for multi-parameter polling. For the purpose of multi-parameter polling, the PNOs are arranged in 16 blocks of 8. Bit 0 of this parameter controls block 0 (PNO 0 to 7), bit 1 controls block 1 (PNO 8 to 15) bit 15 controls block 15 (PNO 120 to 127).</p> <p>When a bit is 1 (default), a multi-parameter poll on this block operates normally.</p> <p>When a bit is 0, a multi-parameter poll on this block with PNO = multiple of 8, and CNO = 8 performs an enquiry poll instead (a pseudo-enquiry poll).</p>						

**Block 1 :**

PNO	ASCII mnemonic	Tag No.	Access	Bit number	ASCII data format	Binary data format	Limits	Description
8	08	38	R/O	-	21	xxx.xx	-	DRIVE CURRENT (%)
9	09	60	R/O	-	21	xxx.xx	-	DRIVE LOAD (%)
10	0A	62	R/O	-	21	xxx.xx	-	EXT TORQUE LIMIT (%)
11	0B	39	R/O	-	21	xxx.xx	-	INVERTER FREQUENCY (%)
12	0C	61	R/O	-	21	xxx.xx	-	SPEED SETPOINT (%)
13	0D	85	R/O	-	21	xxx.x	-	INVERTER FREQUENCY (Hz)
14	0E	84	R/O	-	21	xxx.x	-	SPEED SETPOINT (Hz)
15	0F	58	R/O	-	23	xxxxx	-	DRIVE STATUS
	-	-	0				-	DRIVE STOPPED
	-	-	1				-	DRIVE RUNNING
	-	-	2				-	DRIVE AT ZERO SPEED
	-	-	3				-	DRIVE AT SPEED SETPOINT
	-	-	4				-	DRIVE RUNNING WITH I*T WARNING
	-	-	5				-	RESERVED
	-	-	6				-	RESERVED
	-	-	7				-	EXTERNAL TRIP
	-	-	8				-	D.C. LINK OVERVOLTAGE TRIP
	-	-	9				-	D.C. LINK UNDERVOLTAGE TRIP
	-	-	10				-	OVERCURRENT TRIP
	-	-	11				-	I*T TRIP
	-	-	12				-	STALL TRIP
	-	-	13				-	4-20MA CONTROL TRIP
	-	-	14				-	HEATSINK OVERTEMP TRIP
	-	-	15				-	MOTOR OVERTEMP TRIP

**Block 2 :**

PNO	ASCII mnemonic	Tag No.	Access	Bit number	ASCII data format	Binary data format	Limits	Description
16	10	14	R/W	-	21	xxx.x	0.1 3000.0	RAMP UP TIME (sec)
17	11	13	R/W	-	21	xxx.x	0.1 3000.0	RAMP DOWN TIME (sec)
18	12	6	R/W <sup>2</sup>	-	21	xxx.xx	0 100.00	MAX SPEED (%)
19	13	7	R/W <sup>2</sup>	-	21	xxx.xx	0 100.00	MIN SPEED (%)
20	14	17	R/W	-	21	xxx.xx	50.00 150.00	MOTOR CURRENT LIMIT (%)
21	15	12	R/W <sup>2</sup>	-	21	xxx.xx	6.25 100.00	BASE FREQUENCY (%)
22	16	18	R/W	-	21	xxx.xx	0.00 25.00	FIXED BOOST (%)
23	17	59	R/O	-	23	xxxxx	-	DIGITAL INPUTS
-	-	-	0				-	RUN /STOP
-	-	-	1				-	FRAMP
-	-	-	2				-	DIRECTION
-	-	-	3				-	EXTERNAL TRIP
-	-	-	4				-	JOG
-	-	-	5				-	PRESET 1
-	-	-	6				-	PRESET 2
-	-	-	7				-	MANUAL/AUTO
-	-	-	8				-	LOCAL BUTTON
-	-	-	9				-	PROG BUTTON
-	-	-	10				-	DIRECTION BUTTON
-	-	-	11				-	JOG BUTTON
-	-	-	12				-	STOP BUTTON
-	-	-	13				-	START BUTTON
-	-	-	14 - 15					RESERVED

**Block 3 :**

PNO	ASCII mnemonic	Tag No.	Access	Bit number	ASCII data format	Binary data format	Limits	Description
24	18	8	R/W	-	21	xxx.xx	-100.00 100.00	PRESET SPEED 1 (%)
25	19	9	R/W	-	21	xxx.xx	-100.00 100.00	PRESET SPEED 2 (%)
26	1A	10	R/W	-	21	xxx.xx	-100.00 100.00	PRESET SPEED 3 (%)
27	1B	11	R/W	-	21	xxx.xx	-100.00 100.00	PRESET SPEED 4 (%)
28	1C	31	R/W	-	21	xxx.xx	50.00 105.00	I*T THRESHOLD (%)
29	1D	5	R/W	-	21	xxx.xx	-100.00 100.00	AUX SETPOINT (%)
30	1E	165	R/W	-	21	xxx.xx	-100.00 100.00	JOG SPEED (%)
31	1F		-	-	23	xxxxx	(Note 1)	
	-	44	R/W	0			0 → 1	EXT TORQUE LIM SELECT
	-	55	R/W	1			0 → 1	AUX RUN
	-	56	R/W	2			0 → 1	AUX FRAMP
	-	57	R/W	3			0 → 1	AUX DIRECTION
	-	167	R/W	4			0 → 1	AUX JOG
	-	147	R/W <sup>2</sup>	5			0 → 1	AUTO BOOST ENABLE
	-	-	-	6 - 15				RESERVED

**Block 4 :**

PNO	ASCII mnemonic	Tag No.	Access	Bit number	ASCII data format	Binary data format	Limits	Description
32	20	19	R/W	-	21	xxx.xx	0.00 100.00	SKIP FRQ 1 CENTRE (%)
33	21	23	R/W	-	21	x.xx	0.00 8.34	SKIP FRQ 1 DELTA (%)
34	22	20	R/W	-	21	xxx.xx	0.00 100.00	SKIP FRQ 2 CENTRE (%)
35	23	24	R/W	-	21	x.x	0.00 8.34	SKIP FRQ 2 DELTA (%)
36	24	43	R/W	-	21	xxx.x	0.1 3000.0	FRAMP TIME (sec)
37	25	53	R/W	-	21	x.xx	0.00 4.17	SLIP COMP (%)
38	26	86	R/W	-	21	xxx.xx	-100.00 100.00	SERIAL LINK SETPOINT (%)
39	27		-	-	23	xxxxx	(Note 1)	
	-	27	R/W	0			0 → 1	SKIP FRQ 1 SELECT
	-	28	R/W	1			0 → 1	SKIP FRQ 2 SELECT
	-	-		2 - 15			-	RESERVED

Block 5 :

PNO	ASCII mnemonic	Tag No.	Access	Bit number	ASCII data format	Binary data format	Limits	Description
40	28	21	R/W	-	21	xxx.xx	0.00 100.00	SKIP FRQ 3 CENTRE (%)
41	29	25	R/W	-	21	x.xx	0.00 8.34	SKIP FRQ 3 DELTA (%)
42	2A	22	R/W	-	21	xxx.xx	0.00 100.00	SKIP FRQ 4 CENTRE (%)
43	2B	26	R/W	-	21	x.xx	0.00 8.34	SKIP FRQ 4 DELTA (%)
44	2C	171	R/W <sup>2</sup>	-	21	xxx.xx	0 100.00	S-RAMP % (%)
45	2D	213	R/W	-	21	x.xxxx	3.0000 -3.0000	MANUAL SETPOINT RATIO
46	2E	214	R/W	-	21	x.xxxx	3.0000 -3.0000	MANUAL SETPOINT DIVIDER
47	2F		-	-	23	xxxxx	(Note 1)	
	-	29	R/W	0				SKIP FRQ 3 SELECT
	-	30	R/W	1			0 → 1	SKIP FRQ 4 SELECT
	-	-	-	2 - 15			0 → 1	RESERVED

**Block 6 :**

PNO	ASCII mnemonic	Tag No.	Access	ASCII data format	Binary data format	Values		Description
48	30	2	R/W	21	xxxxx	0	0V TO 10V SPEED SETPOINT	MANUAL SETPOINT
						1	-10V TO + 10V SPEED SETPOINT	
						2	AUX SPEED SETPOINT	
						3	PRESET SPEED 1	
						4	PRESET SPEED 2	
						5	PRESET SPEED 3	
						6	PRESET SPEED 4	
						7	PRESET SPEED 5	
						8	PRESET SPEED 6	
						9	PRESET SPEED 7	
						10	PRESET SPEED 8	
						11	DIGITAL MOP	
49	31	3	R/W	21	xxxxx	0	0 TO 20mA SPEED SETPOINT	AUTO SETPOINT SELECT
						1	20 TO 0mA SPEED SETPOINT	
						2	4 TO 20mA SPEED SETPOINT	
						3	20 TO 4mA SPEED SETPOINT	
						4	SERIAL LINK SPEED SETPOINT	
						5	DIGITAL PRESET SPEED SELECT	
						6	SPEED FEEDBACK	
50	32	4	R/W <sup>2</sup>	21	xxxxx	0	120 Hz LIMIT	ULF SELECT
						1	240 Hz LIMIT	
						2	480 Hz LIMIT	
51	33	15	R/W <sup>2</sup>	21	xxxxx	0	RAMP DOWN	STOPPING MODE SELECT
						1	COAST DOWN	
						2	INJECTION BRAKING	
						3	RAMP DOWN + DC HOLDING PULSE	
52	34	16	R/W <sup>2</sup>	21	xxxxx	0	LINEAR	VF CHARACTERISTIC
						1	FAN LAW	
53	35	32	R/W <sup>2,3</sup>	21	xxxxx	0	3k Hz CARRIER	SWITCH FREQUENCY SELECT
						1	6k Hz CARRIER	
						2	9k Hz	
54	36	36	R/W <sup>2</sup>	21	xxxxx	0	ZERO SPEED	RELAY 1 CONFIG
						1	AT SPEED	
						2	RUN CONFIRM	
						3	BRAKE CONTROL	
						4	AT LOAD	
						5	AT FEEDBACK SPEED	
55	37	37	R/W <sup>2</sup>	21	xxxxx	0	ZERO SPEED	RELAY 2 CONFIG
						1	AT SPEED	
						2	RUN CONFIRM	
						3	BRAKE CONTROL	
						4	AT LOAD	
						5	AT FEEDBACK SPEED	

Block 7

PNO	ASCII mnemonic	Tag No.	Access	Bit No.	ASCII data format	Binary data format	Limits and values	Description	
56	38	115	R/W		21	xxx.xx	-150.00 - 50.00	REGEN CURRENT LIMIT (%)	
57	39	202	R/W	-	21	xxxxx	0	MANUAL & AUTO	TRIM CHOICE
							1	MANUAL ONLY	
							2	AUTO ONLY	
58	3A	131	R/W <sup>2</sup>		21	xxx.xx	0.00 100.00	BASE VOLTS (%)	
59	3B	132	R/W	-	21	xxxxx	0	MICRO AC DRIVE	MENU POSITION
							1	SPEED SP (Hz)	
							2	DRIVE FREQUENCY	
							3	MOTOR CURRENT	
							4	MOTOR LOAD	
							5	EXT TORQUE LIM	
							6	DRIVE STATUS	
							7	DIGITAL INPUTS	
							8	TORQUE MODE	
							9	PID ERROR	
							1	PID CLAMPED	
							0		
							1	PID OUTPUT	
							1		
							1	SPEED FB (RPM)	
							2		
1	SPEED FB (HZ)								
3									
1	SPEED SP (RPM)								
4									
1	MANUAL SP (HZ)								
5									
1	AUTO SP (HZ)								
6									
60	3C	54	R/W	-	21	x.xx	0.00 4.17	STABILISATION (%)	
61	3D	134	R/W	-	21	xxxx.x	0.1 3000.0	STALL TRIP TIME (SEC)	
62	3E	136	R/W	-	21	xxx.xx	10.00 100.00	OP CURRENT CAL (%)	
63	3F		-	-	23	xxxxx	(Note 1)		
	-	116	R/W	0			0 → 1	REGEN LIM SELECT	
	-	128	R/W	1			0 → 1	RAMP HOLD SELECT	
	-	133	R/W	2			0 → 1	STALL TRIP ENABLE	
	-			3-15			-	RESERVED	



**Block 8**

PNO	ASCII mnemonic	Tag No.	Access	Bit No.	ASCII data format	Binary data format	Limits	Description
64	40	137	R/W	-	21	xxx.xx	50.00 150.00	I*T UPPER LIMIT (%)
65	41	138	R/W	-	21	xx.x	5.0 60.0	I*T TIME (sec)
66	42	140	R/W	-	21	xxx.xx	0.00 150.00	BRAKE RELAY ON LOAD LEVEL (%)
67	43	141	R/W	-	21	xxx.xx	0.00 100.00	BRAKE RELAY ON FREQUENCY LEVEL (%)
68	44	142	R/W	-	21	xxx.xx	0.00 100.00	BRAKE RELAY OFF FREQUENCY LEVEL (%)
69	45	215	R/W	-	21	x.xxxx	3.0000 -3.0000	AUTO SETPOINT RATIO
70	46	216	R/W	-	21	x.xxxx	3.0000 -3.0000	AUTO SETPOINT DIVIDER
71	47							RESERVED

**Block 9**

PNO	ASCII mnemonic	Tag No.	Access	Bit No.	ASCII data format	Binary data format	Limits and values	Description	
72	48	144	R/W	-	21		0	MIN TO MAX	RAMP OUTPUT TERMINAL CHOICE
							1	0 TO LIMIT FREQ	
							2	0 TO MAX	
73	49	172	R/W <sup>2</sup>	-	21		0	LINEAR RAMP	RAMP TYPE
							1	PARABOLIC RAMP	
							2	S RAMP	
74	4A	168	R/W	-	21	xxx.xx	100.00 - 100.00	MAX MOP SPEED (%)	
75	4B	169	R/W	-	21	xxx.xx	100.00 -100.00	MIN MOP SPEED (%)	
76	4C	170	R/W	-	21	xxx.xx	100.00 -100.00	MOP PRESET SPEED (%)	
77	4D	159	R/W	-	21	xxx.xx	100.00 0	ZERO SPEED THRESHOLD	
78	4E	160	R/W	-	21	xxx.xx	100.00 0	AT SPEED THRESHOLD	
79	4F							RESERVED	

**Block 10**

PNO	ASCII mnemonic	Tag No.	Access	Bit No.	ASCII data format	Binary data format	Limits and values	Description	
80	50	161	R/W	-	21	xxx.xx	-100.00 100.00	PRESET SPEED 5 (%)	
81	51	162	R/W	-	21	xxx.xx	-100.00 100.00	PRESET SPEED 6 (%)	
82	52	163	R/W	-	21	xxx.xx	-100.00 100.00	PRESET SPEED 7 (%)	
83	53	164	R/W	-	21	xxx.xx	-100.00 100.00	PRESET SPEED 6 (%)	
84	54	166	R/W <sup>2</sup>	-	21		0	4 PRESET & JOG	RECONFIG I/PS
							1	8 PRESETS	
							2	DIGITAL MOP & PRESET	
85	55	178	R/W	-	21	xxx.xx	150.00 0	LOAD THRESHOLD (%)	
86	56	179	R/W	-	21	xxx.xx	100.00 0	FEEDBACK SPEED THRESHOLD (%)	
87	57	210	R/W	-	23	xxxxx	FFFF 0	AUTO RESTART TRIP MASK	

**Block 11:**

PNO	ASCII mnemonic	Tag No.	Access	Bit No.	ASCII data format	Binary data format	Limits and values	Description
88	58	205	R/W	-	21	xxx.xx	600.0 0.5	AUTO RESTART ATTEMPT DELAY (S)
89	59	211	R/W	-	21	xx	10 1	AUTO RESTART NUMBER OF ATTEMPTS
90	5A	217	R/O	-	21	xx	-	AUTO RESTART ATTEMPTS LEFT
91	5B	212	R/W	-	21	xxx.x	600.00 0.1	AUTO RESTART CANCEL TIME
92	5C							RESERVED
93	5D							RESERVED
94	5E							RESERVED
95	5F	-	-		23	xxxxx	(Note 1)	
	-	204	R/W	0			0 → 1	AUTO RESTART ENABLE
	-		-	1→15				RESERVED

**Blocks 12 & 13:**

PNO	ASCII mnemonic	Tag No.	Access	Bit No.	ASCII data format	Binary data format	Limits	Description
96	60	91	R/W	-	21	xxxxx	0 → 255	POINTER FOR PNO 112 (MNEMONIC 70)
97	61	92	R/W	-	21	xxxxx	0 → 255	POINTER FOR PNO 113 (MNEMONIC 71)
98	62	93	R/W	-	21	xxxxx	0 → 255	POINTER FOR PNO 114 (MNEMONIC 72)
99	63	94	R/W	-	21	xxxxx	0 → 255	POINTER FOR PNO 115 (MNEMONIC 73)
100	64	95	R/W	-	21	xxxxx	0 → 255	POINTER FOR PNO 116 (MNEMONIC 74)
101	65	96	R/W	-	21	xxxxx	0 → 255	POINTER FOR PNO 117 (MNEMONIC 75)
102	66	97	R/W	-	21	xxxxx	0 → 255	POINTER FOR PNO 118 (MNEMONIC 76)
103	67	98	R/W	-	21	xxxxx	0 → 255	POINTER FOR PNO 119 (MNEMONIC 77)
104	68	99	R/W	-	21	xxxxx	0 → 255	POINTER FOR PNO 120 (MNEMONIC 78)
105	69	100	R/W	-	21	xxxxx	0 → 255	POINTER FOR PNO 121 (MNEMONIC 79)
106	6A	101	R/W	-	21	xxxxx	0 → 255	POINTER FOR PNO 122 (MNEMONIC 7A)
107	6B	102	R/W	-	21	xxxxx	0 → 255	POINTER FOR PNO 123 (MNEMONIC 7B)
108	6C	103	R/W	-	21	xxxxx	0 → 255	POINTER FOR PNO 124 (MNEMONIC 7C)
109	6D	104	R/W	-	21	xxxxx	0 → 255	POINTER FOR PNO 125 (MNEMONIC 7D)
110	6E	105	R/W	-	21	xxxxx	0 → 255	POINTER FOR PNO 126 (MNEMONIC 7E)
111	6F	106	R/W	-	21	xxxxx	0 → 255	POINTER FOR PNO 127 (MNEMONIC 7F)

**Blocks 14 & 15:**

These blocks on PNOs and mnemonics are configurable. The tags to which they point are defined by PNOs 60 to 6F in blocks 12 and 13.

PNO	ASCII mnemonic	Tag No.	Access	Bit No.	ASCII data format	Binary data format	Limits	Description
112	70	(PNO 96)	*	-	*	*	*	CONFIGURABLE MNEMONIC 1
113	71	(PNO 97)	*	-	*	*	*	CONFIGURABLE MNEMONIC 2
114	72	(PNO 98)	*	-	*	*	*	CONFIGURABLE MNEMONIC 3
115	73	(PNO 99)	*	-	*	*	*	CONFIGURABLE MNEMONIC 4
116	74	(PNO 100)	*	-	*	*	*	CONFIGURABLE MNEMONIC 5
117	75	(PNO 101)	*	-	*	*	*	CONFIGURABLE MNEMONIC 6
118	76	(PNO 102)	*	-	*	*	*	CONFIGURABLE MNEMONIC 7
119	77	(PNO 103)	*	-	*	*	*	CONFIGURABLE MNEMONIC 8
120	78	(PNO 104)	*	-	*	*	*	CONFIGURABLE MNEMONIC 9
121	79	(PNO 105)	*	-	*	*	*	CONFIGURABLE MNEMONIC 10
122	7A	(PNO 106)	*	-	*	*	*	CONFIGURABLE MNEMONIC 11
123	7B	(PNO 107)	*	-	*	*	*	CONFIGURABLE MNEMONIC 12
124	7C	(PNO 108)	*	-	*	*	*	CONFIGURABLE MNEMONIC 13
125	7D	(PNO 109)	*	-	*	*	*	CONFIGURABLE MNEMONIC 14
126	7E	(PNO 110)	*	-	*	*	*	CONFIGURABLE MNEMONIC 15
127	7F	(PNO 111)	*	-	*	*	*	CONFIGURABLE MNEMONIC 16

\* = The access, data format and limits depend on the tag to which the corresponding pointer points.

## Tag List

Tag	Description	Default	Min	Max		User Setting
0	Unallocated	-	-	-	-	-
1	Eprom version number	-	-	-	RO	-
2	Manual setpoint select	0V to 10V	0	11	RW	
3	Auto setpoint select	0mA to 20mA	0	6	RW	
4	Limit frequency select	120Hz	0	2	RW	
5	Aux speed setpoint	0.00%	-100.00%	100.00%	RW	
6	Max speed	41.67%	0%	100.00%	RW	
7	Min speed	0.00%	0%	100.00%	RW	
8	Preset speed 1	0.00%	-100.00%	100.00%	RW	
9	Preset speed 2	0.00%	-100.00%	100.00%	RW	
10	Preset speed 3	0.00%	-100.00%	100.00%	RW	
11	Preset speed 4	0.00%	-100.00%	100.00%	RW	
12	Base speed	41.67%	6.25%	100.00%	RW	
13	Ramp down time	10.0s	0.1s	3000.0s	RW	
14	Ramp up time	10.0s	0.1s	3000.0s	RW	
15	Stopping mode	Ramp down	0	3	RW	
16	Vf characteristic	Linear law	0	1	RW	
17	Motor current limit	100.00%	50.00%	150.00%	RW	
18	Fixed Boost	0.00%	0%	25.00%	RW	
19	Skip frequency 1 centre	0.00%	0%	100.00%	RW	
20	Skip frequency 2 centre	0.00%	0%	100.00%	RW	
21	Skip frequency 3 centre	0.00%	0%	100.00%	RW	
22	Skip frequency 4 centre	0.00%	0%	100.00%	RW	
23	Skip frequency 1 delta	0.00%	0%	8.34%	RW	
24	Skip frequency 2 delta	0.00%	0%	8.34%	RW	
25	Skip frequency 3 delta	0.00%	0%	8.34%	RW	
26	Skip frequency 4 delta	0.00%	0%	8.34%	RW	
27	Skip frequency 1 select	Disabled	0	1	RW	
28	Skip frequency 2 select	Disabled	0	1	RW	
29	Skip frequency 3 select	Disabled	0	1	RW	
30	Skip frequency 4 select	Disabled	0	1	RW	
31	I*t threshold	105.00%	50.00%	105.00%	RW	
32	Switch frequency select	3kHz	0	2	RW	
33	MMI menu delay	20	0	200	RW	
34	Reserved					

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Tag	Description	Default	Min	Max		User Setting
35	Reserved	-	-	-	-	-
36	Relay 1 configuration	Zero speed	0	5	RW	
37	Relay 2 configuration	At speed	0	5	RW	
38	Drive current	-	-200.00%	200.00%	RO	
39	Inverter frequency	-	-100.00%	100.00%	RO	
40	Enter password	0x0000	0	FFFF	RW	
41	Change password	0x0000	0	FFFF	RW	
42	Reserved	-	-	-	-	-
43	Framp time	1.0s	0.1s	3000.0s	RW	
44	External torque limit select	Disabled	0	1	RW	
45	Reserved	-	-	-	-	-
46	Reserved	-	-	-	-	-
47	Reserved	-	-	-	-	-
48	Reserved	-	-	-	-	-
49	Reserved	-	-	-	-	-
50	Reserved	-	-	-	-	-
51	Reserved	-	-	-	-	-
52	Reserved	-	-	-	-	-
53	Slip compensation	0.0Hz	0%	4.17%	RW	
54	Stabilisation	0.6Hz	0%	4.17%	RW	
55	Aux run	Enabled	0	1	RW	
56	Aux framp	Enabled	0	1	RW	
57	Aux direction	Enabled	0	1	RW	
58	Drive status	-	0	FFFF	RO	
59	Digital inputs	-	0	00FF	RO	
60	Drive load	-	-200.00%	200.00%	RO	
61	Speed setpoint	-	-100.00%	100.00%	RO	
62	External torque limit	-	0%	150.00%	RO	
63	Reserved	-	-	-	-	-
64	Reserved	-	-	-	-	-
65	P1 serial link enable	Enabled	0	1	RO	
66	P3 serial link enabled	Enabled	0	1	RO	
67	P1 GID	0	0	7	RO	
68	P3 GID	0	0	7	RO	
69	P1 UID	0	0	15	RO	
70	P3 UID	0	0	15	RO	

Tag	Description	Default	Min	Max		User Setting
71	P1 mode	ASCII	0	1	RO	
72	P3 mode	ASCII	0	1	RO	
73	P1 baud	9600	0	5	RO	
74	P3 baud	9600	0	5	RO	
75	P1 esp support (ASCII)	Disabled	0	1	RW	
76	P3 esp support (ASCII)	Disabled	0	1	RW	
77	P1changeband (bin)	0.0%	0%	327.67%	RW	
78	P3 changeband (bin)	0.0%	0%	32.767%	RW	
79	P1 error report	-	0	FFFF	RO	
80	P3 error report	-	0	FFFF	RO	
81	P1 pno.7	0xFFFF	0	FFFF	RW	
82	P3 pno.7	0xFFFF	0	FFFF	RW	
83	P1 parity	Even	0	1	RO	
84	Speed setpoint (Hz)	-	-120.0Hz	120.0Hz	RO	
85	Inverter frequency (Hz)	-	-100.00%	100.00%	RO	
86	Serial link setpoint	0.0Hz	-100.00%	100.00%	RW	
87	Serial link buffer length	-	0	FFFF	RO	
88	Serial link config information	-	0	FFFF	RO	
89	Serial link instrument identifier	-	0	FFFF	RO	
90	Serial link mode number	-	0	FFFF	RO	
91	Pointer for pno 112	0 or 129*	0	255	RW	
92	Pointer for pno 113	0	0	255	RW	
93	Pointer for pno 114	0	0	255	RW	
94	Pointer for pno 115	0	0	255	RW	
95	Pointer for pno 116	0	0	255	RW	
96	Pointer for pno 117	0	0	255	RW	
97	Pointer for pno 118	0	0	255	RW	
98	Pointer for pno 119	0	0	255	RW	
99	Pointer for pno 120	0	0	255	RW	
100	Pointer for pno 121	0	0	255	RW	
101	Pointer for pno 122	0	0	255	RW	
102	Pointer for pno 123	0	0	255	RW	
103	Pointer for pno 124	0	0	255	RW	
104	Pointer for pno 125	0	0	255	RW	
105	Pointer for pno 126	0	0	255	RW	
106	Pointer for pno 127	0	0	255	RW	

\* Factory Default

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Tag	Description	Default	Min	Max		User Setting
107	Reserved	-	-	-	-	-
108	Reserved	-	-	-	-	-
109	Reserved	-	-	-	-	-
110	Reserved	-	-	-	-	-
111	Reserved	-	-	-	-	-
112	Reserved	-	-	-	-	-
113	Reserved	-	-	-	-	-
114	Reserved	-	-	-	-	-
115	Regen current limit	-100.00%	-150.00%	-50.00%	RW	
116	Regen current limit select	Enabled	0	1	RW	
117	Feedback source	None	0	1	RW	
118	Pole pairs	2	1	4	RW	
119	Encoder lines	1000	1	10000	RW	
120	Speed feedback (rpm)	-	-24000	24000	RO	
121	Speed feedback	-	-100.00%	100.00%	RO	
122	Encoder sign	Positive	0	1	RW	
123	Option version	0.00	0	327.67	RO	
124	Reserved	-	-	-	-	-
125	Reserved	-	-	-	-	-
126	Reserved	-	-	-	-	-
127	Option address	0	0	32767	RO	-
128	Ramp hold select	Disabled	0	1	RW	
129	EEPROM write (parameter save)	Inactive	0	2	RW	
130	Reserved	-	-	-	-	-
131	Base volts	100.00%	0%	115.47%	RW	
132	Menu position	Micro AC drive	0	16	RW	
133	Stall enable	Enabled	0	1	RW	
134	Stall trip time	600.0s	0.1s	3000.0s	RW	
135	Reserved	-	-	-	-	-
136	Op current cal	100.00%	10.00%	100.00%	RW	
137	I*t upper limit	150.00%	50.00%	150.00%	RW	
138	I*t time	60.0s	5.0s	60.0s	RW	
139	Reserved	-	-	-	-	-
140	Brake relay on load level	50.00%	0%	150.00%	RW	
141	Brake relay on frequency level	4.17%	0%	100.00%	RW	
142	Brake relay off frequency level	2.50%	0%	100.00%	RW	
143	Reserved	-	-	-	-	-

Tag	Description	Default	Min	Max		User Setting
144	Ramp output terminal choice	Min to max	0	2	RW	
145	Reserved	-	-	-	-	
146	Torque mode	Const torque	0	1	RO	
147	Auto boost enable	Disabled	0	1	RW	
148	Reserved	-	-	-	-	
149	Reserved	-	-	-	-	-
150	Reserved	-	-	-	-	-
151	Reserved	-	-	-	-	-
152	Reserved	-	-	-	-	-
153	Reserved	-	-	-	-	-
154	Reserved	-	-	-	-	-
155	Reserved	-	-	-	-	-
156	Reserved	-	-	-	-	-
157	Reserved	-	-	-	-	-
158	Reserved	-	-	-	-	-
159	Zero speed relay threshold	0.83%	0%	100.00%	RW	
160	At speed relay threshold	0.83%	0%	100.00%	RW	
161	Preset speed 5	0.00%	-100.00%	100.00%	RW	
162	Preset speed 6	0.00%	-100.00%	100.00%	RW	
163	Preset speed 7	0.00%	-100.00%	100.00%	RW	
164	Preset speed 8	0.00%	-100.00%	100.00%	RW	
165	Jog speed	4.17%	-100.00%	100.00%	RW	
166	Reconfig i/ps	4 presets & jog	0	2	RW	
167	Aux jog	Enabled	0	1	RW	
168	Max mop speed	100.00%	-100.00%	100.00%	RW	
169	Min mop speed	0.00%	-100.00%	100.00%	RW	
170	Mop preset speed	0.00%	-100.00%	100.00%	RW	
171	S-ramp %	100.00%	0%	100.00%	RW	
172	Ramp type	Linear ramp	0	2	RW	
173	Reserved	-	-	-	-	-
174	Reserved	-	-	-	-	-
175	Reserved	-	-	-	-	-
176	Reserved	-	-	-	-	-
177	Reserved	-	-	-	-	-
178	Load relay threshold	50.00%	0%	150.00%	RW	
179	Feedback speed relay threshold	8.34%	0%	100.00%	RW	



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Tag	Description	Default	Min	Max		User Setting
180	Change torque mode	Inactive	0	3	RW	
181	PID derivative tc	0.000s	0s	10.000s	RW	
182	PID integral tc	1.00s	0.01s	100.00s	RW	
183	PID filter tc	2.000s	0s	10.000s	RW	
184	PID prop gain	1.0	0	100.0	RW	
185	PID positive limit	100.00%	0%	105.00%	RW	
186	PID negative limit	-100.00%	0%	-105.00%	RW	
187	PID o/p scaler (trim)	0.0417	-3.0000	3.0000	RW	
188	PID enable	Disabled	0	1	RW	
189	PID integral defeat	Off	0	1	RW	
190	PID input 1	0.00%	-300.00%	300.00%	RW	
191	PID input 2	0.00%	-300.00%	300.00%	RW	
192	PID ratio1	1.0000	-3.0000	3.0000	RW	
193	PID ratio 2	1.0000	-3.0000	3.0000	RW	
194	PID divider 1	1.0000	-3.0000	3.0000	RW	
195	PID divider 2	1.0000	-3.0000	3.0000	RW	
196	PID error	-	-300.00%	300.00%	RO	
197	PID clamped	-	0	1	RO	
198	PID output	-	-300.00%	300.00%	RO	
199	PID sp choice	None	0	4	RW	
200	PID fb choice	None	0	4	RW	
201	PID op choice	None	0	4	RW	
202	Trim choice	Manual & auto	0	2	RW	
203	PID op mode	Unipolar	0	1	RW	
204	Auto restart enable	Disabled	0	1	RW	
205	Auto restart attempt delay	10.0s	0.5s	600.0s	RW	
206	Flycatching Enable	Disabled	1	0	RW	
207	Speed setpoint (rpm)	-	-28000	28000	RO	
208	Manual speed setpoint	-	-100.00%	100.00%	RO	
209	Auto speed setpoint	-	-100.00%	100.00%	RO	
210	Auto restart trip mask	0x1F00	0	FFFF	RW	
211	Auto restart number of attempts	5	1	10	RW	
212	Auto restart cancel time	300.0s	0.1s	600.0s	RW	
213	Manual setpoint ratio	1.0000	-3.0000	3.0000	RW	
214	Manual setpoint divider	1.0000	-3.0000	3.0000	RW	
215	Auto setpoint ratio	1.0000	-3.0000	3.0000	RW	

Tag	Description	Default	Min	Max		User Setting
216	Auto setpoint divider	1.0000	-3.0000	3.0000	RW	
217	Auto restart attempts left	-	0	10	RO	
218	Flycatching search volts	15.00%	0%	100.00%	RW	
219	Reserved	-	-	-	-	-
220	Reserved	-	-	-	-	-
221	Flycatching search time	5.0s	0.1s	10.0s	RW	
222	Flycatching reflux time	2.0s	0.1s	10.0s	RW	
223	Flycatching search mode	Bidirectional	0	2	RW	
224	Reserved	-	-	-	-	-
225	Flycatching min search speed	8.34%	0%	100.00%	RW	
226	Reserved	-	-	-	-	-
227	Reserved	-	-	-	-	-
228	Reserved	-	-	-	-	-
229	Local speed setup	0.00%	0%	100.00%	RW	
230	Local speed setpoint	0.00%	0%	100.00%	RW	
231	Control mode	Remote	0	1	RW	
232	Local direction setup	Forward	0	1	RW	
233	Local mode setup	Disabled	0	1	RW	
234	Start button	Enabled	0	1	RW	
235	Stop button	Enabled	0	1	RW	
236	Jog button	Enabled	0	1	RW	
237	Direction button	Enabled	0	1	RW	
238	Local button	Enabled	0	1	RW	
239	Local speed setpoint buttons	Enabled	0	1	RW	
240	Local setpoint	-	0%	100.00%	RO	
241	Language	English	0	3	RW	
242	Local setpoint ratio	1.0000	-3.0000	3.0000	RW	
243	Local setpoint divider	1.0000	-3.0000	3.0000	RW	
244	Reserved	-	-	-	-	-
245	Reserved	-	-	-	-	-
246	Overload status	Normal	0	1	RO	
247	Reserved	-	-	-	-	-
248	Reserved	-	-	-	-	-
249	DC Pulse Time	2.0	0.1	20.0	RW	-
250	Regen Slip Comp	Disabled	0	1	RW	-

Tag	Description	Default	Min	Max		User Setting
251	Reserved	-	-	-	-	-
252	Ramp Up Time	10.0	0.1	3000.0	RW	
253	Ramp Down Time	10.0	0.1	3000.0	RW	
254	Framp	Framp	0	2	RW	
		-	-	-	-	-

## Additional Features

1. There is a option on the way in which the 2 state (binary) parameters return values when polled. These are accessible only via the configurable PNOs. If ESP SUPPORT is disabled the data part of the message consists of

>x

where x = 0 or 1. Thus the message length is minimised.

If ESP SUPPORT is enabled the data part of the message consists of

>0 0 0 x

where x = 0 or 1. This option is intended for use with Eurotherm ESP devices. When sending a selection message to these parameters any leading zeros are ignored.

2. On the main RS485 serial port (P1) the parity is EVEN by default, but may be switched to ODD using the keypad.

## References

1. Eurotherm International Bisynch Communications Handbook Part No. HP022047C

## Notes

1. The reserved bits in these parameters return zero for a poll. The state for a selection is immaterial.
2. Access to these parameters is read/write if the drive is not running or read-only if the drive is running.
3. The range of this parameter is restricted as a function of the drive power rating. For Type 5, 6 and 7 power ratings the switching frequency is limited to 6kHz.

## APPENDIX C - PARAMETER LANGUAGE

This appendix contains a list of MMI parameter language codes with English description. Space is provided for translation into non-supported language.

<b>D - DIAGNOSTICS</b>			
<b>D_1</b>	Speed sp (Hz)		<b>D_1</b>
<b>D_2</b>	Drive frequency		<b>D_2</b>
<b>D_3</b>	Motor current		<b>D_3</b>
<b>D_4</b>	Motor load		<b>D_4</b>
<b>D_5</b>	Overload status		<b>D_5</b>
	0 = Normal		
	1 = Overload		
<b>D_6</b>	External torque limit		<b>D_6</b>
<b>D_7</b>	Torque mode		<b>D_7</b>
	0 = Constant torque		
	1 = Quadratic torque		
<b>D_8</b>	Drive status		<b>D_8</b>
<b>D_9</b>	Digital inputs		<b>D_9</b>
<b>D_10</b>	PID error		<b>D_10</b>
<b>D_11</b>	PID clamped		<b>D_11</b>
	0 = False		
	1 = True		
<b>D_12</b>	PID output		<b>D_12</b>
<b>D_13</b>	Auto setpoint (Hz)		<b>D_13</b>
<b>D_14</b>	Manual setpoint (Hz)		<b>D_14</b>
<b>D_15</b>	Local setpoint (Hz)		<b>D_15</b>
<b>D_16</b>	Speed feedback (RPM)		<b>D_16</b>
<b>D_17</b>	Speed feedback (Hz)		<b>D_17</b>
<b>D_18</b>	Speed setpoint (RPM)		<b>D_18</b>

<b>P - PARAMETERS</b>			
<b>P_1</b>	Base frequency		<b>P_1</b>
<b>P_2</b>	Maximum speed		<b>P_2</b>
<b>P_3</b>	Minimum speed		<b>P_3</b>
<b>P_4</b>	Ramps		<b>P_4</b>
	<b>P_4.1</b>	Ramp up time 1	<b>P_4.1</b>
	<b>P_4.2</b>	Ramp down time 1	<b>P_4.2</b>
	<b>P_4.3</b>	S ramp %	<b>P_4.3</b>

	<b>P_4.4</b>	Ramp type		<b>P_4.4</b>
		0 = Linear ramp		
		1 = Parabolic ramp		
		2 = S ramp		
	<b>P_4.5</b>	Ramp hold		<b>P_4.5</b>
		0 = Disabled		
		1 = Enabled		
	<b>P_4.6</b>	Ramp up time 2		<b>P_4.6</b>
	<b>P_4.7</b>	Ramp down time 2		<b>P_4.7</b>
<b>P_5</b>	V/F shape			<b>P_5</b>
		0 = Linear		
		1 = Fan law		
<b>P_6</b>	Current limits			<b>P_6</b>
	<b>P_6.1</b>	Motor current limit		<b>P_6.1</b>
	<b>P_6.2</b>	Regen current limit		<b>P_6.2</b>
	<b>P_6.3</b>	Regen limit select		<b>P_6.3</b>
		0 = Disabled		
		1 = Enabled		
	<b>P_6.4</b>	External torque limit		<b>P_6.4</b>
		0 = Disabled		
		1 = Enabled		
	<b>P_6.5</b>	Output current cal		<b>P_6.5</b>
<b>P_7</b>	Voltage boost			<b>P_7</b>
	<b>P_7.1</b>	Fixed boost		<b>P_7.1</b>
	<b>P_7.2</b>	Auto boost		<b>P_7.2</b>
		0 = Disabled		
		1 = Enabled		
<b>P_8</b>	Stopping mode			<b>P_8</b>
		0 = Ramp		
		1 = Coast		
		2 = Injection		
		3 = Ramp + injection		
<b>P_34</b>	Stopping Control			<b>P_34</b>
	<b>P_34.1</b>	DC Pulse Time		<b>P_34.1</b>
	<b>P_34.2</b>	Inj Timeout		<b>P_34.2</b>
<b>P_9</b>	Setpoint select			<b>P_9</b>
	<b>P_9.1</b>	Manual setpoint		<b>P_9.1</b>
		0 = 0 to +10V		
		1 = -10V to +10V		

		2 = Auxiliary setpoint	
		3 = Preset speed 1	
		4 = Preset speed 2	
		5 = Preset speed 3	
		6 = Preset speed 4	
		7 = Preset speed 5	
		8 = Preset speed 6	
		9 = Preset speed 7	
		10 = Preset speed 8	
		11 = MOP	
	<b>P_9.2</b>	Auto setpoint	<b>P_9.2</b>
		0 = I loop SP 0-20mA	
		1 = I loop SP 20-0mA	
		2 = I loop SP 4-20mA	
		3 = I loop SP 20-4mA	
		4 = Serial link	
		5 = Digital preset	
		6 = Speed feedback	
	<b>P_9.3</b>	Trim choice	<b>P_9.3</b>
		0 = Manual & auto	
		1 = Manual	
		2 = Auto	
<b>P_10</b>	Setpoint scale		<b>P_10</b>
	<b>P_10.1</b>	Manual ratio	<b>P_10.1</b>
	<b>P_10.2</b>	Manual divider	<b>P_10.2</b>
	<b>P_10.3</b>	Auto ratio	<b>P_10.3</b>
	<b>P_10.4</b>	Auto divider	<b>P_10.4</b>
	<b>P_10.5</b>	Local ratio	<b>P_10.5</b>
	<b>P_10.6</b>	Local divider	<b>P_10.6</b>
<b>P_11</b>	Framp time		<b>P_11</b>
<b>P_12</b>	Jog speed		<b>P_12</b>
<b>P_13</b>	Digital MOP		<b>P_13</b>
	<b>P_13.1</b>	Maximum MOP speed	<b>P_13.1</b>
	<b>P_13.2</b>	Minimum MOP speed	<b>P_13.2</b>
	<b>P_13.3</b>	MOP preset speed	<b>P_13.3</b>
<b>P_14</b>	Preset speeds		<b>P_14</b>
	<b>P_14.1</b>	Preset 1	<b>P_14.1</b>
	<b>P_14.2</b>	Preset 2	<b>P_14.2</b>

	<b>P_14.3</b>	Preset 3		<b>P_14.3</b>
	<b>P_14.4</b>	Preset 4		<b>P_14.4</b>
	<b>P_14.5</b>	Preset 5		<b>P_14.5</b>
	<b>P_14.6</b>	Preset 6		<b>P_14.6</b>
	<b>P_14.7</b>	Preset 7		<b>P_14.7</b>
	<b>P_14.8</b>	Preset 8		<b>P_14.8</b>
<b>P_15</b>	Skip frequency			<b>P_15</b>
	<b>P_15.1</b>	Skip freq. selection		<b>P_15.1</b>
	<b>P_15.1.1</b>	Skip frequency 1		<b>P_15.1.1</b>
		0 = Disabled		
		1 = Enabled		
	<b>P_15.1.2</b>	Skip frequency 2		<b>P_15.1.2</b>
		0 = Disabled		
		1 = Enabled		
	<b>P_15.1.3</b>	Skip frequency 3		<b>P_15.1.3</b>
		0 = Disabled		
		1 = Enabled		
	<b>P_15.1.4</b>	Skip frequency 4		<b>P_15.1.4</b>
		0 = Disabled		
		1 = Enabled		
	<b>P_15.2</b>	Skip frequency 1		<b>P_15.2</b>
	<b>P_15.3</b>	Skip frequency 1 band		<b>P_15.3</b>
	<b>P_15.4</b>	Skip frequency 2		<b>P_15.4</b>
	<b>P_15.5</b>	Skip frequency 2 band		<b>P_15.5</b>
	<b>P_15.6</b>	Skip frequency 3		<b>P_15.6</b>
	<b>P_15.7</b>	Skip frequency 3 band		<b>P_15.7</b>
	<b>P_15.8</b>	Skip frequency 4		<b>P_15.8</b>
	<b>P_15.9</b>	Skip frequency 4 band		<b>P_15.9</b>
<b>P_16</b>	Auxiliary setpoint			<b>P_16</b>
<b>P_17</b>	Auxiliary digital inputs			<b>P_17</b>
	<b>P_17.1</b>	Auxiliary run		<b>P_17.1</b>
		0 = Disabled		
		1 = Enabled		
	<b>P_17.2</b>	Auxiliary framp		<b>P_17.2</b>
		0 = Disabled		
		1 = Enabled		
	<b>P_17.3</b>	Auxiliary jog		<b>P_17.3</b>
		0 = Disabled		
		1 = Enabled		

	<b>P_17.4</b>	Auxiliary direction		<b>P_17.4</b>
		0 = Disabled		
		1 = Enabled		
<b>P_18</b>	I*T alarm			<b>P_18</b>
	<b>P_18.1</b>	I*T threshold		<b>P_18.1</b>
	<b>P_18.2</b>	I*T upper limit		<b>P_18.2</b>
	<b>P_18.3</b>	I*T time		<b>P_18.3</b>
<b>P_19</b>	Slip compensation			<b>P_19</b>
	<b>P_19.1</b>	Comp level		<b>P_19.1</b>
	<b>P_19.2</b>	Regen Slip Comp		<b>P_19.2</b>
		0 = Disabled		
		1 = Enabled		
<b>P_20</b>	Speed feedback			<b>P_20</b>
	<b>P_20.1</b>	Feedback source		<b>P_20.1</b>
		0 = None		
		1 = Encoder		
	<b>P_20.2</b>	Encoder sign		<b>P_20.2</b>
	<b>P_20.3</b>	Encoder lines		<b>P_20.3</b>
	<b>P_20.4</b>	Pole pairs		<b>P_20.4</b>
<b>P_21</b>	PID			<b>P_21</b>
	<b>P_21.1</b>	Proportional gain		<b>P_21.1</b>
	<b>P_21.2</b>	PID output		<b>P_21.2</b>
	<b>P_21.2.1</b>	PID output choice		<b>P_21.2.1</b>
		0 = None		
		1 = Ramp out as trim		
		2 = Ramp in as trim		
		3 = Ramp in as speed		
	<b>P_21.2.2</b>	PID output mode		<b>P_21.2.2</b>
		0 = Unipolar		
		1 = Bipolar		
	<b>P_21.3</b>	PID feedback choice		<b>P_21.3</b>
		0 = None		
		1 = Speed feedback		
		2 = Manual setpoint		
		3 = Auto setpoint		
		4 = Local setpoint		
	<b>P_21.4</b>	PID setpoint choice		<b>P_21.4</b>
		0 = None		



		1 = Ramp output		
		2 = Manual setpoint		
		3 = Auto setpoint		
		4 = Local setpoint		
	<b>P_21.5</b>	Divider 2		<b>P_21.5</b>
	<b>P_21.6</b>	Ratio 2		<b>P_21.6</b>
	<b>P_21.7</b>	Input 2		<b>P_21.7</b>
	<b>P_21.8</b>	Divider 1		<b>P_21.8</b>
	<b>P_21.9</b>	Ratio 1		<b>P_21.9</b>
	<b>P_21.10</b>	Input 1		<b>P_21.10</b>
	<b>P_21.11</b>	Integral defeat		<b>P_21.11</b>
		0 = Off		
		1 = On		
	<b>P_*34*</b>	Enable		<b>P_*34*</b>
		0 = Disabled		
		1 = Enabled		
	<b>P_21.12</b>	Output scalar		<b>P_21.12</b>
	<b>P_21.13</b>	Negative limit		<b>P_21.13</b>
	<b>P_21.14</b>	Positive limit		<b>P_21.14</b>
	<b>P_21.15</b>	Filter time constant		<b>P_21.15</b>
	<b>P_21.16</b>	Derivative time constant		<b>P_21.16</b>
	<b>P_21.17</b>	Integral time constant		<b>P_21.17</b>
<b>P_22</b>	Flycatching			<b>P_22</b>
	<b>P_*34*</b>	Enable		<b>P_*34*</b>
		0 = Disabled		
		1 = Enabled		
	<b>P_22.1</b>	Minimum search speed		<b>P_22.1</b>
	<b>P_22.2</b>	Search volts		<b>P_22.2</b>
	<b>P_22.3</b>	Search time		<b>P_22.3</b>
	<b>P_22.4</b>	Reflux time		<b>P_22.4</b>
	<b>P_22.5</b>	Search mode		<b>P_22.5</b>
		0 = Unidirectional		
		1 = Bidirectional		
		2 = Reflux at speed		
<b>P_23</b>	Auto restart			<b>P_23</b>
	<b>P_*34*</b>	Enable		<b>P_*34*</b>
		0 = Disabled		
		1 = Enabled		
	<b>P_23.1</b>	Attempt delay		<b>P_23.1</b>

	<b>P_23.2</b>	Attempts		<b>P_23.2</b>
	<b>P_23.3</b>	Attempts left		<b>P_23.3</b>
	<b>P_23.4</b>	Trip mask		<b>P_23.4</b>
	<b>P_23.5</b>	AR cancel time		<b>P_23.5</b>
<b>P_24</b>	Switching frequency			<b>P_24</b>
<b>P_25</b>	Stabilisation			<b>P_25</b>
<b>P_26</b>	Start up			<b>P_26</b>
	<b>P_26.1</b>	Menu position		<b>P_26.1</b>
	<b>P_26.2</b>	Control mode		<b>P_26.2</b>
		0 = Remote		
		1 = Local		
<b>P_27</b>	Stall trip time			<b>P_27</b>
<b>P_28</b>	Inhibit alarms			<b>P_28</b>
	<b>P_28.1</b>	Stall alarm		<b>P_28.1</b>
		0 = Disabled		
		1 = Enabled		
<b>P_29</b>	Reconfigure outputs			<b>P_29</b>
	<b>P_29.1</b>	At speed threshold		<b>P_29.1</b>
	<b>P_29.2</b>	Feedback speed threshold		<b>P_29.2</b>
	<b>P_29.3</b>	Load threshold		<b>P_29.3</b>
	<b>P_29.4</b>	Brake control		<b>P_29.4</b>
	<b>P_29.4.1</b>	On load level		<b>P_29.4.1</b>
	<b>P_29.4.3</b>	Off frequency level		<b>P_29.4.2</b>
	<b>P_29.4.4</b>	On frequency level		<b>P_29.4.3</b>
	<b>P_29.5</b>	0 speed threshold		<b>P_29.5</b>
<b>P_30</b>	Ramp output			<b>P_30</b>
		0 = Min speed to max speed		
		1 = 0 to limit frequency		
		2 = 0 to maximum speed		
<b>P_31</b>	Limit frequency select			<b>P_31</b>
<b>P_32</b>	Op station			<b>P_32</b>
	<b>P_32.1</b>	Initial setup		<b>P_32.1</b>
	<b>P_32.1.1</b>	Direction		<b>P_32.1.1</b>
	<b>P_32.1.2</b>	Auto start		<b>P_32.1.2</b>
		0 = Disabled		
		1 = Enabled		
	<b>P_32.1.3</b>	Speed setpoint		<b>P_32.1.3</b>
	<b>P_32.2</b>	Key inhibits		<b>P_32.2</b>

	<b>P_32.2.1</b>	Start		<b>P_32.2.1</b>
		0 = Disabled		
		1 = Enabled		
	<b>P_32.2.2</b>	Stop		<b>P_32.2.2</b>
		0 = Disabled		
		1 = Enabled		
	<b>P_32.2.3</b>	Jog		<b>P_32.2.3</b>
		0 = Disabled		
		1 = Enabled		
	<b>P_32.2.4</b>	Speed setpoint		<b>P_32.2.4</b>
		0 = Disabled		
		1 = Enabled		
	<b>P_32.2.5</b>	Direction		<b>P_32.2.5</b>
		0 = Disabled		
		1 = Enabled		
	<b>P_32.2.6</b>	Local/remote		<b>P_32.2.6</b>
		0 = Disabled		
		1 = Enabled		
<b>P_33</b>	Base volts			<b>P_33</b>

<b>PA - PASSWORD</b>				
<b>PA_1</b>	Enter password			<b>PA_1</b>
<b>PA_2</b>	Clear password			<b>PA_2</b>
<b>PA_3</b>	Change password			<b>PA_3</b>

<b>AL - ALARMS</b>				
<b>AL_1</b>	Last alarm			<b>AL_1</b>

<b>M - MENUS</b>				
<b>M_1</b>	Menu delay			<b>M_1</b>
<b>M_2</b>	Language			<b>M_2</b>

<b>EP - EPROM (PARAMETER SAVE)</b>				
<b>EP_1</b>	Up to action			<b>EP_1</b>

<b>C - COMMS (SERIAL LINK)</b>				
<b>C_1</b>	Main port (P1)			<b>C_1</b>
	<b>C_1.1</b>	Serial link enable		<b>C_1.1</b>
		0 = Disabled		
		1 = Enabled		

	<b>C_1.2</b>	Group ID (GID)		<b>C_1.2</b>
	<b>C_1.3</b>	Unit ID (UID)		<b>C_1.3</b>
	<b>C_1.4</b>	Protocol		<b>C_1.4</b>
		0 = ASCII		
		1 = Binary		
		2 = Option		
	<b>C_1.5</b>	Baud rate		<b>C_1.5</b>
	<b>C_1.6</b>	ESP support		<b>C_1.6</b>
		0 = Disabled		
		1 = Enabled		
	<b>C_1.7</b>	Changeband (BIN)		<b>C_1.7</b>
	<b>C_1.8</b>	Error report		<b>C_1.8</b>
	<b>C_1.9</b>	PNO 7		<b>C_1.9</b>
	<b>C_1.10</b>	Parity		<b>C_1.10</b>
		0 = Even		
		1 = Odd		
	<b>C_1.11</b>	Option version		<b>C_1.11</b>
<b>C_2</b>	Auxiliary port (P3)			<b>C_2</b>
	<b>C_2.1</b>	Serial link enable		<b>C_2.1</b>
		0 = Disabled		
		1 = Enabled		
	<b>C_2.2</b>	Group ID (GID)		<b>C_2.2</b>
	<b>C_2.3</b>	Unit ID (UID)		<b>C_2.3</b>
	<b>C_2.4</b>	ASCII / binary		<b>C_2.4</b>
		0 = ASCII		
		1 = Binary		
	<b>C_2.5</b>	Baud rate		<b>C_2.5</b>
	<b>C_2.6</b>	ESP support		<b>C_2.6</b>
		0 = Disabled		
		1 = Enabled		
	<b>C_2.7</b>	Changeband (BIN)		<b>C_2.7</b>
	<b>C_2.8</b>	Error report		<b>C_2.8</b>
	<b>C_2.9</b>	PNO 7		<b>C_2.9</b>
<b>C_3</b>	PNO configuration			<b>C_3</b>
	PNO 112 to 127			

<b>S - SYSTEM</b>			
<b>S_1</b>	Reconfigure outputs		<b>S_1</b>
	<b>S_1.1</b>	Relay 1	<b>S_1.1</b>
		0 = Zero speed	
		1 = At speed	
		2 = Run confirm	
		3 = Brake control	
		4 = At load	
		5 = At FB speed	
	<b>S_1.2</b>	Relay 2	<b>S_1.2</b>
		0 = Zero speed	
		1 = At speed	
		2 = Run confirm	
		3 = Brake control	
		4 = At load	
		5 = At FB speed	
<b>S_2</b>	Reconfigure inputs		<b>S_2</b>
	<b>S_2.1</b>	Presets & JOG	<b>S_2.1</b>
		0 = 4 Presets & JOG	
		1 = 8 Presets	
		2 = Digital MOP & presets	
	<b>S_2.2</b>	Framp	<b>S_2.2</b>
		0 = Framp	
		1 = PID Reset	
		2 = 2ND Ramp Rates	
<b>S_3</b>	Torque Mode		<b>S_3</b>
		0 = Constant Torque	
		1 = Quadratic Torque	

<b>OP STATION DISPLAY</b>			
<b>REF.</b>	Setpoint reference		<b>REF.</b>
<b>O/P.</b>	Drive output frequency		<b>O/P.</b>
<b>JOG</b>	JOG		<b>JOG</b>
[+]	Forward		[+]
[-]	Reverse		[-]
<b>0</b>	Stopped		<b>0</b>
<b>1</b>	Running		<b>1</b>

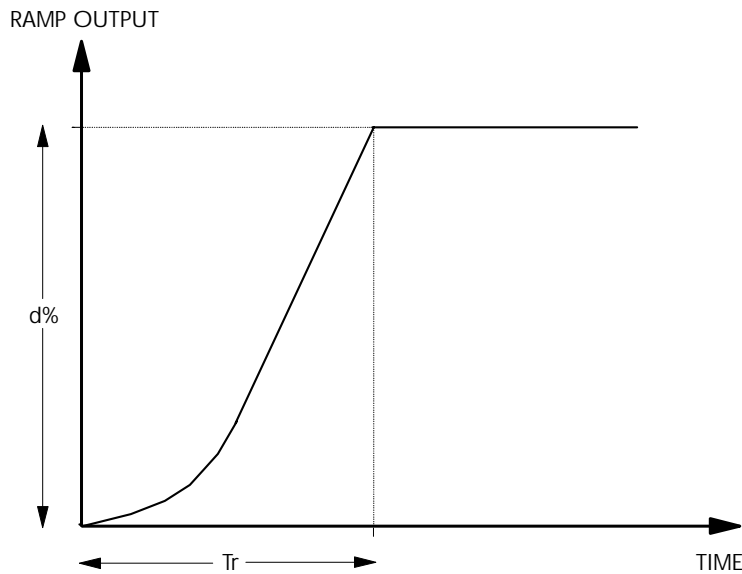
<b>MS - MESSAGES</b>			
<b>MS_1</b>	Reading		<b>MS_1</b>
<b>MS_2</b>	Saving		<b>MS_2</b>
<b>MS_3</b>	Finished		<b>MS_3</b>
<b>MS_4</b>	Initialising		<b>MS_4</b>
<b>MS_5</b>	'M' to reselect		<b>MS_5</b>
<b>MS_6</b>	Please remember		<b>MS_6</b>
<b>MS_7</b>	Now save parameters		<b>MS_7</b>
<b>MS_8</b>	Password cleared		<b>MS_8</b>
<b>MS_9</b>	No active alarms		<b>MS_9</b>

<b>W - WARNINGS / ERRORS</b>			
<b>W_1</b>	Drive running!		<b>W_1</b>
<b>W_2</b>	Not selected!		<b>W_2</b>
<b>W_3</b>	Read only!		<b>W_3</b>
<b>W_4</b>	Password???		<b>W_4</b>
<b>W_5</b>	Key inhibited!		<b>W_5</b>
<b>W_6</b>	Incorrect build!		<b>W_6</b>
<b>W_7</b>	C20 high!		<b>W_7</b>
<b>W_8</b>	C24 high!		<b>W_8</b>
<b>W_9</b>	Auxiliary run high!		<b>W_9</b>
<b>W_10</b>	Auxiliary jog high!		<b>W_10</b>

<b>A - ALARMS</b>			
<b>A_1</b>	I*T integrating		<b>A_1</b>
<b>A_2</b>	Link overcurrent		<b>A_2</b>
<b>A_3</b>	Link overvolts		<b>A_3</b>
<b>A_4</b>	I*T overload		<b>A_4</b>
<b>A_5</b>	Motor stalled		<b>A_5</b>
<b>A_6</b>	Heatsink temperature		<b>A_6</b>
<b>A_7</b>	Motor temperature		<b>A_7</b>
<b>A_8</b>	Current loop loss		<b>A_8</b>
<b>A_9</b>	Link undervolts		<b>A_9</b>
<b>A_10</b>	External trip		<b>A_10</b>
<b>A_11</b>	Multiple alarms		<b>A_11</b>
<b>A_12</b>	Fault or braking		<b>A_12</b>
<b>A_13</b>	Checksum failed		<b>A_13</b>
<b>A_14</b>	EE version error		<b>A_14</b>
<b>A_15</b>	EE write error		<b>A_15</b>

**APPENDIX D - PARABOLIC RAMP TIMES**

This appendix contains a simple look up table method of calculating the response times for the parabolic ramp for a given setpoint step size,  $d\%$ , and  $S$  RAMP %. Note, 100% is assumed to be equal to the **LIMIT FREQUENCY**.

**Parabolic Ramp****Which Formula?**

The formula required to calculate the parabolic ramp response time is dependent on the size of the change in setpoint,  $d\%$ . For a given value of  $S$  RAMP %, the table below indicates which response time formula is relevant for a given  $d\%$ .

<b>S RAMP %</b>	<b>Formula 1</b>	<b>Formula 2</b>
0	linear Ramp	linear Ramp
10	$d\% < 2.6\%$	$d\% > 2.6\%$
20	$d\% < 5.6\%$	$d\% > 5.6\%$
30	$d\% < 8.8\%$	$d\% > 8.8\%$
40	$d\% < 12.5\%$	$d\% > 12.5\%$
50	$d\% < 16.7\%$	$d\% > 16.7\%$
60	$d\% < 21.4\%$	$d\% > 21.4\%$
70	$d\% < 26.9\%$	$d\% > 26.9\%$
80	$d\% < 33.3\%$	$d\% > 33.3\%$
90	$d\% < 40.9\%$	$d\% > 40.9\%$
100	$d\% < 50.0\%$	$d\% > 50.0\%$

## Formula 1

The first response time formula, formula 1, is given below:

$$Tr = RAMPTIME \times \sqrt{2 \times \frac{d\%}{100\%} \times \frac{SRAMP\%}{200\% - SRAMP\%}}$$

This can be simplified as follows:

$$Tr = RAMPTIME \times A \times B$$

The factors A and B are given for varying values of **S RAMP %** and **d%** in the tables below:

<b>S RAMP %</b>	<b>A</b>
0	0
10	0.032
20	0.047
30	0.059
40	0.071
50	0.082
60	0.093
70	0.104
80	0.116
90	0.128
100	0.141

<b>d%</b>	<b>B</b>
0	0
10	3.16
20	4.47
30	5.48
40	6.32
50	7.07
60	7.75
70	8.37
80	8.94
90	9.49
100	10.0



**Formula 2**

The second response time formula, formula 2, is given below:

$$Tr = RAMPTIME \times \left[ \frac{d\%}{100\%} + \frac{1}{2} \times \frac{SRAMP\%}{200\% - SRAMP\%} \right]$$

This can be simplified as follows:

$$Tr = RAMPTIME \times [A + B]$$

The factors A and B are given for varying values of **S RAMP %** and **d%** in the tables below:

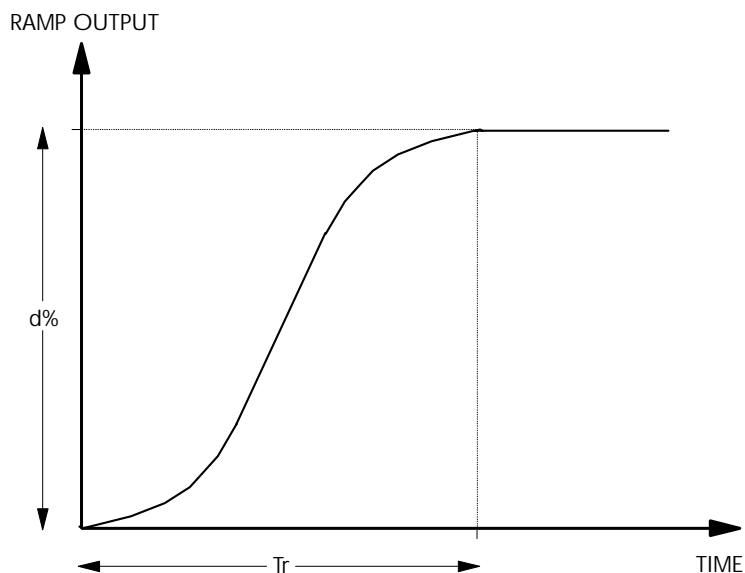
<b>SRAMP%</b>	<b>A</b>
0	0
10	0.026
20	0.056
30	0.088
40	0.125
50	0.167
60	0.214
70	0.269
80	0.333
90	0.409
100	0.500

<b>d%</b>	<b>B</b>
0	0
10	0.1
20	0.2
30	0.3
40	0.4
50	0.5
60	0.6
70	0.7
80	0.8
90	0.9
100	0.10

## APPENDIX E - S RAMP TIMES

This appendix contains a simple look up table method of calculating the response times for the s ramp for a given setpoint step size,  $d\%$ , and **S RAMP %**. Note, 100% is assumed to be equal to the **LIMIT FREQUENCY**.

### S Ramp:



### Which Formula?

The formula required to calculate the s ramp response time is dependent on the size of the change in setpoint,  $d\%$ . For a given value of **S RAMP %**, the table below indicates which response time formula is relevant for a given  $d\%$ .

<b>S RAMP %</b>	<b>Formula 1</b>	<b>Formula 2</b>
0	linear Ramp	linear Ramp
00	$d\% < 5.3\%$	$d\% > 5.3\%$
20	$d\% < 11.1\%$	$d\% > 11.1\%$
30	$d\% < 17.6\%$	$d\% > 17.6\%$
40	$d\% < 25.0\%$	$d\% > 25.0\%$
50	$d\% < 33.3\%$	$d\% > 33.3\%$
60	$d\% < 42.9\%$	$d\% > 42.9\%$
70	$d\% < 53.8\%$	$d\% > 53.8\%$
80	$d\% < 66.7\%$	$d\% > 66.7\%$
90	$d\% < 81.8\%$	$d\% > 81.8\%$
100	$d\% < 100.0\%$	$d\% > 100.0\%$

## Formula 1

The first response time formula, formula 1, is given below:

$$Tr = RAMPTIME \times 2 \times \sqrt{\frac{d\%}{100\%} \times \frac{SRAMP\%}{200\% - SRAMP\%}}$$

This can be simplified as follows:

$$Tr = RAMPTIME \times A \times B$$

The factors A and B are given for varying values of **S RAMP %** and **d%** in the tables below:

<b>S RAMP %</b>	<b>A</b>
0	0
10	0.046
20	0.067
30	0.084
40	0.100
50	0.116
60	0.131
70	0.147
80	0.163
90	0.181
100	0.200

<b>d%</b>	<b>B</b>
0	0
10	3.16
20	4.47
30	5.48
40	6.32
50	7.07
60	7.75
70	8.37
80	8.94
90	9.49
100	10.0

## Formula 2

The second response time formula, formula 2, is given below:

$$Tr = RAMPTIME \times \frac{d\%}{100\%} \times \frac{200\%}{200\% - SRAMP\%}$$

This can be simplified as follows:

$$Tr = RAMPTIME \times A \times B$$

The factors A and B are given for varying values of **S RAMP %** and **d%** in the tables below:

<b>S RAMP %</b>	<b>A</b>
0	1
10	1.05
20	1.11
30	1.18
40	1.25
50	1.33
60	1.43
70	1.54
80	1.67
90	1.82
100	2

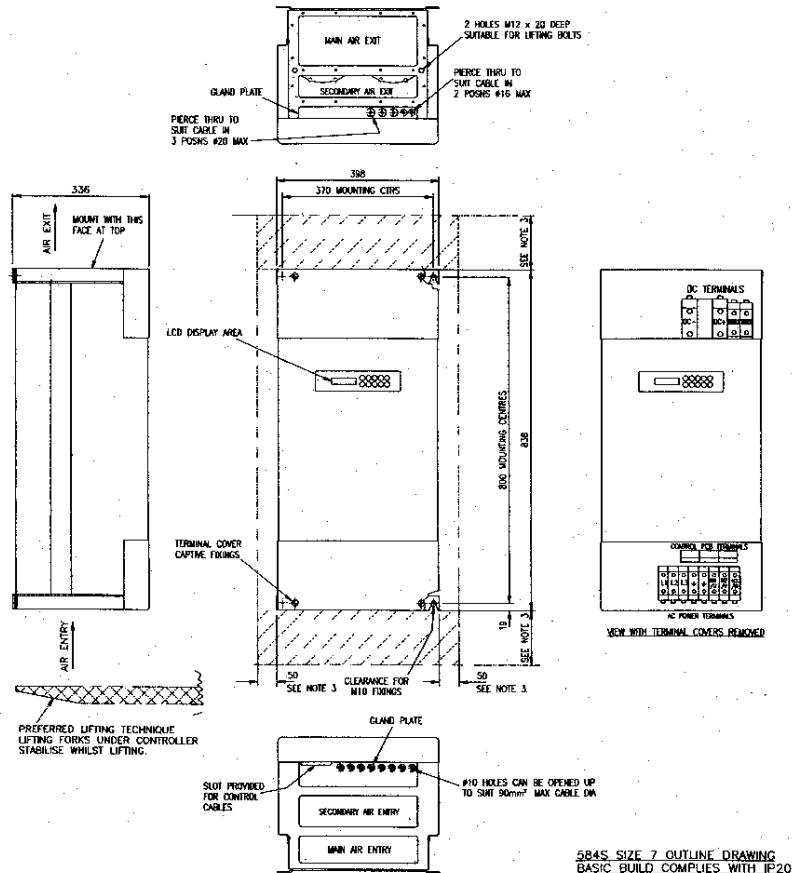
<b>d%</b>	<b>B</b>
0	0
10	0.1
20	0.2
30	0.3
40	0.4
50	0.5
60	0.6
70	0.7
80	0.8
90	0.9
100	1.0

APPENDIX F - 584S TYPE 7 MECHANICAL OUTLINE DRAWINGS

IP20

NOTES

1. AC POWER TERMINALS AND DC TERMINALS. DRY1 & DRY2 ARE CAPABLE OF ACCEPTING 90mm<sup>2</sup> (4/0 AWG) CABLE. DC+ & DC- ARE CAPABLE OF ACCEPTING 150mm<sup>2</sup> (4/0 AWG) CABLE. CONTROL PCB TERMINALS ARE CLAMP STYLE LOOPS CAPABLE OF ACCEPTING 1.5mm<sup>2</sup> CABLE. ALL NECESSARY FIXINGS FOR ELECTRICAL CONNECTIONS ARE SUPPLIED. GLANDS & MECHANICAL FIXINGS ARE NOT SUPPLIED.
2. TERMINAL COVERS MAYBE REMOVED BY RELEASING RETAINING SCREWS TO GIVE ACCESS TO POWER TERMINALS AND CONTROL TERMINALS.
3. AIR FLOW CLEARANCE AS INDICATED IS 250mm MIN FREE SPACE TOP AND BOTTOM AND AT SIDES AS SHOWN.
4. AC POWER TERMINALS AND DC TERMINALS. DRY1 & DRY2 REQUIRE 6mm A/F/ HEXAGONAL DRIVER TO SECURE CABLES, RECOMMENDED TIGHTENING TORQUE 20Nm (12lb/ft). DC+ & DC- REQUIRE 8mm A/F/ HEXAGONAL DRIVER TO SECURE CABLES, RECOMMENDED TIGHTENING TORQUE 30Nm (22lb/ft).
5. TO PRESERVE IP20 RATING MAX DIAMETER/CAL CLEARANCE OVER ANY CABLE TO BE 5mm.

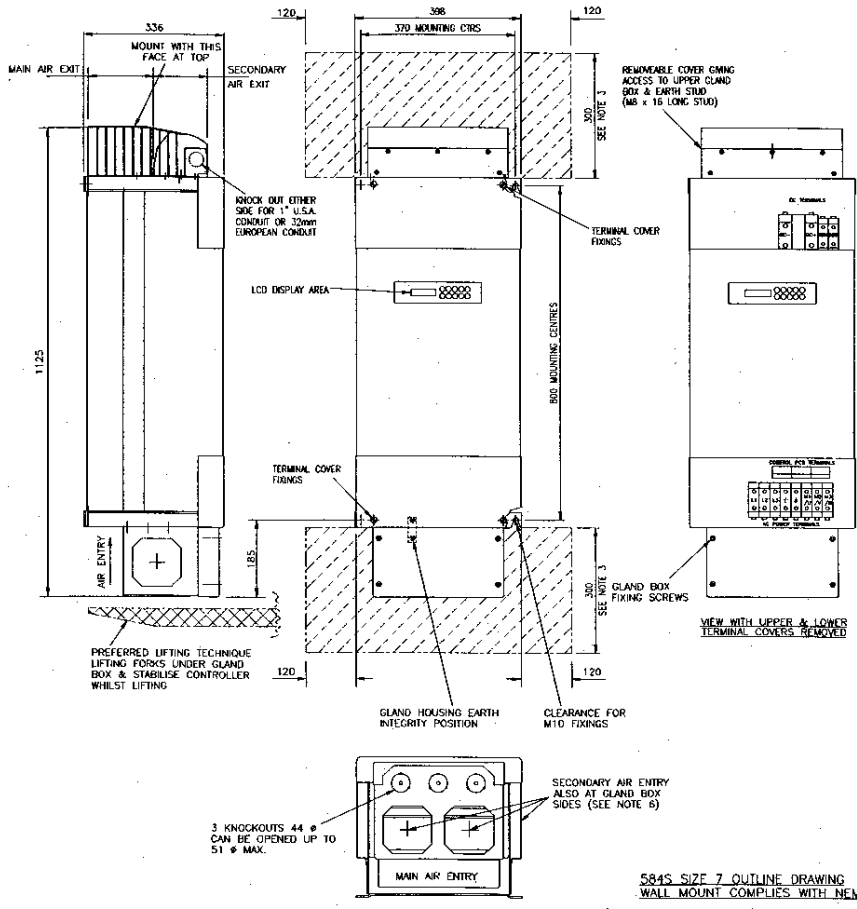


584S SIZE 7 OUTLINE DRAWING  
 BASIC BUILD COMPLIES WITH IP20

UL Type 1


NOTES

1. AC POWER TERMINALS AND DC TERMINALS. DBR1 & DBR2 ARE CAPABLE OF ACCEPTING 30mm<sup>2</sup> (4/0 AWG) CABLE. DC+ & DC- ARE CAPABLE OF ACCEPTING 150mm<sup>2</sup> (6/0 AWG) CABLE. CONTROL PCB TERMINALS ARE CLAMP STYLE LOOPS CAPABLE OF ACCEPTING 1.5mm<sup>2</sup> CABLE. ALL NECESSARY FIXINGS FOR ELECTRICAL CONNECTIONS ARE SUPPLIED. GLANDS & MECHANICAL FIXINGS ARE NOT SUPPLIED.
2. TERMINAL COVERS MUST BE REMOVED BY RELEASING RETAINING SCREWS TO GIVE ACCESS TO POWER TERMINALS AND CONTROL TERMINALS.
3. AIR FLOW CLEARANCE AS INDICATED
4. AC POWER TERMINALS AND DC TERMINALS. DBR1 & DBR2 REQUIRE 6mm A/F HEXAGONAL DRIVER TO SECURE CABLES, RECOMMENDED TIGHTENING TORQUE 20Nm (150in/lb). DC+ & DC- REQUIRE 8mm A/F HEXAGONAL DRIVER TO SECURE CABLES, RECOMMENDED TIGHTENING TORQUE 30Nm (220in/lb).
5. TO PRESERVE IP20 RATING MAX DIAMETRIC CLEARANCE OVER ANY CABLE TO BE 5mm.
6. AIR FILTERS MAY BE FITTED AT THESE APERTURES (4 POSITIONS).



584S020000 ISSUE 8 DATE 06/11/14 ALPACAD FILENAME 020471350001\_2



ISS.	MODIFICATION	ECN No.	DATE	DRAWN	CHK'D
	584S Product Manual HA389756 Sheets 1 and 2 filed in drawing office.				
7	Page 1-7 added fixing details for when gland box is fitted. Page 4-8 Highlighted 4) "motor rotation" Address list removed from Chapter 6 and added to back cover and added Disposal information. Chapter 7 added new style Certificates.	12419 14074 13164 13908	20.11.00	FEP	CM
FIRST USED ON		MODIFICATION RECORD			
		584S Frequency Inverter			
 <b>EUROTHERM DRIVES</b>		DRAWING NUMBER			SHT. 2
		ZZ389756			OF 2