

T1676EN Getting Started Manual Rev 0009

MV3000e AC-Fed Drives

MicroCubicle™ Style Drives Only



## DOCUMENT HISTORY

Revision Number	Date Of Revision	Details
Issue 0006	02/02	New control board with revised I/O.
Issue 0007	06/06	New Control Block Diagrams and Company name change.
Issue 0008	June 2012	Company name change, etc.
Rev 0009	April 2013	Company name change, etc.

## DEFINITIONS

- NOTE:** Notes separate important information from the text and give additional information.
- CAUTION** “An instruction that draws attention to the risk of damage to the product, process or surroundings” (BS 4884-1: 1992).
- WARNING** “An instruction that draws attention to the risk of injury or death” (BS 4884-1: 1992).

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## SAFETY INSTRUCTIONS

Care has been taken with the design of this product to ensure that it is safe. However, in common with all products of this type, misuse can result in injury or death. Therefore, it is very important that the instructions in this manual and on the product are observed during transportation, commissioning, operation, maintenance and disposal.

This technical manual must be regarded as part of the product. It should be stored with the product and must be passed on to any subsequent owner or user.

Local safety laws and regulations must always be observed.

Persons working on the product must be suitably skilled and should have been trained in that work for these products.

The product is a component designed for incorporation in installations, apparatus and machines.

The product must not be used as a single item safety system. In applications where maloperation of the product could cause danger, additional means must be used to prevent danger to persons.

Product approvals and certifications will be invalidated if the product is transported, used or stored outside its ratings or if the instructions in this manual are not observed.

Third party approvals to safety standards UL508C and CSA C22.2 No 14 are marked on the product.

In The European Union:

- Products within the scope of the Low Voltage Directive, 2006/95/EC are CE marked.
- The product complies with the essential protection requirements of the EMC directive 2004/108/EC, when installed and used as described in this manual.
- The requirements of the EMC Directive should be established before any installation, apparatus or machine, which incorporates the product, is taken into service.
- A machine must not be taken into service until the machine has been declared in conformity with the provisions of the Machinery (Safety) Directive, 2006/42/EC.



## DISPOSAL

This equipment or any part of the equipment should be disposed of in accordance with the laws of the country of use.

Modern high technology materials have been used in the manufacture of the equipment to ensure optimum performance. Care has been taken with the selection of these materials to minimise risks to health and safety. However, some materials require special consideration during disposal.

In common with all products of this type, the high voltage electrolytic capacitors contain an electrolyte, which must be disposed of as hazardous waste. The electrolytes are solutions of organic and/or boric acid. The major solvents in the capacitors are butyrolactone and ethylene glycol. The electrolyte is non-carcinogenic, but may cause irritation to the skin if contact is prolonged.

Liquid coolant is subject to special considerations during handling, storage and disposal. Refer to the manufacturer's instructions.

## SCOPE

This Getting Started Manual provides a competent user trained in electrical installation practice with sufficient information to safely install, commission, operate, maintain and dispose of simple Active Energy Management (AEM) systems, based on the MV3000e series of converters.

This manual should be regarded as part of the product. It should be retained for the life of the product and passed on to any subsequent owner or user.



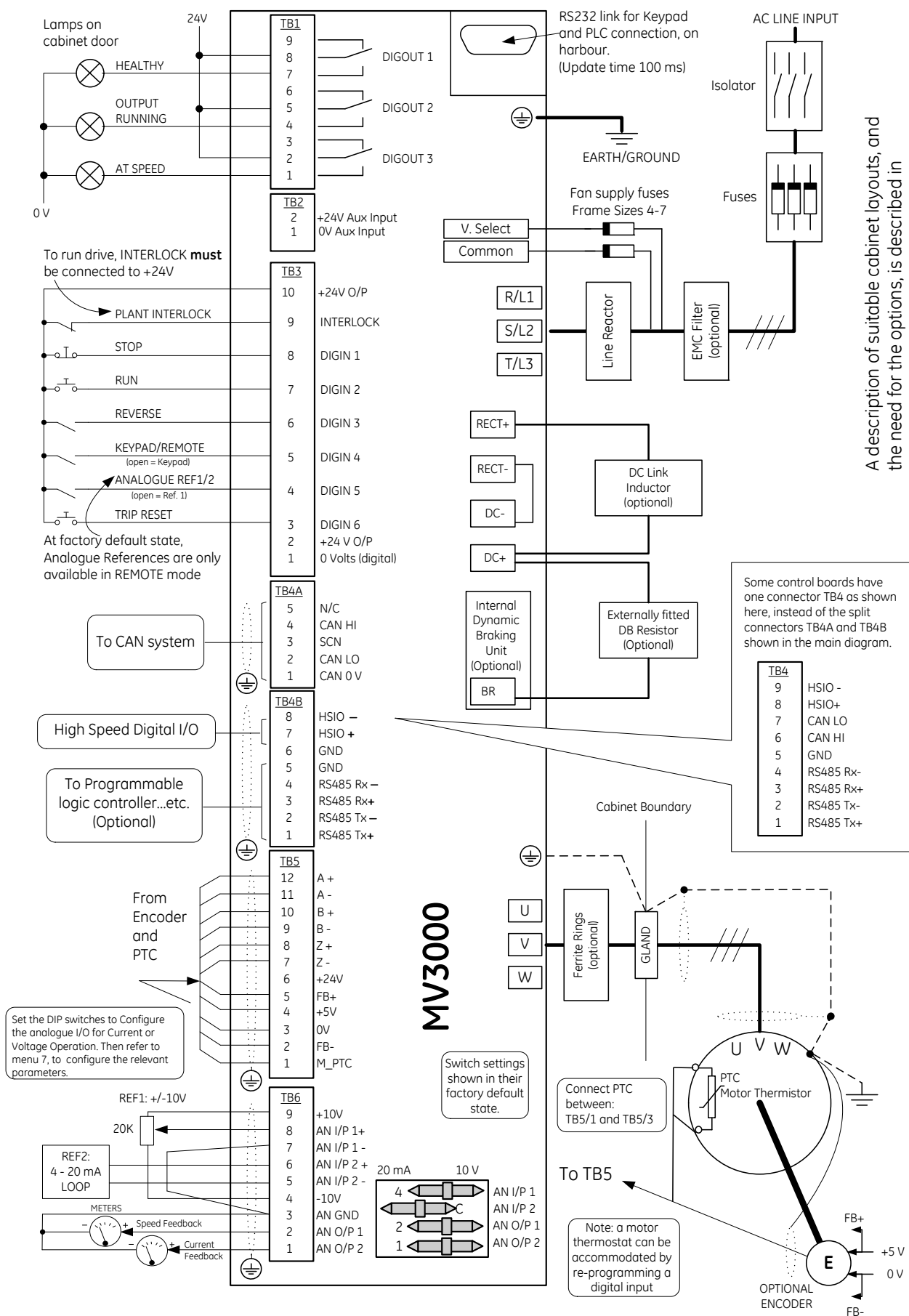


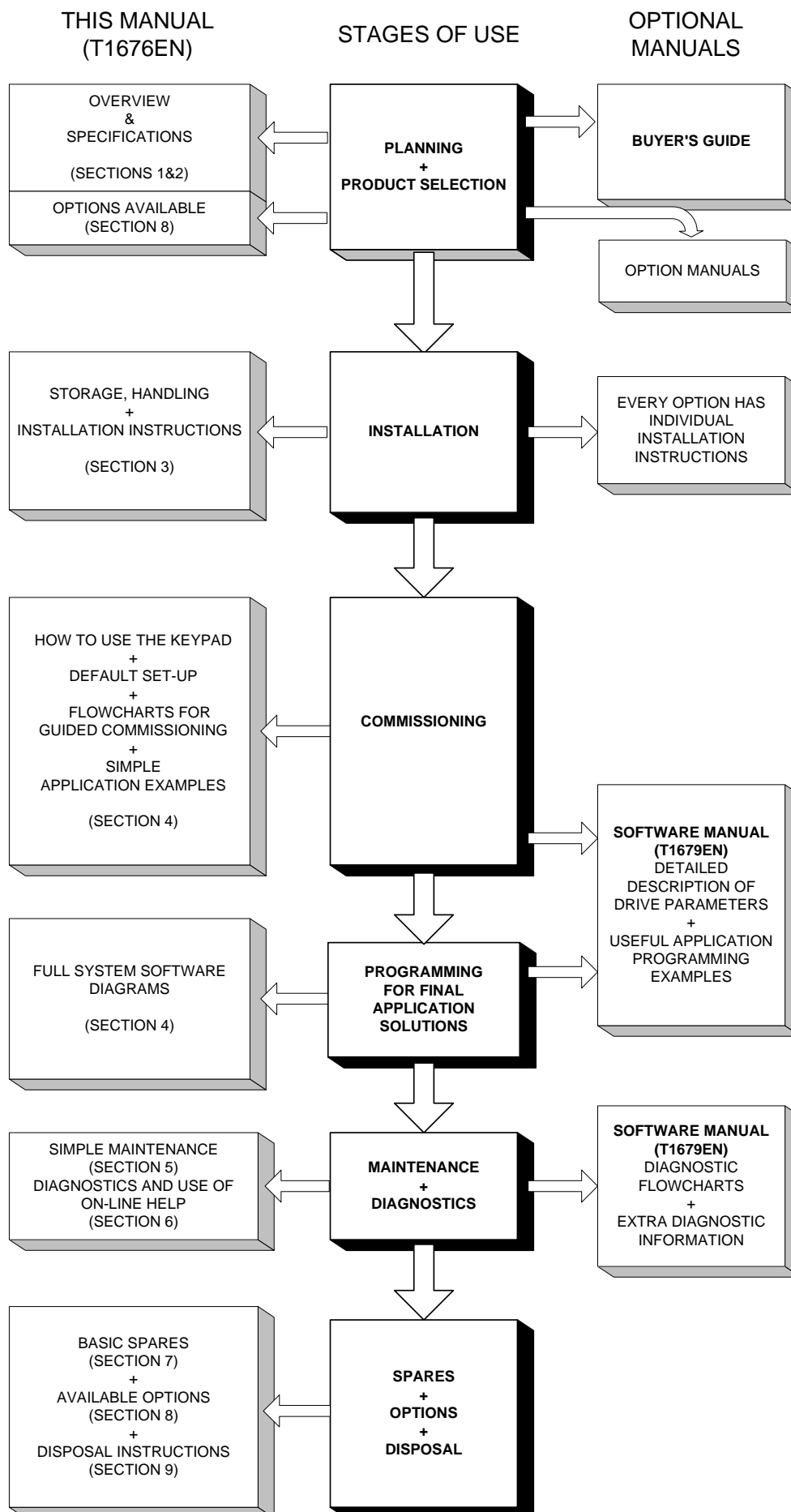
Figure 1. – Default Input/Output Diagram

TB1				Digital Outputs		Specifications	
DIGOUT 1 to 3				Volt-free changeover relay outputs		Max volts : 250 Vac, 30 Vdc Max current : 3 A (resistive load)	
TB2				Auxiliary Input Supply		Specifications	
+24 V Aux input				Allows monitoring and programming with main power switched off.		Current, nominal (Keypad+Controller) : 500 mA Current, max (all versions) : 2.2 A	
TB3				Digital Inputs		Specifications	
Pin	Signal			Menu 7			
3 to 8	DIGIN 1-6			For remote control of drive – default functions are shown in the default I/O diagram (Figure 1).		Impedance: 15 kΩ Active: +12 V to +50 V Inactive: Open circuit or < 7 V	
9	INTERLOCK			Hardware interlock – must be made to enable drive.		Impedance: 15 kΩ Healthy: +12 V to +50 V Unhealthy: Open circuit or < 7 V	
2 & 10	+24 V O/P			User supply for peripheral equipment.		Volts range: +22.8 V to +25.3 V Max load: 500 mA	
1	0 V (digital)			0 V reference of digital inputs.		Connected to earth (ground) internally	
TB4	TB4A	TB4B	Communications			Specifications	
Pin	Pin	Pin	Signal				
1/2		½	RS485 Tx+/-			0 - 2 km range. Update time 10 ms.	
3/4		¾	RS485 Rx +/-				
5		5/6	GND			Connected to earth (ground) internally.	
	1		CAN 0 V				
6/7	4/2		CAN HI/LO			Future	
	3		SCN				
8/9		7/8	HSIO +/-			RS422 protocol, ± signal differential with respect to GND pin. Common mode ≅ 15 V	
TB5				Encoder/PTC		Specifications	
Pin	Signal			Menu 13			
1	M_PTC			Input from motor PTC		Resistive: Trip: P2.13 (0 Ω to 10 kΩ) Reset: (Value in parameter) -0.1 kΩ	
2/5	FB -/FB+			Encoder power supply feedback for accurate setting.			
4/6	+5 V/+24 V			Power supply outputs for the encoder.		+5 V: Adjustable, 4.5 - 6.5 V, 350 mA maximum +24 V: Fixed, 350 mA maximum	
3	0 V			Common return line for encoder power supply and the PTC.		Connected to earth (ground) internally.	
7/8	Z-/Z+			Marker signal from encoder.		EIA RS422A, Max edge freq 1.5 MHz, see Section 3.8	
9 - 12	B-/B+, A-/A+			Encoder position signals.			
TB6				Analogue Inputs/O utputs		Specifications	
Pin	Signal			Menu 7			
1/2	ANOP 1 and 2			Analogue outputs 1 and 2, V or I as selected by SW1.		V or I: (11 bit + sign), ±5% full scale accuracy, update time 5 ms: V: -10 V to +10 V, ≤ 5 mA load I: -20 mA to +20 mA, ≤ 500 Ω load	
3	AN GND			Analogue ground (earth) for inputs and outputs.		Connected to earth (ground) internally.	
4/9	-10 V/+10 V to V/+10.5 V			Reference supplies for analogue inputs.		Maximum Load : 5 mA current limited	
5/6	AN I/P 2 -/+			Differential analogue input 2 Differential analogue input 1  Voltage (V) or Current (I) as selected by switch SW1		V or I as selected by SW1 (11 bit + sign), ±5% full scale accuracy: V: -10 V to +10 V, 100 kΩ load input impedance. I: -20 mA to +20 mA, 235 Ω load input impedance. Common mode volts = ±2.5 V maximum.	
7/8	AN I/P 1 -/+						

Table 1-1. – I/O Panel: Connector Specifications



## DOCUMENT STRUCTURE



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Provides electrical and mechanical data for all MicroCubicle™ AC-fed drives, also physical dimensions and miscellaneous data common to all the drives, such as derating information.	
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Explains how to properly install a MicroCubicle™ AC-fed drive, ready for commissioning. Mechanical aspects include the illustrated layout of components with regard to ventilation and EMC requirements. Electrical installation instructions include the layout of cables for EMC requirements, segregation, access to drive connectors, and the connection of power and control cables.	
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Explains how to configure a MicroCubicle™ AC-fed drive to turn a motor, using factory default settings, also how to configure the drive in more detail using Guided Commissioning (simple flowcharts), and shows how to set up the drive for more advanced applications using Control Diagrams supplied.	
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Simple maintenance procedures for keeping the MicroCubicle™ AC-fed drive serviceable.	
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## 1. INTRODUCTION

### 1.1 ABOUT THIS MANUAL

This Getting Started Manual provides a competent user trained in electrical installation practice with sufficient information to safely install, commission, operate, maintain and dispose of a simple MV3000e MicroCubicle™ AC-fed drive. Detailed instructions for programming the more advanced software features are contained in the MV3000e Software Technical Manual (T1679), which is available from GE Power Conversion as an option.

Instructions for high power modular (DELTA) based MV3000e drives are provided in T1689, MV DELTA, Technical Manual for MV3000e DELTA, for air-cooled drives and in T1693, MV DELTA Liquid Cooled Drive System, for liquid cooled drives.

This manual should be regarded as part of the MV3000e AC-fed drive. It should be retained for the life of the drive and passed on to any subsequent owner or user.

### 1.2 ABOUT THE MV3000 MICROCUBICLE™ DRIVE

The MV3000e range of MicroCubicle™ variable speed AC-fed drives provides powerful features at an economical price. At the standard level, MV3000e is a simple to use inverter for general purpose applications for ratings from 22 kW to above 1.8 MW. At a higher level, open up the parameter menus, add fieldbus communications, hardware expansion and programming enhancement facilities, and the power of MV3000e comes alive. Add to this universal control strategies such as frequency control (VVF), closed loop flux vector control and encoderless flux vector control, and MV3000e easily manages a vast spectrum of industrial applications. A typical MV3000e drive unit is shown in Figure 1-1, shown with the optional Drive Data Manager™ (Keypad) fitted.

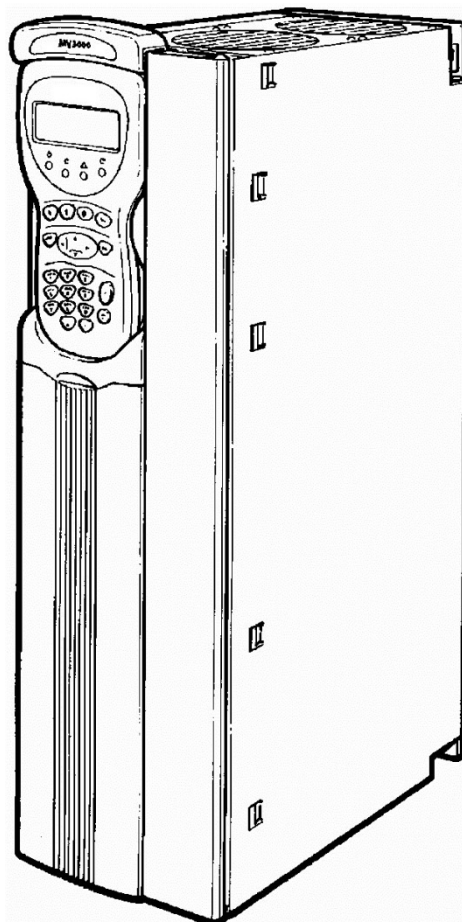


Figure 1-1. – MV3000e MicroCubicle™ Drive with Keypad (option) Fitted

### 1.3 RANGE OF DRIVES COVERED BY THIS MANUAL

The MicroCubicle™ AC-fed drives covered by this manual are listed in Table 1-1. The drives are supplied in four frame sizes as shown; dimensions and weights are provided in Section 2.3.

Voltage Ratings 380 V - 440 V (400 V nominal)					
Drive	Frame Size	Drive	Frame Size	Drive	Frame Size
MV3058A4A1	3	MV3168A4A1	6	MV3449A4A1	7
MV3071A4A1	3	MV3204A4A1	6	MV3503A4A1	7
MV3086A4A1	4	MV3244A4A1	6	MV3566A4A1	7
MV3105A4A1	4	MV3292A4A1	6		
MV3140A4A1	4	MV3364A4A1	6		
Voltage Ratings 460 V - 525 V (480 V nominal)					
Drive	Frame Size	Drive	Frame Size	Drive	Frame Size
MV3052A5A1	3	MV3124A5A1	4	MV3302A5A1	6
MV3065A5A1	3	MV3156A5A1	6	MV3361A5A1	7
MV3077A5A1	4	MV3180A5A1	6	MV3414A5A1	7
MV3096A5A1	4	MV3240A5A1	6	MV3477A5A1	7
Voltage Ratings 575 V - 690 V (600 V nominal)					
Drive	Frame Size	Drive	Frame Size	Drive	Frame Size
MV3062A6A1	4	MV3144A6A1	6	MV3336A6A1	7
MV3077A6A1	4	MV3192A6A1	6	MV3382A6A1	7*
MV3099A6A1	4	MV3242A6A1	6		
MV3125A6A1	6	MV3289A6A1	7		

Table 1-1. – Range of MV3000e AC-Fed Drives

\* 690 V operation only

### 1.4 EXPLANATION OF PRODUCT CODE

The code used to identify drives is illustrated below, using the code for an AC-fed (6-pulse) MV3000e drive, rated at 96 A with a maximum supply voltage of 525 V.

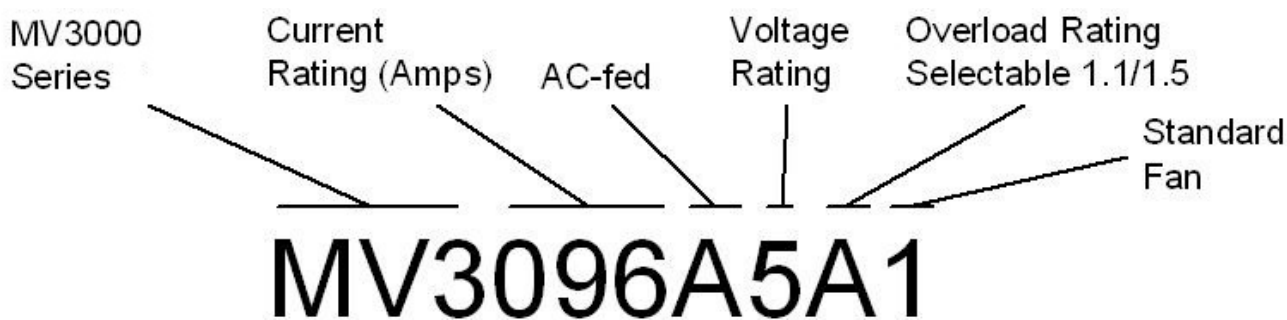


Figure 1-2. – MV3000e Identity Code



## 1.5 USE OF METRIC UNITS

The MV3000e range of drives has been designed to IEC standards using SI units. In this manual approximate values for inches, lb and hp are also included for convenience.

## 1.6 CUSTOMER SUPPORT AND TRAINING

GE Power Conversion provides comprehensive telephone technical support, application planning, service and training for customers.

Contact GE Power Conversion at the address and telephone numbers shown at the end of this manual.

## 1.7 ASSOCIATED PUBLICATIONS

### 1.7.1 T1699 MV3000e Buyer's Guide

The comprehensive Buyer's Guide gives detailed information for all MV3000e products and options, including DELTA products, to help the user select suitable components for applications and systems.

### 1.7.2 T1679 MV3000e Software Technical Manual

This manual contains detailed technical information to enable a competent user trained in drives to safely configure the MV3000e drives for specific applications. It includes full descriptions of the menu structure and parameters, also the serial communications systems.

### 1.7.3 T1684 MV3000e Dynamic Braking Units

Comprehensive instructions are provided to allow a competent user to install, commission, maintain the MV3DB series DB Units, and to select and install the associated braking resistors.

### 1.7.4 T2013 MV3000e CANopen Fieldbus Facility Technical Manual

This manual enables a competent user trained in drives to use the on-board CANopen facility to add input/output functions (extended I/O) and to configure communication between two or more drives, using the CANopen Fieldbus.

### 1.7.5 T1689 MV DELTA, Technical Manual for MV3000e DELTA T1693 MV DELTA Liquid Cooled Drive System

These manuals include specifications and instructions to allow a competent user trained in drives to safely install the components of MV3000e DELTA systems to construct DELTA drives.

DELTA drives are a unique system of modular based drive units, 150 kW to 1.8 MW in air-cooled versions, 600 kW to 3.6 MW in liquid cooled versions.



## 2. DRIVE DATA

### 2.1 PHYSICAL DIMENSIONS - DRIVE

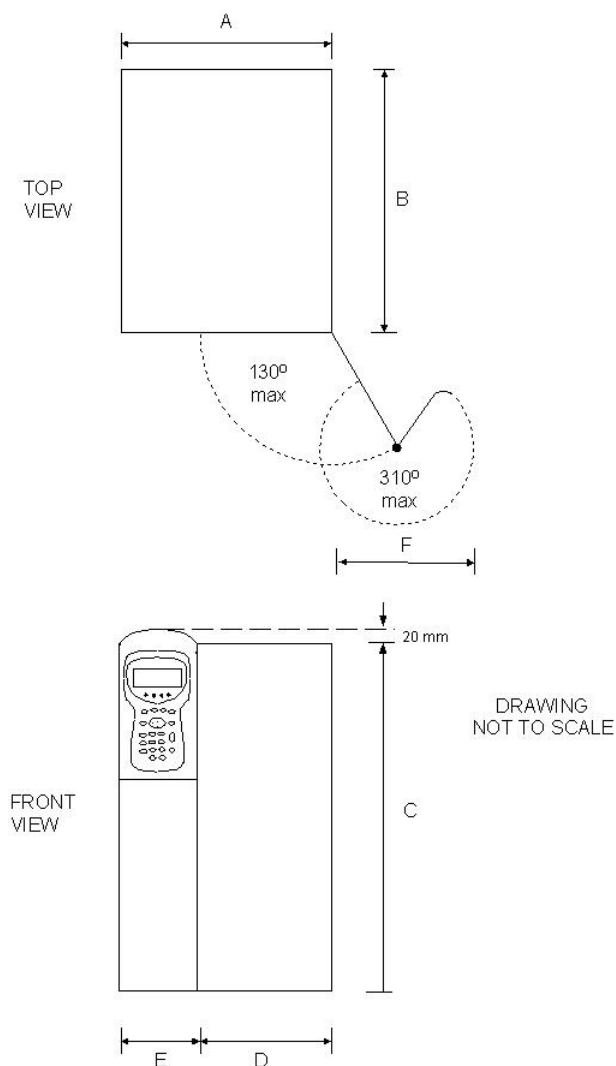


Figure 2-1. – Drive Dimensions

**NOTE:** Template drilling dimensions for mounting are provided in Section 3.5.

Frame	Dimensions mm (in)						Weight
Size	A	B	C	D	E	F (max)	kg (lb)
3	170 (6.7)	350 (13.8)	600 (23.7)	60 (2.37)	110 (4.33)	149 (5.9)	27(60)
4	255 (10.0)	370 (14.6)	789 (31.2)	145 (5.7)	110 (4.33)	204 (8.0)	45.5 (100)
6	430 (17.0)	420 (16.6)	873 (34.4)	320 (12.6)	110 (4.33)	316 (12.4)	100 (220)
7	485 (19.1)	450 (17.8)	1155 (45.5)*	372 (14.7)	110 (4.33)	350 (13.8)	155 (342)

Table 2-1. – Drive Physical Dimensions

\* Overall height, including keypad harbour overhang.

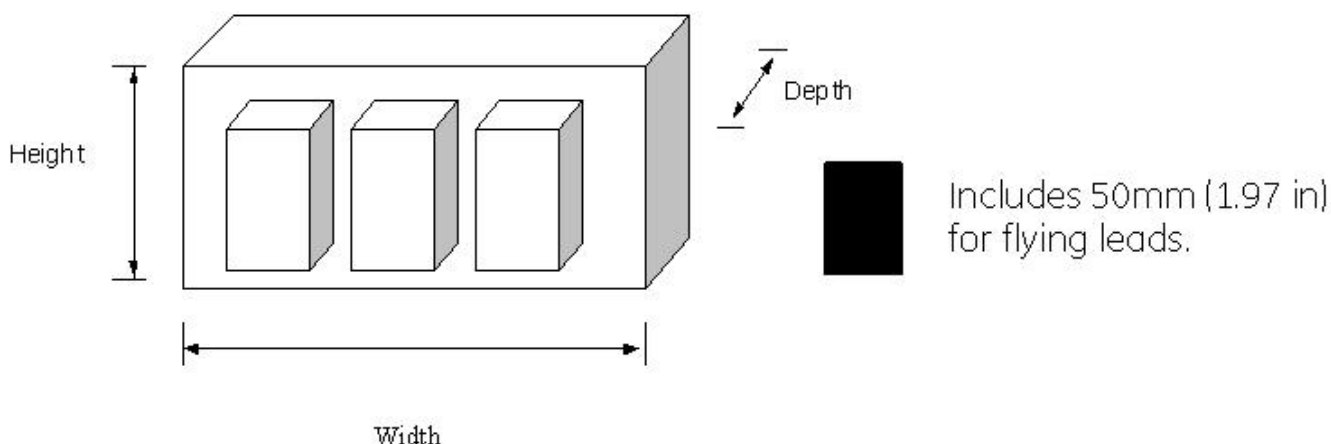


## 2.2 PHYSICAL DIMENSIONS - LINE REACTOR

Line Reactor Part No.	Dimensions			Cable Fixing Holes mm / in	Earth Stud Lug mm / in	Weight Kg / lb
	Height mm / in	Width mm / in	Depth mm / in			
<b>400V</b>						
MV3ACL022A4	195/7.68	180/7.09	166/6.54	Flying Leads	M6 (1/4)	12/26.4
MV3ACL030A4	195/7.68	180/7.09	166/6.93	Flying Leads	M6 (1/4)	12/26.4
MV3ACL037A4	195/7.68	180/7.09	166/6.54	Flying Leads	M6 (1/4)	12/26.4
MV3ACL045A4	250/9.84	240/9.45	170/6.69	Flying Leads	M8 (5/16)	17/37.4
MV3ACL055A4	260/10.24	280/11.02	170/6.69	9/0.354 dia	M8 (5/16)	14/30.8
MV3ACL075A4	260/10.24	280/11.02	190/7.48	9/0.354 dia	M8 (5/16)	18/39.6
MV3ACL090A4	320/12.6	346/13.62	225/8.86	11/0.433 dia	M10 (3/8)	25/55
MV3ACL110A4	320/12.6	346/13.62	235/9.25	11/0.433 dia	M10 (3/8)	30/66
MV3ACL132A4	320/12.6	346/13.62	245/9.25	11/0.433 dia (x 2)	M10 (3/8)	35/77
MV3ACL160A4	320/12.6	346/13.62	245/9.65	11/0.433 dia (x 2)	M10 (3/8)	35/77
MV3ACL200A4	320/12.6	346/13.62	255/10.04	11/0.433 dia (x 2)	M10 (3/8)	45/99
MV3ACL250A4	372/14.64	430/16.93	275/10.83	11/0.433 dia (x 2)	M12 (1/2)	50/110
MV4ACL280A4	372/14.64	430/16.93	290/11.42	11/0.433 dia (x 2)	M12 (1/2)	56/123.2
MV3ACL315A4	373/14.7	430/16.93	300/11.81	11/0.433 dia (x 2)	M12 (1/2)	70/154
<b>690V</b>						
MV3ACL045A7	250/9.84	240/9.45	170/6.69	Flying Leads	M8 (5/16)	16/35.2
MV3ACL055A7	250/9.84	240/9.45	170/6.69	Flying Leads	M8 (5/16)	16/35.2
MV3ACL075A7	250/9.84	240/9.45	190/7.48	Flying Leads	M8 (5/16)	19/41.8
MV3ACL090A7	250/9.84	240/9.45	190/7.48	Flying Leads	M8 (5/16)	21/46.2
MV3ACL110A7	320/12.6	346/13.62	235/9.25	11/0.433 dia	M8 (5/16)	35/77
MV3ACL132A7	320/12.6	346/13.62	245/9.65	11/0.433 dia	M8 (5/16)	35/77
MV3ACL160A7	320/12.6	346/13.62	245/9.65	11/0.433 dia	M8 (5/16)	35/77
MV3ACL200A7	320/12.6	346/13.62	255/10.04	11/0.433 dia (x 2)	M10 (3/8)	50/110
MV3ACL250A7	375/14.8	430/16.93	275/10.83	11/0.433 dia (x 2)	M10 (3/8)	50/110
MV3ACL280A7	372/14.65	430/16.93	290/11.42	11/0.433 dia (x 2)	M10 (3/8)	56/123.2
MV3ACL315A7	372/14.65	430/16.93	300/11.81	11/0.433 dia (x 2)	M10 (3/8)	70/154

Table 2-2. – Line Reactor Dimensions, 50Hz Models

\* Refer to supplier for dimensions of 60Hz models.



## 2.3 DATA COMMON TO ALL DRIVES

Environment	Storage	-	Temperature range	-25°C to +55°C (-13°F to 130°F)
		-	Relative humidity	5% to 95%, non-condensing
		-	Altitude	Not critical below 40°C (104°F)
	Transport	-	Temperature range	-25°C to +70°C (-13°F to 158°F)
		-	Relative humidity	≤ 95%, non-condensing
		-	Altitude	Not critical below 40°C (104°F)
		-	Vibration, drop	IEC 60721-3-2 Class 2M1
	Operating	-	Altitude (max)	1000, 1000m to 2000m with derating. Refer to Sections 2.1 and 2.2.
		-	Temperature range	0°C to +40°C (+32°F to 104°F); 40°C to +50°C (+104°F to 122°F) with derating. Refer to Sections 2.1 and 2.2.
		-	Relative humidity	5% to 95%, non-condensing
			Vibration	IEC 60721-3-3 Class 3M1 & EN50178
		-	Cooling air (pollution and dust)	Pollution Degree 2 (IEC 60664-1, UL 840, CSA C22.2 No. 0.2-93) i.e. clean, free from dust, condensation and conductive or corrosive gases. If optional dirty air kit is fitted, the main heatsink can be exposed to unfiltered air that does not contain corrosive, conductive or explosive dust or gases.
		-	Acoustic noise	Refer to Section 2.8
	Ingress protection			IP20, (NEMA 1). Loose items are IP00 (unprotected). IP21 with Drip Option
Electrical	Supply	-	Voltage range (as selected)	380 V - 440 V (400 V nominal), 50 Hz 460 V - 525 V (480 V nominal), 60 Hz 575 V - 690 V (600 V nominal), 60 Hz (690 V, 50 Hz)
		-	Voltage variation (on voltage range)	±10% long term, ±15% for 0.5 to 30 cycles with loss of performance but no trip
		-	Voltage unbalance	Negative sequence voltage 3%--
		-	Frequency (optimised)	50 Hz, 60 Hz, as selected
		-	Operational frequency range	45 Hz to 63 Hz. With frequencies outside the optimised values, extra DC link ripple may be apparent and may impair motor control performance.
		-	Network type	TN or TT (earthed/grounded neutral). Can also be connected to IT network (i.e. isolated neutral) if IT network is separated from public mains supply by an isolating transformer.
	Insulation	-		UL 840, CSA C22-2 No. 0.2, EN 50178: TN or TT network: Overvoltage Category III. IT network: Overvoltage Category II. For full compliance with UL 508C, transient suppressors complying with UL 1449 must be fitted external to the drive.
	Switching frequency			1.25 kHz, 2.5 kHz, 5 kHz, 7.5 kHz for all drives (programmable by P99.02)
	Output	-	Overload current	50% or 10% for one minute, as selected, with a maximum of six equally spaced overloads in any hour.

Table 2-3. – Common Data



## 2.4 DRIVE PERFORMANCE DATA

Frequency	-	Resolution	0.01%	
	-	Control accuracy	0.1%	
Speed	-	Resolution	0.01%	
		Accuracy (absolute)	0.01%	
		FREQUENCY CONTROL (VVVF)	ENCODERLESS FLUX VECTOR	FLUX VECTOR WITH ENCODER
Speed Control Range		50 : 1	50 : 1	> 1000 : 1
Speed Control Bandwidth		N/A	20 Rad/s	100 Rad/s
Torque Control Bandwidth		< 1 Rad/s	> 500 Rad/s	> 500 Rad/s
Torque Control Accuracy		≅ 10%	≅ 10%	≅ 5%
Speed Control Accuracy		≅ 1%	≅ 5%	≅ 0.02%

Table 2-4. – Drive Performance Data

## 2.5 DC LINK OVERVOLTAGE TRIP LEVELS

When a motor is braked, power is returned to the drive and the DC link voltage rises. The drive is programmed to trip if the DC link voltage rises to an excessive level, the trip levels are set for the nominal supply voltages and are given in Table 2-5.

	Nominal Supply Voltage			
	400V	480V	600V	690V
<b>Overvoltage Trip Setting ±5V</b>	784	882	1172	1172

Table 2-5. – DC Link Overvoltage Trip Levels

## 2.6 ACOUSTIC NOISE LEVELS

Frame Size	Maximum noise level 1.0 m (39.4 in) in any direction from drive dBA
2	63
4	66
6	76 *
7	80*

Table 2-6. – Acoustic Noise Levels

\* Refer to WARNING in Sections 3.5 and 4.



## 2.7 STANDARDS

The MV3000e AEM product complies with the standards listed below.

### Safety

EN 50178	Electronic equipment for use in power installations.
ANSI / UL508C	Power conversion equipment.
CAN / CSA C22.2-14	Industrial control equipment, industrial products.

### Electromagnetic Compatibility (EMC)

EN 61800-3 (IEC 61800-3)	Adjustable speed electrical power drive systems: Part 3 – EMC product standard including specific test methods.
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In particular, this includes the following immunity requirements:

IEC 61000-4-2	Electrostatic discharge	6 kV contact discharge 8 kV air discharge
IEC 61000-4-3	Electromagnetic field	20 MHz – 1 GHz, 10 V/m
IEC 61000-4-4	Electrical fast transient/burst	2 kV
IEC 61000-4-5	Surge	1 kV line-line 2 kV line-earth

### Ratings/Performance

EN 61800-2 (IEC 61800-2)	Adjustable speed electrical power drive systems:  Part 2 – General requirements - Rating specifications for low voltage adjustable frequency power drive systems.
EN 60146-1-1 (IEC 60146-1-1)	Semiconductor converters. General requirements and line commutated converters.



### 3. INSTALLATION

#### 3.1 INTRODUCTION

This section covers everything which should be considered for the successful installation of an MV3000e drive, to ensure long and trouble-free operation.

Figure 3-1 gives a simple overview of the installation procedure.

Proceed as follows:

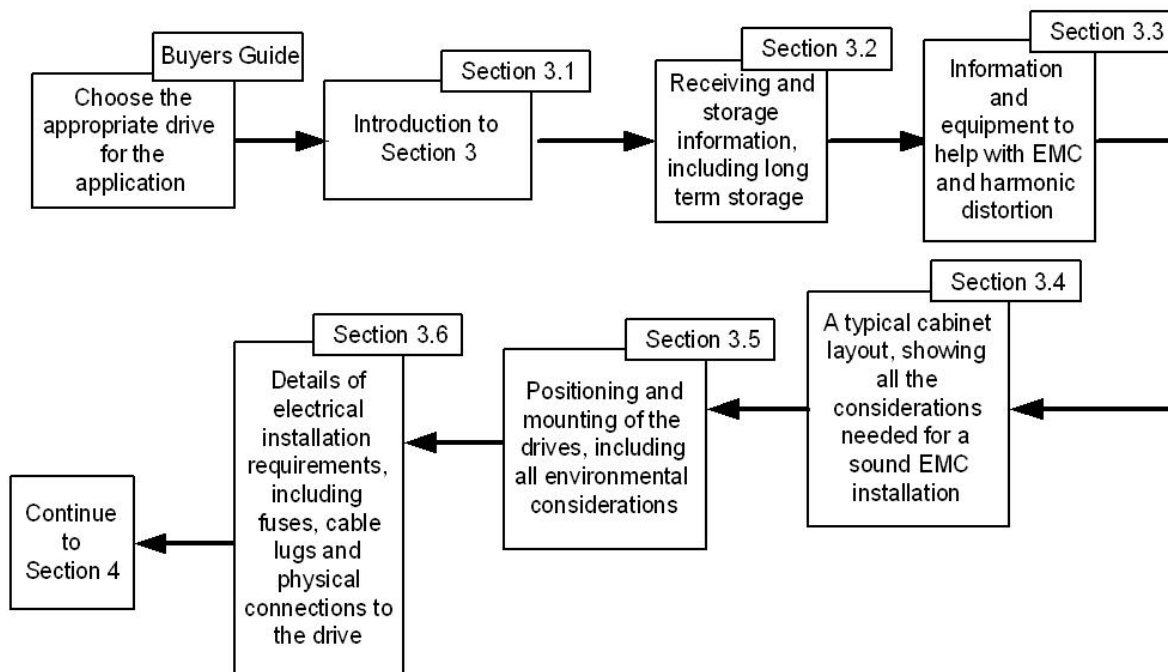


Figure 3-1. – Installation Procedure

#### 3.2 RECEIPT OF EQUIPMENT

##### 3.2.1 Inspection & Storage

Check the contents of the complete consignment against the Delivery Note for any damage, shortages or loss in transit. If any item is found to be damaged or missing, contact GE Power Conversion at the address/telephone number shown at the end of this manual, quoting the following details:

- List of damaged or missing items with names and part numbers.
- Description of damage.
- Delivery Note numbers and dates, and order and item numbers.

##### 3.2.2 Storage

If the product is not to be installed immediately:

- Re-pack it in its original packaging material. If this is not possible it should be enclosed in polythene sheet to protect it from the ingress of dust.
- Store it in a clean, dry atmosphere, preferably at room temperature, ensuring that the storage environment meets the requirements of Section 2.6.
- The product can be stored indefinitely at normal room temperature without the need to re-form the DC link capacitors before use.
- If the product is unpacked in a warm environment condensation may occur. Should condensation be seen, the converter should not be used until its temperature has stabilised to that of the working environment.



### 3.2.3 Handling

#### WARNING

- Items marked with weights greater than 20kg should only be moved with lifting apparatus.

Lifting points incorporating holes for shackles are fitted to the top of each Drive. The lifting points are flush with the case and pull out when required.

Frame size 7 drives are fitted with extra lifting points underneath, so they can be lifted with the doors facing upwards.

A suggested method of lifting is shown in Figure 3-2. Use shackles which are suitable for the weight of the MicroCubicle™. See Section 2.3.

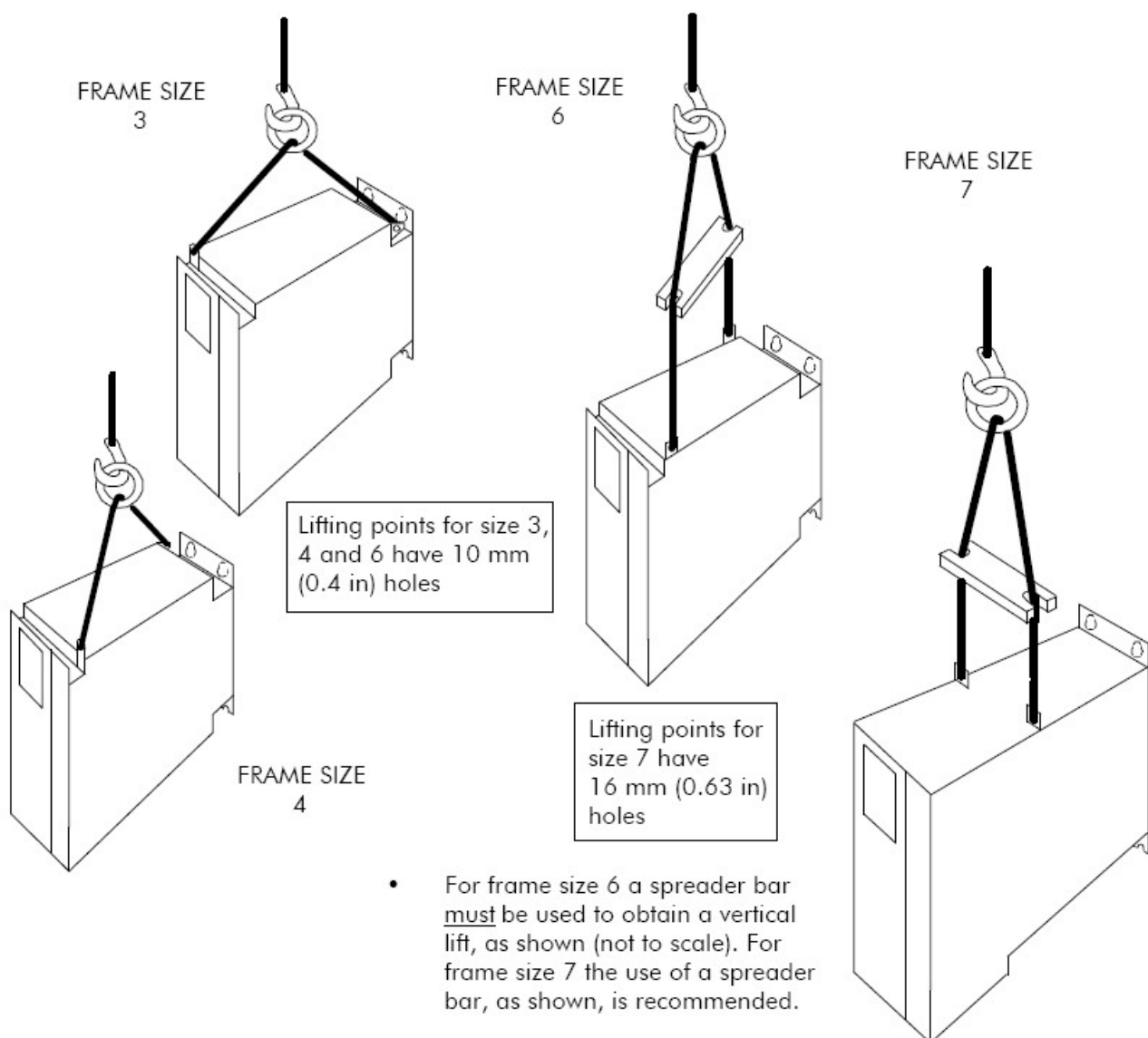


Figure 3-2. – Lifting a Drive

### 3.3 HARMONIC & EMC RECOMMENDATIONS

#### 3.3.1 AC Line Reactors & DC Link Inductors

The MV3000e must be used with an input AC line reactor and may be used with a DC link inductor, depending on the application requirements. The following information will assist correct selection of reactors for use with the drive.

##### 3.3.1.1 AC line reactor:

The line reactor reduces the harmonics generated by the drive and, in conjunction with DC link capacitance inside the drive, protects the drive against supply voltage surges. A 2.2% line reactor is used in the standard installation.

Types of 2.2% line reactors for drives rated at 1.1 and 1.5 overload are shown in Sections 2.1 and 2.2, dimensions are shown in Section 2.4.

##### 3.3.1.2 DC link inductor

A DC link inductor may be used in addition to the AC line reactor where an improved harmonic performance is required. For additional information refer to the Buyer's Guide T1699.

#### 3.3.2 EMC Compliance

MV3000e complies with the requirements of IEC 61800-3 (EN 61800-3), EMC product standard for power drive systems provided that it is installed and used in accordance with the instructions in this manual. Additional standards with which the drive complies are listed in Section 2.9.

EMC filters are not normally required for use in the industrial environment ("second environment according to IEC 61800-3).

If the drive is installed on a public low voltage supply which also supplies domestic premises (first environment" according to IEC 61800-3) then EMC filtering will be required. Filtering will also be required if other items connected to the same supply are sensitive to radio frequency interference or would normally be used in domestic environments.

EMC filters may only be used if the supply neutral is connected to earth (ground) at the source of the supply (also known as TN or TT network). If EMC filters are to be used and there are also thyristor converters (e.g. DC drives) on the same supply, any commutation notches from these converters must not exceed 40%.

For compliance with the limits of EN 50081-2 or the Class A limits of CISPR 11 or the first environment limits of IEC 61800-3, the following items are used:

**EMC filter:** Fitted between the mains supply and the AC line reactor.

**Y-class capacitor boards:** A pair of PCB's which may be fitted inside the drive if an EMC filter is installed, and which provide extra RF filtering to that provided by the EMC filter.

**Ferrite assembly:** Fitted on the output of the drive.

A suggested cabinet layout is shown in Figure 3-3. However, for types, distortion levels, dimensions and installation details of optional equipment refer to documentation supplied with the equipment.



### 3.4 CABINET LAYOUT FOR EMC COMPLIANCE

Figure 3-3 shows the layout for a typical cabinet installation for EMC compliance. The EMC filters and ferrite rings are required for EMC Class A compliance, the associated Y-class capacitor boards (where specified) are installed within the drive.

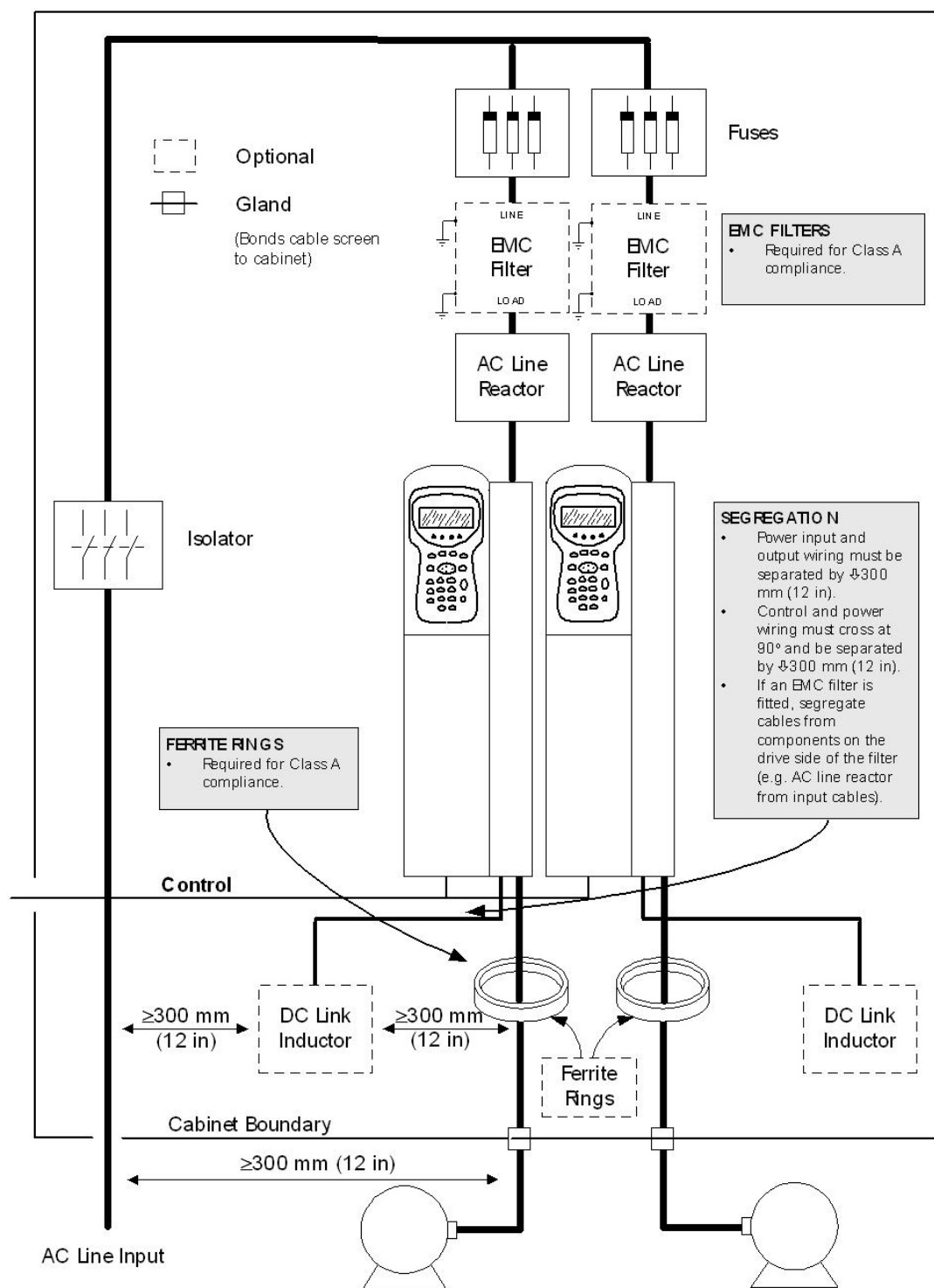


Figure 3-3. – Typical Layout for EMC Compliance

The layout shown is suitable for smaller size drives, large drives have larger auxiliary components which may require floor mounting.

Note that input and output AC cables must be segregated by at least 300 mm (12 in) and that control wiring should always cross AC wiring at 90°.



## 3.5 MECHANICAL INSTALLATION

### 3.5.1 Cooling & Environment

#### Cooling

The heat loss under 1.1/1.5 overload conditions, and typical airflow requirement for each product, including the associated AC line reactors, are shown in Section 2. The effect of these losses must be considered when choosing a location for the drive or when selecting a cabinet. A typical airflow arrangement is shown in Figure 3-4.

If optional equipment is installed, heat losses for these items must also be considered; these losses can be found in the associated manuals.

The drive complies with the requirements for Pollution Degree 2 according to IEC 60664-1, UL 840 and CSA C22.2 No. 0.2-93. Therefore the cooling air must comply with the requirements of Section 2.5, which includes requirements where a dirty air kit is to be fitted.

#### Environment

All bi-directional converters comply with IP20 and NEMA 1. They must be protected from dripping liquids either by use of a suitable enclosure or by the use of a protective canopy available from GE Power Conversion.

The operating environment must comply with the requirements in Section 2.6.

If conductive pollution or condensation are expected (Pollution Degree 3), the drive must be placed in an enclosure which achieves Pollution Degree 2 by:

- Excluding the conductive pollution e.g. by the use of filtered air
- Preventing condensation e.g. by the use of anti-condensation heaters.

#### Noise Levels

The maximum acoustic noise levels generated by MV3000e Drives are shown in Section 2.6.

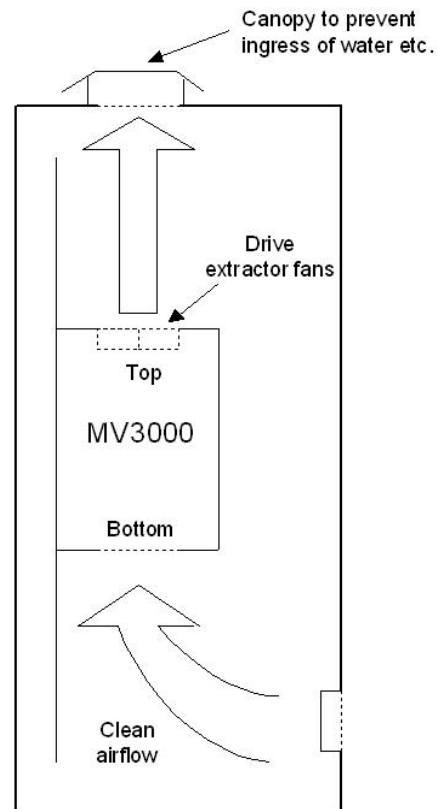


Figure 3-4. – Typical Airflow Arrangement

### 3.5.2 Clearances & Mounting Distances

**NOTE:** The 75 mm (3 in) clearance from the left hand side of the cabinet allows for easy access to control wiring. However, as the control connections are 2-Part and can be separated to facilitate connection of wiring, then this clearance can be reduced to zero.

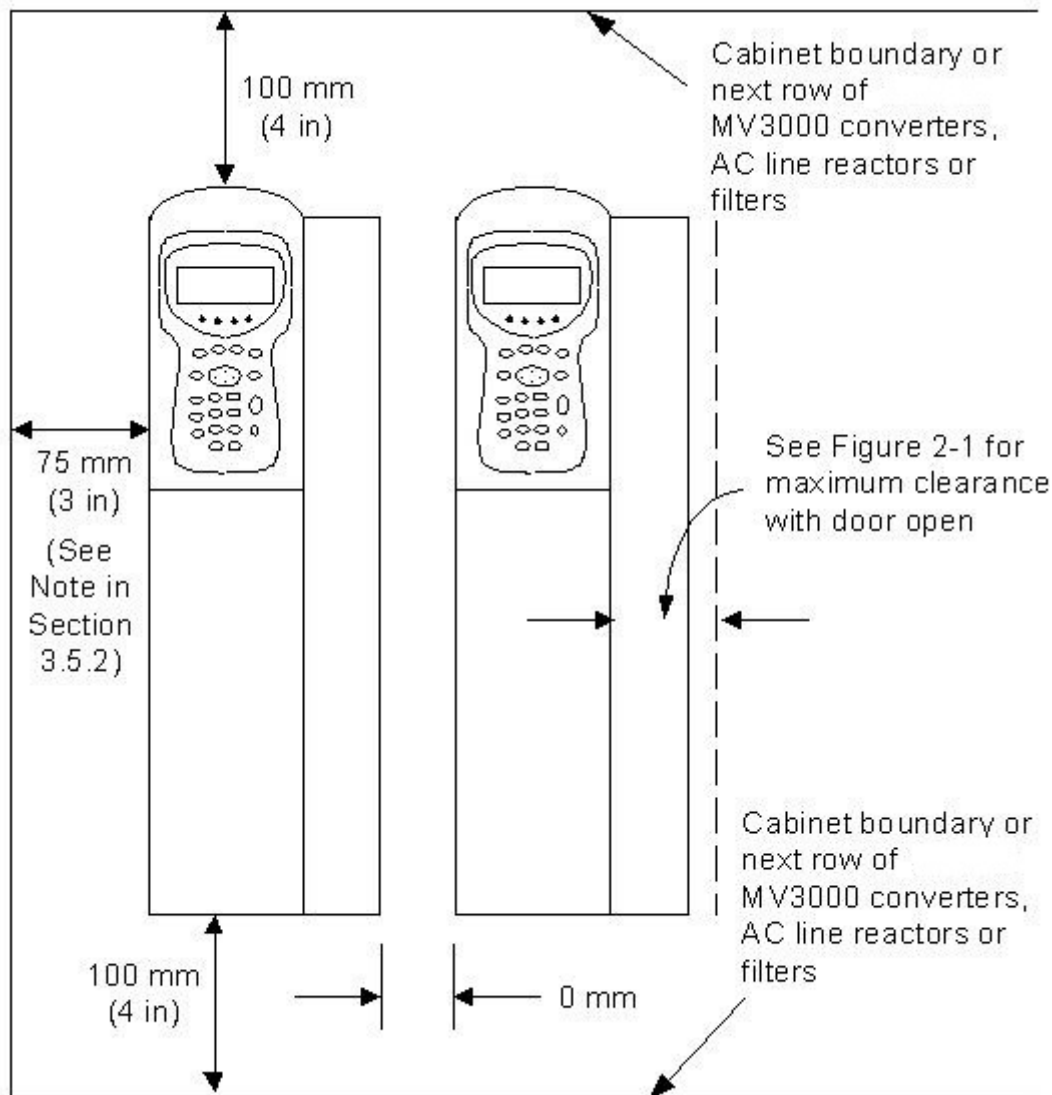


Figure 3-5. – Minimum Recommended Clearances

### 3.5.3 Mounting Checklist

When mounting the product the following five items should be considered, in the order they are shown.

- The position of mounting studs/bolts for all converter frame sizes are shown in Figure 3-6 and Table 3-1. If "dirty air" ventilation is to be used with cabinet mounting, allow space for ducting cut-outs in the panel, above and below the converter.
- The size, weight and fixing dimensions of auxiliary components are given in Section 2. Most of these components can be mounted on a metal component panel with the converter. For larger frame sizes, the line reactor (part /02) may be more suited to floor mounting, due to its weight.
- If a dirty air kit is to be installed for high IP grades (e.g. IP54), read the instructions provided with the kit before mounting the converter.
- Install any required options that fit inside the MicroCubicle™. Installation instructions are provided in the associated publications – refer to Section 9 for available options.
- Mount the converter and ancillary components in the cabinet.

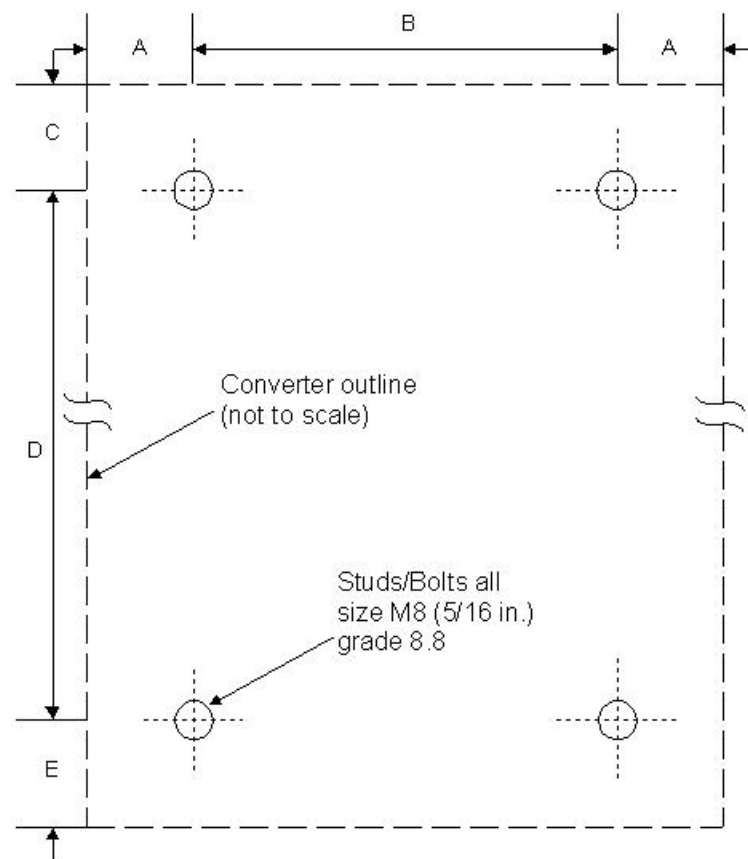


Figure 3-6. – Bolt Stud Locations for Mounting the Converter on a Panel

Dimension	Frame Size			
mm (in)	3	4	6	7
A	35 (1.4)	40 (1.6)	38 (1.5)	47 (1.85)
B	100 (3.9)	175 (6.8)	354 (13.9)	390 (15.4)
C	12 (0.47)	12 (0.47)	20 (0.8)	12 (0.47)
D	578 (22.8)	766 (30)	838 (33.0)	1124 (44.3)
E	10 (0.4)	11 (0.4)	15 (0.6)	15 (0.6)

Table 3-1. – Position of Mounting Studs/Bolts

Maximum length of studs protruding from mounting panel is 25.4 mm (1 in)

## 3.6 ELECTRICAL INSTALLATION

### WARNING

- **High Leakage Current**  
**This equipment and the driven motor(s) must be earthed (grounded).**

### CAUTION

- **Ensure that all conductors connected to this product are mechanically restrained.**

This section contains details on connecting the drive for a basic application.

Details include:

- Fuse ratings, cable sizes and selection.
- Power wiring, supply input and motor output torque settings.
- Control wiring, for control and monitoring.
- Encoder selection and wiring

A simple wiring diagram and brief description of I/O is located inside the front cover.

### 3.6.1.2 Protection Devices Drive Isolation

**NOTE:** The drive must be connected to the mains network via an isolator (disconnect).

The isolator should be rated to carry full load input current, and 1.1 or 1.5 x full load input current (as selected) for 60 seconds, (see Sections 2.1 and 2.2).

If auxiliary supplies (digital outputs, fan supplies) are not fed from this isolator, the isolator for these supplies must be clearly identified.

### 3.6.1.3 Recommended Drive Fuses

Sections 2.1 and 2.2 give the current rating of fuses recommended to protect the drive and typical input cables as shown in Table 3-3, Section 3.6.5. The fuses are shown under two utilisation categories:

IEC rating - Use general purpose fuses class gG or gL according to IEC 60269 and European standards.

Examples - GE Redspot to BS88  
- Bussmann gG to BS88  
- Bussmann with part numbers NH.....G

UL rating - Use general purpose class RK1 fuses according to UL 248-12, or class J fuses according to UL 248-8.

Examples - Bussmann LPS\_RK\_SP  
- Bussmann LPJ\_SP

These fuses may not prevent damage to the inverter in the event of short circuits on the DC link and other components.

When choosing fuses for a specific application, the user must also comply with local safety regulations.



### 3.6.1.4 Recommended Fan Fuses

Frame size 3 drives have DC-fed fans supplied internally. All other drives have AC-fed fans supplied via an internal transformer. Sections 2.1 and 2.2 give the current ratings of fuses (external to the drive) recommended to protect the transformer supply. These fuses are shown below in two utilisation categories:

IEC rating - Use general purpose fuses class gG or GL

Examples - Gould 160..-G for drives rated 400 V  
- Gould 170..-G for drives rated 480 V, 690 V

UL rating - Use class CC time delay fuses

Examples - Gould ATQR range  
- Bussmann FNQ-R range

Fuse holders are available from the fuse suppliers.

### 3.6.2 Cable Lugs & Recommended Torque Settings

Copper or plated copper cable lugs may be used. Table 3-2 shows the size of suitable studs for each frame size, and gives recommended cable lug sizes and torque settings.

Frame Size	Stud Size	Use Lug Size	Torque Settings	
			Nm	lbf in
3	M6	M6 or 1/4 in.	8	70
4	M8	M8 or 5/16 in.	15	130
6	M10	M10 or 3/8 in.	30	265
7	M12	M12 or 1/2 in.	45	400

Table 3-2. – Drive Stud Sizes, Cable Lugs & Torque Settings

### 3.6.3 Suitability of Motors & Cables

To avoid EMC problems, the motor cable should be screened (e.g. NYCWY according to VDE 0276 or steel wire armoured) or fully enclosed in metallic trunking. The screen or metallic trunking must be continuous throughout its length and be connected directly to both the drive cabinet and the motor.

Outside the drive cabinet the motor cable must be segregated from other cables by at least 300 mm (12 in).

Motors with Insulation Peak Voltage Withstand ratings of 1200 V (400 V motors), 1500 V (500 V motors) and 2250 V (690 V motors) can be operated with MV3000e without risk to the motor winding insulation, for cable lengths up to 500 m (1640 ft). Such motors are available from reputable manufacturers, as standard motors up to 500 V and with an enhanced insulation system for voltages greater than 500 V up to 690 V. For lower quality motors a dv/dt filter will be required.

**NOTE:** If a high control bandwidth (Vector control) is required from the MV3000e, dv/dt filters cannot be used. Cable the motor directly to the drive.

If (outside the drive enclosure) parallel motor cables are used, or if the cable size is greater than the maximum permitted value detailed in Table 3-3, output inductors should be used. Contact GE Power Conversion for details.



### 3.6.4 Encoders & Encoder Cables

#### 3.6.4.1 Encoder Selection

Only encoders having RS422A output (A/B/Z) can be used (a marker pulse is only required when using the drive's position controller).

The MV3000e is equipped with two power supplies to power various encoders which may be used. There are two acceptable types of encoder:

##### **Encoders requiring +5 V supply and producing RS422A output.**

For these encoders use TB5/4 (+5 V) to supply them and in cases where long cable runs cause supply volts drop to the encoder, parameter P13.06 will allow this supply voltage to be adjusted between +4.5 V to +6.5 V. Refer to the guided commissioning charts in Section 4.6 for details. If the sense wires are connected (FB+ and FB-) at the encoder end of the cable, the MV3000e will automatically adjust the encoder supply accordingly.

##### **Encoders requiring +24 V supply and producing RS422A output.**

**For these encoders use TB5/6 (+24 V).**

Encoders requiring +24 V supply and producing 24 V differential output are NOT compatible with the MV3000e, the pulse train must be RS422A.

#### 3.6.4.2 Encoder Resolution

For accurate speed control, especially at low speeds, a resolution ("line count") of no less than 1024 pulses per revolution is suggested.

There are two limits on the maximum line count for the chosen encoder. The line count must comply with both of the following conditions:

- The line count must be less than or equal to 64 000 pulses per revolution (due to the drive software).
- The time delay between an edge on encoder channel A and an edge on channel B must be greater than 333 ns at the required top speed of the motor.

Due to imperfections in encoder manufacture, the edges are not equally spaced. Some encoder manufacturers quote the minimum edge separation in electrical degrees. This is 90° for a perfect encoder but can be as low as 40°.

For a given required top speed and encoder minimum edge separation, the line count must not exceed:

$$Max\_Line\_Count = \frac{500 \times 10^3 \times (Min\_Edge\_Separation)}{Required\_Top\_Speed}$$

where:

Min\_Edge\_Separation is in electrical degrees

Required\_Top\_Speed is in rev/min.

If the encoder manufacturer quotes a "scribing error" in electrical degrees, then

Min\_Edge\_Separation = 90 - Scribing\_Error.

If the encoder manufacturer quotes a symmetry of  $180^\circ \pm x^\circ$  and a quadrature phase shift of  $90 \pm y$ , then

Min\_Edge\_Separation =  $90 - x - y$ .

### 3.6.4.3 Encoder Mounting

For vector control mode, the mechanical coupling between motor and encoder is critical and any eccentricity in the mechanical coupling will impair performance. The best solution is a motor built with an integral shaft encoder, otherwise accurate alignment of encoder with motor shaft is very important.

An encoder may be used to perform position control. For position control in frequency control or encoderless vector control modes, an encoder or linear scale may be mounted on the controlled plant.

### 3.6.4.4 Encoder Screening

The encoder wires, including the encoder power supply wires, must be contained in a screened cable and the screen must be connected to the M4 screw adjacent to connector TB5. The screen must be continuous throughout its length and must be grounded at both ends, as shown on the wiring diagram inside the front cover.

## 3.6.5 Power Cable Selection and Control Wiring

### 3.6.5.1 Power Cables

All cables must have copper conductors.

Cable sizes must comply with local safety regulations. In addition:

- All drives can accept cables rated 70°C (158°F) to 120°C (248°F).
- Drives rated below 100A motor current (frame size 3 and some in frame size 4) can also accept cables rated at 60°C (140°F).

Table 3-3 shows the maximum permitted cable size for each drive. In the table, drives are grouped by order of nominal supply voltage as defined in Sections 2.1 and 2.2. The cable data shown for 690 V is for operation at 690 V only.

Table 3-3 also shows some typical cable sizes, which may be used in the following conditions:

- Metric cable sizes for single core or multicore copper cable with 70°C (158°F) PVC insulation, clipped to a surface in air, in a 30°C (86°F) ambient, based on IEC 60364-5-523. These sizes are also suitable for steel wire armoured cable according to BS 7671, or NYCWY cable according to VDE 0276-603 installed in the same conditions.
- USA/Canadian cable sizes for copper conductors with 75°C (167°F) insulation in a raceway, or cable in a 30°C (86°F) ambient, based on NFPA 70-1999.

Table 3-3. – Power Cable Sizes										
		Max. Permitted Cable Sizes (Physical Limitation)			Typical Sizes (Section 3.6.5) (1.1 overload duty)			Typical Sizes (Section 3.6.5) (1.5 overload duty)		
Drive	Frame Size	Metric	USA/Canadian		Metric	USA/Canadian		Metric	USA/Canadian	
		mm <sup>2</sup>	AWG	MCM	mm <sup>2</sup>	AWG	MCM	mm <sup>2</sup>	AWG	MCM
400 V										
MV3058A4A1	3	50	1	-	16	4	-	10	6	-
MV3071A4A1	3	50	1	-	25	3	-	16	4	-
MV3086A4A1	4	95	4/0	-	35	2	-	25	3	-
MV3105A4A1	4	95	4/0	-	50	1/0	-	35	2	-
MV3140A4A1	4	95	4/0	-	70	3/0	-	50	1/0	-
MV3168A4A1	6	2x240	-	2x500	95	4/0	-	70	3/0	-
MV3203A4A1	6	2x240	-	2x500	120	-	300	70	3/0	-
MV3204A4A1	6	2x240	-	2x500	120	-	300	95	4/0	-
MV3244A4A1	6	2x240	-	2x500	185	-	400	120	-	300
MV3292A4A1	6	2x240	-	2x500	185	-	500	185	-	400
MV3364A4A1	6	2x240	-	2x500	240	-	2x350	185	-	500
MV3449A4A1	7 (Note 1)	2x300	-	2x600	2x185	-	2x500	240	-	2x350
MV3503A4A1	7 (Note 1)	2x300	-	2x600	2x240	-	2x600	2x185	-	2x500



**Table 3-3. – Power Cable Sizes**

		Max. Permitted Cable Sizes (Physical Limitation)			Typical Sizes (Section 3.6.5) (1.1 overload duty)			Typical Sizes (Section 3.6.5) (1.5 overload duty)		
Drive	Frame Size	Metric	USA/Canadian		Metric	USA/Canadian		Metric	USA/Canadian	
		mm²	AWG	MCM	mm²	AWG	MCM	mm²	AWG	MCM
MV3566A4A1	7 (Note 1)	2x300	-	2x600	2x240	(Note 2)		2x185	-	2x500
480 V										
MV3052A5A1	3	50	1	-	16	4	-	6	8	-
MV3065A5A1	3	50	1	-	25	4	-	16	4	-
MV3077A5A1	4	95	4/0	-	25	3	-	25	4	-
MV3096A5A1	4	95	4/0	-	35	1	-	25	3	-
MV3124A5A1	4	95	4/0	-	70	2/0	-	35	1	-
MV3156A5A1	6	2x240	-	2x500	95	4/0	-	70	2/0	-
MV3179A5A1	6	2x240	-	2x500	95	-	250	70	3/0	-
MV3180A5A1	6	2x240	-	2x500	95	-	250	95	4/0	-
MV3240A5A1	6	2x240	-	2x500	185	-	400	95	-	250
MV3302A5A1	6	2x240	-	2x500	240	-	2x250	185	-	400
MV3361A5A1	7 (Note 1)	2x300	-	2x600	240	-	2x350	240	-	2x250
MV3414A5A1	7 (Note 1)	2x300	-	2x600	2x185	-	2x500	240	-	2x350
MV3477A5A1	7 (Note 1)	2x300	-	2x600	2x240	-	2x600	2x185	-	2x500
600 V										
MV3062A6A1	4	95	4/0	-	25	4	-	16	4	-
MV3077A6A1	4	95	4/0	-	25	3	-	25	4	-
MV3099A6A1	4	95	4/0	-	50	1/0	-	25	3	-
MV3125A6A1	6	2x240	-	2x500	70	2/0	-	50	1/0	-
MV3144A6A1	6	2x240	-	2x500	70	3/0	-	70	2/0	-
MV3192A6A1	6	2x240	-	2x500	120	-	300	70	3/0	-
MV3242A6A1	6	2x240	-	2x500	185	-	400	120	-	300
MV3289A6A1	7 (Note 1)	2x300	-	2x600	185	-	2x250	185	-	400
MV3336A6A1	7 (Note 1)	2x300	-	2x600	240	-	2x300	185	-	2x250
690 V										
MV3062A6A1	4	95	4/0	-	16	N/A		16	N/A	
MV3077A6A1	4	95	4/0	-	35	N/A		16	N/A	
MV3099A6A1	4	95	4/0	-	35	N/A		35	N/A	
MV3125A6A1	6	2x240	-	2x500	50	N/A		35	N/A	
MV3144A6A1	6	2x240	-	2x500	70	N/A		50	N/A	
MV3192A6A1	6	2x240	-	2x500	95	N/A		70	N/A	
MV3242A6A1	6	2x240	-	2x500	120	N/A		95	N/A	
MV3289A6A1	7 (Note 1)	2x300	-	2x600	185	N/A		120	N/A	
MV3336A6A1	7 (Note 1)	2x300	-	2x600	185	N/A		185	N/A	
MV3382A6A1	7 (Note 1)	2x300	-	2x600	240	N/A		185	N/A	
Note 1:	Alternatively, busbars may be connected to frame size 7 drives. The maximum permitted busbar sizes are: AC connections: 51 mm x 6.4 mm (2" x ¼") DC connections: 76 mm x 6.4 mm (3" x ¼") When busbars are used the fingerguard must be removed and the installer must provide alternative protection against contact with live parts.									
Note 2:	Cables rated according to the above rules are too large for this connection. Use high temperature cables or busbars.									

### 3.6.5.2 Control Wiring

Wiring connected to the I/O panel should have a cross section between limits of:

**Minimum** 0.5 mm<sup>2</sup> or 20 AWG \* (Use a consolidating crimp for smaller wires).

**Maximum** 2.5 mm<sup>2</sup> or 14 AWG





### 3.6.6 Cable Segregation

Control and encoder cables must be segregated from power cables as shown in Section 3.4.

### 3.6.7 Access to Electrical Connections

(Refer to Figure 3-6).

#### WARNING

- This equipment may be connected to more than one live circuit. Disconnect all supplies before working on the equipment.
- Wait at least 6 minutes after isolating supplies and check that the voltage between DC+ and DC- has reduced to a safe level before working on this equipment.

#### CAUTION

- Where nuts, bolts and washers are supplied fitted to the busbar, remove these fasteners, place the user's crimp (or busbar) directly against the terminal busbar of the unit and refit the fasteners. This is to prevent large currents flowing through steel fasteners and causing overheating.
- Ensure that all conductors connected to this equipment are mechanically restrained.

**NOTE:** The equipment can remain energised by the motor after supplies have been removed. The installer should place a label, carrying the above warning, adjacent to the enclosure isolator (disconnect switch).

The location of electrical connectors is shown in Figure 3-6 (frame sizes 3 and 4), Figure 3-9 (frame size 6) and Figure 3-10 (frame size 7). All units have two doors, for accessing control and power connections.

Sections 3.6.8 and onwards show how to lay out the cables.

#### 3.6.7.1 Access to Control Connections

- a) Open the "control" door under the keypad harbour by carefully pulling the bottom of the door and the depression at the top.

#### 3.6.7.2 Access to Power Cable Connections

- a) Open the control door as above.
- b) Release the two screws "A" securing the "power" door.
- c) Swing the door open.



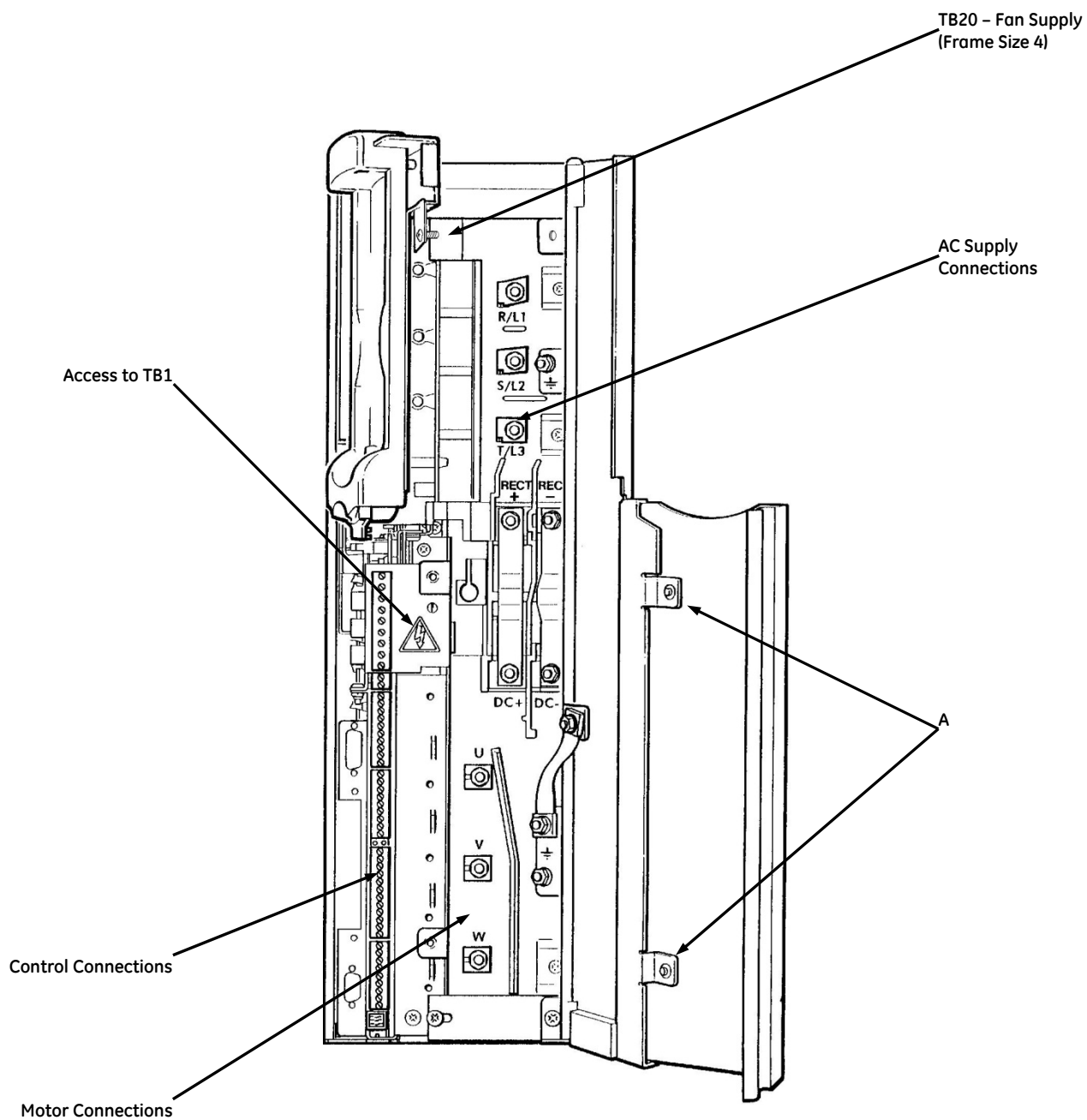


Figure 3-7. – Typical Front View with doors open  
Showing Electrical Connectors

### 3.6.8 Control Connections

- a) Referring to Figure 1 and to Figure 3-8, connect the control cables as required.. Multicore screened cables should always be used, except for TB1, TB2 and TB3, where screened cable is not mandatory.
- b) For each screened cable, crimp the braid to an M4 (No. 8 or 3/16 in) ring crimp and secure it to the chassis with the M4 screw provided.
- c) Use cable ties to secure all cables to cable saddles.
- d) External cables must be secured as close as possible to the drive.
- e) Secure the plastic access cover over TB1 using the screw provided.
- f) The control door cannot be locked. However, the user may connect voltages in excess of 42.4 V d.c. to TB3. If this is done and compliance with UL508C or CSA C22.2 No. 14 is required, the MicroCubicle™ must be installed in a suitable enclosure with restricted access.

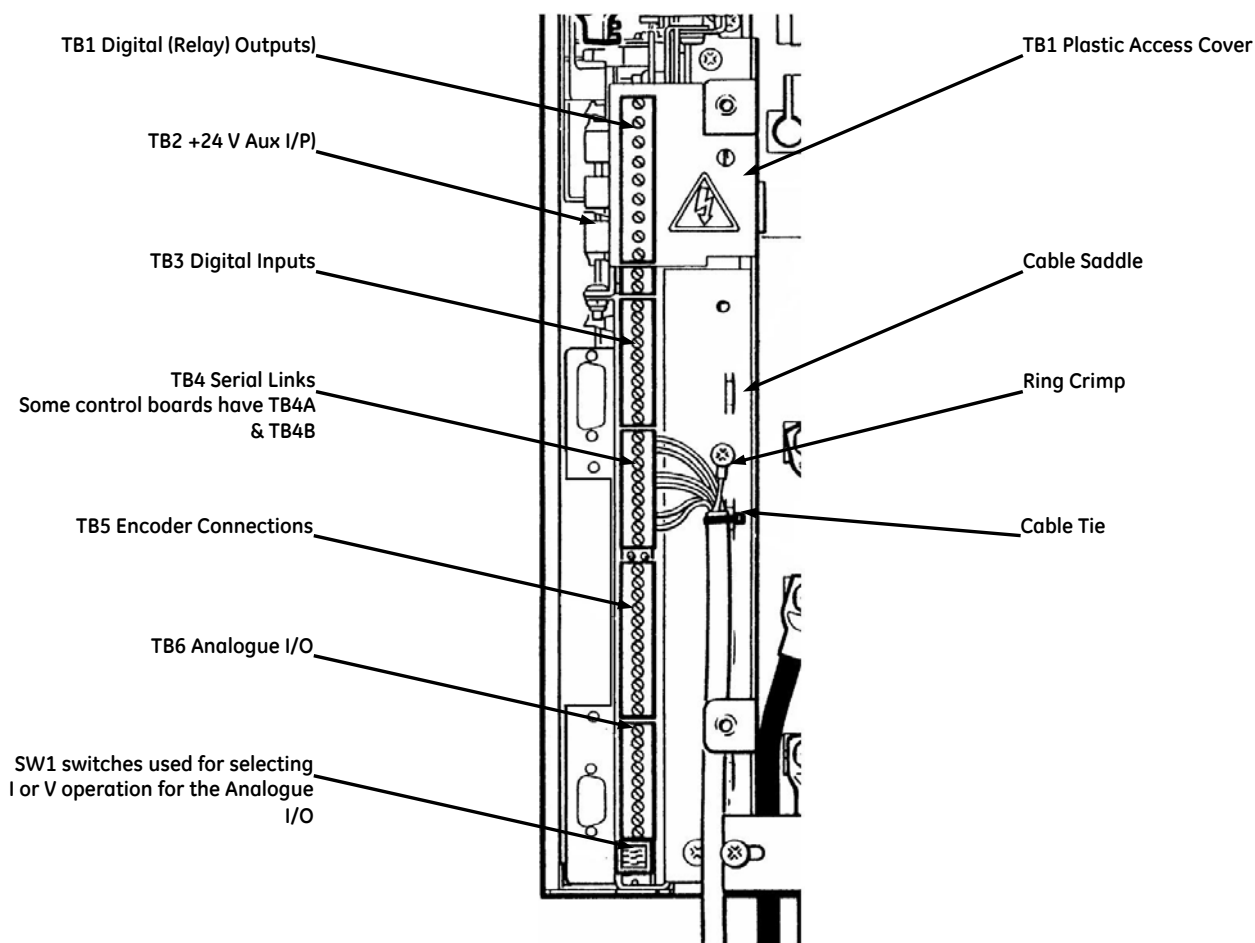


Figure 3-8. – Control Connections

### 3.6.9 Power Connections: Frame Sizes 3 & 4

Frame sizes 3 and 4 have a similar connector layout (Figure 3-9). The means of connecting supply and motor cables is also similar, so the procedure and illustration are given for frame size 3 only. The connection of control cables is the same for all frame sizes.

### 3.6.9.1 Connecting the AC Supply Cables

- a) Loosen the captive screw securing the Keypad harbour to floating nut "A". (On frame size 4 remove the front finger guard).
- b) Swing the harbour out to gain access to the AC Supply connectors. On some frame size 3 models the harbour is backed with sponge rubber to prevent finger access to the connectors.
- c) For other frame size 3 and all frame size 4, make holes in the plastic finger guard by breaking off removable parts to allow cable entry.
- d) Connect the AC supply cables to terminals R/L1, S/L2 and T/L3 on the drive.
- e) Connect the earth (ground) cable to the drive terminal marked  $\oplus$ . The earth cable must be the same size as the power cable unless local safety regulations require a larger size.
- f) Tighten the connections to the torque values shown in Table 3-2.
- g) If the AC supply cable is screened or armoured, terminate the screen at a gland where the cable enters the cabinet.

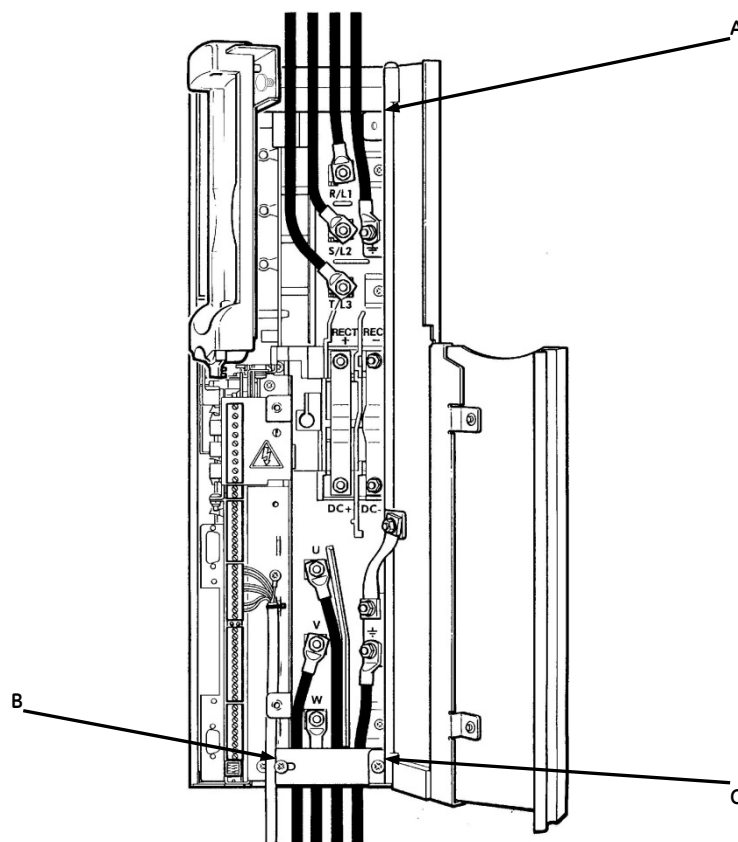


Figure 3-9. – Power Connections for Frame Sizes 3 & 4

### 3.6.9.2 Fan Connections (Frame size 4)

- a) For frame size 4 drives, remove the plastic screen from the fan supply connector TB20 (see Figure 3-7).
- b) Connect any two phases of the AC supply, via fuses (see Section 3.6.1, also Tables 2-1 and 2-2), between the Common terminal and the terminal for the correct line voltage. Re-fit the plastic shroud.
- c) Swing the Keypad harbour into position and secure with the captive screw. On frame size 4, re-fit the plastic finger guard.

External cables must be secured as close as possible to the drive; for Frame Size 4 this includes the fan supply cables.

- d) Connecting the Motor Cables For frame size 3 models fitted with a cable access plate, slacken screw C, remove bolt B and withdraw the cable access plate.
- e) For other frame size 3 and for all frame size 4 models, remove the plastic finger guard strips by unscrewing the taptite screws. Retain strips and screws.
- f) Connect the motor supply cables to terminals U, V and W on the drive.
- g) Connect the earth (ground) cable to the drive terminal marked  $\oplus$ . The earth cable must be the same size as the power cable unless local safety regulations require a larger size.
- h) Tighten the connections to the torque values shown in Table 3-2.
- i) For frame size 3 models fitted with a cable access plate (Figure 3-9), fit the plate and secure using bolt B. Tighten screw C.  
For frame size 3 models having no access plate, and for all frame size 4 models, fit plastic fingerguard strips at cable entry/exit points, breaking off plastic as required to fit round the cables, then secure with taptite screws.
- j) Close and secure the power door, close the control door.
- k) External cables must be secured as close as possible to the drive.
- l) Terminate any motor cable screen or conduit at the gland where the cable exits the cabinet.

### 3.6.10 Power Connections – Frame Size 6

The power connector layout for frame size 6 is shown in Figure 3-10.

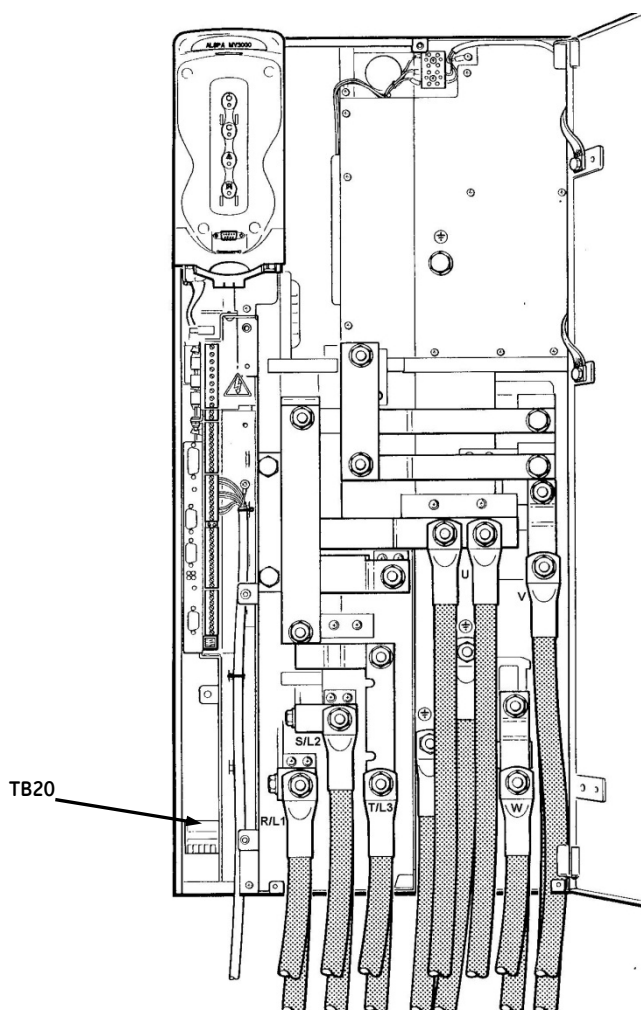



Figure 3-10. – Power Connections for Frame Size 6  
Showing Parallel Cabling


### 3.6.10.1 Connecting the AC Supply Cables

- a) Refer to Figure 3-10 and connect the AC supply cables to terminals R/L1, S/L2 and T/L3 on the drive.
- b) Figure 3-10 Power connections for frame size 6, showing parallel cabling
- c) Connect the earth (ground) cable to the drive terminal marked . The earth cable must be the same size as the power cable unless local safety regulations require a larger size.
- d) Tighten the connections to the torque values shown in Table 3-2.
- e) If the AC supply cable is screened or armoured, terminate the screen at a gland where the cable enters the cabinet.

### 3.6.10.2 Fan Connections

- a) Remove the plastic shroud from the fan supply connector TB20 (see Figure 3-7).
- b) Connect any two phases of the AC supply, via fuses (see Section 3.6.1 and Tables 2-1, 2-2), between the Common terminal and the terminal for the correct line voltage. Re-fit the plastic shroud.
- c) External cables must be secured as close as possible to the drive.


### 3.6.10.3 Connecting the Motor Cables to Frame Size 6

- a) Referring to Figure 3-10, connect the motor supply cables to terminals U, V and W on the drive.
- b) Connect the earth (ground) cable to the drive terminal marked . The earth cable must be the same size as the power cable unless local safety regulations require a larger size.
- c) Tighten the connections to the torque values shown in Table 3-2.
- d) Fit plastic finger guard strips at the drive cable entry/exit points as required, breaking off the plastic, as appropriate, to allow the cables to pass through. Secure the finger guard strips with taptite screws provided.
- e) Close the power door, secure with screws A (Figure 3-7), close the control door.
- f) External cables must be secured as close as possible to the drive, this includes the fan supply cables.
- g) Terminate the motor cable screen or conduit at the gland where the cable exits the cabinet..

## 3.6.11 Power Connections – Frame Size 7

The power connector layout for frame size 7 is shown in Figure 3-10.

### 3.6.11.1 Connecting the AC Supply Cables

- a) Referring to Figure 3-10, connect the AC supply cables to terminals R/L1, S/L2 and T/L3 on the drive. Note that the diagram shows parallel connections.
- b) Connect the earth (ground) cable to one of the two earth terminals marked  as shown on the diagram. The earth cable must be the same size as one of the power cables unless local safety regulations require a larger size.
- c) Tighten the connections to the torque values shown in Table 3-2.

If the AC supply cable is screened or armoured, terminate the screen at a gland where the cable enters the cabinet.

### 3.6.11.2 Fan Connections

- a) Release the screw X securing the plastic shroud over fan connector TB20, rotate the shroud upwards and clip it behind the metal dowel Y.
- b) Connect any two phases of the AC supply, via fuses, between the Common terminal and the terminal for the correct line voltage. Close and secure the plastic shroud.

External cables must be secured as close as possible to the drive.

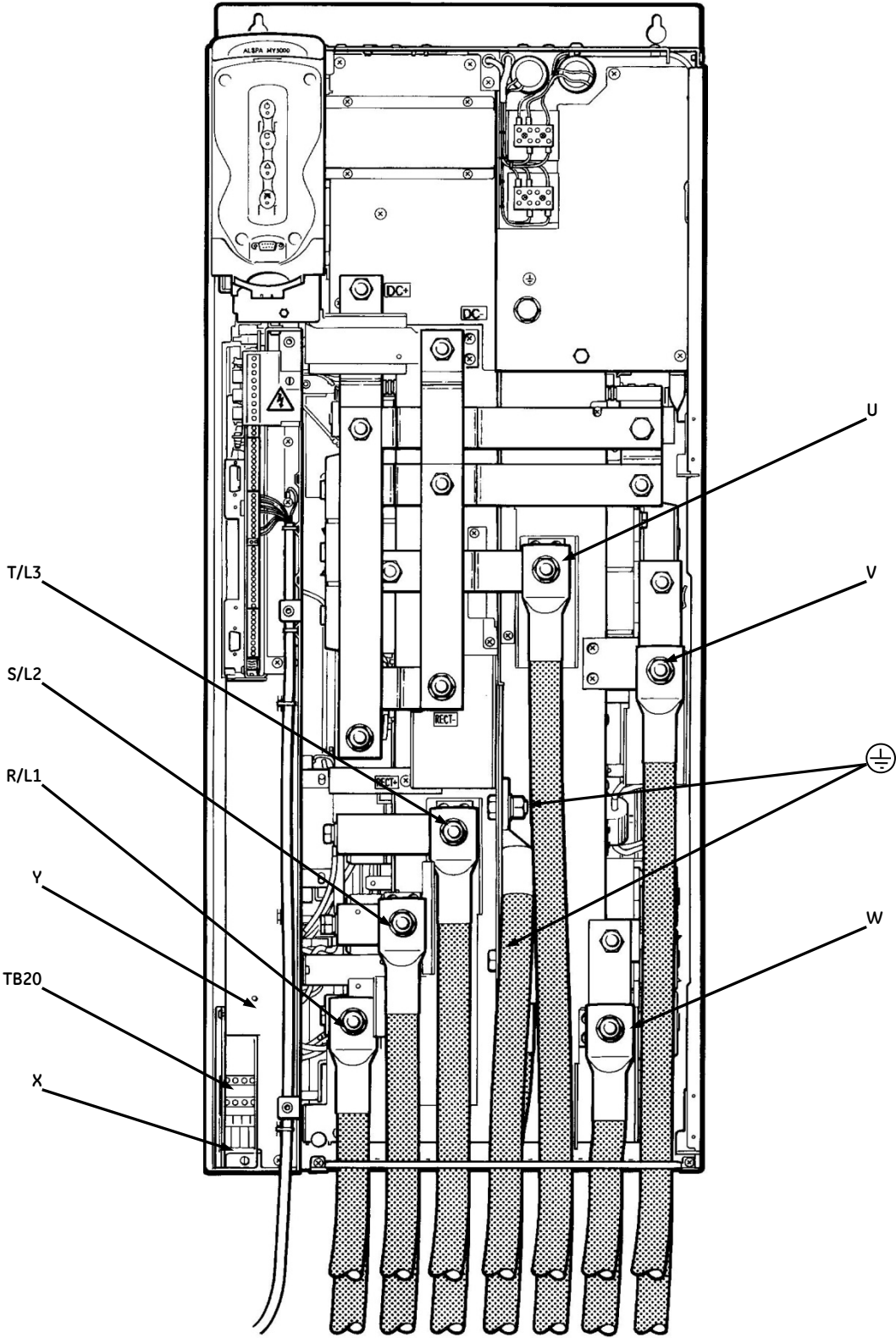


Figure 3-11. – Power Connections for Frame Size 7



### 3.6.11.3 Connecting the Motor Cables to Frame Size 7

- a) Referring to Figure 3-12, connect the motor supply cables to terminals U, V and W on the drive. Note that the diagram shows paralleled connections. For making parallel connections with smaller cable sizes, copper spacers have been provided to space the crimps off the busbars, as shown in Figure 3-11. Where sizes above 2x300 mm<sup>2</sup> are required (2x600 MCM), insulated busbars may be connected directly to the terminals.
- b) Connect the earth (ground) cable to the second drive terminal marked  $\oplus$  as shown in the diagram. The earth cable must be the same size as one of the power cables unless local safety regulations require a larger size.
- c) Tighten the connections to the torque values shown in Table 3-2.
- d) Fit plastic finger guard strips at the drive cable entry/exit points as required, breaking off the plastic, as appropriate, to allow the cables to pass through. Secure the finger guard strips with taptite screws provided.
- e) Close the power door; secure with screws A (Figure 3-7). Close the control door.
- f) External cables must be secured as close as possible to the drive; this includes the fan supply cables.
- g) Terminate the motor cable screen or conduit at the gland where the cable exits the cabinet.

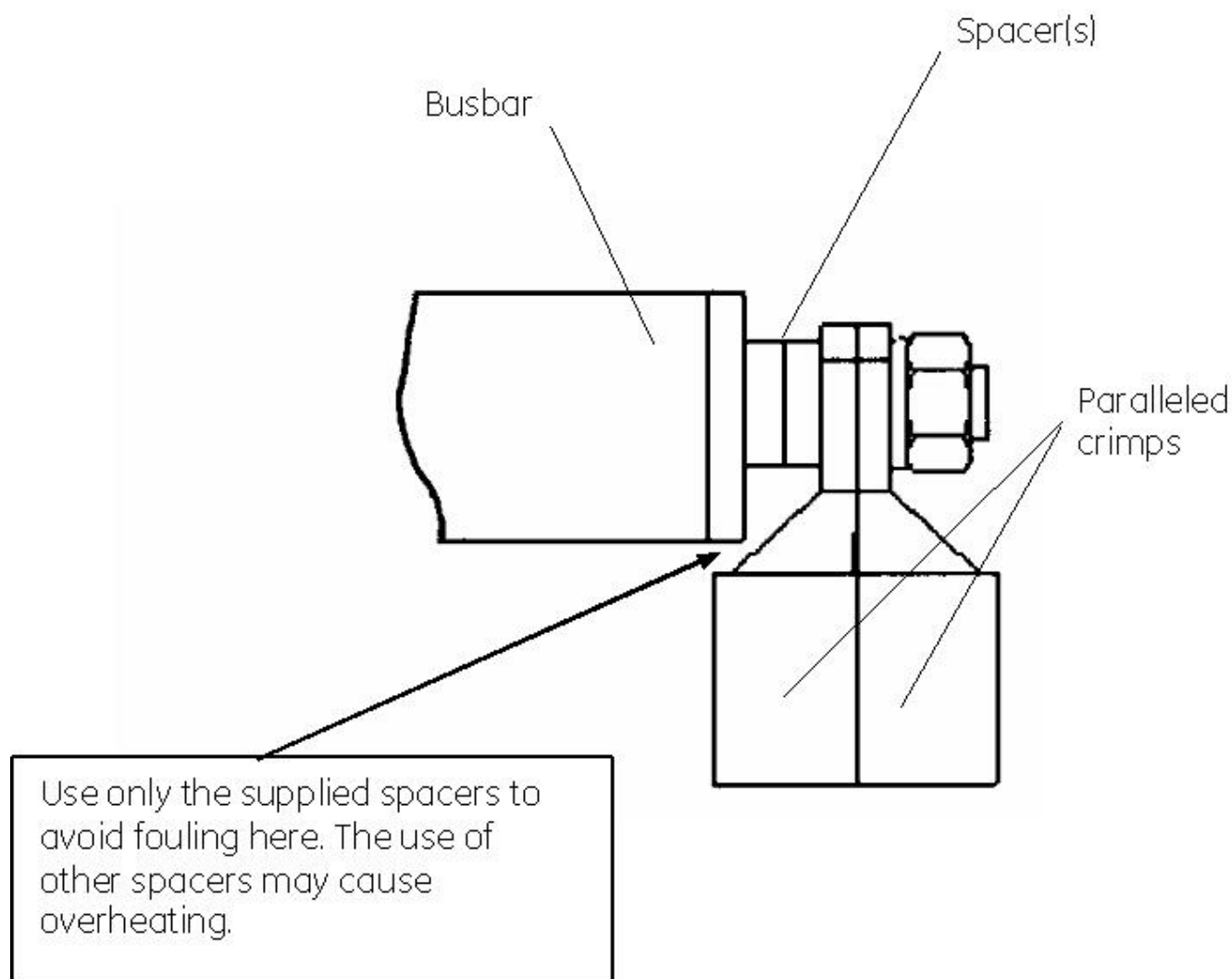


Figure 3-12. – Use of Spacers to Avoid Fouling Busbar



## 4. COMMISSIONING

### WARNING

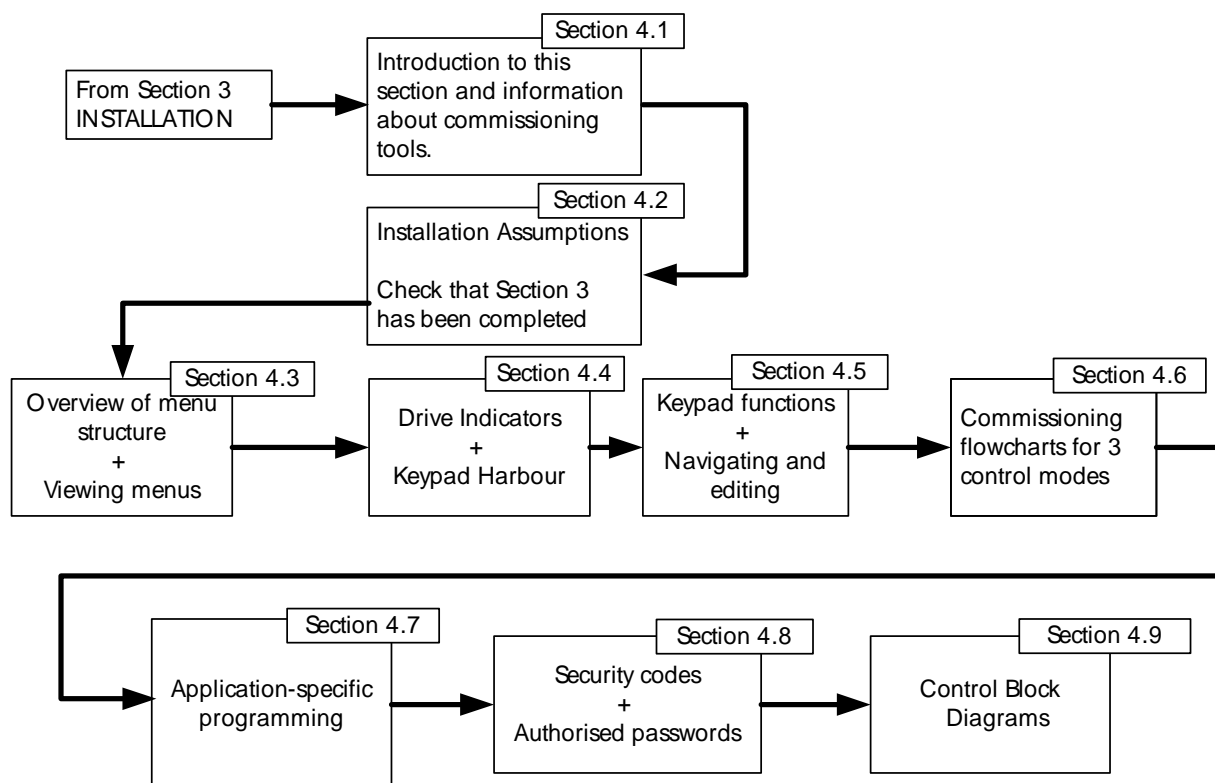
- This equipment may be connected to more than one live circuit. Disconnect ALL supplies before working on the equipment.
- Wait at least 6 minutes after isolating supplies and check that the voltage between DC+ and DC- has reduced to a safe level before working on this equipment.
- All items exposing high voltage must be placed in a suitable enclosure with restricted access.
- Do NOT use mobile phones or walkie talkies within 2 metres (6 feet) of the equipment.
- The combined audible noise emitted by fans in an installation can be greater than 70dB (A), dependant on the air flow path.  
Measure the audible noise level in the installation.  
When the audible noise level exceeds 70dB (A), appropriate warning notices should be displayed.

### CAUTION

- High voltage insulation tests can damage this equipment.  
Cables/external components to be insulation tested must be disconnected from this equipment.

### 4.1 INTRODUCTION

This section shows how to easily commission a simple stand-alone drive unit for a basic application. The flowchart below shows how commissioning is carried out in simple steps:



When the drive unit leaves the factory it is programmed with sensible default values for all parameters.

During commissioning the user is given the opportunity to amend the values of some of these parameter to allow the motor to turn in one of the three motor control modes. However, if needed follow the installation instructions and press RUN from the digital I/O – the drive will safely run in frequency control mode. Refer to Section 4.3.3 for details of the default settings.

Commissioning is carried out by using the Drive Data Manager™, which provides Keypad functionality to enter values for various parameters – the user is guided through the process, simply following the procedure given in flowcharts provided in Section 4.6.3. Once basic commissioning is complete, further application-specific parameters may require setting. Section 4.7 explains how to customise the drive.

The MV3000e can be commissioned from a PC by using Drive Coach. Refer to Section 8 for further information.

## 4.2 INSTALLATION ASSUMPTIONS

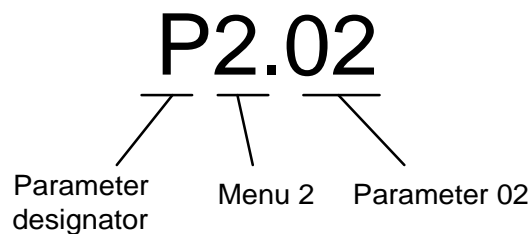
The commissioning procedure assumes that the drive unit has been correctly installed as described in Section 3. Check against the flowchart in Section 3.1.

## 4.3 MENU STRUCTURE OVERVIEW

### 4.3.1 Parameters

The MV3000e software uses system constants, scaling factors and other data (collectively referred to as PARAMETERS), which are arranged into MENUS for ease of use. Menus group parameters by like function e.g. Menu 6 is Ramp Settings. The complete menu listing is shown in Table 4-1.

Every parameter has a Parameter Number comprising a designator (prefix) P, followed by the menu number and the number of the parameter, separated by a decimal point. For example the MOTOR FULL LOAD CURRENT parameter in Menu 2 has the Parameter Number P2.02. See below.



Menu	Description	Menu	Description
1	User configured menu	38	Position controller monitor (encoder only)
2	Basic motor settings	39	Menu 1 Setup Menu
3	Frequency control settings	40	Summing nodes settings
4	Start and stop control	41	Programmable status word settings
5	Speed reference settings	42	Pointer source settings
6	Ramp settings	43	Load fault detection window settings
7	Plant I/O settings	44	Reference shaper settings
8	Torque limit settings	45	Drive temperature monitoring
9	Basic drive monitoring	46	Ridethrough Menu
10	Trips and warnings	47	Second Logic Menu
11	Advanced drive monitoring	54	Mains Monitor Menu
12	Motor advanced settings (vector only)	55	Machine Bridge Control Menu
13	Speed feedback settings (vector only)	58*	CANopen Extended I/O Settings CAN Port 2
14	Speed loop settings (vector only)	59	CANopen extended I/O settings
15	Torque reference settings (vector only)	60	CANopen scaling parameters
16	PID controller settings	61	CDC CAN port
17	Reference sequencer settings	62	CDC CANopen
18	Motorised potentiometer settings	63	CDC DeviceNet
19	Trim reference settings	65	CAN Port 2
20	High speed digital I/O settings	66	CAN 2 CANopen
21	Fixed reference settings	67	CAN 2 DeviceNet
22	Skip speed settings	70-72	Application Code Developer
23	Dynamic brake control settings	74	PROFIBUS Fieldbus Coupler
24	Speed trim settings	75	PROFIBUS Fieldbus Coupler
25	Inertia compensation settings	76	Reserved
26	History log settings	77	Reserved
27	History log playback settings	78	MicroPEC
28	Auto-reset settings	80	Fieldbus - Configuration and status data
29	Speed and torque monitor settings	83	Fieldbus - Fast produced VCOMs
30	Logic block settings	84	Fieldbus - Fast consumed VCOMs
31	Status flag generator settings	85	Fieldbus - Slow VCOMs and FIP refs.
32	Serial links settings	89	Spy setup module
33	Control flag 0 to 99 source settings	90	Manufacturer's Menu
34	Control flag 100 to 127 source settings	91	Fast Analogue Menu
35	Miscellaneous features	98	Menu enable selection settings
36	Position controller settings (encoder only)	99	Configuration settings
37	Position reference settings (encoder only)		

Table 4-1. – Menu Listing

### 4.3.2 Menu 1

This is a special menu containing a selection of 33 parameters copied from the drive's complete parameter list. Menu 1 can be configured via Menu 39 to hold the most useful parameters in any application. Table 4-2 shows the default parameters copied into Menu 1, together with their factory default values. The table also shows the identity of the source parameters.

Table 4-2. – Menu 1 – User Configured Menu					
Parameter No.	Source Parameter Configured by Menu 39	Function	Default	Range	Attribute
P1.00	P9.00	Speed Reference	0.00	-100.00 % Max. Speed to +100.00 % Max. Speed	O
P1.01	P9.01	Speed Feedback	0.00	-300.00 % Max. Speed to 300.00 % Max. Speed	R
P1.02	P9.05	Motor Current	0.0	0.0 A to 9999.0 A	R
P1.03	P9.09	Frequency Feedback	0.00	-200.00 Hz to +200.00 Hz	R
P1.04	P9.07	Motor Volts	0	0 to 999 Vrms	R
P1.05	P9.08	Motor Power	0.0	-999.0 kW to +999.9 kW	R



Table 4-2. – Menu 1 – User Configured Menu

Parameter No.	Source Parameter Configured by Menu 39	Function	Default	Range	Attribute
P1.06	P10.00	Warning No. 1	0	100 to 129	R
P1.07	P10.10	Trip No. 1	0	0 to 199	R
P1.08	P10.11	Trip No. 2	0	0 to 199	R
P1.09	P99.10	User Text Language	1	1 = English 2 = French 3 = Portuguese 4 = German	O
P1.10	P2.01	Motor Base Voltage	As drive size	25 V to 1000 V(rms)	S.E.N
P1.11	P2.00	Motor Base Frequency	50.00	5.00 Hz to 200.00 Hz	S.E
P1.12	P2.02	Motor Full Load Current	As P99.05	0.125 x P99.05 to 1.5 x P99.05 A (rms)	S.E.N
P1.13	P2.04	Motor Nominal Speed	As drive size	100 r/min to 9999 r/min	S.E.N
P1.14	P2.05	Motor Full Load Power Factor	As drive size	Drive size dependent	S.E
P1.15	P5.15	Maximum Speed Forward	1500	10 r/min to 6000 r/min	E
P1.16	P5.16	Maximum Speed Reverse	1500	0 r/min to 6000 r/min	E
P1.17	P5.17	Minimum Speed Forward	0	0 r/min to P5.15	E
P1.18	P5.18	Minimum Speed Reverse	0	0 r/min to P5.15	E
P1.19	P3.00	Fluxing Control	1	1 = Linear V to F 2 = Quadratic V to F (Fan curve) 3 = Economy flux mode	S.E.N.L
P1.20	P3.01	Fixed Volts Boost	0	0 V to 50 V	E
P1.21	P3.31	Economy Factor (Economy Flux Mode)	0	0 % to 50 % Nominal Flux	E
P1.22	P6.00	Accel. Rate Forward	10	0.1 %/s to 3000 %/s	E
P1.23	P6.02	Decel. Rate Forward	10	0.1 %/s to 3000 %/s	E
P1.24	P4.00	Start Mode	1	1 = Normal start 2 = Synchrostart	S.E.L
P1.25	P4.07	Normal Stop Mode	1	1 = Disable and Coast 2 = Ramp to Stop 3 = Torque limit 1 Stop 4 = Torque limit 2 Stop 5 = DC Injection	S.E.N.L
P1.26	P3.05	Fixed Current Limit	150 % when P1.29 = 0 110 % when P1.29 = 1	10 % to 150 % when P1.29 = 0 10 % to 110 % when P1.29 = 1	E
P1.27	P99.05	Drive Nominal Current	As drive size	As drive size	R
P1.28	P4.12	Motor Regenerative kW Limit	Drive size dependent	-0.1 kW to 3000.0 kW -0.1 means NO LIMIT, energy to be absorbed by DB unit.	E
P1.29	P99.02	Overload Duty. Note! Keypad goes off-line briefly when edited.	1	0 = 150% Overload 1 = 110% overload	S.E.N.L
P1.30	P99.00	Number of Deltas	0 1 – 6	0 = MicroCubicle™ Number of DELTA's in system	R
The following parameters are <b>ALWAYS</b> present in Menu 1					
P1.31	None Always a Menu Parameter	Advanced Menus (Controls which menus are open)	0	0 = None (Menu 1 only) 1 = As Menu 98 choices 2 = All Menus Open	E.N.L
P1.32	None Always a Menu Parameter	Security Code (P99.06)	As P99.06		O



### 4.3.3 Default Configuration

When the drive unit leaves the factory, all the parameters are pre-loaded with default values which allow it to drive a motor safely and in a sensible manner. Table 4-3 will provide help in understanding the default settings for Start/Stop control and Speed reference selection. The table should be read in conjunction with the control block diagrams (Appendix ??) and the explanation of Control Flags (CF) and Status Flags (SF) in Section 4.7.1.

	LOCAL CONTROL			
WHEN  IS IT SELECTS BECAUSE  WHICH MEANS  NOTE	DIGIN4 (Local/Remote)			
	OPEN			
	Keypad Control		& Reference Selection #1	
	CF116 is set OFF, as it is connected to <b>DIGIN4</b>  (P4.09 = 1.004)		CF4 is set ON, as it is connected to the INV of <b>DIGIN4</b> (P5.07 = -1.004)	
	Keypad has Start/Stop Control		The reference chosen by P5.01 is active, the default for which is Keypad. (P5.01 = 1)	
	All other Start/Stops are inactive		Lowest Control Flag reference selector takes priority, thus when CF4 is ON, CF5, CF6 and CF7 are ignored.	
	REMOTE CONTROL			
WHEN  IS IT SELECTS BECAUSE  WHICH MEANS  NOTE	DIGIN4 (Local/Remote)		DIGIN5 (Remote Reference 1/2 selection)	
	CLOSED		OPEN	CLOSED
	Remote Control & The next priority reference selection becomes active		Reference selection #2 (if <b>DIGIN4</b> closed)	Reference selection #3 (if <b>DIGIN4</b> closed)
	CF116 is set ON, as it is connected to <b>DIGIN4</b>  (P4.09 = 1.004)	CF4 is now OFF (INV <b>DIGIN 4</b> ), thus CF5, CF6 and CF7 become active (P5.08 to P5.10)	CF5 is ON, as it is connected to the INV of <b>DIGIN5</b> (P5.08 = -1.005)	CF5 is OFF, and CF6 is ON as it is connected directly to <b>DIGIN5</b> (P5.09 = 1.005)
	Remote Start/Stop connections become active ( <b>DIGIN1</b> and <b>DIGIN 2</b> at default)	<b>DIGIN5</b> becomes able to select between reference selections #2 and #3	The reference chosen by P5.02 is active, the default for which is Analogue I/P 1 (P5.02 = 2)	The reference chosen by P5.03 is active, the default for which is Analogue I/P 2 (P5.03 = 3)
	Keypad Start/Stops are inactive	Lowest control flag still has priority, thus CF5 has priority over CF6	Menu 7 and the DIP switches configure analogue inputs	Menu 7 and the DIP switches configure analogue inputs

**Table 4-3. – Start/Stop & Referencing at Default**

The basic set-up procedure adjusts these default parameters to suit individual application requirements. If for any reason the commissioning procedure results in an unworkable system, it is possible to restore the default values and re-commission the drive – see Section 4.3.5 on how to restore defaults.

Table 4-4 shows some useful parameters and their values at default.



Parameter Number	Description	Default Value	Comment
P1.00	Speed reference	0.00	Shows value. Allows editing when Keypad Reference selected (i.e. P5.01=1)
P1.15, P1.16	Maximum speeds	1500 r/min	Duplicates of P5.15, P5.16
P1.17, P1.18	Minimum speeds	0 r/min	Duplicates of P5.17, 5.18
P1.22	Accelerate forward	10% per sec	Duplicate of P6.00
P1.23	Decelerate forward	10% per sec	Duplicate of P6.02
P6.01	Accelerate reverse	0 = as forward	Allows forward and reverse rates
P6.03	Decelerate reverse	0 = as forward	to differ
P1.24	Start mode	1 = Normal start (i.e. low frequency)	Duplicate of P4.00
P4.01	Synchrostart mode	1 = Ref. direction only	Determines how a spinning load can be found
P1.25	Stop mode	1 = Disable and coast	Duplicate of P4.07
P99.07, P99.08	Operator and engineer security	0	Use to lock drive after commissioning

**Table 4-4. – Useful Parameter Default Values**

When commissioning is complete the user may duplicate up to 30 parameters from any menu into the User Menu 1 and close other menus. This allows the chosen parameters to be edited without navigating the menu structure.

#### 4.3.4 Access to Other Menus (P1.31)

As shipped, only Menu 1 is accessible. Access to other menus is controlled by the value entered into parameter P1.31, which determines the menus that can be displayed by the Keypad. Three levels of access are provided:

P1.31 value	Access level
0	Show Menu 1 only (by default, only Menu 1 is shown).
1	As specified by Menu 98 (can choose which individual menus are open by setting parameters in Menu 98).
2	All menus open.

**NOTE:** The Engineer password must be set in P1.32 before P1.31 can be edited. Refer to Section 4.8.2.



#### 4.3.5 Returning to Factory Default Settings

If for any reason the commissioning procedure results in an unworkable system, it is possible to restore the factory default values and re-commission the drive.

##### CAUTION

- When the product is reset to factory default, all customised parameter settings will be lost. Record customised parameter settings before the product is reset. They can be re-entered when required.

**NOTE:** Record the settings in "Edit Review Mode" (set P35.03 = 1).

- Set parameter P1.31 = 2.
- Navigate to P35.03 and edit its value to 1, to set up a review of edits.
- Press  to scroll through the current user edits; note these values.
- When P35.03 re-appears all user edits have been displayed. Change P35.03 back to 0.
- Navigate to P99.06 (see Section 4.5) and enter the password for engineer access (see Section 4.8.2).
- Set P99.17 = 1 and press 

The drive will now be at default settings.



## 4.4 KEYPAD HARBOUR STATUS INDICATORS

When the keypad is fitted to a converter, the status of that converter is indicated by four LEDs as shown on the back cover of this manual. If the keypad is not fitted, four LEDs on the keypad harbour indicate the converter status as shown below. These LEDs duplicate the functions of the LEDs on the keypad.

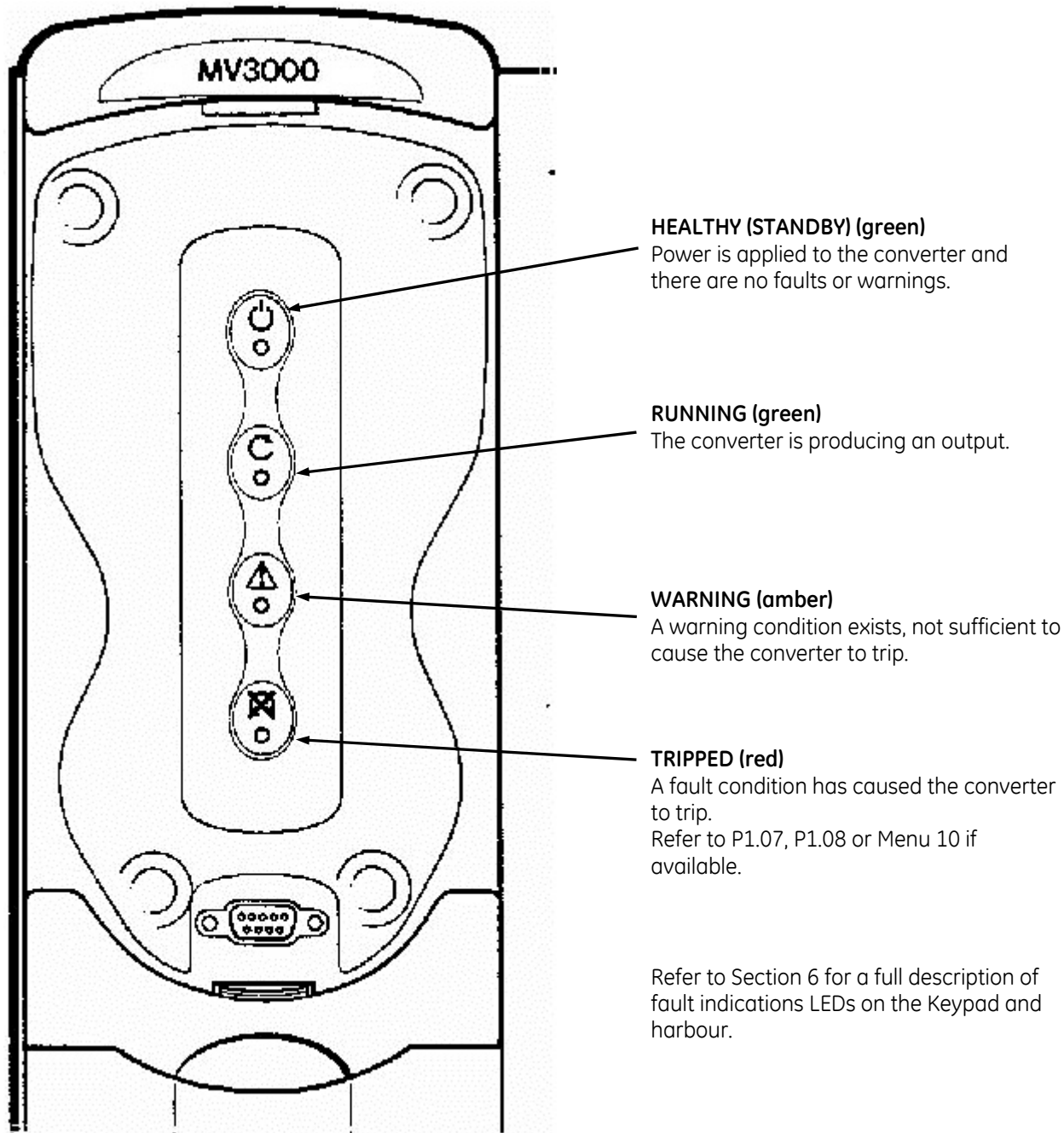


Figure 4-1. – Keypad Harbour Status Indicators

## 4.5 DRIVE DATA MANAGER™ (KEYPAD) FUNCTIONS

The Drive Data Manager™ provides Keypad functionality to configure the drive, in addition to providing motor control and diagnostic functions.

Keypad functions are illustrated on the back cover of this manual.

### 4.5.1 Navigation Key

The 4-way Navigation key is used to navigate menus and parameters, and to edit parameter values. Operation of the Navigation key is shown inside the back cover of this manual.

## 4.5.2 Navigating Menus and Parameters

Figure 4-2 shows how to navigate the menus and parameters to find any parameter. Menu 1 and its parameters are illustrated as an example, other menus are treated in exactly the same way. To access menus other than Menu 1, edit parameter P1.31 as shown in Section 4.3.4.

The start-up screen which is displayed when the drive is first switched on with the Keypad connected is shown shaded, this shows the default value for P1.00.

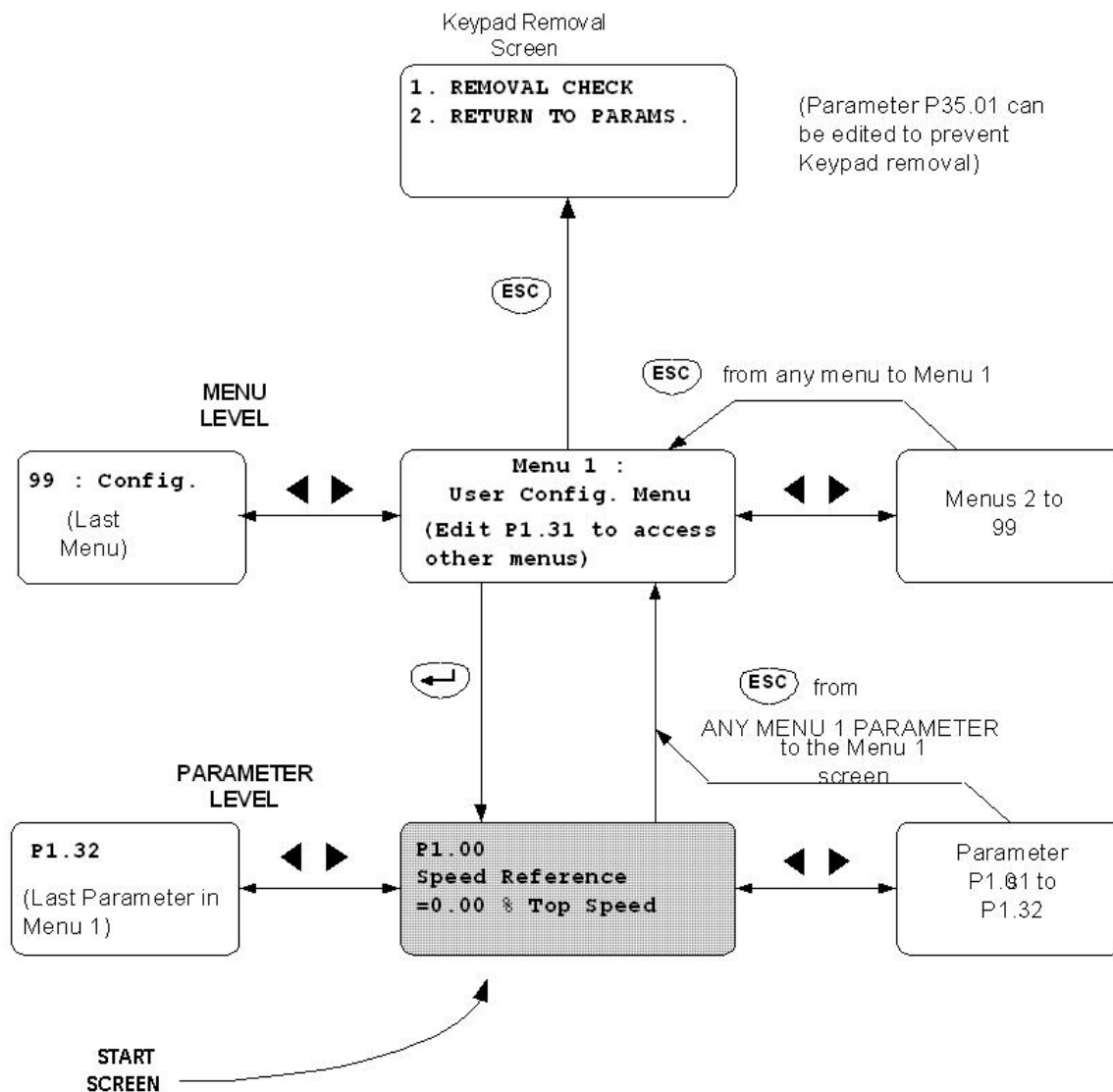


Figure 4-2. – Navigating Menus & Parameters



## 4.5.3 Editing Parameters

Two types of parameter may be edited:

- NUMERICAL parameters – to change the value
- LIST parameters – to choose from a list

### 4.5.3.1 NUMERICAL Parameter

As an example of editing "numerical" parameters, Figure 4-3 shows how to edit the value of the Motor Base Frequency parameter P2.00.

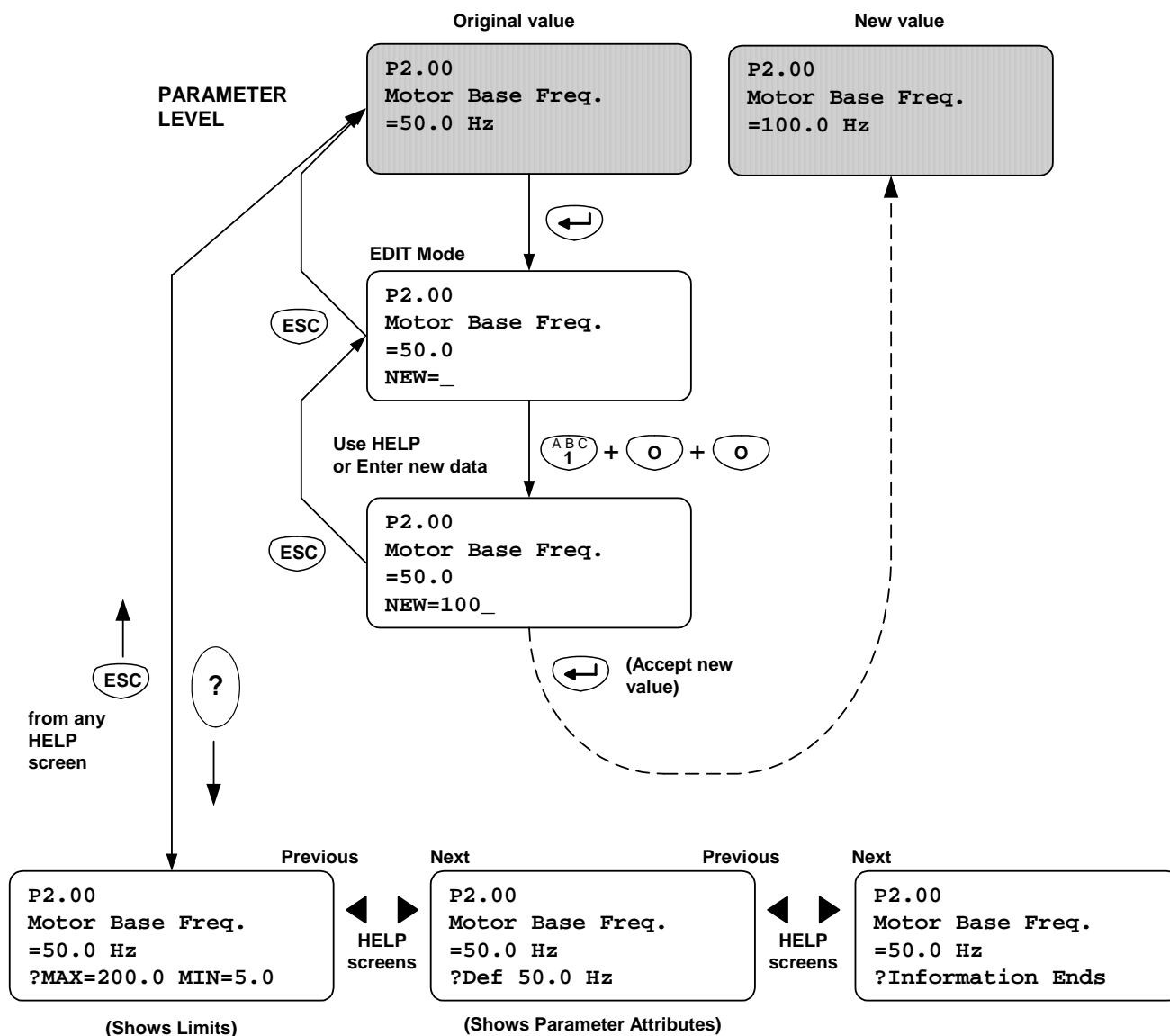


Figure 4-3. – Editing a "Numerical" Parameter

#### 4.5.3.2 LIST Parameter

This type of parameter contains a list of sources, items etc. Figure 4-4 shows how to select from a "list" parameter, using the Speed Reference 1 Source parameter P5.01 as an example.

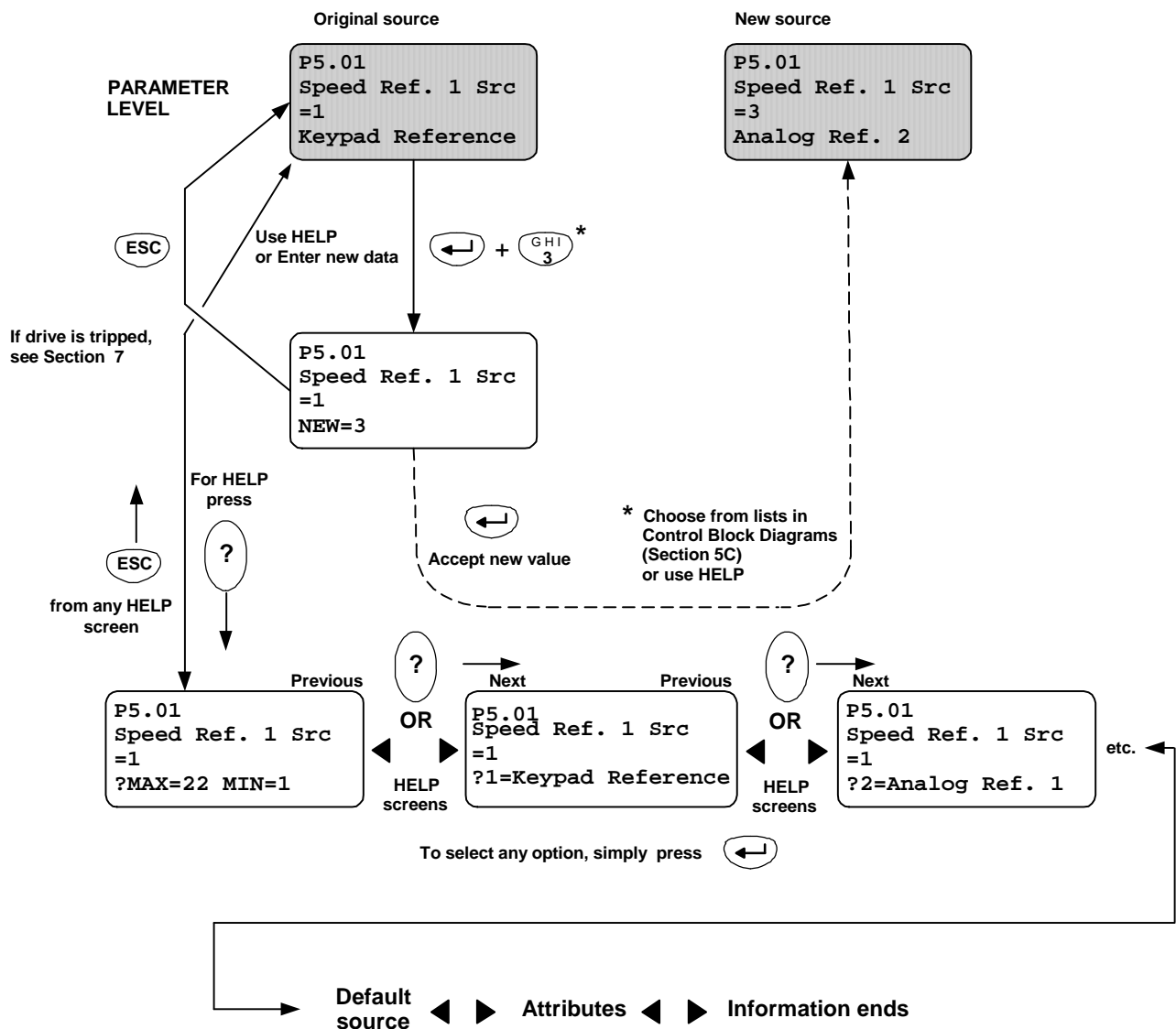




Figure 4-4. – Editing a "List" Parameter

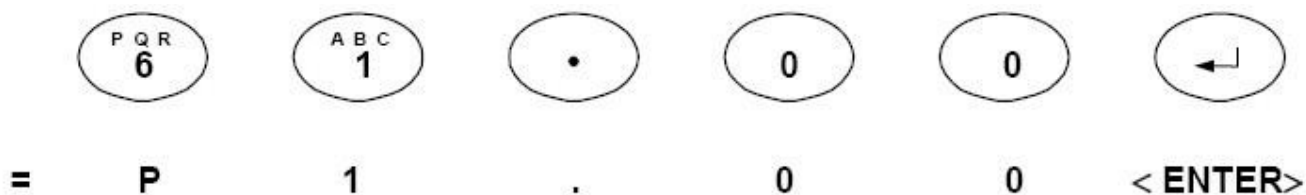
#### 4.5.4 Using The Keypad HELP (?) Key

The  key can provide diagnostic help or parameter help, this help function is context sensitive. Section 7 describes the use of the  key during diagnostics, and Figures 4-3 and 4-4 (Numerical and List parameters) show examples of how to get Parameter help.

#### 4.5.5 SHORTCUT Method Of Entering A Parameter Number

If the parameter number is known, it can be entered directly from the Menu or Parameter level, using a shortcut method.

For example, the key sequence to shortcut to P1.00 (the Speed Reference) is :



## 4.5.6 Keypad Removal

**NOTE:** To allow the converter to make the necessary safety checks, this removal procedure should always be followed. A trip may result if this procedure is not followed.

The drive checks if keypad removal is allowed as the keypad may have Start/Stop control, or the keypad Speed Reference may be active.

To remove the keypad, continue as shown in Table 4-5.

**NOTE:** CF = control flag, described in Section 4.7.1.

	Do What?	How?
1	Ensure the keypad is neither in control of the Start/Stop nor the keypad Speed Reference is active	<p>AT DEFAULT: Simply close DIGIN4, this will select Remote.</p> <p>ELSE: <b>Gain the necessary authorisation before continuing.</b></p> <p>a) Make P34.16 = 1, to set CF116 ON, this removes the Start/Stop control from the keypad.</p> <p>b) If a machine bridge, the keypad must <u>not</u> be either the <u>active</u> reference source or the <u>backup</u> reference source. The reference sources are held in P5.01 to P5.05 and are made active by CF4 to CF7 (P5.07 to P5.10) respectively.</p>
2	<p>Access the keypad removal screen</p> <div style="border: 1px solid black; border-radius: 10px; padding: 10px; width: fit-content; margin: 10px auto;"> <p>1. REMOVAL CHECK 2. RETURN TO PARAMS.</p> </div>	Press the “ <b>esc</b> ” key repeatedly.
3	Select “REMOVAL CHECK”	<p>Press the “<b>1</b>” key on the keypad</p> <p>The converter checks to see if the keypad is allowed to be removed. As well as the above control and reference checks, P35.01 (Allow keypad Removal) is also checked.</p>
4	<p>Remove keypad if the screen allows:</p> <div style="border: 1px solid black; border-radius: 10px; padding: 10px; width: fit-content; margin: 10px auto;"> <p>****KEYPAD READY****</p> <p>****FOR REMOVAL****</p> </div>	A message may be flashed disallowing removal because the keypad is either still in control, still has active/backup reference (see step 1 above) or if it is simply disallowed (see step 3 above).

**Table 4-5. – How to Remove the Keypad**

## 4.6 COMMISSIONING PROCEDURE

### CAUTION

- Excessive switching of the AC supply can cause internal protection circuits to operate. Do not switch the supply on and off more than 3 times in any 10 minutes and not more than 10 times in one hour.

**NOTE:** Various hazards exist whilst commissioning this equipment. Before commencing work, ensure you have read the various safety instructions in Sections 3 and 4.

### 4.6.1 Introduction

To commission the MV3000e, choose the required commissioning level from the two alternatives:

- |    |                      |   |
|----|----------------------|---|
| 1. | SIMPLE START         | Basic wiring and press RUN! (See Section 4.6.2) |
| 2. | GUIDED COMMISSIONING | Follow the Flowcharts in Section 4.6.3          |

Then fully configure the drive for:

THE APPLICATION (Use the Control Block Diagrams in Section 4.9)

### 4.6.2 Simple Start

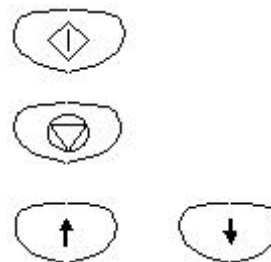
Using this simple method, the MV3000e will turn a 400 V 50 Hz motor with the drive current matching the nameplate current, in Frequency Control (VVVF) mode, with no parameter edits.

#### 4.6.2.1 Install the Drive

- Connect the drive as shown on the front cover diagram
- Switch on the main AC supply to the drive
- Check that the fans are running, then –

#### With a keypad

- Open the switch on DIGIN 4 (= Keypad control) and check that the Keypad green “Standby” led is lit.
- Start the motor by pressing
- Stop the motor by pressing
- Raise/Lower the speed using



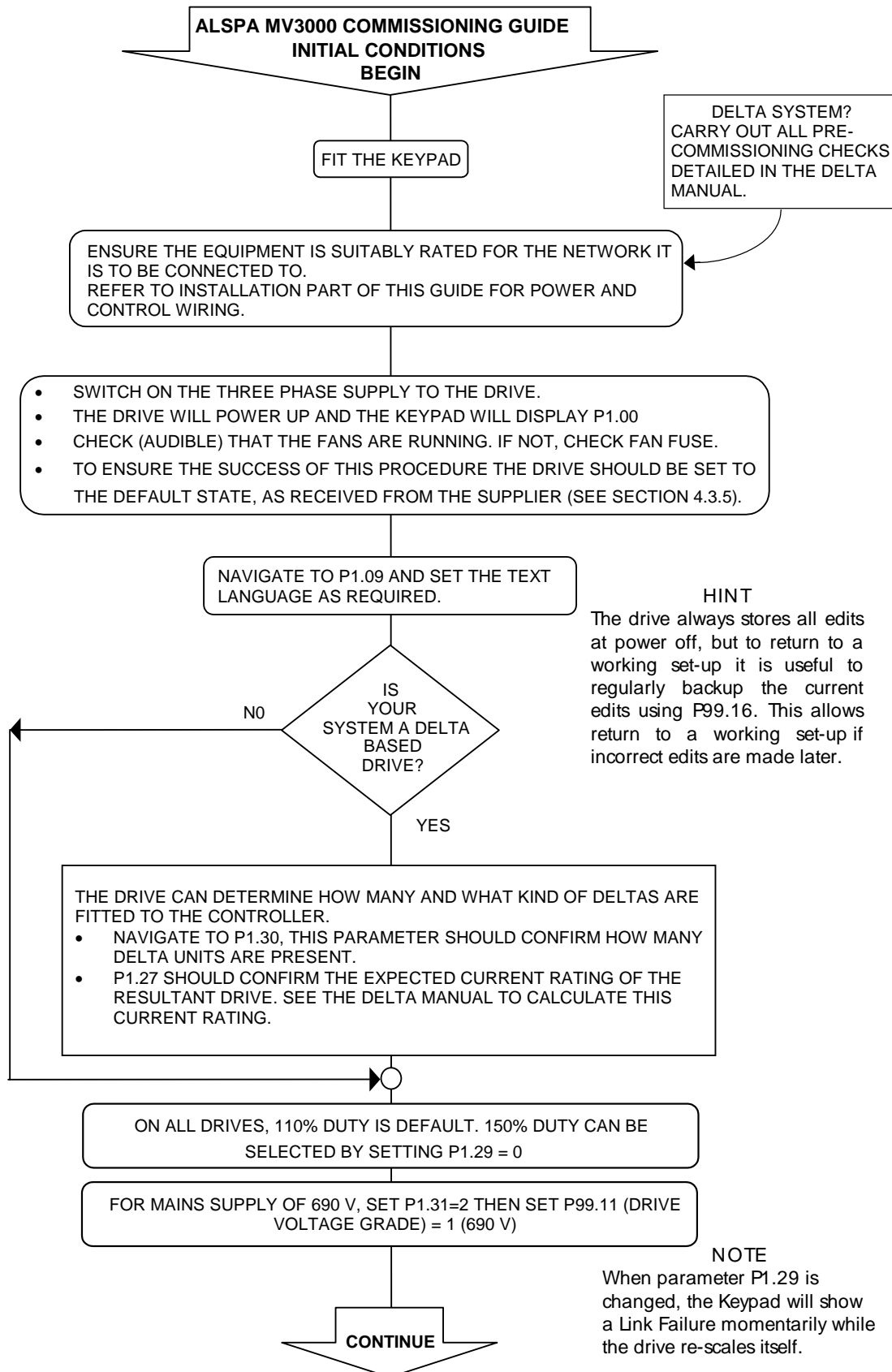
#### Or without a Keypad

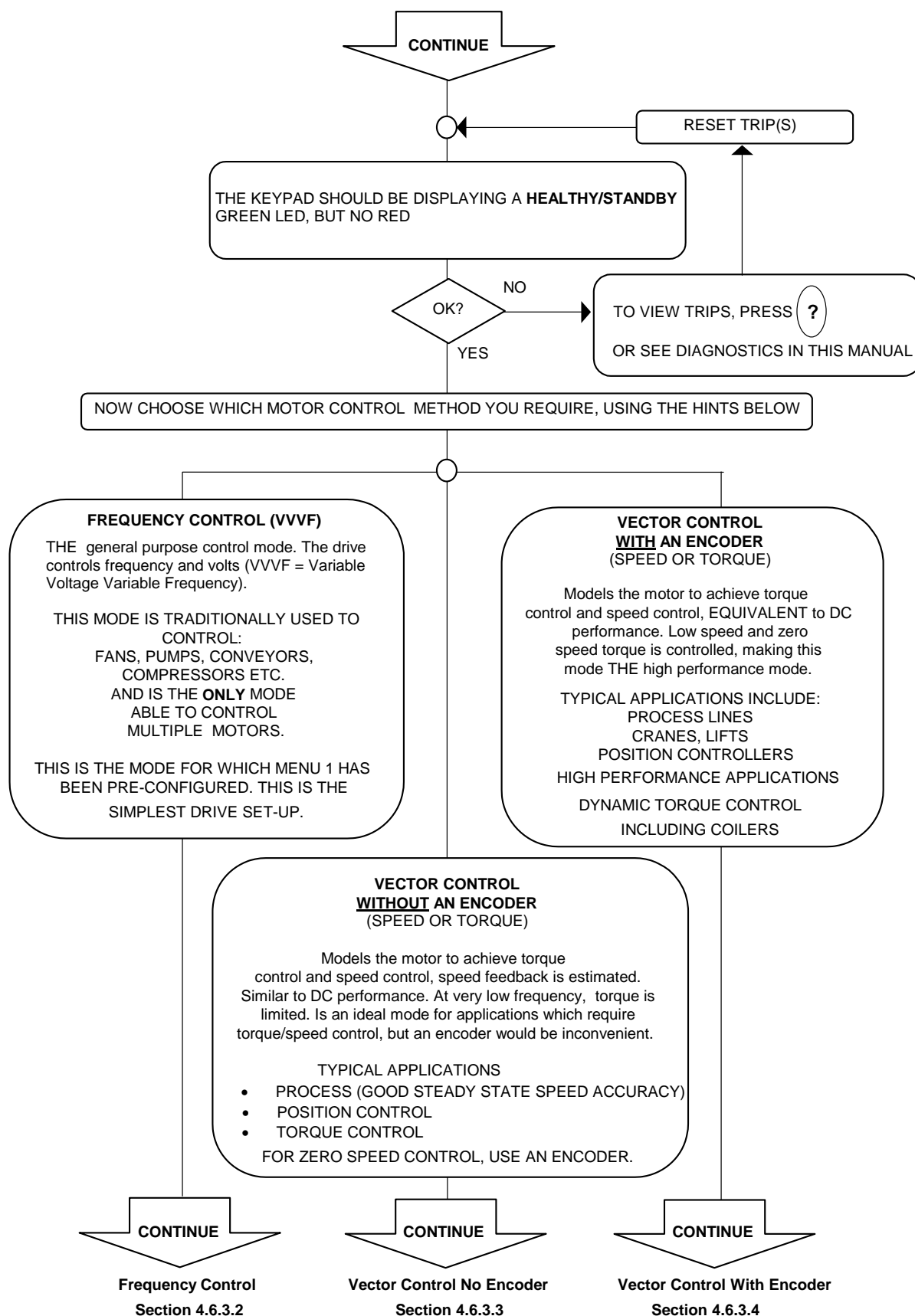
- Close the switch on DIGIN 4 (= Remote control) and check that the Harbour green “Standby” led is lit.
- Start the motor by closing DIGIN 2
- Stop the motor by opening DIGIN 1
- Control the speed using Analogue Inputs Ref1 or Ref2, depending on the position of DIGIN 5

## 4.6.3 Guided Commissioning

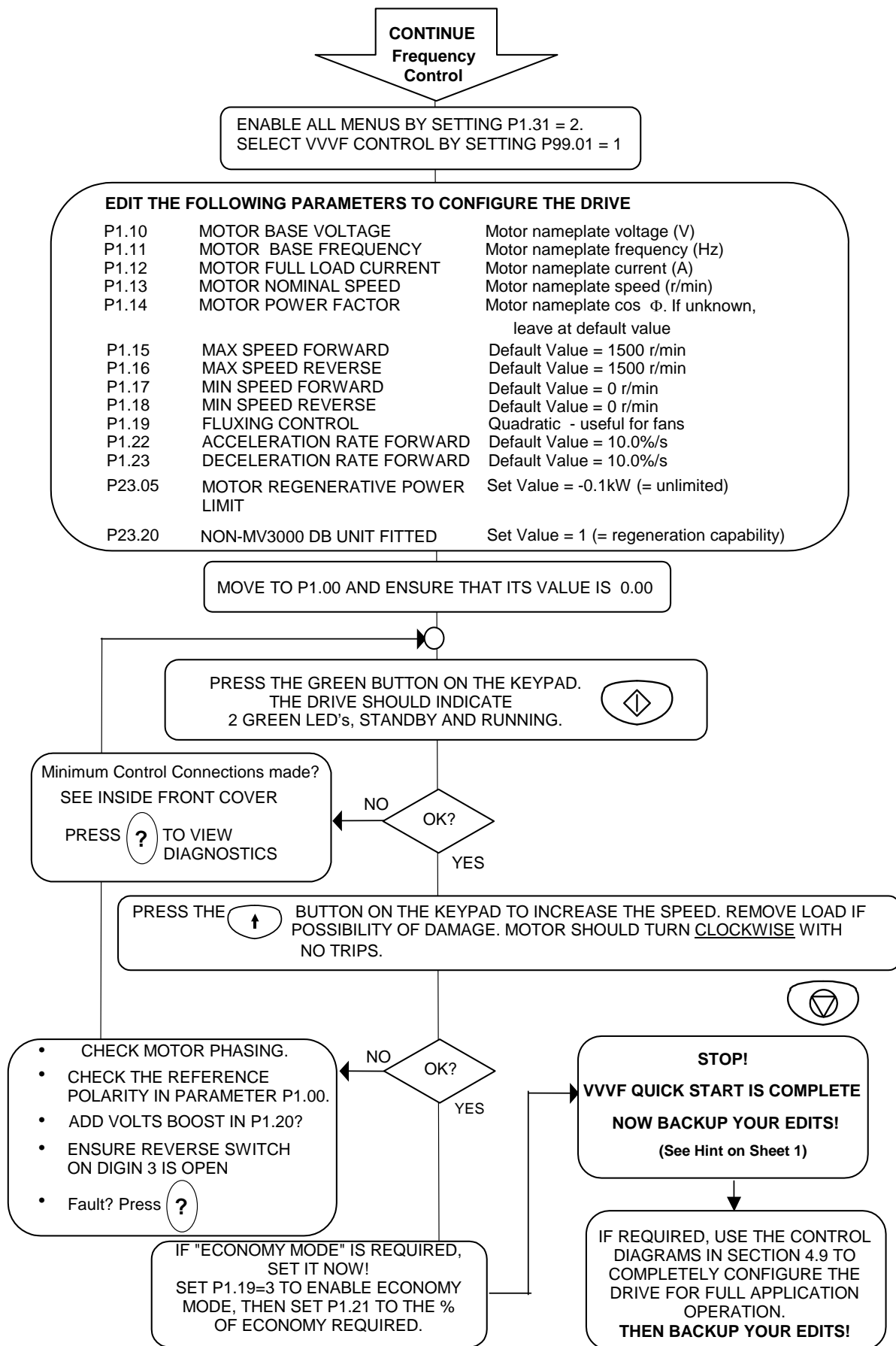
Start here and follow the flowcharts for a simple commissioning procedure.

### 4.6.3.1 Initial Conditions



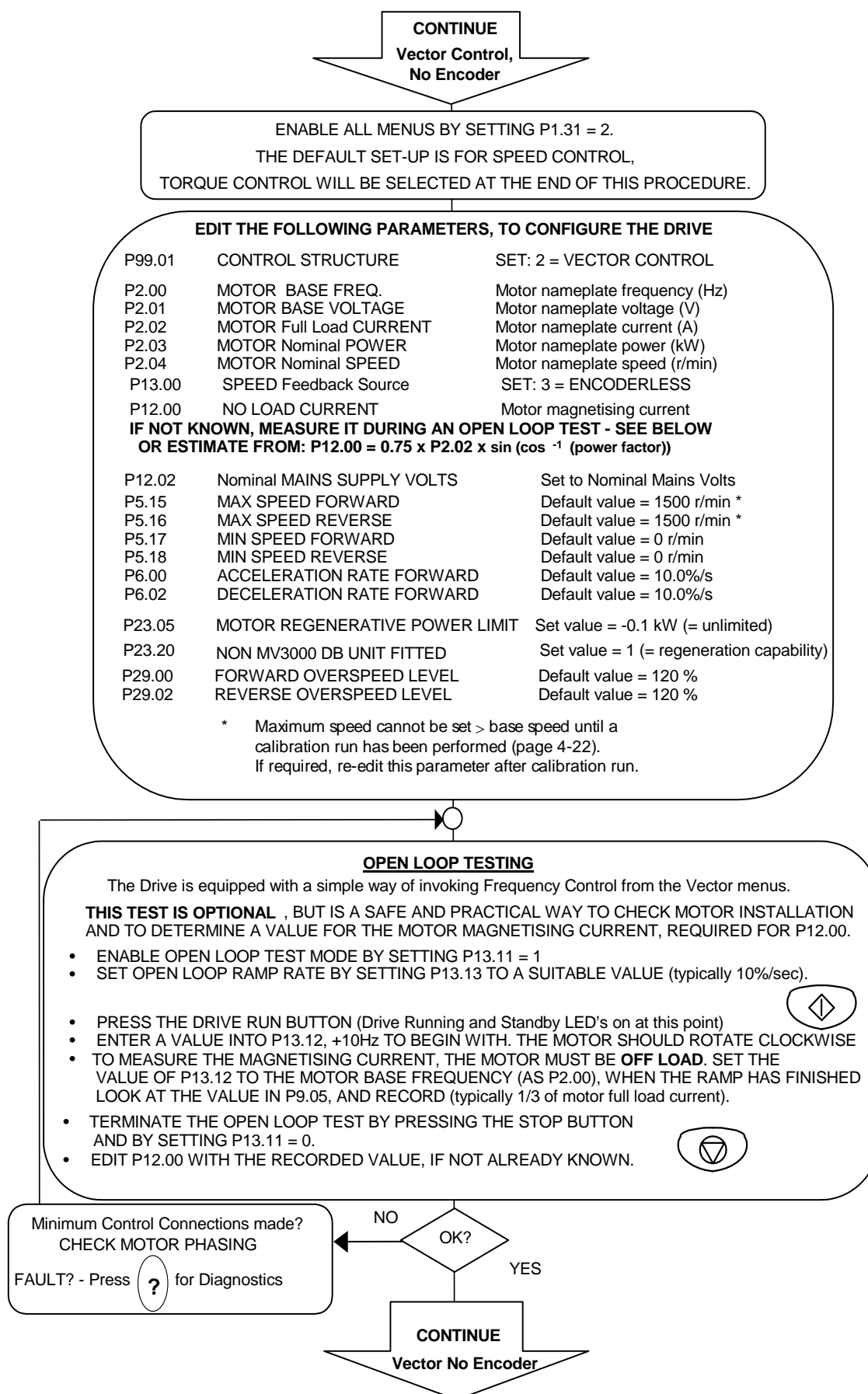


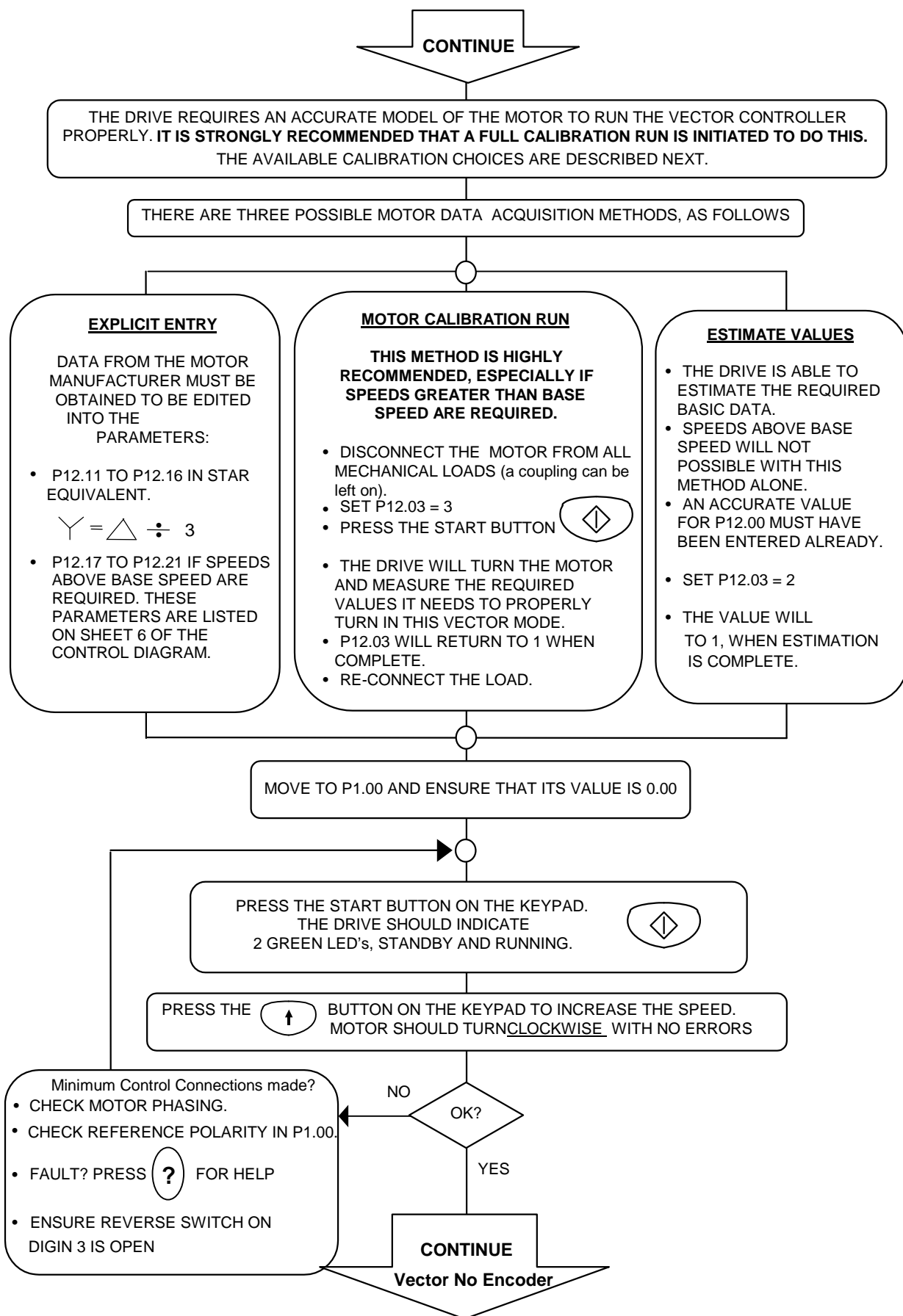
### 4.6.3.2 Frequency Control (VVVF) Mode

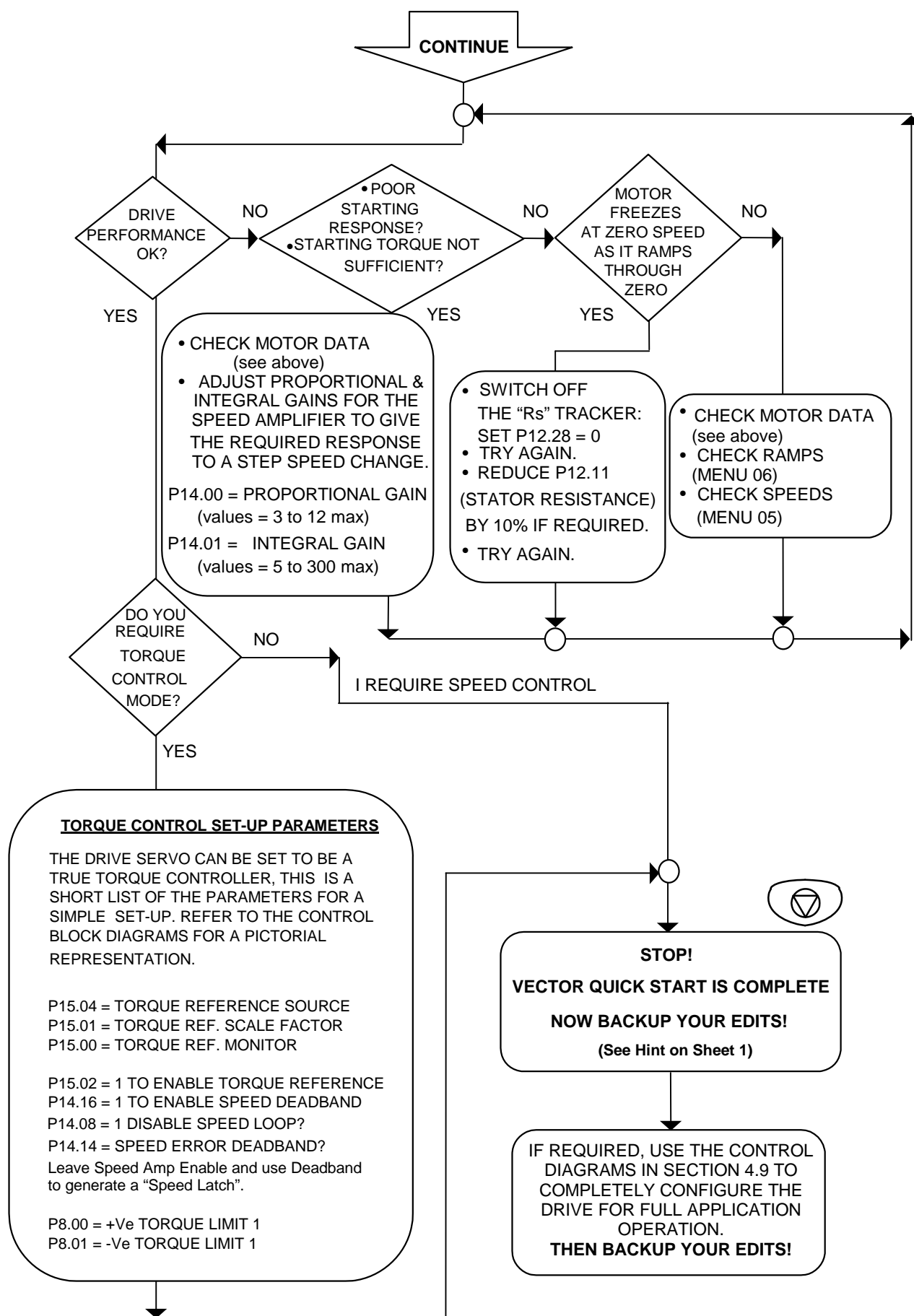




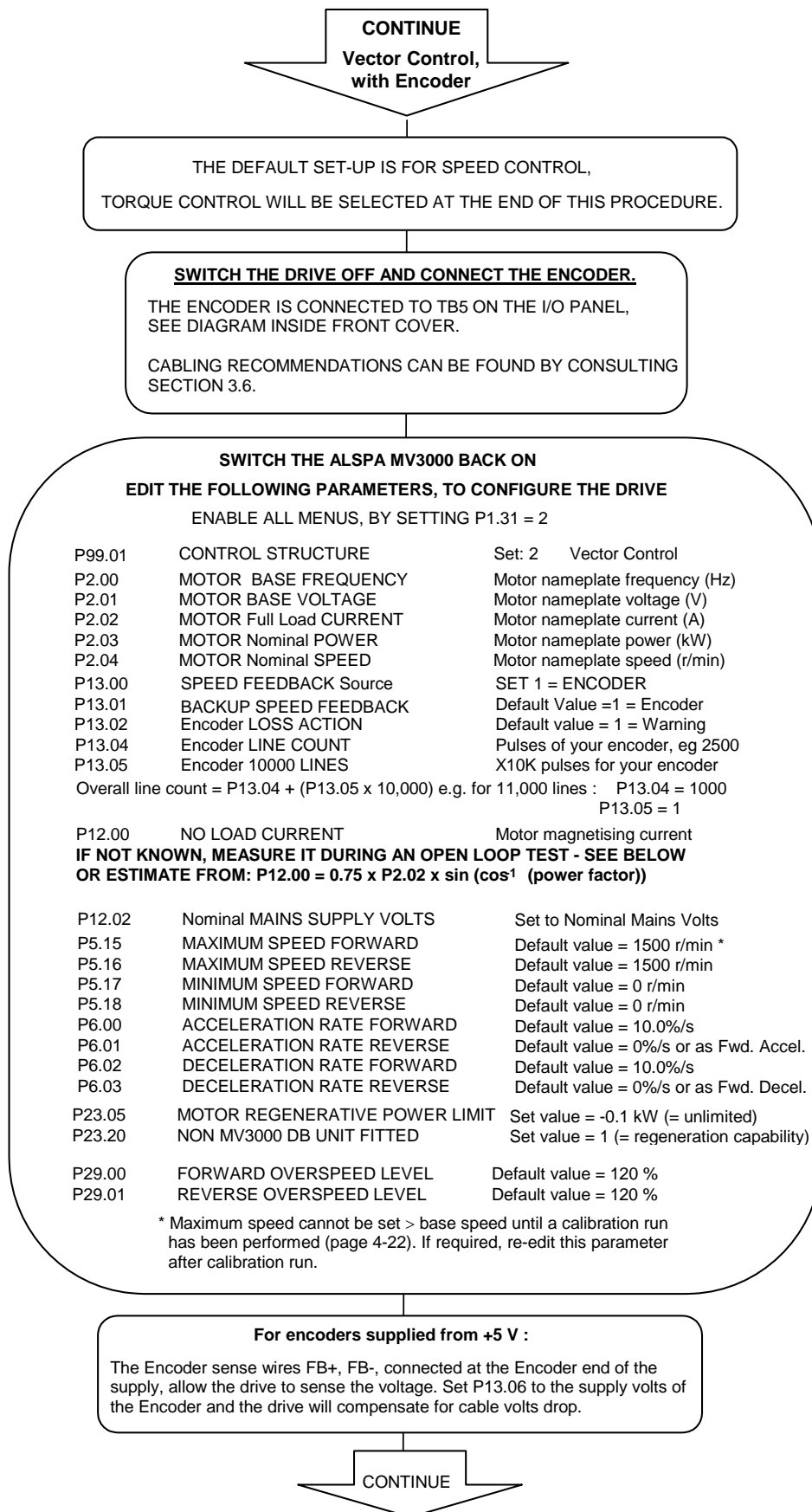
### 4.6.3.3 Vector Control, No Encoder

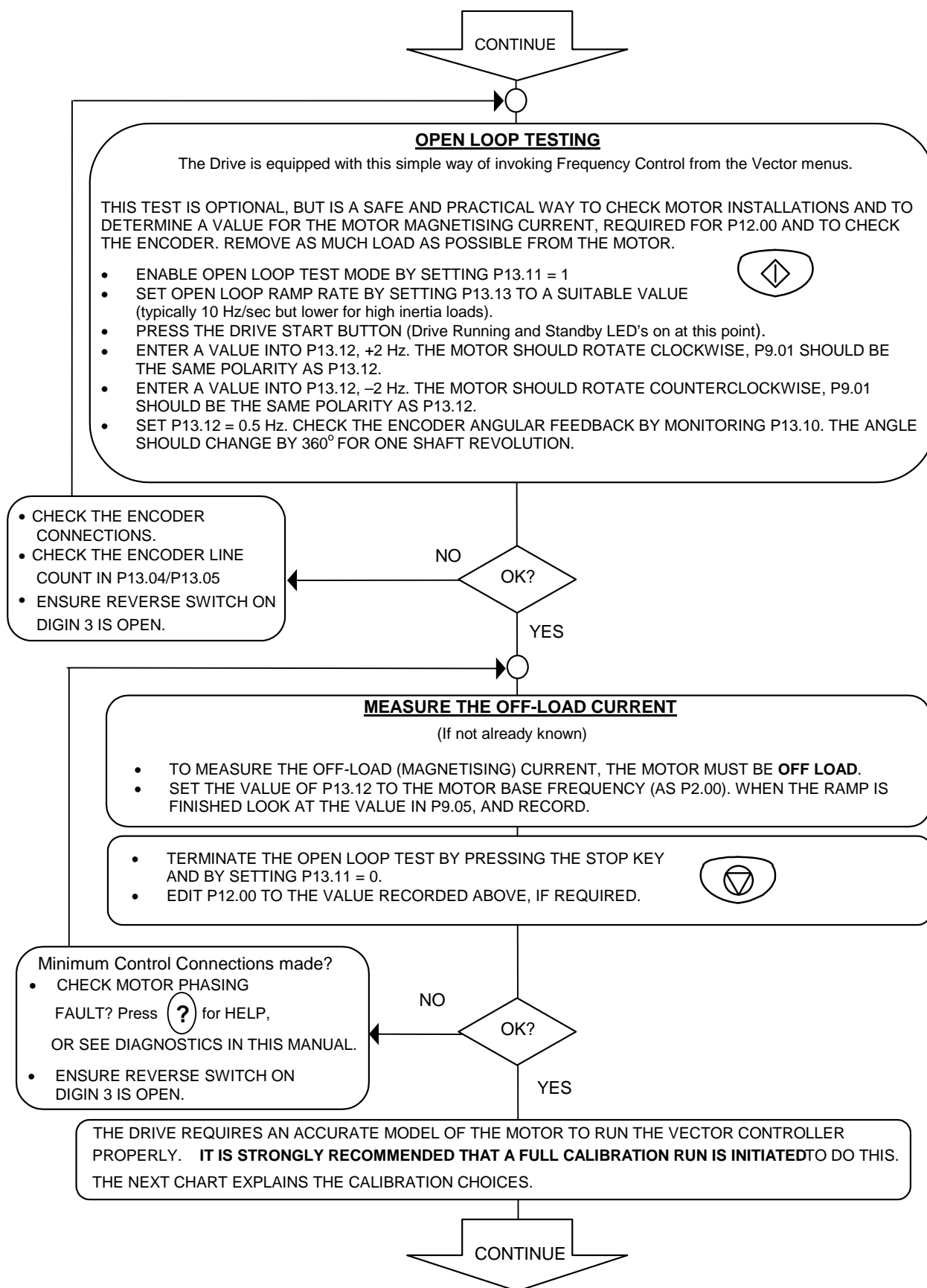


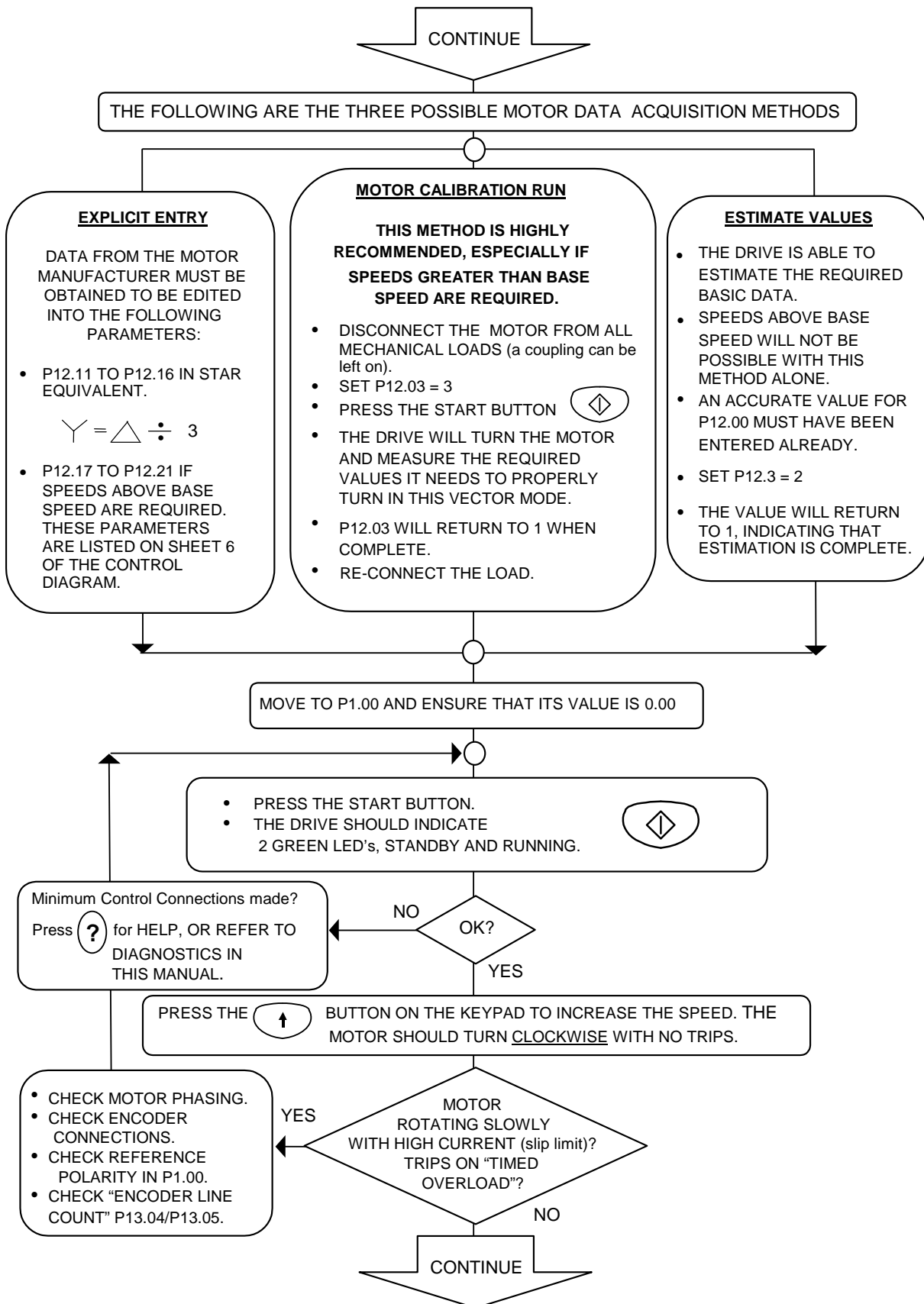


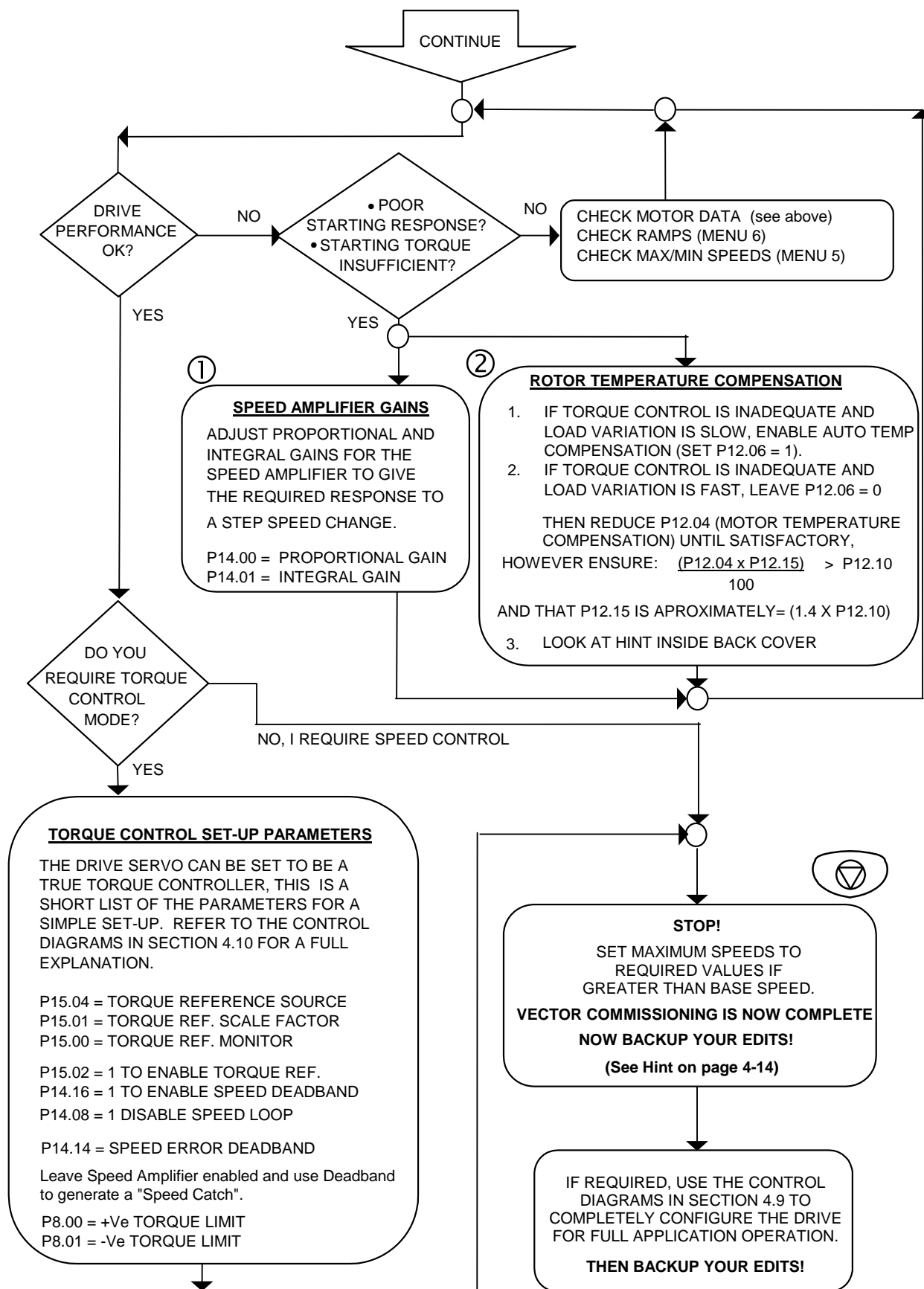


#### 4.6.3.4 Vector Control with Encoder









## 4.7 APPLICATION PROGRAMMING

Once the basic commissioning procedure has been completed, the user may find the need to customise the MV3000e parameters to accurately satisfy all the needs of the application.

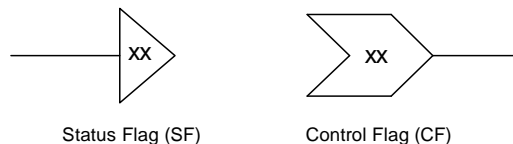
The MV3000e software contains a large number of pre-defined special functions and a range of freely connectable logic, which, when combined, will allow the user to solve many application problems and generally enhance the final application solution.

For machine bridges, special functions such as speed and torque monitors can be used to generate conditional outputs to allow brake control or duty standby pump control. A full position controller is included and a function called Load Fault Detection, which will allow the converter to “condition monitor” the application so that preventive maintenance can take place.

The following sections provide hints about how to achieve this. Detailed parameter descriptions are contained within the optional Software Technical Manual T1679.

### 4.7.1 Control Flags & Status Flags

The MV3000e system employs two kinds of flags. These flags either allow the user to CONTROL a function (Control Flag), e.g. Enable Jogging, or the converter can report the STATUS of a function (Status Flag), e.g. Overspeed. In this manual these flags are shown as below, where xx represents the flag number.



The flags can be combined together to form elegant application solutions or simply passed to digital outputs or serial links to gain status information about the converter's condition. The most used flags are connected up already by the factory default conditions. The Default conditions are clearly marked on the control block diagrams.

The Control flags have parameters which allow the user to “patch” them to other parts of the converter system. The control flag parameters appear in two logical places:

- In the menus local to the function associated with the flag, e.g. the START flag is available in Menu 4, Starting and Stopping, and is parameter P4.04.
- In the control flag menus, Menu 33 and 34, where all the flags are grouped together for easy location, e.g. the Start flag (CF1) is also P33.01, see the “rules” below.

The Status flags have no parameters associated with them, as they are simply possible connection sources for the Control flags etc.

#### Rules for use

- a) Refer to the control block diagram to determine the control flag required. The diagram actually has the “Local” menu parameter number printed next to it.
- b) Alternatively determine the control flag parameter number thus:  
P33.xx, where xx is the control flag number  
CF1     =P33.01  
CF9     =P33.09 etc.  
CF116   = P34.16 (the hundreds are in Menu 34)
- c) Edit a value into the control flag parameter, this value will determine what the flag is connected to. Table 4-6 summarises the possible choices:



Value	Control Flag (CF) or Digital Output is connected to:
0.000 or 0	OFF
0.001 or 1	ON
1.001 to 1.006	DIGITAL INPUT 1 to 6
2.000 to 2.110	STATUS FLAGS 0 to 110
3.000 to 3.015, 3.100 to 3.115	RS485 CONTROL WORDS 0 and 1, BITS 0 to 15
4.000 to 4.015, 4.100 to 4.115	RS232 CONTROL WORDS 0 and 1, BITS 0 to 15
5.100 to 5.115, 5.200 to 5.215	FIELD BUS CONTROL WORDS 1 and 2, BITS 0 to 15
6.000 to 6.031	APPLICATION CODE BITS 0 to 31
7.000 to 7.031	CAN CONTROL BITS 0 to 31

Table 4-6. – Control Flag &amp; Digital I/O Connections

**NOTE:** Any of the signals above can be inverted without the need to “waste” logic gates by simply preceding the value with a “-” sign.

Thus if:

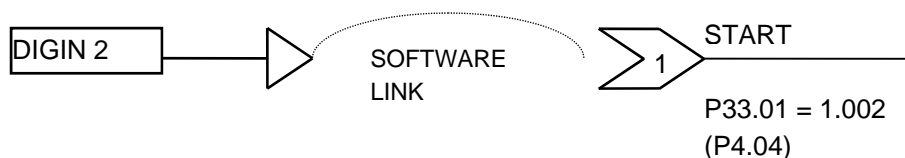
P33.01 = 1.002, then control flag 1 will be connected to digital input 2

or if

P33.01 = -1.002, then control flag 1 will be connected to the INV of input 2.

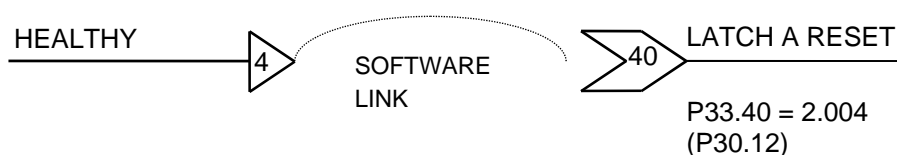
### Example 1: How the Start Flag is connected

At default the drive has the START flag connected to digital input 2, this example shows the software connections and the required edits, by way of a control flag programming example:



### Example 2: How to connect control and status flags together

This example shows a simple connection which might be made to the logic blocks



## 4.7.2 Programming Digital I/O

The digital I/O is programmed and used in exactly the same way as the control and status flags. The digital inputs are used like status flags, and appear in the list of possible values which can be edited into the control flag parameters (see Table 4-2).

The Digital Outputs have parameters and are programmed like control flags, having access to all of the same connections (see Table 4-2). The control block diagram plant I/O page shows the digital I/O.

Example : How the “O/P Running” output is connected



### 4.7.3 Programming Analogue I/O

Sheet 2 of the control block diagrams shows the parameters associated with the analogue I/O.

#### 4.7.3.1 Analogue Inputs

The two inputs AN I/P 1 and AN I/P 2 can be put into either current or voltage mode. The mode is chosen by combining the mode parameter with the 4-pole 2-way analogue DIP switch SW1. If a voltage mode is chosen the relevant switch must be in its voltage position. The analogue input option in all of the reference parameter lists can then be used. Alternatively, the analogue voltage can be picked as a source for the comparator logic or a pointer. Additionally, for AEM drive applications, it is possible to configure either analogue input channel to perform a specific "load power feedforward" function.

#### 4.7.3.2 Scaling and Offsets

If a minimum speed is programmed, and the full range of the analogue input is required to span minimum speed to maximum speed, then the scaling and offset values must be set, for example as follows :

P5.15 = Maximum speed forward = 1500 r/min

P5.17 = Minimum speed forward = 150 r/min

Then set :

$$P7.01 = \frac{150}{1500} \times 100 = 10\% \text{ offset} \quad P7.02 = \frac{1500 - 150}{1500} = 0.9 \text{ gain}$$

#### 4.7.3.3 Analogue Outputs

The two outputs AN O/P 1 and AN O/P 2 can be put into either current or voltage mode. The mode is chosen by combining the mode parameter with the 4-pole 2-way analogue DIP switch SW1. If a voltage mode is chosen the relevant switch must be in its voltage position. Any parameter within the MV3000e software can then be output via an analogue output and either displayed on a meter or passed to another drive.

#### 4.7.3.4 Scaling and Polarity

Once a parameter has been chosen for output, the relevant scaling and polarity must be applied so that a sensible value appears. The scaling parameter will automatically acquire the units of the parameter being output, then simply edit the scaling to be the value that is required to represent full scale deflection of the analogue output.

For example:

P7.17 = 11.03 (Parameter P11.03, DC link volts)


P7.19 = 0 (monopolar)


P7.20 = 560 (at 560 V the analogue output will show full scale)



## 4.8 SECURITY ATTRIBUTES & PASSWORDS

### 4.8.1 Attributes

All parameters have attributes which specify how they may be accessed. Attributes are determined by the parameter function, e.g. security level password requirement, or the type of parameter, e.g. a List. The keypad will display these attributes when the  key is pressed. The types of attribute are described below.

Attribute	Security Level /Type
E	<b>E</b> ngineer accessible - only accessible if the engineering password has been entered in P99.06 or P1.32, see Section 4.5.2.
L	<b>L</b> ist parameter, value selected from a pre-defined list.
N	 ( <b>eN</b> ter) has to be pressed to update.
O	<b>O</b> perator accessible - only accessible if the operator password has been entered in P99.06 or P1.32, see Section 4.5.2.
R	<b>R</b> ead only (monitoring parameters).
S	<b>S</b> top to edit, the output must be stopped to allow editing.

### 4.8.2 Parameter Passwords

A simple system of passwords allows control of access to parameters. Two levels of access are provided:

Access Level	Default Password	Default Status
Operator	0	Unlocked
Engineer	0	Unlocked

#### Using the passwords

- The Engineer's password is stored in P99.08 (a 4-digit code).
- The Operator's password is stored in P99.07 (a 4-digit code).
- Enter the "key" code into P99.06 (or P1.32, it's duplicate). If the key matches either the Engineer's or the Operator's code, then that relevant level is unlocked, and parameters with those attributes can be edited.
- Once unlocked, new passwords can be edited into P99.08 or P99.07.



## 4.9 CONTROL BLOCK DIAGRAMS

Control Block Diagrams for the MV3000e are provided in Appendix C and are listed in Table 11-1.

These diagrams graphically represent most of the parameters of the mains and machine bridges. They are designed to show the inter-relationship of the functions and features of the mains and machine bridges, and form a set of sheets which will allow the user to completely design customised application solutions. This section shows how to use the diagrams to configure the equipment for specific applications.

Functions within the converters either output a value, which can be the source for an analogue output or for another function, or they output status information (Status Flags), e.g. Overspeed. The functions also accept control inputs (Control Flags), e.g. Enable Jog, or Freeze Ramps etc. The diagrams clearly show this information by easily recognised symbols. The symbols are shown in a key which is featured on each of the diagram pages.

Sheets 1 and 2 are an overview of the menus and the other sheets, and can be used as a reference sheet.

Figure 4-5 shows how to use the control block diagrams to assist in configuring the drive for an application.

For a full description of drive parameters and their functions, refer to the optional Software Technical Manual T1679.

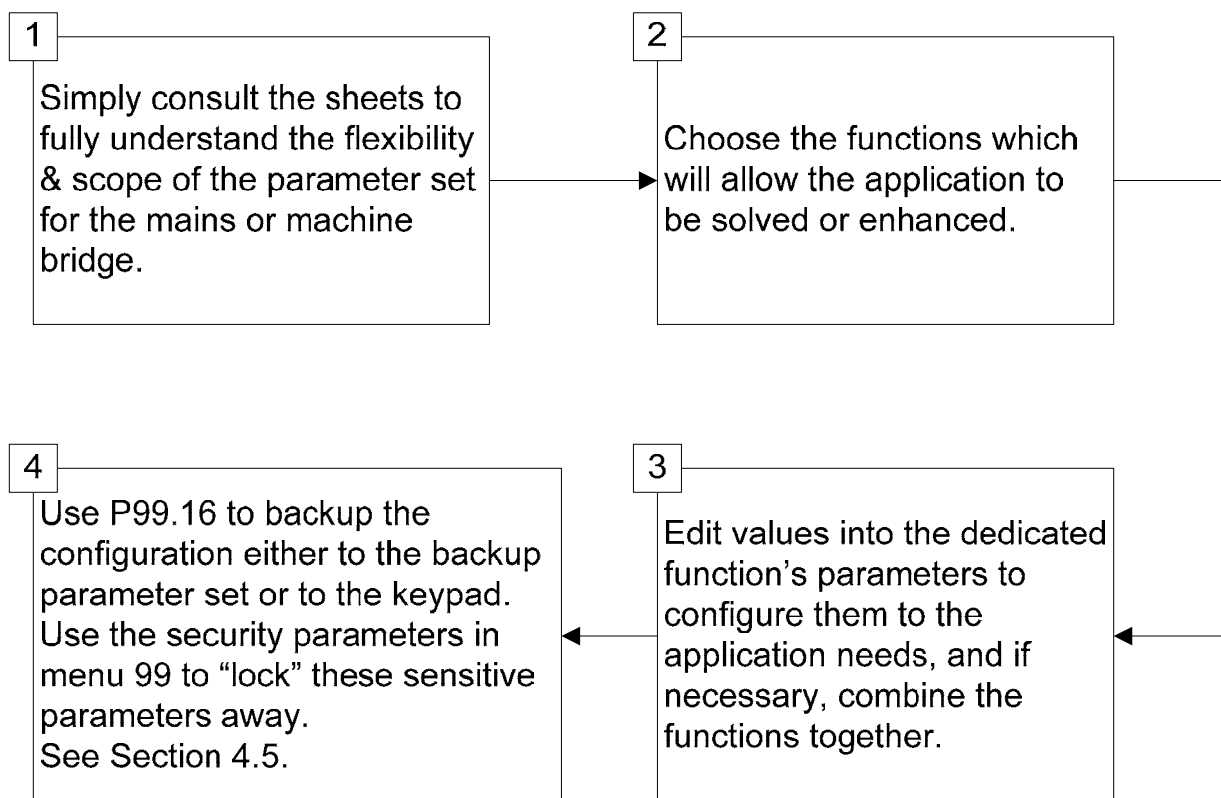


Figure 4-5. – Use of Control Block Diagrams

## 5. PREVENTIVE MAINTENANCE

### WARNING

- This equipment may be connected to more than one live circuit. Disconnect ALL supplies before working on the equipment.
- Wait at least 6 minutes after isolating supplies and check that the voltage between DC+ and DC- has reduced to a safe level before working on this equipment.

### 5.1 TOOLS & EQUIPMENT REQUIRED

- Torque wrench, suitable size for the converter power terminals. The torque range required is dependent on drive size. See Table 3-2.
- Terminal screwdriver, suitable for control connectors.
- Flat blade screwdriver, suitable for opening the power door (RH door).
- Star headed screwdriver, suitable for removing upper and lower fingerguards.

### 5.2 MAINTENANCE SCHEDULES

#### Access to Equipment

- a) Switch off the equipment and isolate it from the electrical supply.
- b) Gain access to the equipment as shown in Section 3.6.7.

#### Monthly Servicing

- a) Ensure all ventilation louvres are unobstructed. They are located at the top and bottom of the converter, and on the PWM filter.
- b) Examine the AC supply terminals R/L1, S/L2 and T/L3, and the power output terminals U, V and W for signs of overheating (damaged insulation and discolouration).
- c) Check security of mounting bolts.

**NOTE:** The nominal value for any specific filter should be between 1 and 20 Amp.

#### Annual Servicing

- a) Carry out the Monthly schedule as above.
- b) Check all power and control terminations are secure, refer to Table 3-2 for torque settings of power terminations.
- c) Remove accumulated dust from the equipment, using a suction cleaner with a soft nozzle.

**NOTE:** Periodic checking of the converter bridge temperature (P11.05) can show when cleaning is required, indicated by a temperature rise.



## 6. DIAGNOSTICS

### 6.1 LED INDICATORS

The four LED indicators on the keypad are repeated on the keypad harbour and give a first indication of converter status. The keypad harbour indicators are shown in Section 4.3 and the keypad indicators are shown in Appendix A.

#### 6.1.1 Fault Indication

A fault condition is indicated by illumination of the WARNING or flashing TRIPPED indicator and extinguishing of the HEALTHY/STANDBY indicator.

### 6.2 WARNINGS

If the WARNING indicator is lit a problem has occurred which is not sufficiently serious to trip the converter. A warning code is stored in one of 10 locations in the Warning Record, parameters P10.00 to P10.09, the code stored in P10.00 being the most recent warning.

**NOTE:** Warnings are not latched and if the warning condition ceases, the WARNING indicator will extinguish. (At default configuration, Warning 1 is located at P1.06).

Some of the more common codes for WARNINGS are listed in Section 6.9.

### 6.3 TRIPS



If the TRIPPED indicator is flashing, a serious fault has occurred which has caused the drive to shut down. Each time a trip occurs a Fault is stored in one of ten locations in the Active Trip record, parameters P10.10 to P10.19, the fault stored in P10.10 being for the most recent trip.

**NOTE:** Trips are latched and must be reset before the converter can be operated again.

### 6.4 VIEWING WARNINGS AND TRIPS

Parameters in the drive report the trip or warning currently present, and other parameters hold a history of the last 10 trips. These parameters display codes and text which describe particular warnings or trips, the Keypad automatically displays these text messages. Menu 10 is dedicated to trips and warnings, but at default Menu 1 also has some of these parameters collected together for easy access.

#### Available parameters in Menu 01

P1.06 = FIRST WARNING  
P1.07 - P1.08 = FIRST 2 TRIPS


#### Available parameters in Menu 10

P10.00 - P10.09 = WARNINGS 1 to 10  
P10.10 - P10.19 = CURRENT TRIPS 1 to 10  
P10.20 - P10.29 = TRIP HISTORY 1 to 10


#### Viewing using navigation keys

- Navigate to one of the above parameters, either a Trip or a Warning.


#### Viewing using "help" key

- When the converter is showing either a Trip or Warning, press 
- The keypad will display a menu, depending on the state of the converter, e.g. the Warning option will not show if there is no Warning present.

### 6.4.1 Action in the Event of a Warning

- a) Press  and select "2" – Display Warnings.
- b) Display P10.00 and note the first warning. This is the problem which is causing the warning indication.
- c) In turn, Display P10.01 to P10.09 and note any additional warnings. Any warnings in these locations will be for secondary problems and will help with diagnosis.
- d) Refer to Section 6.9 and check the meaning of each warning. Take corrective action as necessary.

### 6.4.2 Action in the event of a Trip

- a) Press  and select "2" – Display Trips.
- b) Display P10.10 and note the most recent trip. This is the problem which has caused the trip indication. (For the default configuration, Trips 1/2 are located at P1.07/P1.08).
- c) In turn, Display P10.11 to P10.19 and record any additional trips which may be present.
- d) Refer to the table inside the back cover and check the meaning of each fault. Take corrective action as necessary.
- e) See Section 6.4.3 for resetting trips.


### 6.4.3 Resetting Trips

#### From the Digital Inputs

- a) From Default, press and release the button wired to DIGIN 6.

**NOTE:** CF9 (the Reset flag) may have been re-programmed, but at Default it is connected to DIGIN 6.

#### From the Keypad

- a) Press  and select option 3 (Attempt Trip Reset).

### 6.4.4 Trip Fault Codes

Some of the more common Trip fault codes for the SFE and the machine bridge are listed in Section 6.9. A full listing and description is given in the Software Technical Manual T1679.



## 6.5 USING THE HELP KEY

- a) **If the drive trips**, get information on the trip by pressing **?**.

A screen appears, giving four choices as shown below:

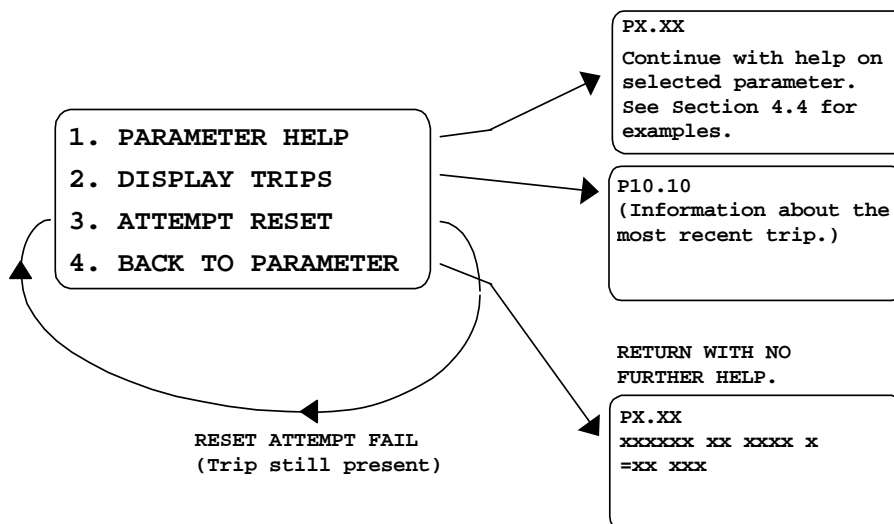


Figure 6-1. – Help Screen For Trips

### PRESS

- 1 To view parameter help when a trip is present.
- 2 Displays parameter P10.10 – giving information about the trip.
- 3 Attempts to reset the trip. If the attempt fails, this screen re-appears.
- 4 Returns to the parameter being viewed before **?** was pressed, with no further help.

**If the drive shows a Warning**, get information on the warning by pressing **?**.

The HELP system works as described for trips, except that the diagnostic menu is modified to allow warnings to be displayed, as in Figure 6-2. Pressing option 2 displays P10.00

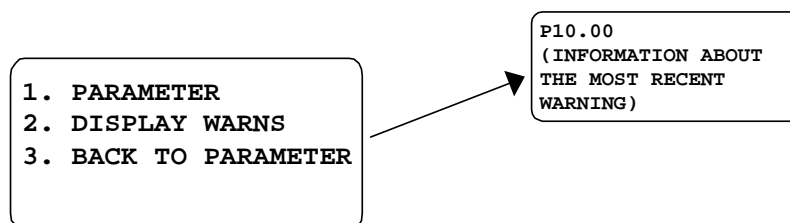


Figure 6-2. – Help Screen For Warnings



## 6.6 DIAGNOSTIC HINTS

There is a list of helpful hints recorded on the inside of the back cover of this manual.

- a) Use Sections 6.4 and 6.5 to find out what the problem is. The trip or warning messages give a clue to the problem, and the lists of trip and warning codes inside the back cover of this manual will also help.
- b) Examine the trip or warning history as shown in Section 6.4.

### 6.6.1 Changing PCB's

Before changing PCB's refer to the precautions given in Section 8.2.

### 6.6.2 Failure of Drive Firmware

Should a fault develop in the drive firmware, normal software operation will stop. If a keypad is plugged in it will display:

**FIRMWARE INTEGRITY  
FAILURE  
(E000)  
SEE USER MANUAL**

To assist GE Power Conversion personnel in diagnosing the cause of the software malfunction, the memory contents of the converter can be uploaded to a PC as shown in Section 6.6.3 and sent to GE Power Conversion at the address shown at the end of this manual.

### 6.6.3 Uploading the Converter Memory Contents to a PC

#### 6.6.3.1 Using Windows™ 3.1 or 3.11 Terminal Emulation

- a) Start Windows™ Terminal.
- b) From **Settings**, choose **Communications**.
- c) In the dialogue box, change the baud rate to **9600**, change the flow control to **Xon/Xoff**. Leave the other settings at default values (8 data, 1 stop, no parity).
- d) Choose an available Comm port.
- e) Check that in **Settings**, Emulation is at default (= VT-100 [ANSI]).
- f) From **Transfers**, choose **Receive text file**.
- g) Name the file.
- h) Ensure the MV3000e RS232 port is connected to the PC, via the RS232 lead. The keypad lead can be used but the programming lead GDS1009-4001 (see Section 8) has a connector more suited for connection to a PC serial port.
- i) Press capital **G** to start the memory contents upload. The upload takes about 10 minutes.
- j) When the upload is complete press **Stop** to terminate. This saves the file.
- k) Press the "." key to re-start the MV3000e firmware.
- l) See Section 6.6.2 for mailing instructions.
- m) The Terminal connection can be saved as "MV3000e" for next time.



### 6.6.3.2 Using Windows™ 95 or NT4

- a) Start Windows™ Hyper Terminal.
- b) Follow the **"wizard"** as presented.
- c) Name the new connection "MV3000e" and choose an icon.
- d) Choose an available Comm port.
- e) Set communications parameters to **9600** baud, **no parity**, **1 stop**, **Xon/Xoff** flow control.
- f) Select **File - Properties**. From the dialogue box choose the **Settings** tab. Set the emulation to VT100.
- g) Ensure the MV3000e RS232 port is connected to the PC, via the RS232 lead. The keypad lead can be used but the programming lead GDS1009-4001 (see Section 8) has a connector more suited for connection to a PC serial port.
- h) From **Transfer**, choose **Capture text**.
- i) Name the file.
- j) Press capital **G** to start the memory contents upload. The upload takes about 10 minutes.
- k) When the upload is complete press **Stop** to terminate. This saves the file.
- l) Press the "." key to re-start the MV3000e firmware.
- m) See Section 6.6.2 for mailing instructions.
- n) The Terminal connection can be saved as "MV3000e" for next time.



**6.7 WARNING & TRIP CODES**

TRIP CODE	DESCRIPTION	WARNING CODE	DESCRIPTION
1	Interlock	100	Excess Current
2	Reference Loss	101 M	Motor Thermostat
3	DC Overvolts	102 M	Motor I <sup>2</sup> t
4	DC Undervolts	103	Motor PTC
5	Timed Overload	104	DB Resistor
6	Over Temperature	105	Reference Loss
7	Instantaneous Overcurrent	107	High Temperature
8	U-Phase – Overcurrent	108	Low Temperature
9	U-Phase – HW Overtemp	110	Backup Ref Loss
10, 11	As 8, 9 for V-Phase	112	RS232 Loss
12, 13	As 8, 9 for W-Phase	113	RS485 Loss
14	Encoder PS Fails	114 M	Overspeed
15	Auxiliary ±15 V Fail	115 M	Encoder Loss
16	Auxiliary 24 V Fail	116	FIP Loss
17	Unidentified PIB	120 – 125	Internal Software Fault
18	History Restore Fail	128 M	Load Fault - High
19	New Drive	129 M	Load Fault - Low
20	Parameter Edits Lost	130	CAN 1 Loss - see P61.43
21 M	Motor Thermostat	131	CAN PDO/sec too high
22 M	Motor I <sup>2</sup> T	132	Bad CAN ID - see P61.45
23	RS232 Loss	133 SFE	Mains Frequency Warning
24	RS485 Loss	134 SFE	Mains Sync Loss
25	Internal Reference Fail	135	CAN 1 PDO/IO clash
26	Under Temperature	136 SFE	CF25 /LCN F/B Loss
27	Keypad Loss/Removed	137 SFE	Choke PTC
28 M	Current Imbalance		
29	Precharge Failure	<b>VIEWING WARNINGS AND TRIPS MENU 10</b>	
30	Drive ID Violation	<b>Parameter</b>	<b>View</b>
57 M	Overspeed	10.00 – 10.09	Warning Nos. 1 - 10
58	Current Control Fault	10.10 – 10.19	Trip Nos. 1 - 10
59 M	Motor Calibration Failure	10.20 – 10.29	Trip History Nos. 1 - 10
60 M	Unsuitable Motor	10.30	Secs Since Trip
61 M	Encoder Loss	10.31	Hours Since Trip
62	User Trip 1	10.32	CF10 - User Trip 1
63	FIP Loss	10.33	CF112 - User Trip 2
64 M	Load Fault - High	10.34	CF9 - Trip Reset
65 M	Load Fault - Low		
66	Motor PTC		
67	DB Resistor	<b>HISTORY</b>	
68	Reserved	THE DRIVE IS EQUIPPED WITH A 10-CHANNEL HISTORY RECORDER	
70 M	Datumize Error		
71 M	Speed Feedback Loss	MENU 26	ALLOWS SET-UP OF THE LOG
72 M	Over Frequency	MENU 27	ALLOWS PLAYBACK OF THE LOG
73	User Trip 2		
93 SFE	Mains Freq Trip	<b>WARNING/TRIP code annotations :</b>	
94 SFE	Mains Sync Loss	M = only if motor control (P99.01 = 1, 2 or 3)	
95 SFE	Mains Monitor Loss	SFE = only if SFE control (P99.01 = 4)	
96 SFE	Aux Phase Loss		
97	Unknown Trip		
98 SFE	Choke PTC		
99	Unknown Trip		
100-149	Reserved		
150	PWM Error	69	(Relate to DELTA systems. Refer to Software Manual T1679EN)
151	DB Overcurrent Trip	31-56	
152	DB Hardware Overtemp Trip	74-92	
200	CAN,1, Loss, - see P61.43	153-199	



## 7. SPARE PARTS

The pre-charge fuses may be obtained from any source, including GE Power Conversion. All other spares, as listed in Table 7-1, must be obtained from GE Power Conversion.

### 7.1 PRE-CHARGE FUSES

Data for pre-charge fuses is shown in Table 7-1. The data is given here in addition to the part numbers shown in Section 8.2 to allow local purchase of fuses, which may be helpful during commissioning. Replacing these fuses with any other rating or type will invalidate safety approvals.

Frame size	Fuse rating A	Fuse type (Qty. 3)
<b>400 V nominal voltage rating</b>		
3	2	Bussmann KTK-2
4	4	Bussmann KTK-4
6	6	Bussmann KTK-6
7	6	Bussmann KTK-6
<b>480 V nominal voltage rating</b>		
3	2	Littelfuse KLKD002.T
4	3	Bussmann KTK-3
6	3	Bussmann KTK-3
7	5	Bussmann KTK-5
<b>600/690 V nominal voltage rating</b>		
4	3	Bussmann KTK-3
6	4	Bussmann KTK-4
7	5	Bussmann KTK-5

Table 7-1. – Pre-charge Fuse Data

#### 7.1.1 Replacing Pre-Charge Fuses

##### WARNING

- This equipment may be connected to more than one live circuit. Disconnect ALL supplies before working on the equipment.
- Wait at least 6 minutes after isolating supplies and check that the voltage between DC+ and DC- has reduced to a safe level before working on this equipment.

- a) Switch off the converter and isolate all supplies.
- b) Gain access to the converter interior as described in Section 3.6.7.

##### 7.1.1.2 Procedure for Frame Sizes 3 & 4

(See Figure 7-1, size 3 shown).

- a) Locate the pre-charge fuses mounted on a printed circuit board behind the keypad harbour. Remove the fuses, taking care that they do not fall inside the converter.
- b) Fit replacement fuses of the correct type and rating, (see Table 7-1).
- c) Close and secure the keypad harbour, then close the converter doors.



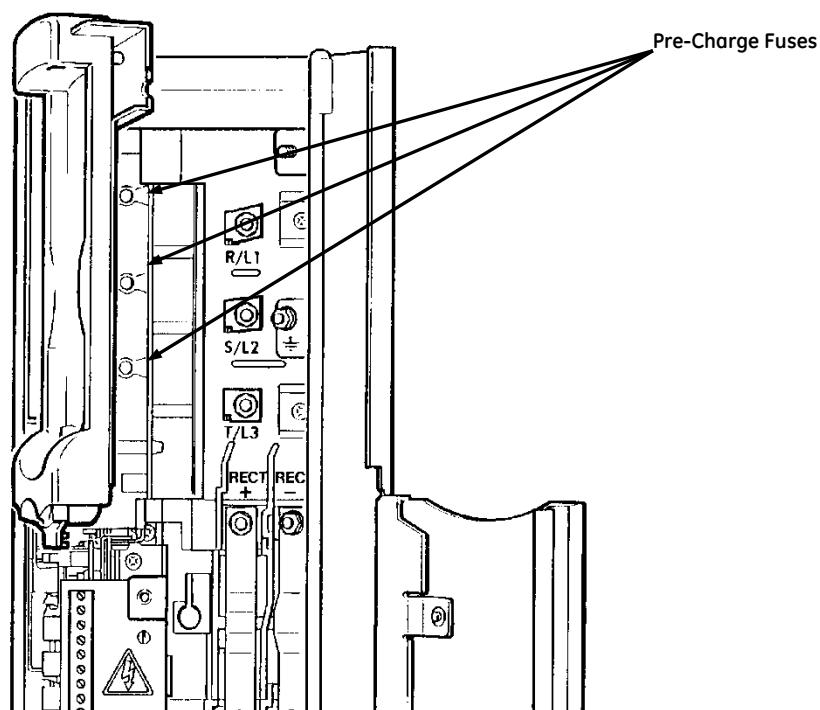


Figure 7-1. – Frame Size 3 & 4 Pre-charge Fuse Access

### 7.1.1.3 Procedure For Frame Sizes 6 & 7

(See Figure 7-2, size 6 shown below).

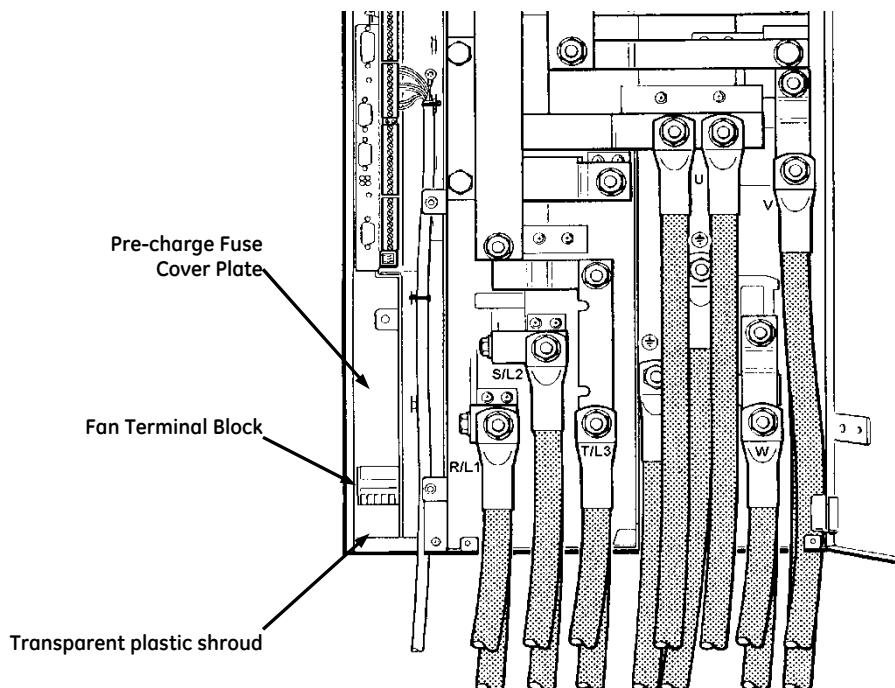


Figure 7-2. – Frame Size 6 & 7 Pre-charge Fuse Access

The pre-charge fuses are mounted on a printed circuit board (PCB) behind the pre-charge fuse cover plate, see Figure 7-2. The fan terminal block is protected by a transparent plastic shroud which is attached to the cover plate.

Replace the pre-charge fuses as follows:

- a) On frame size 6 drives, remove the two M5 screws (Z) securing the cover plate and remove the plate, complete with attached plastic shroud.  
  
On frame size 7 converters, release the retained screw (X) securing the plastic shroud to the chassis, then rotate the shroud upward and clip it behind the metal dowel on the cover plate. Remove the six M5 screws (Y and Z) (four on some models) securing the cover plate and remove the plate, complete with attached plastic shroud.
- b) Locate the three pre-charge fuses mounted on the printed circuit board (pcb), exposed when the cover plate is removed. The pcb is similar to that shown for frame size 3 in Figure 7-1.
- c) Remove the three fuses, taking care that they do not fall inside the converter.
- d) Fit replacement fuses of the correct type and rating (see Table 7-1).
- e) On frame size 6 converters, re-fit the cover plate to the converter chassis and secure with the two M5 screws (Z).

On frame size 7 converters, use the M5 screws (Y) to fit the pcb mounting metalwork to the pre-charge fuse cover plate, then use two M5 screws to secure the plate to the drive chassis. Secure the shroud to the chassis with the retained screw

- f) Close the drive doors.

## 7.2 SPARE PARTS LISTING

The parts listed in Table 7-2 are available as spares from your local authorised GE Power Conversion dealer.

All spare parts are supplied with documentation explaining the procedure for replacement. Never remove a pcb from the converter unless carrying out the replacement procedures supplied with the spare pcb.

### CAUTION

- **Never remove the switch mode power supply (SMPS) and the control board PCB from a converter at the same time.**
- **The SMPS and the control board have the same identity parameters contained in EEPROM and must be used as a matched pair. If one PCB is replaced with a spare unprogrammed PCB, the remaining PCB will copy the converter identity parameters into the new PCB. If both PCBs are removed, the converter identity will be lost and it will be rendered useless.**
- **Never swap PCBs between converters, not even between apparently identical drives. Even if the Combination Number of the PCBs is identical. The identity parameters programmed into EEPROM will be different.**
- **Swapping PCBs between converters would move the programmed drive identity between converters which may have other components with different build standards. This can affect scaling factors etc. and prevent correct operation.**
- **If PCBs are swapped between drives of different ratings, serious damage is likely to occur.**



MicroCubicle™	Frame	Control Module	Fan	Frame Size 3 & 4 Rectifier Module	Frame Size 6 & 7 Transistor - Transistor Module	Frame Size 6 & 7 Rectifier-Transistor Module	SMPS (Switch Mode Power Supply)	Precharge Fuses (Qty. 3)
<b>400 V</b>								
MV3058A4A1	3	S41Y7784/40	S41Y7786/10	S41Y7782/10			S20X4320/10	S82028/220
MV3071A4A1	3	S41Y7784/40	S41Y7786/10	S41Y7782/20			S20X4320/10	S82028/220
MV3086A4A1	4	S41Y7784/40	S98101/153	S41Y8008/30			S20X4320/10	S82028/260
MV3105A4A1	4	S41Y7784/40	S98101/153	S41Y8008/20			S20X4320/10	S82028/260
MV3140A4A1	4	S41Y7784/40	S98101/153	S41Y8008/10			S20X4320/10	S82028/260
MV3168A4A1	6	S41Y7784/40	SMV98101/151		S41Y7770/40	S41Y7771/30	S20X4321/20	S82028/280
MV3204A4A1	6	S41Y7784/40	SMV98101/151		S41Y7770/40	S41Y7771/30	S20X4321/20	S82028/280
MV3244A4A1	6	S41Y7784/40	SMV98101/151		S41Y7770/40	S41Y7771/20	S20X4321/20	S82028/280
MV3292A4A1	6	S41Y7784/40	SMV98101/151		S41Y7770/30	S41Y7771/10	S20X4321/20	S82028/280
MV3364A4A1	6	S41Y7784/40	SMV98101/151		S41Y7770/10	S41Y7771/70	S20X4321/20	S82028/280
MV3449A4A1	7	S41Y7784/40	SMV98101/151		S41Y8081/10	S41Y8082/10	S20X4321/20	S82028/280
MV3503A4A1	7	S41Y7784/40	SMV98101/151		S41Y8081/20	S41Y8082/20	S20X4321/20	S82028/280
MV3566A4A1	7	S41Y7784/40	SMV98101/151		S41Y8081/30	S41Y8082/20	S20X4321/20	S82028/280
<b>480 V</b>								
MV3052A5A1	3	S41Y7784/40	S41Y7786/10	S41Y7782/30			S20X4320/20	S82030/366
MV3065A5A1	3	S41Y7784/40	S41Y7786/10	S41Y7782/30			S20X4320/20	S82030/366
MV3077A5A1	4	S41Y7784/40	S98101/153	S41Y8008/40			S20X4320/20	S82028/240
MV3096A5A1	4	S41Y7784/40	S98101/153	S41Y8008/40			S20X4320/20	S82028/240
MV3124A5A1	4	S41Y7784/40	S98101/153	S41Y8008/50			S20X4320/20	S82028/240
MV3156A5A1	6	S41Y7784/40	SMV98101/151		S41Y7770/80	S41Y7771/50	S20X4321/30	S82028/240
MV3180A5A1	6	S41Y7784/40	SMV98101/151		S41Y7770/80	S41Y7771/50	S20X4321/30	S82028/240
MV3240A5A1	6	S41Y7784/40	SMV98101/151		S41Y7770/80	S41Y7771/60	S20X4321/30	S82028/240
MV3302A5A1	6	S41Y7784/40	SMV98101/151		S41Y7770/20	S41Y7771/40	S20X4321/30	S82028/240
MV3361A5A1	7	S41Y7784/40	SMV98101/151		S41Y8081/40	S41Y8082/30	S20X4321/30	S82028/270
MV3414A5A1	7	S41Y7784/40	SMV98101/151		S41Y8081/50	S41Y8082/30	S20X4321/30	S82028/270
MV3477A5A1	7	S41Y7784/40	SMV98101/151		S41Y8081/60	S41Y8082/40	S20X4321/30	S82028/270
<b>600/690 V</b>								
MV3062A6A1	4	S41Y7784/40	S98101/153	S41Y8008/60			S20X4321/10	S82028/240
MV3077A6A1	4	S41Y7784/40	S98101/153	S41Y8008/60			S20X4321/10	S82028/240
MV3099A6A1	4	S41Y7784/40	S98101/153	S41Y8008/60			S20X4321/10	S82028/240
MV3125A6A1	6	S41Y7784/40	SMV98101/151		S41Y8036/40	S41Y8045/40	S20X4321/10	S82028/260
MV3144A6A1	6	S41Y7784/40	SMV98101/151		S41Y8036/40	S41Y8045/30	S20X4321/10	S82028/260
MV3192A6A1	6	S41Y7784/40	SMV98101/151		S41Y8036/30	S41Y8045/20	S20X4321/10	S82028/260
MV3242A6A1	6	S41Y7784/40	SMV98101/151		S41Y8036/10	S41Y8045/10	S20X4321/10	S82028/260
MV3289A6A1	7	S41Y7784/40	SMV98101/151		S41Y8081/70	S41Y8082/50	S20X4321/10	S82028/270
MV3336A6A1	7	S41Y7784/40	SMV98101/151		S41Y8081/70	S41Y8082/60	S20X4321/10	S82028/270
MV3382A6A1*	7	S41Y7784/40	SMV98101/151		S41Y8081/80	S41Y8082/60	S20X4321/10	S82028/270

\* 690 V only

Table 7-2. – Spares Listing for MV3000 AC-Fed MicroCubicle™ Drives



## 8. OPTIONS

### 8.1 OPTIONAL HARDWARE

The following options are available for the complete MV3000e range.

Additional options are being added to the converter range as part of the ongoing development process. Please contact your authorised GE Power Conversion dealer for the latest list of options.

Item	Part No.	Description
MV3000e Drive Data Manager™	MVS3000-4001	A multi-function unit with keypad functionality that can be used to edit and monitor drive parameters, extract warnings and trip reports, and provide parameter specific help. The keypad has a large, easy to read, backlit display and can be mounted to the drive, held in the hand or permanently mounted on any suitable surface. The keypad incorporates special keys to start and stop a motor, and to control its speed.
MV3000e Drive Data Manager™ Lead and Door Mounting Kit	MVS3001-4001	A keypad-to-drive interconnection cable, mounting gasket and drilling template to allow the keypad to be mounted on a flat surface, e.g. the cabinet door.
Dynamic Brakes Frame Size 3 400/480 V Frame Size 4 400/480 V Frame Size 4 600/690 V Frame Size 6 400/480 V Frame Size 6 600/690 V Frame Size 7 400/480 V Frame Size 7 600/690 V	MV3DB045S5 MV3DB092S5 MV3DB061S6 MV3DB247S5 MV3DB185S6 MV3DB391S5 MV3DB246S6	A range of dynamic brake switch modules, fitted within the drive and rated to suit most applications, allowing a motor load to be decelerated at the required rate. A range of compatible resistors is also available. Full fixing kit supplied.
Drip Proof Canopies (Hood) Frame Size 3 Frame Size 4 Frame Size 6 Frame Size 7	MVS3003-4003 MVS3003-4004 MVS3003-4006 MVS3003-4007	A cover to prevent foreign bodies and water from accidentally dropping into the drive from above.
MV3000e Ethernet Interface - Single Channel. MV3000e Ethernet Interface – Dual Channel.	MVS3012-4001 MVS3012-4002	A self-contained module that fits within the drive to provide connectivity to 10 MHz or 100 MHz Ethernet communications networks. Full fixing kit supplied.
MV3000e Profibus Field Bus Coupler. Baud rates : to 12M bits/s	MVS3007-4002	A self-contained module that fits within the drive to provide communications over a PROFIBUS-DP network. Full fixing kit supplied.
MV3000e 2 <sup>nd</sup> CAN Port Module	MVS3011-4001	A self-contained module that fits within the drive to provide communications over a CAN network.
Drive Coach  PC Programming Lead	MVS3004-4001  GDS1009-4001	A software program that enables uploading of parameters to a PC and downloading of parameters to a drive, with full monitoring facilities and on-line help. The software is supplied on CD-ROM and runs under Microsoft Windows™ 3.1, 95, 98 or NT. Connects a PC serial port to the drive RS232 port.

### 8.2 OPTIONAL MANUALS

Details of manuals which may be obtained from GE Power Conversion as options are given in Section 1.6.

This is not an exhaustive list. As options continue to be developed new manuals will be produced. These are normally shipped with the options but may often be purchased separately. See the latest edition of the Buyer's Guide for further details.



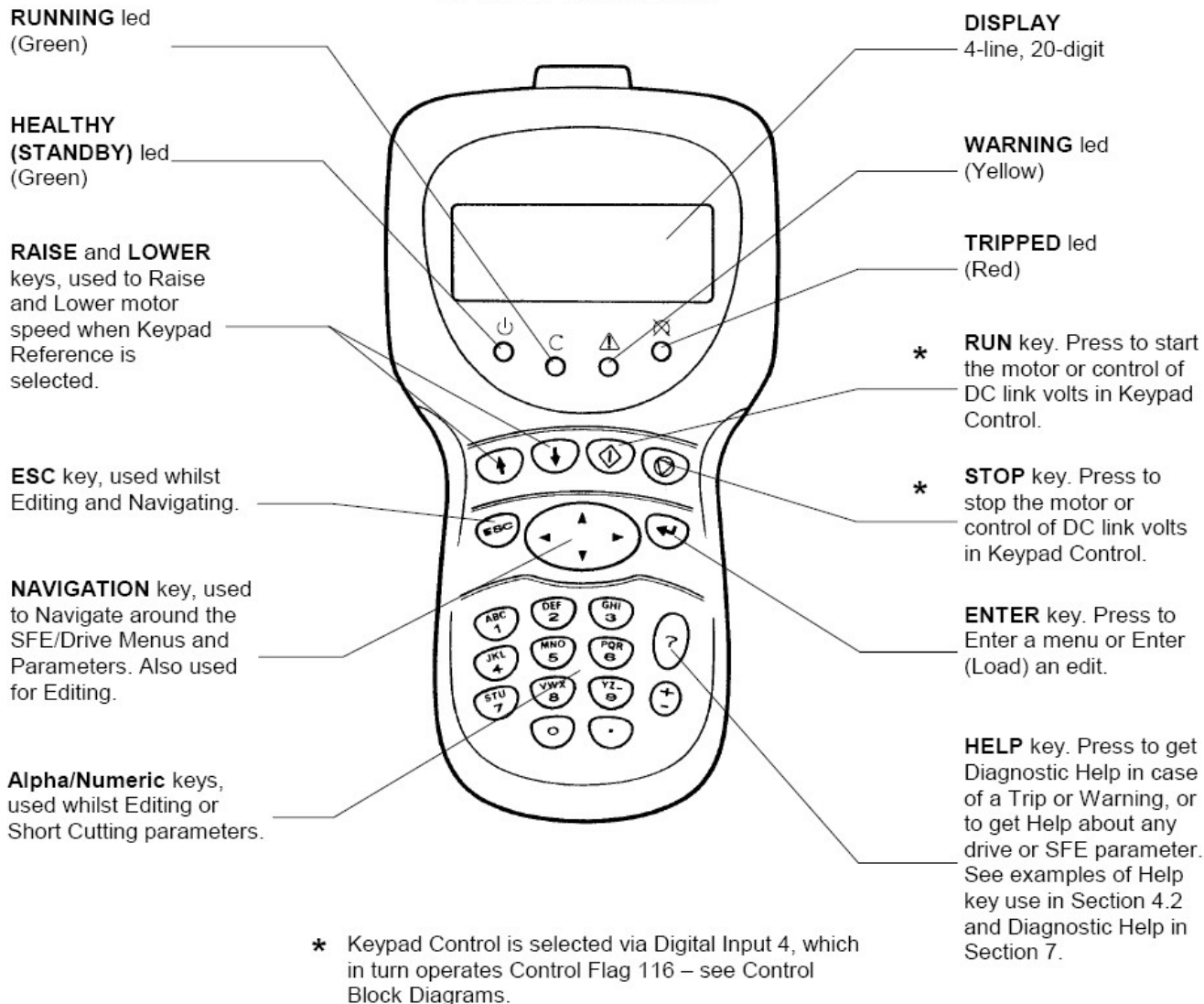


## 9. APPENDIX A

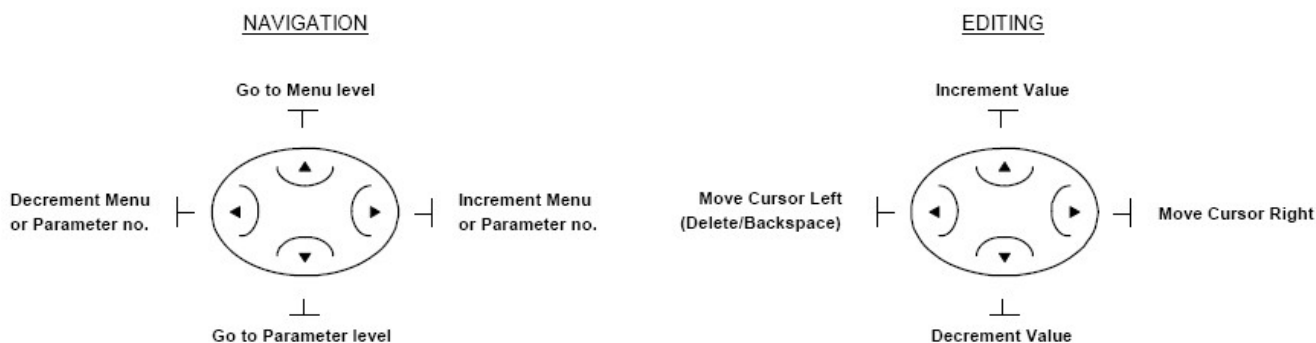
### 9.1 DRIVE DATA MANAGER™

#### 9.1.1 Keypad Functions

#### DRIVE DATA MANAGER™ KEYPAD FUNCTIONS



#### NAVIGATION KEY





10. APPENDIX B

10.1 FUSING & RATING DATA FOR 50Hz DRIVES

NOTE: The data in the Table below is correct for a PWM switching frequency of 1.25 kHz. For data at other switching frequencies refer to GE Power Conversion.

Drive		Input Line Reactor	Motor Rating		Drive Output Current		Mains Supply Rating				Heat Losses into Cabinet		Ventilation		Fan Fuses
Model	Frame Size	Model Number (All models shown are 50Hz)	Nominal Power	Nominal Power	Continuous Current (Maximum Current)		Nominal Voltage  V	Mains I/P Current (1.1/1.5 ) A	IEC Rated Fuse ** (1.1/1.5) A	UL Rated Fuse ** (1.1/1.5) A	Approx. Maximum Losses		Typical Drive Airflow		Rating **
		Rating (1.1/1.5)	(1.1/1.5) kW <sup>◇</sup>	(1.1/1.5) HP <sup>◇◇</sup>	(1.1) A	(1.5) A					Clean Air Configuration kW	With Dirty Air Kit Fitted W	m3/h	cu ft/min	
MV3058A4A1	3	MV3ACL030A4 / MV3ACL022A4	30/22	40/29	58 (64)	44 (66)	400 @ 50 Hz (380 V to 440 V)	59/44	63/50	80/60	1.1	188	140	85	N/A
MV3071A4A1	3	MV3ACL037A4 / MV3ACL030A4	37/30	50/40	71 (78)	58 (87)		73/59	80/63	100/80	1.3	201	140	85	N/A
MV3086A4A1	4	MV3ACL045A4 / MV3ACL037A4	45/37	60/50	86 (95)	71 (107)		88/73	100/80	100/100	1.6	226	255	150	2
MV3105A4A1	4	MV3ACL055A4 / MV3ACL045A4	55/45	74/60	105 (116)	86 (129)		107/88	125/100	150/110	1.8	246	255	150	2
MV3140A4A1	4	MV3ACL075A4 / MV3ACL055A4	75/55	101/74	140 (154)	105 (158)		145/107	160/125	200/150	2.4	263	255	150	2
MV3168A4A1	6	MV3ACL090A4 / MV3ACL075A4	90/75	121/101	168 (185)	140 (210)		173/145	200/160	225/200	3.0	331	680	400	4
MV3204A4A1	6	MV3ACL110A4 / MV3ACL090A4	110/90	147/121	204 (225)	168 (252)		210/173	250/200	300/225	3.4	349	680	400	4
MV3244A4A1	6	MV3ACL132A4 / MV3ACL110A4	132/110	177/147	244 (269)	204 (306)		251/210	315/250	350/300	4.0	377	680	400	4
MV3292A4A1	6	MV3ACL160A4 / MV3ACL132A4	160/132	214/177	292 (321)	244 (366)		304/251	315/315	400/350	4.4	401	680	400	4
MV3364A4A1	6	MV3ACL200A4 / MV3ACL160A4	200/160	268/214	364 (401)	292 (438)		379/304	400/315	500/400	5.6	436	680	400	4
MV3449A4A1	7	MV3ACL250A4 / MV3ACL200A4	250/200	335/268	449 (494)	364 (546)		473/379	500/400	600/500	6.5	534	850	500	4
MV3503A4A1	7	MV3ACL280A4 / MV3ACL250A4	280/250	375/335	503 (554)	449 (674)		529/473	630/500	700/600	7.5	548	850	500	4
MV3566A4A1	7	MV3ACL315A4 / MV3ACL280A4	315/250	422/335	566 (623)*	449 (674)*		595/473	630/500	750/600	8.8	572	850	500	4
MV3062A6A1	4	MV3ACL055A7 / MV3ACL045A7	55/45	74/60	61 (67)	50 (75)	690 <sup>§</sup> @ 50 Hz (data valid for 690 V only)	62/51	63/63		1.6	290	255	150	2
MV3077A6A1	4	MV3ACL075A7 / MV3ACL055A7	75/55	101/74	82 (90)	61 (92)		84/62	100/63		2.0	308	255	150	2
MV3099A6A1	4	MV3ACL090A7 / MV3ACL075A7	90/75	121/101	98 (108)	82 (123)		100/84	100/100		2.4	331	255	150	2
MV3125A6A1	6	MV3ACL110A7 / MV3ACL090A7	110/90	147/121	119 (131)	98 (147)		122/100	125/100		3.0	349	680	400	4
MV3144A6A1	6	MV3ACL132A7 / MV3ACL110A7	132/110	177/147	142 (156)	119 (179)		146/122	160/125	††	3.4	378	680	400	4
MV3192A6A1	6	MV3ACL160A7 / MV3ACL132A7	160/132	214/177	170 (187)	142 (213)		176/146	200/160		4.1	400	680	400	4
MV3242A6A1	6	MV3ACL200A7 / MV3ACL160A7	200/160	268/214	211 (232)	170 (255)		220/176	250/200		4.6	437	680	400	4
MV3289A6A1	7	MV3ACL250A7 / MV3ACL200A7	250/200	335/268	260 (286)	211 (317)		274/220	315/250		5.4	532	850	500	4
MV3336A6A1	7	MV3ACL280A7 / MV3ACL250A7	280/250	375/335	292 (320)	260 (390)		307/274	315/315		6.2	548	850	500	4
MV3382A6A1	7	MV3ACL315A7 / MV3ACL280A7	315/280	422/375	328 (360)	292 (438)		345/307	400/315		7.1	575	850	500	4

Table 10-1. –Data for 50Hz Drives

§ Alternate AC Voltage Grade  
Selectable by parameter P99.11  
(P99.11 = 1)

◇ Motor shaft power ratings are based on standard IEC motor ratings.  
◇◇ 1 HP = 0.746 kW

† Including line reactor  
†† UL/CSA approvals not applicable at this voltage

\* 60 second overload only permitted up to 30 °C ambient.  
  
\*\* For fuse types see Section 3.6

Notes:  
1. Ratings shown are for overloads of 1.1 and 1.5 times nominal power.  
2. In frequency control (VVVF) mode motors as small as 1/8 of the drive rating can be controlled.  
3. In VECTOR mode the drive can control motors as small as 1/2 its rating.

OUTPUT DE-RATING  
ALTITUDE: Nominal 0 to 1000 m, above 1000 m de-rate 7.3% per 1000 m to a maximum of 2000 m.  
TEMPERATURE: Nominal 0°C to 40°C, above 40°C de-rate 2.5% per °C to a maximum of 50°C.

10.2 FUSING & RATING DATA FOR 60HZ DRIVES

NOTE: The data in the Table below is correct for a PWM switching frequency of 1.25 kHz. For data at other switching frequencies refer to GE Power Conversion.

Drive		Input Line Reactor	Motor Rating		Drive Output Current		Mains Supply Rating				Heat Losses into Cabinet		Ventilation		Fan Fuses
Model	Frame Size	Model Number (All models shown are 50Hz)	Nominal Power	Nominal Power	Continuous Current (Maximum Current)		Nominal Voltage  V	Mains I/P Current (1.1/1.5 ) A	IEC Rated Fuse ** (1.1/1.5) A	UL Rated Fuse ** (1.1/1.5) A	Approx. Maximum Losses		Typical Drive Airflow		Rating **
		Rating (1.1/1.5)	(1.1/1.5) kW <sup>◇</sup>	(1.1/1.5) HP <sup>◇◇</sup>	(1.1) A	(1.5) A					Clean Air Configuration kW	With Dirty Air Kit Fitted W	m3/h	cu ft/min	
MV3052A5A1	3	MV3ACL040B5 / MV3ACL030B5	30/22	40/30	52 (57)	40 (60)	480 @ 60 Hz (460 V to 525 V)	53/40	63/40	70/50	1.0	188	140	85	N/A
MV3065A5A1	3	MV3ACL050B5 / MV3ACL040B5	37/30	50/40	65 (72)	52 (78)		66/53	80/63	90/70	1.2	226	140	85	N/A
MV3077A5A1	4	MV3ACL060B5 / MV3ACL050B5	45/37	60/50	77 (85)	65 (98)		79/66	80/80	100/90	1.5	246	255	150	2
MV3096A5A1	4	MV3ACL075B5 / MV3ACL060B5	55/45	75/60	96 (106)	77 (116)		98/79	100/80	125/100	1.7	263	255	150	2
MV3124A5A1	4	MV3ACL100B5 / MV3ACL075B5	75/56	100/75	124 (137)	96 (144)		130/98	160/100	175/125	2.2	286	255	150	2
MV3156A5A1	6	MV3ACL125B5 / MV3ACL100B5	93/75	125/100	156 (172)	124 (186)		162/130	200/160	225/175	2.9	349	680	400	4
MV3180A5A1	6	MV3ACL150B5 / MV3ACL125B5	112/93	150/125	180 (198)	156 (234)		194/162	200/200	250/225	3.1	377	680	400	4
MV3240A5A1	6	MV3ACL200B5 / MV3ACL150B5	149/112	200/150	240 (264)	180 (270)		258/194	315/200	350/250	4.0	401	680	400	4
MV3302A5A1	6	MV3ACL250B5 / MV3ACL200B5	187/149	250/200	302 (332)	240 (360)		321/258	400/315	450/350	4.7	436	680	400	4
MV3361A5A1	7	MV3ACL300B5 / MV3ACL250B5	224/187	300/250	361 (397)	302 (453)		385/321	400/400	500/450	5.6	534	850	500	4
MV3414A5A1	7	MV3ACL350B5 / MV3ACL300B5	261/224	350/300	414 (456)	361 (542)		448/385	500/400	600/500	6.4	548	850	500	4
MV3477A5A1	7	MV3ACL400B5 / MV3ACL350B5	298/261	400/350	477 (525)	414 (621)		512/448	630/500	650/600	7.6	575	850	500	4
MV3062A6A1	4	MV3ACL060B6 / MV3ACL050B6	45/37	60/50	62 (68)	52 (78)	600 <sup>§</sup> @ 60 Hz (575V to 690V)	64/53	80/63	80/70	1.6	290	255	150	2
MV3077A6A1	4	MV3ACL075B6 / MV3ACL060B6	56/45	75/60	77 (85)	62 (93)		79/64	80/80	100/80	1.8	308	255	150	2
MV3099A6A1	4	MV3ACL100B6 / MV3ACL075B6	75/56	100/75	99 (109)	77 (116)		105/79	125/80	150/100	2.4	331	255	150	2
MV3125A6A1	6	MV3ACL125B6 / MV3ACL100B6	93/75	125/100	125 (138)	99 (149)		130/105	1260/125	175/150	3.1	349	680	400	4
MV3144A6A1	6	MV3ACL150B6 / MV3ACL126B6	112/93	150/125	144 (159)	125 (188)		156/130	160/160	200/175	3.3	378	680	400	4
MV3192A6A1	6	MV3ACL200B6 / MV3ACL150B6	149/112	200/150	192 (211)	144 (216)		207/156	250/160	300/200	4.4	400	680	400	4
MV3242A6A1	6	MV3ACL250B6 / MV3ACL200B6	187/149	250/200	242 (266)	192 (288)		258/207	315/250	350/300	5.0	437	680	400	4
MV3289A6A1	7	MV3ACL300B6 / MV3ACL250B6	224/187	300/250	289 (318)	242 (363)		309/258	315/315	400/350	6.0	532	850	500	4
MV3336A6A1	7	MV3ACL350B6 / MV3ACL300B6	261/224	350/300	336 (370)	289 (434)		359/309	400/315	450/400	7.0	548	850	500	4

Table 10-2. –Data for 60Hz Drives

§ Alternate AC Voltage Grade  
Selectable by parameter P99.11  
(P99.11 = 1)

◇ Motor shaft power ratings are based on standard NEMA motor ratings.  
◇◇ 1 kW = 1.34HP  
† Including line reactor

\* 60 second overload only permitted up to 30 °C ambient.  
\*\* For fuse types see Section 3.6

Notes:  
1. Ratings shown are for overloads of 1.1 and 1.5 times nominal power.  
2. In frequency control (VVVF) mode motors as small as 1/8 of the drive rating can be controlled.  
3. In VECTOR mode the drive can control motors as small as 1/2 its rating.

OUTPUT DE-RATING  
ALTITUDE: Nominal 0 to 1000 m, above 1000 m de-rate 7.3% per 1000 m to a maximum of 2000 m.  
TEMPERATURE: Nominal 0°C to 40°C, above 40°C de-rate 2.5% per °C to a maximum of 50°C.



11. APPENDIX C

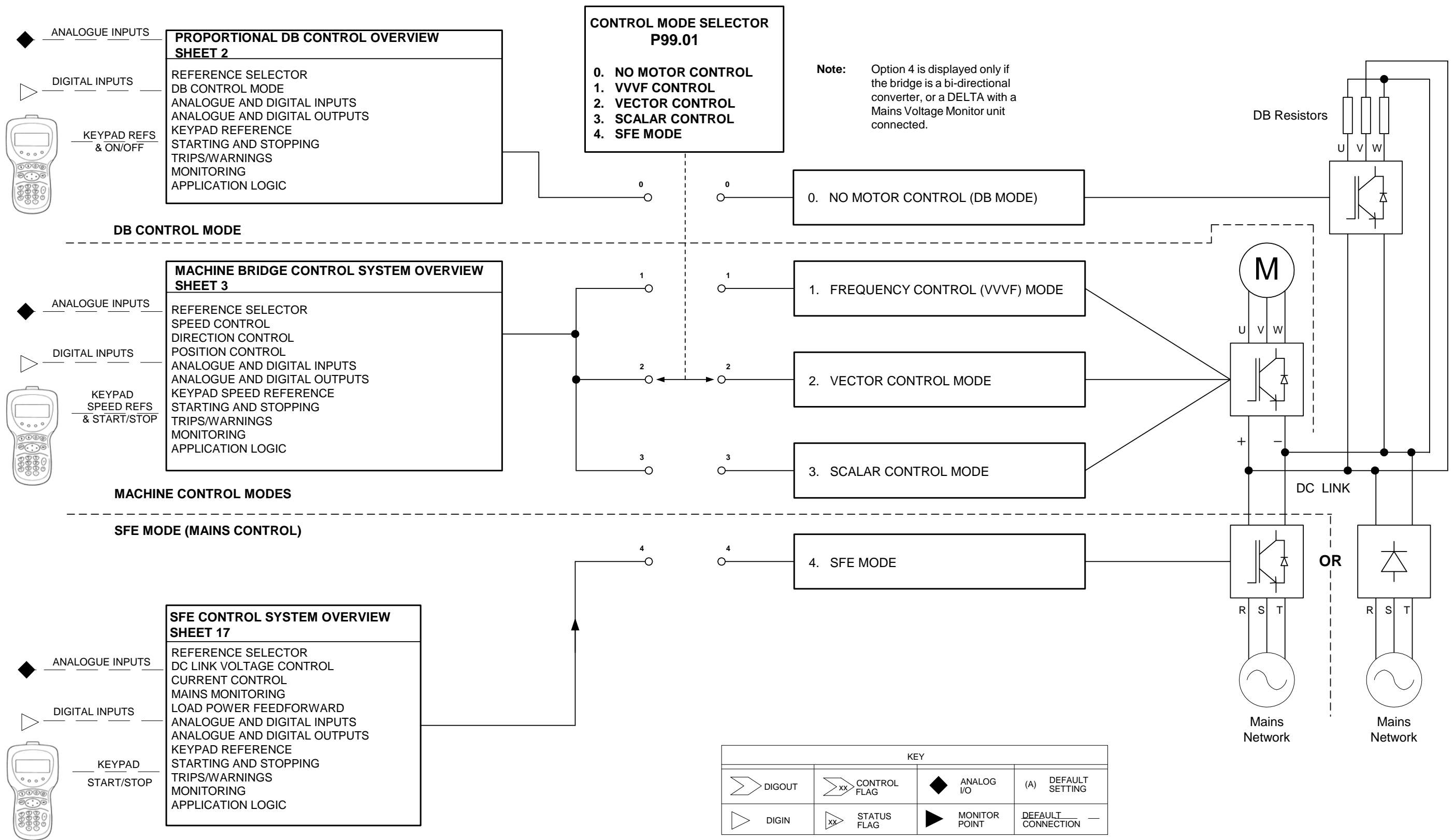
11.1 CONTROL BLOCK DIAGRAMS

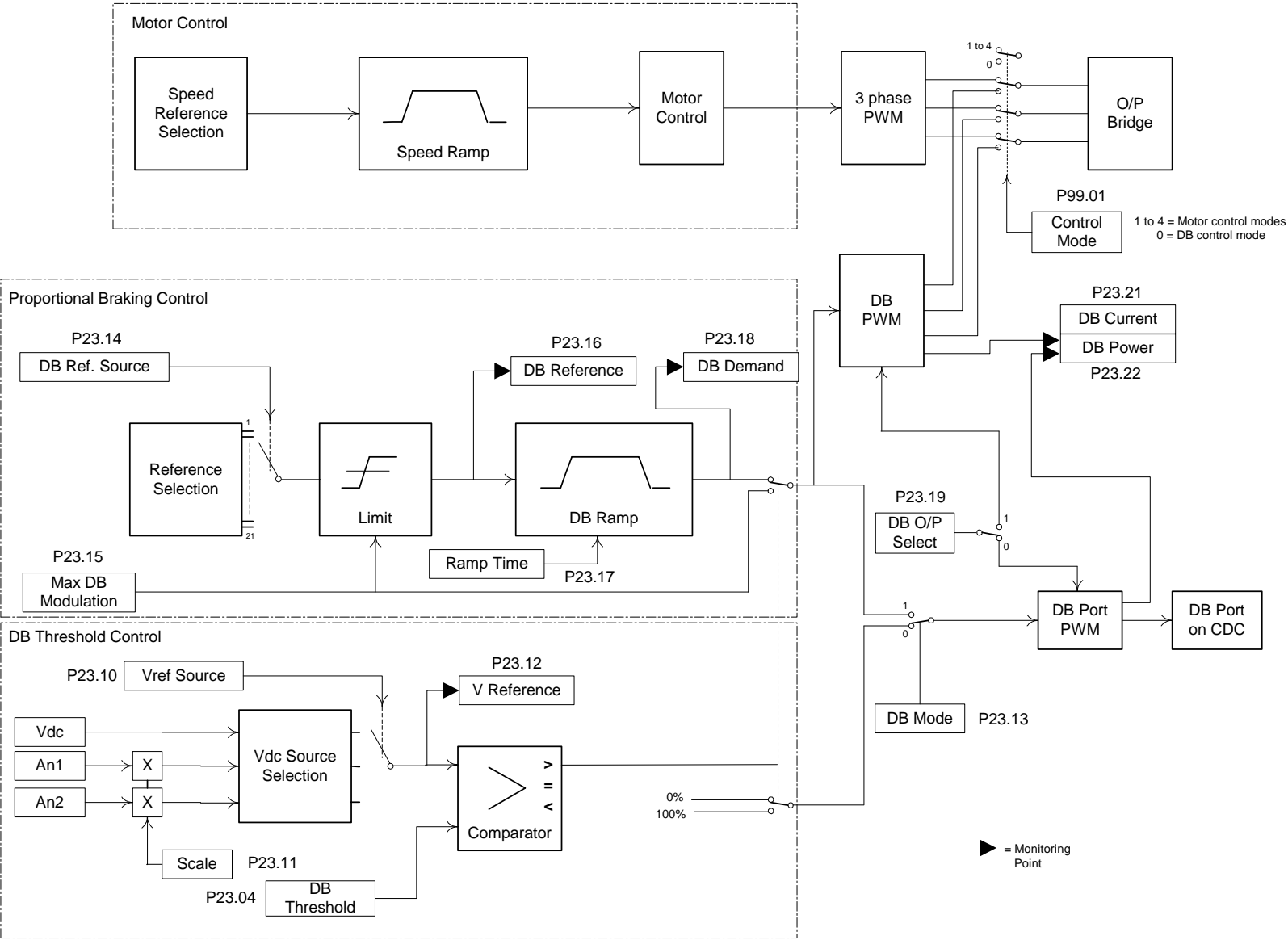
The Control Block Diagrams are listed below.

Sheet No.	Description
1	Control System Overview
2	Proportional DB Control
3	Machine Bridge Control System Overview
4	Plant I/O and Serial Links
5	Reference Arbitration and Starting/Stopping
6	Motor Frequency Control
7	Motor Vector Control Part 1
8	Motor Vector Control Part 2
9	Trips/Warnings and Diagnostic Monitoring
10	Motor Position Controller
11	Pointers
12	Special Monitoring Functions
13	Application Logic – General Purpose Logic Blocks
14	Summing Nodes, Analogue Switched and Square Roots
15	Comparators, Ramp Function & Brake Logic
16	Scalar Control

Table 11-1. – List of Control Block Diagrams

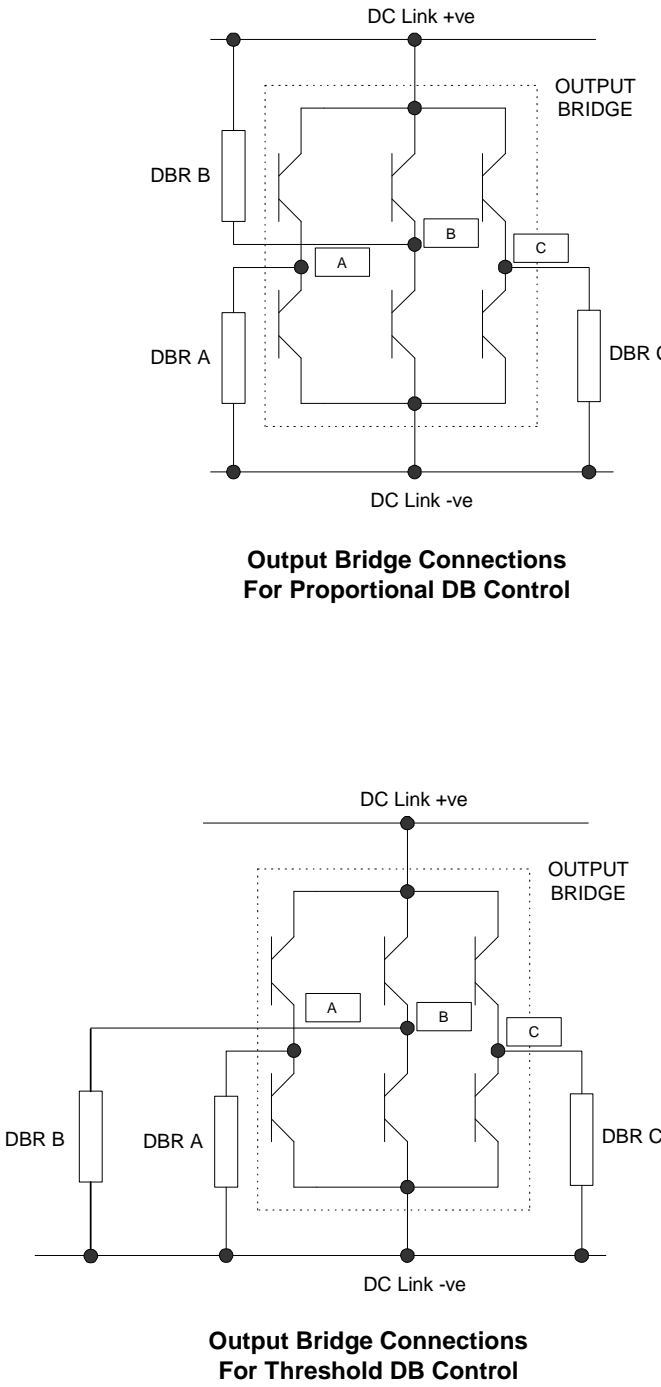
Control System Overview

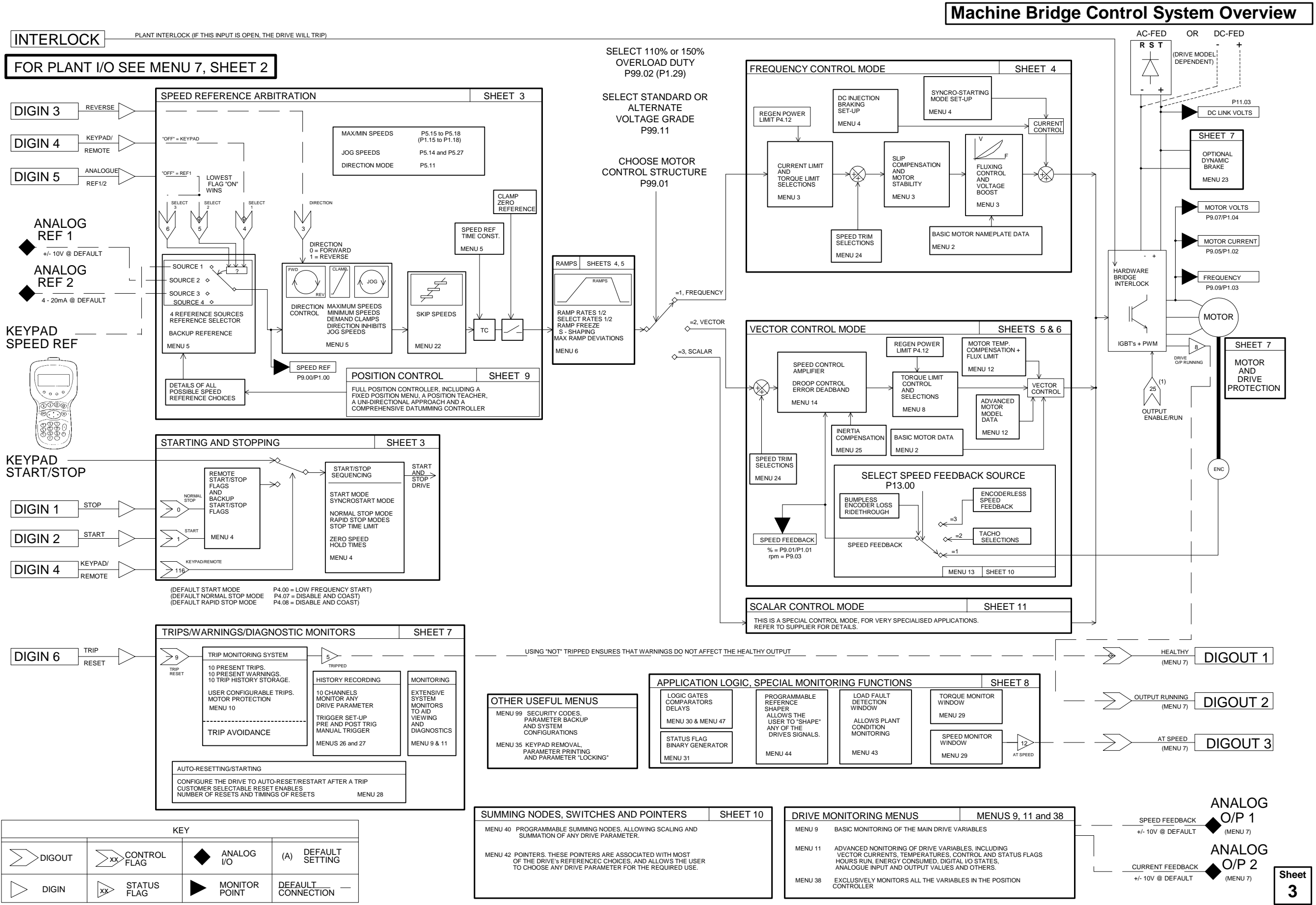




MENU 23

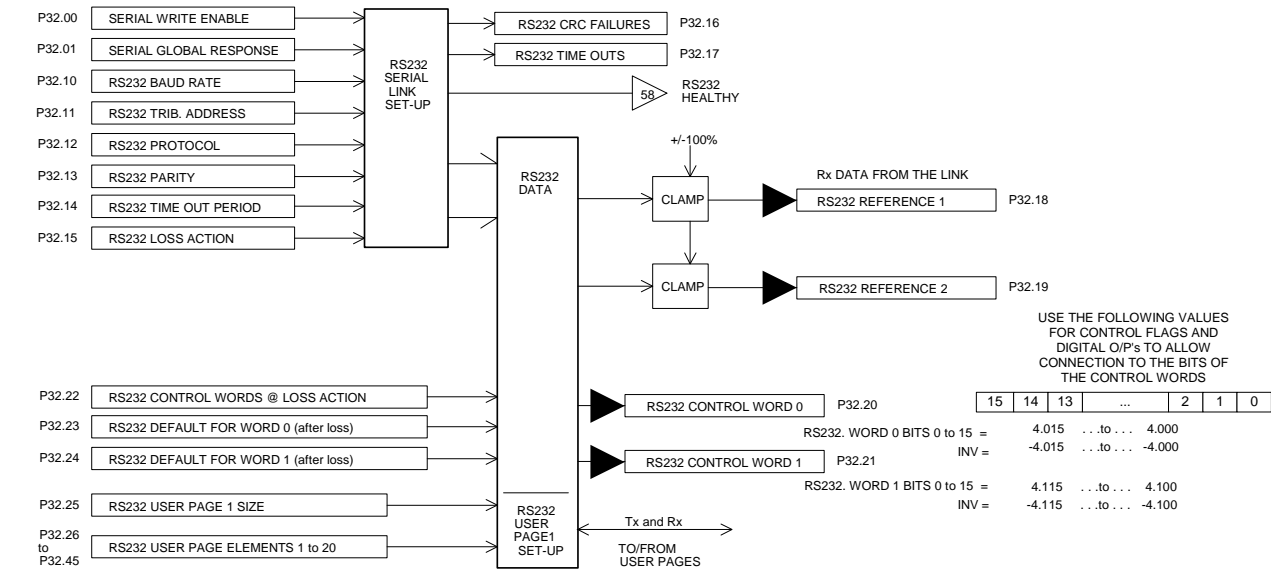
PROPORTIONAL DB CONTROL



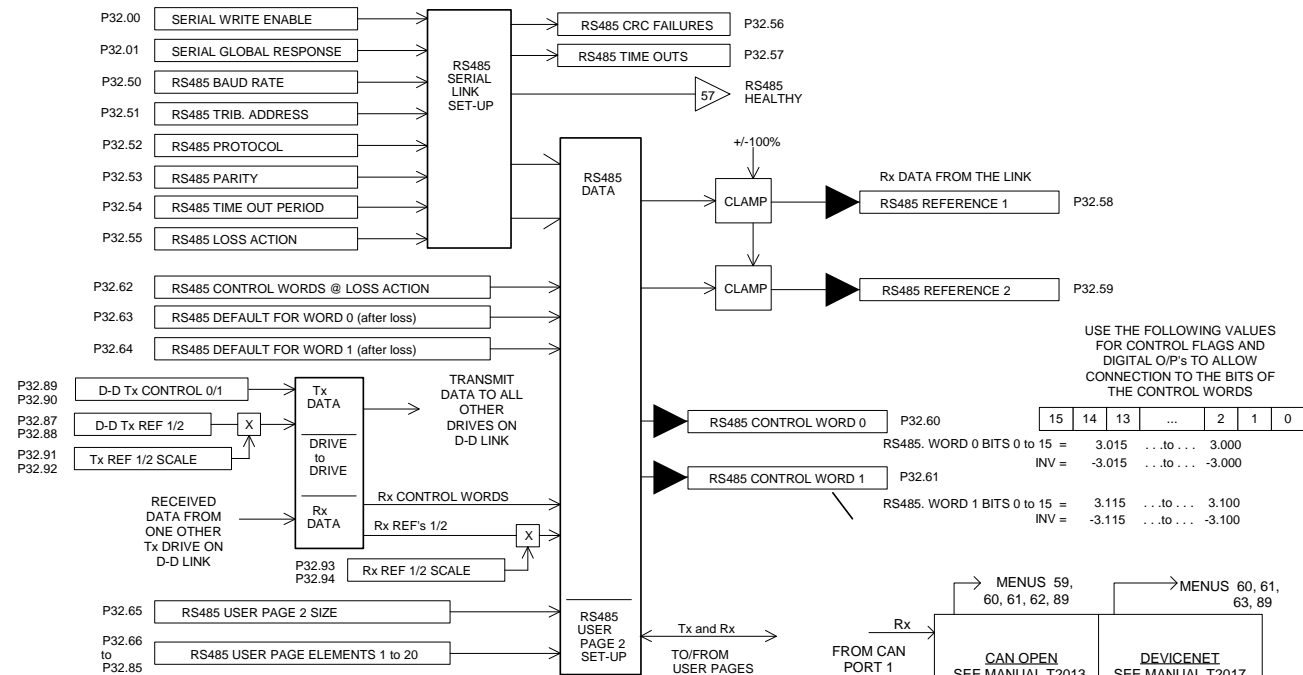




RS232 SERIAL LINK



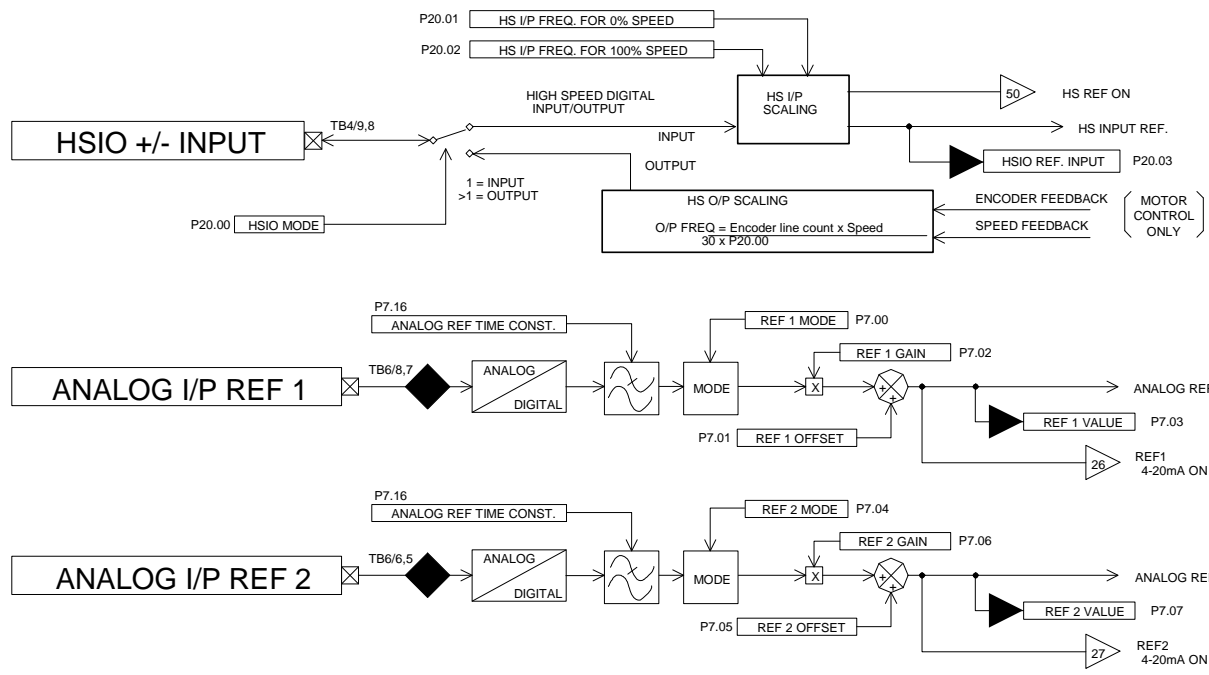
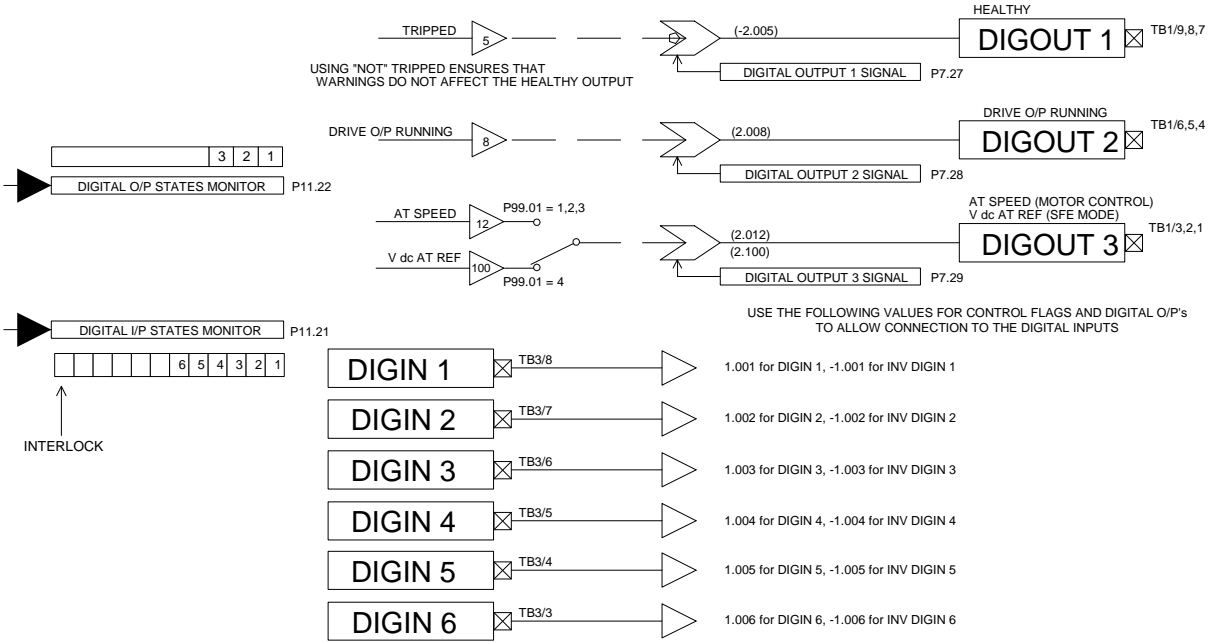
RS485 SERIAL LINK



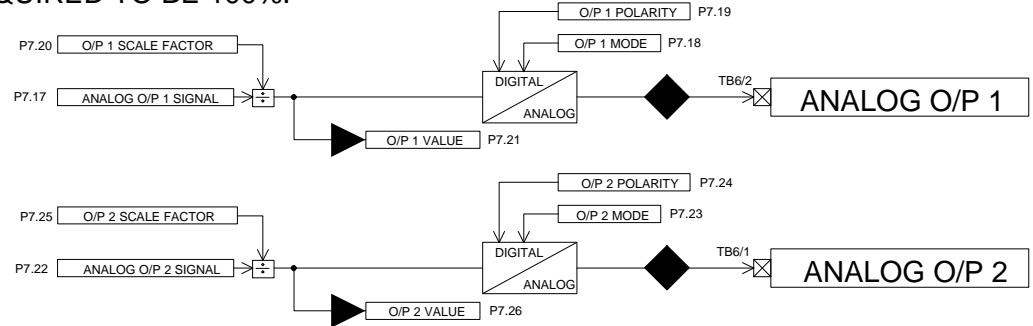
KEY			
	DIGOUT		CONTROL FLAG
	DIGIN		STATUS FLAG
	ANALOG I/O		MONITOR POINT
	DEFAULT SETTING		DEFAULT CONNECTION

Plant I/O and Serial Links

DEFAULT CONNECTIONS TO DIGITAL O/P SHOWN



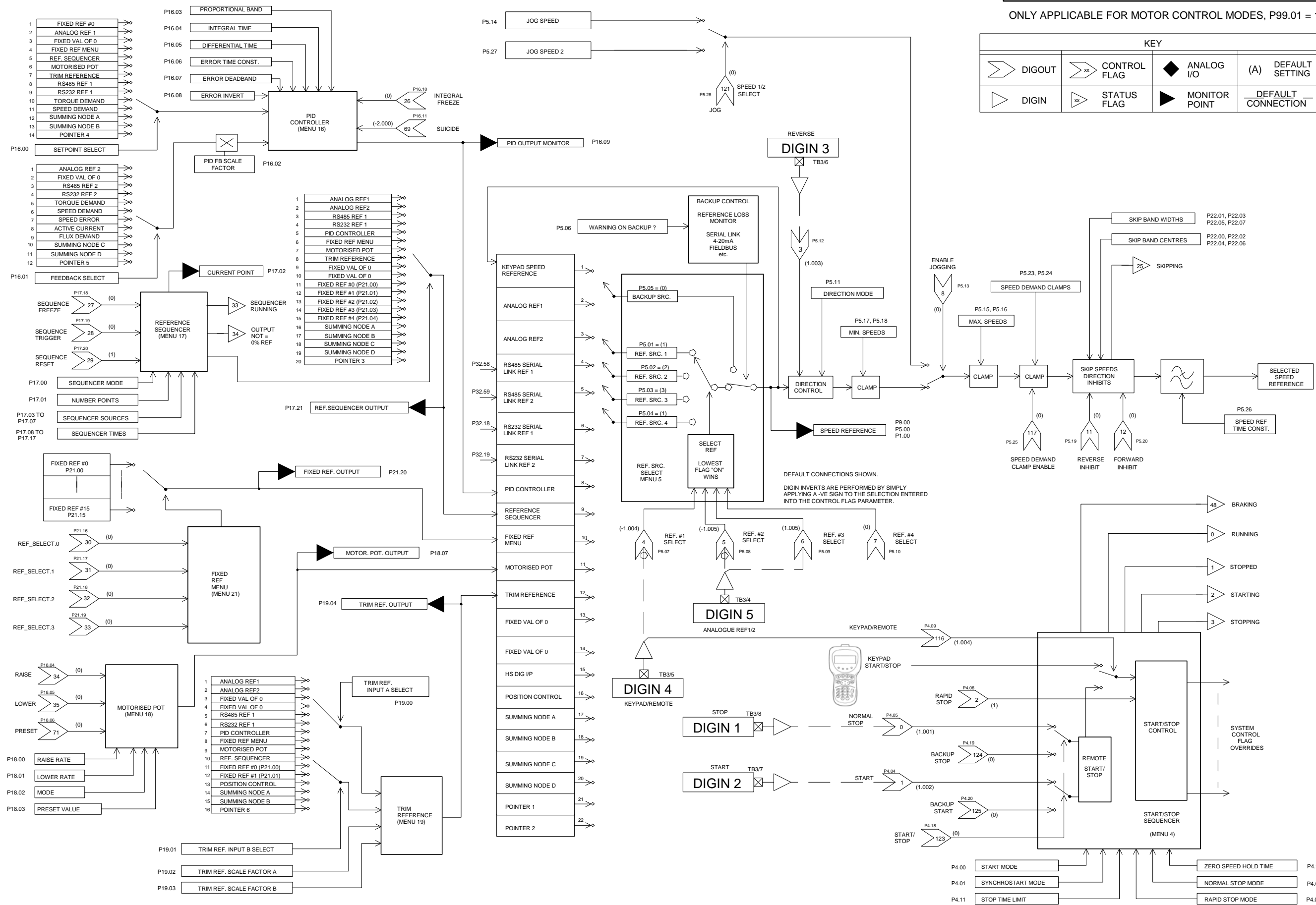
WHEN USING THE O/P SCALERS, SIMPLY EDIT IN THE VALUE THAT IS REQUIRED TO BE 100%.



## Reference Arbitration and Starting/Stopping

ONLY APPLICABLE FOR MOTOR CONTROL MODES, P99.01 = 1, 2, 3

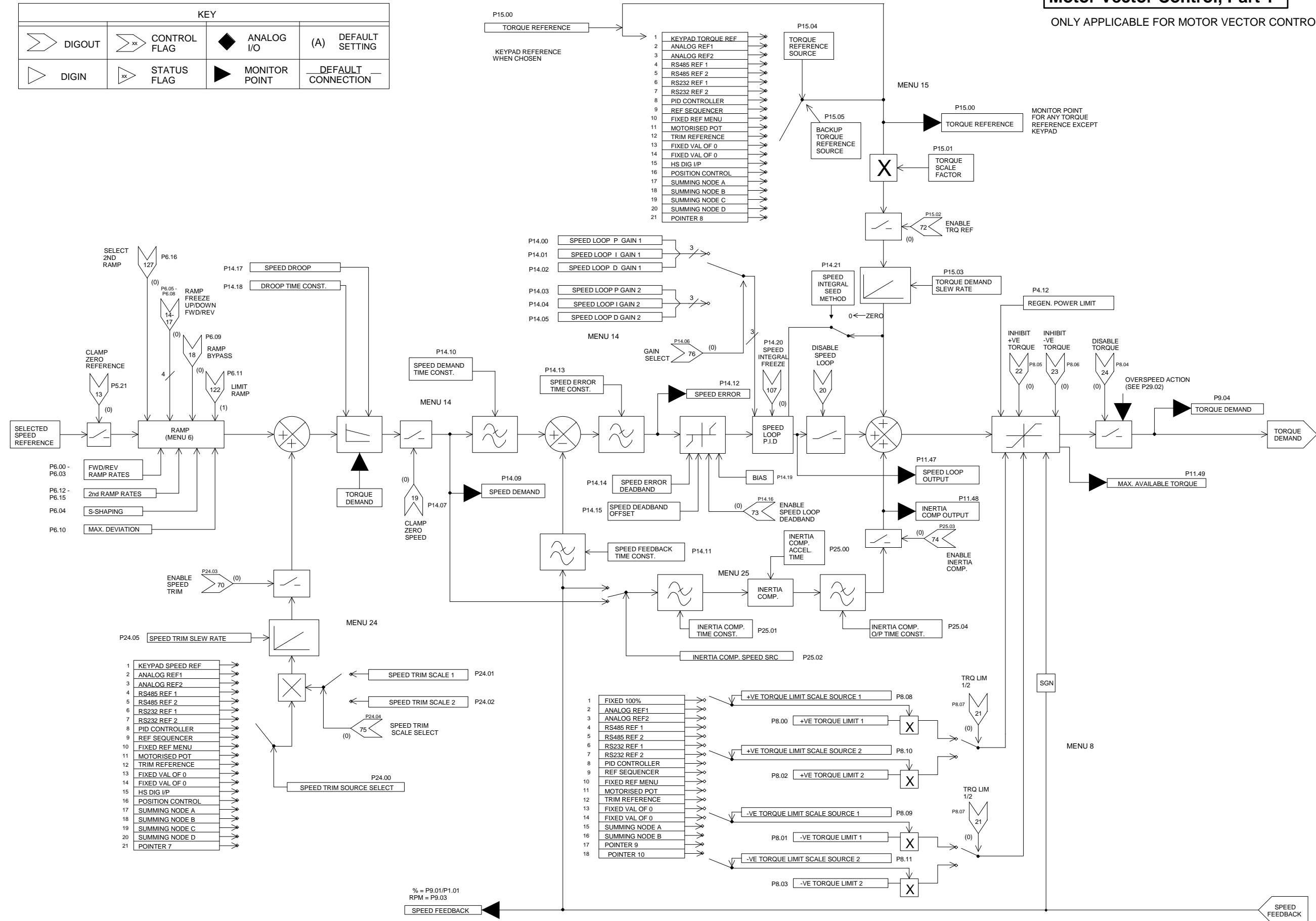
KEY			
	DIGOUT		CONTROL FLAG
	DIGIN		STATUS FLAG
	ANALOG I/O		MONITOR POINT
	(A) DEFAULT SETTING		DEFAULT CONNECTION





## Motor Vector Control, Part 1

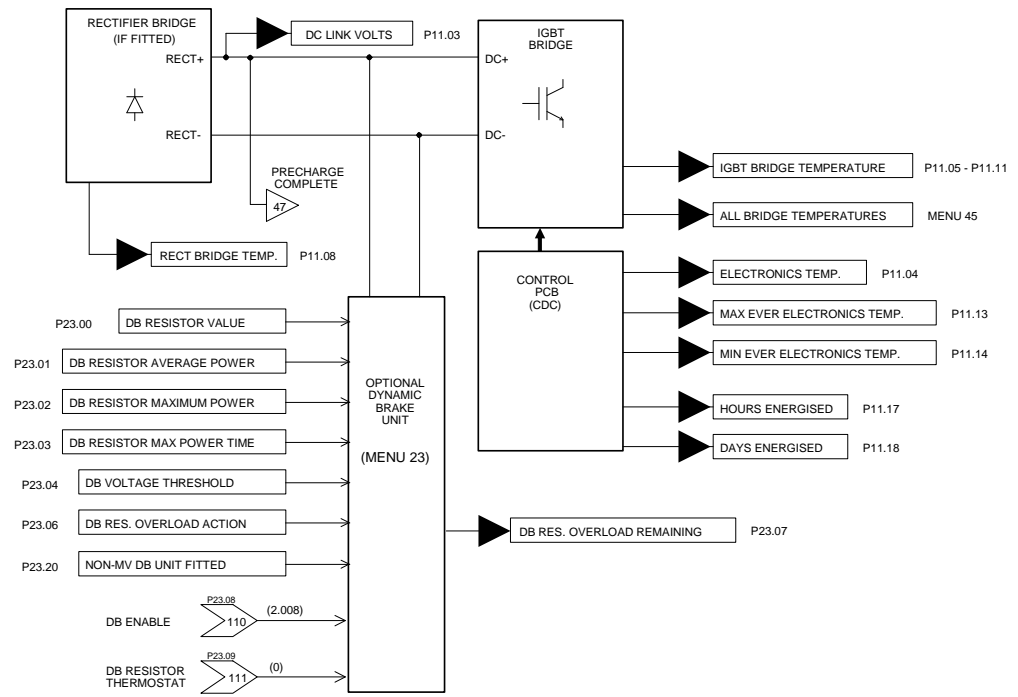
ONLY APPLICABLE FOR MOTOR VECTOR CONTROL, P99.01 = 2



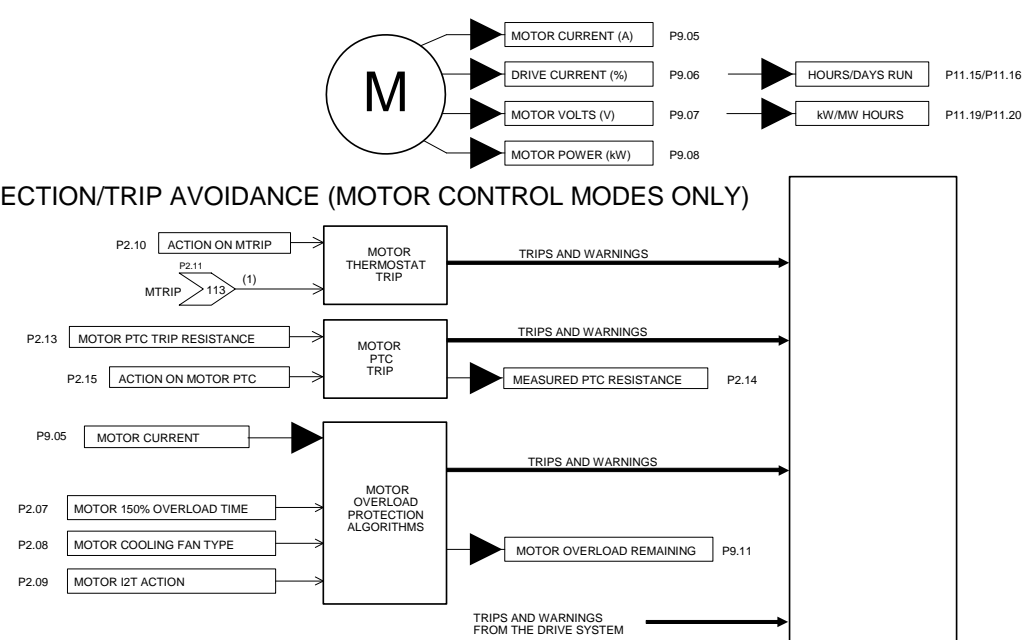


Trips/Warnings and Diagnostic Monitoring

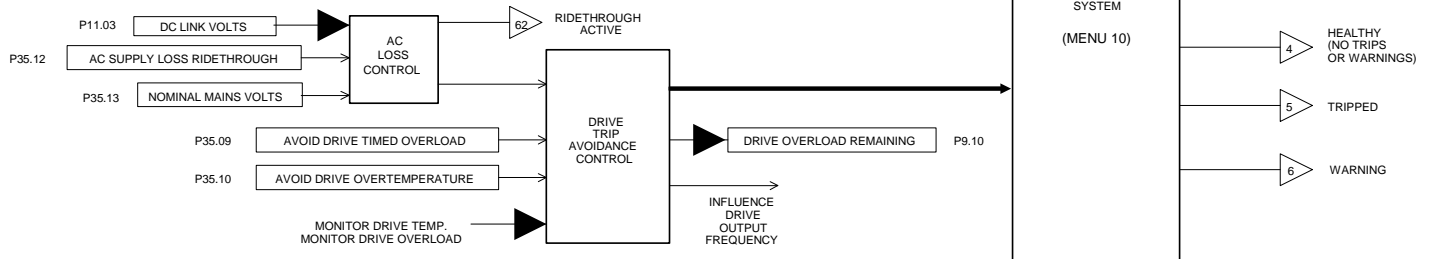
MOTOR MONITORING (MOTOR CONTROL MODES ONLY)



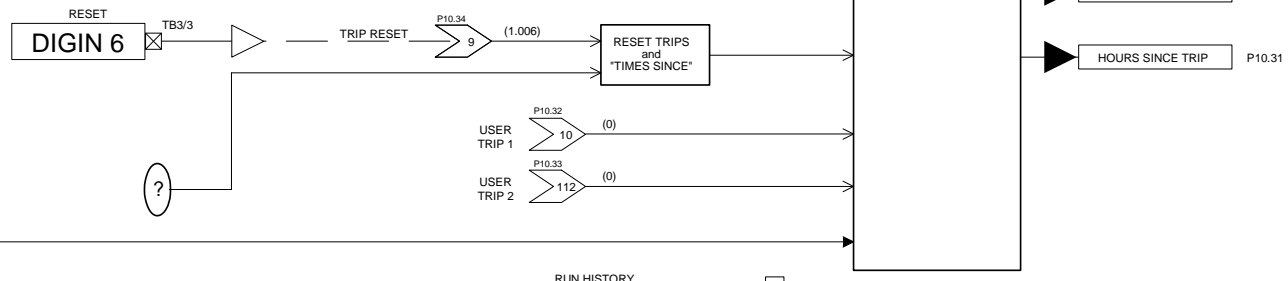
MOTOR PROTECTION/TRIP AVOIDANCE (MOTOR CONTROL MODES ONLY)



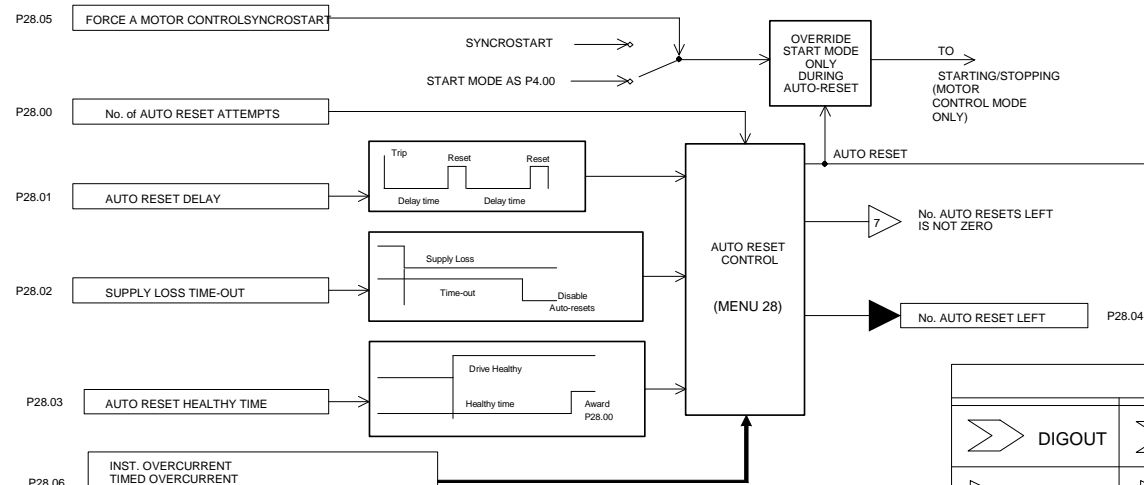
DRIVE TRIP AVOIDANCE (MOTOR CONTROL MODES ONLY)



TRIP RESETTING and USER TRIPS (ALL CONTROL MODES)



AUTO RESETTING CONTROL



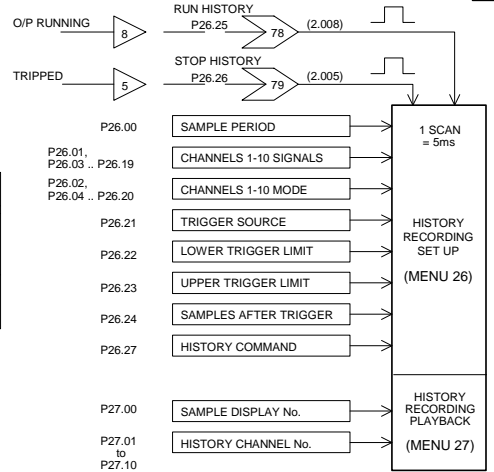
AUTO RESETTING ENABLES

- INST. OVERCURRENT
- TIMED OVERCURRENT
- DC LINK UNDERVOLTS
- DC LINK OVERVOLTS
- ALL MOTOR TRIPS - MOTOR CONTROL MODES ONLY
- INTERLOCK TRIP
- REFERENCE LOSS
- ALL TEMPERATURE TRIPS
- SERIAL LINK LOSS
- BOTH USER TRIPS
- OVERSPEED - MOTOR CONTROL MODES ONLY
- LOAD FAULT DETECT - MOTOR CONTROL MODES ONLY
- DB RESISTOR - MOTOR CONTROL MODES ONLY
- SFE MAINS - SFE MODE ONLY
- INTERLOCK TERMINAL (TB3/9)

**WARNING**  
If the drive is configured to auto-restart, the motor can start rotating without an operator command. Take precautions to prevent injury to personnel.

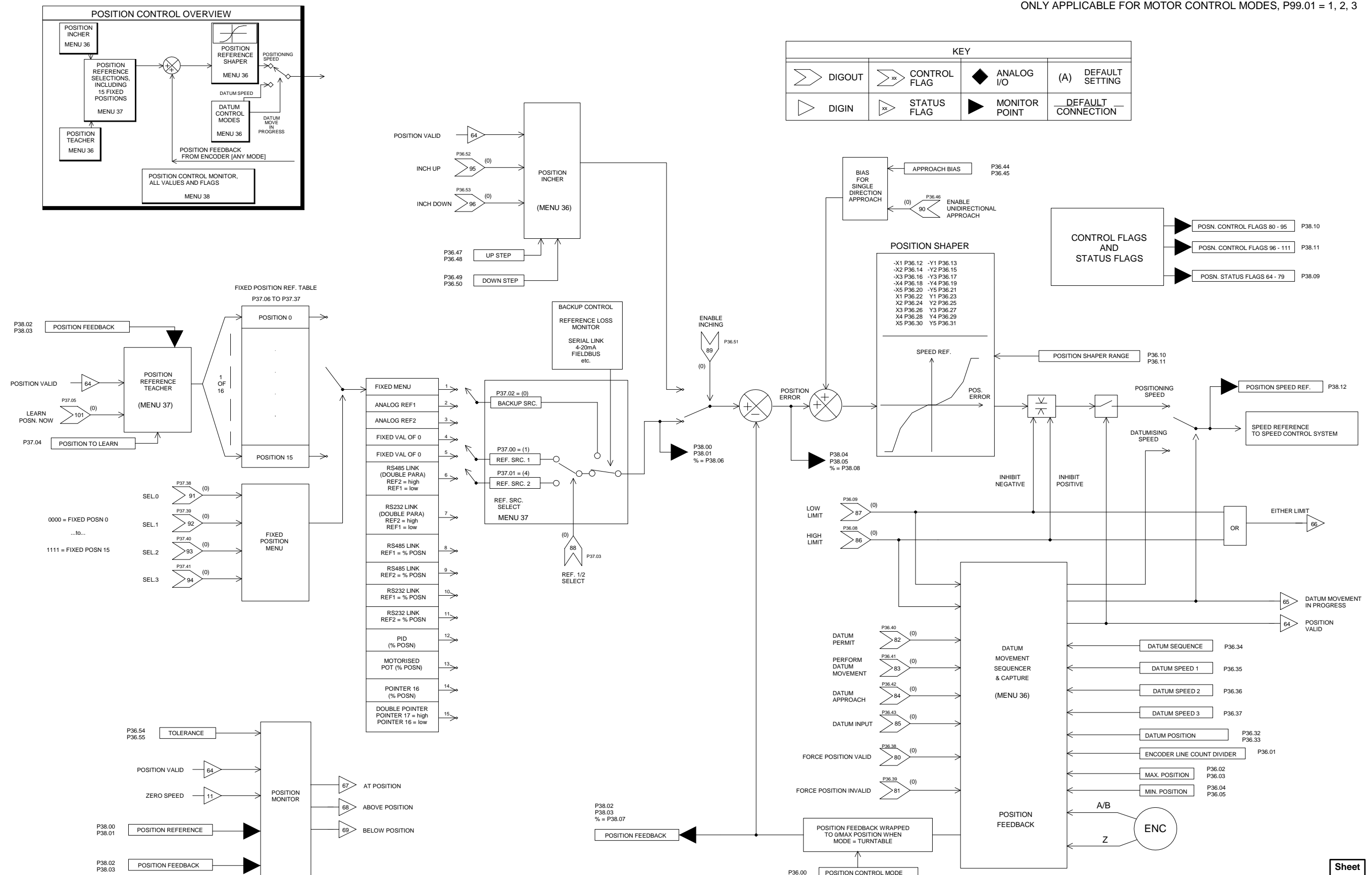
ON BOARD DIAGNOSTIC HISTORY CHART RECORDER

KEY			
DIGOUT	CONTROL FLAG	ANALOG I/O	DEFAULT SETTING
DIGIN	STATUS FLAG	MONITOR POINT	DEFAULT CONNECTION



# Motor Position Controller

ONLY APPLICABLE FOR MOTOR CONTROL MODES, P99.01 = 1, 2, 3



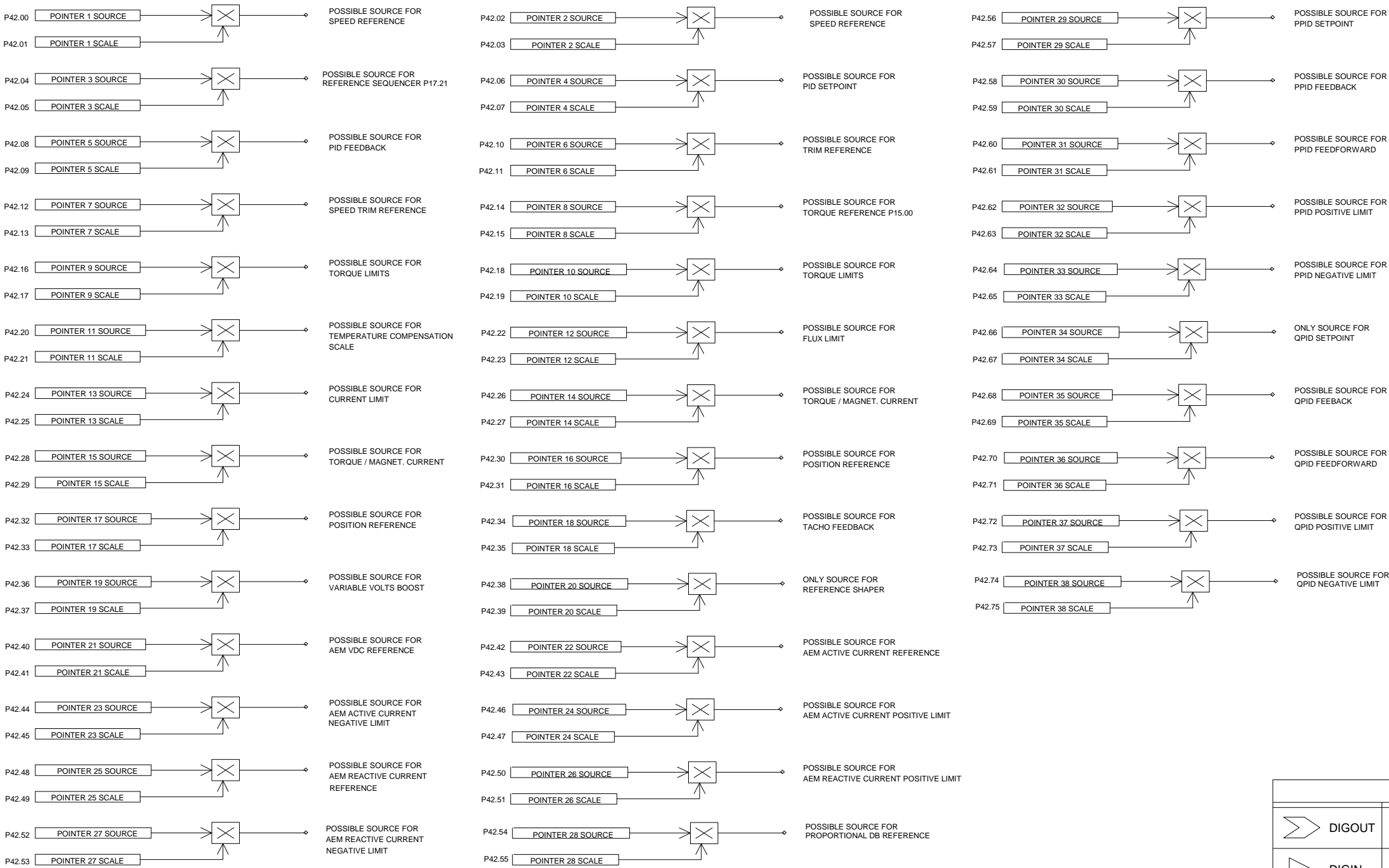
Sheet  
10



Pointers

THE POINTERS BELOW CAN BE USED BY SIMPLY SELECTING THE RELEVANT POINTER FROM THE LIST OFFERED IN THE RELEVANT REFERENCE CHOICE.

E.G. CHOOSE POINTER 1 FROM THE SPEED REFERENCE CHOICE SELECTION (SHEET 2)  
THEN CONFIGURE POINTER 1 BELOW.  
THE POINTER SOURCES CAN BE ANY DRIVE PARAMETER.

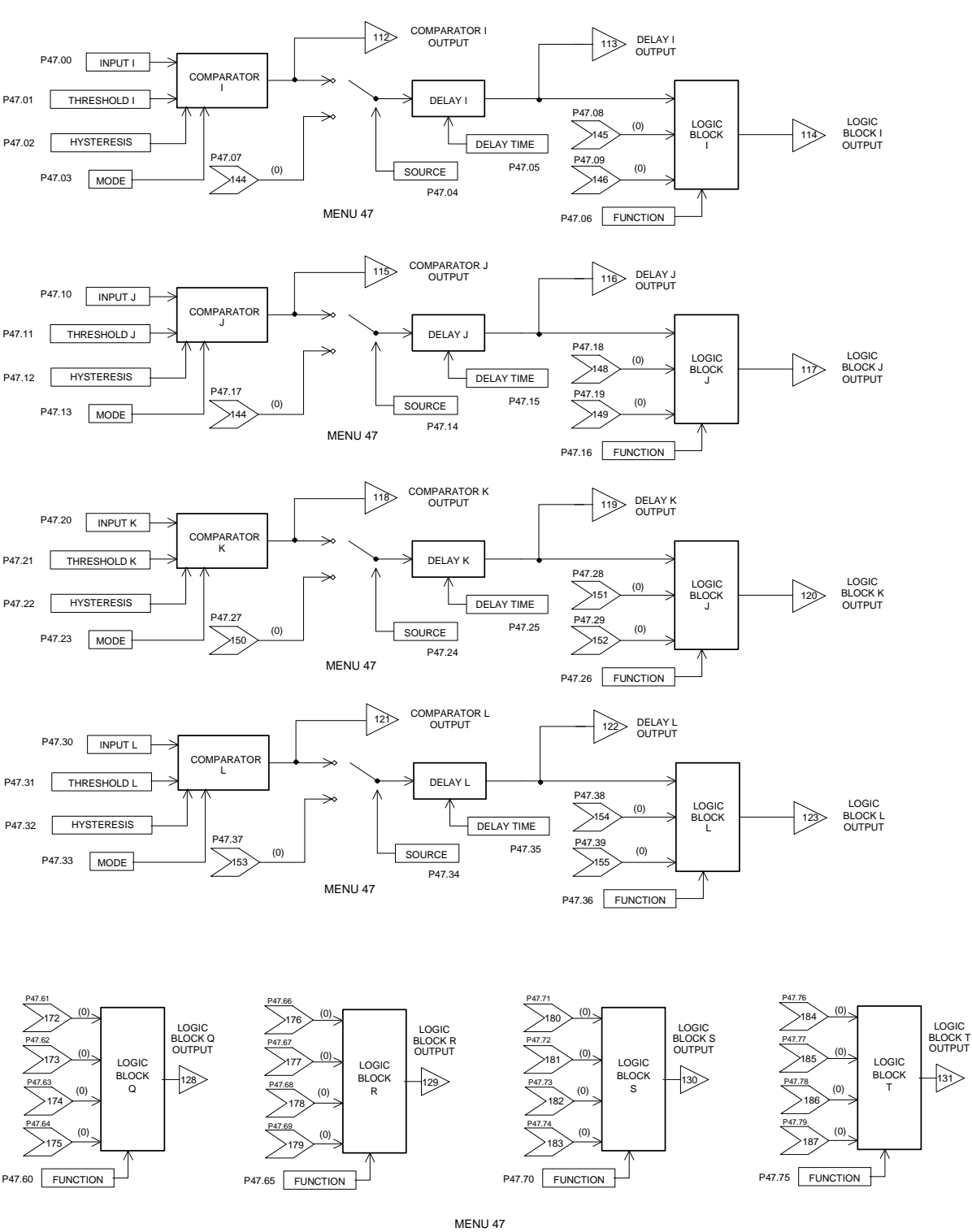
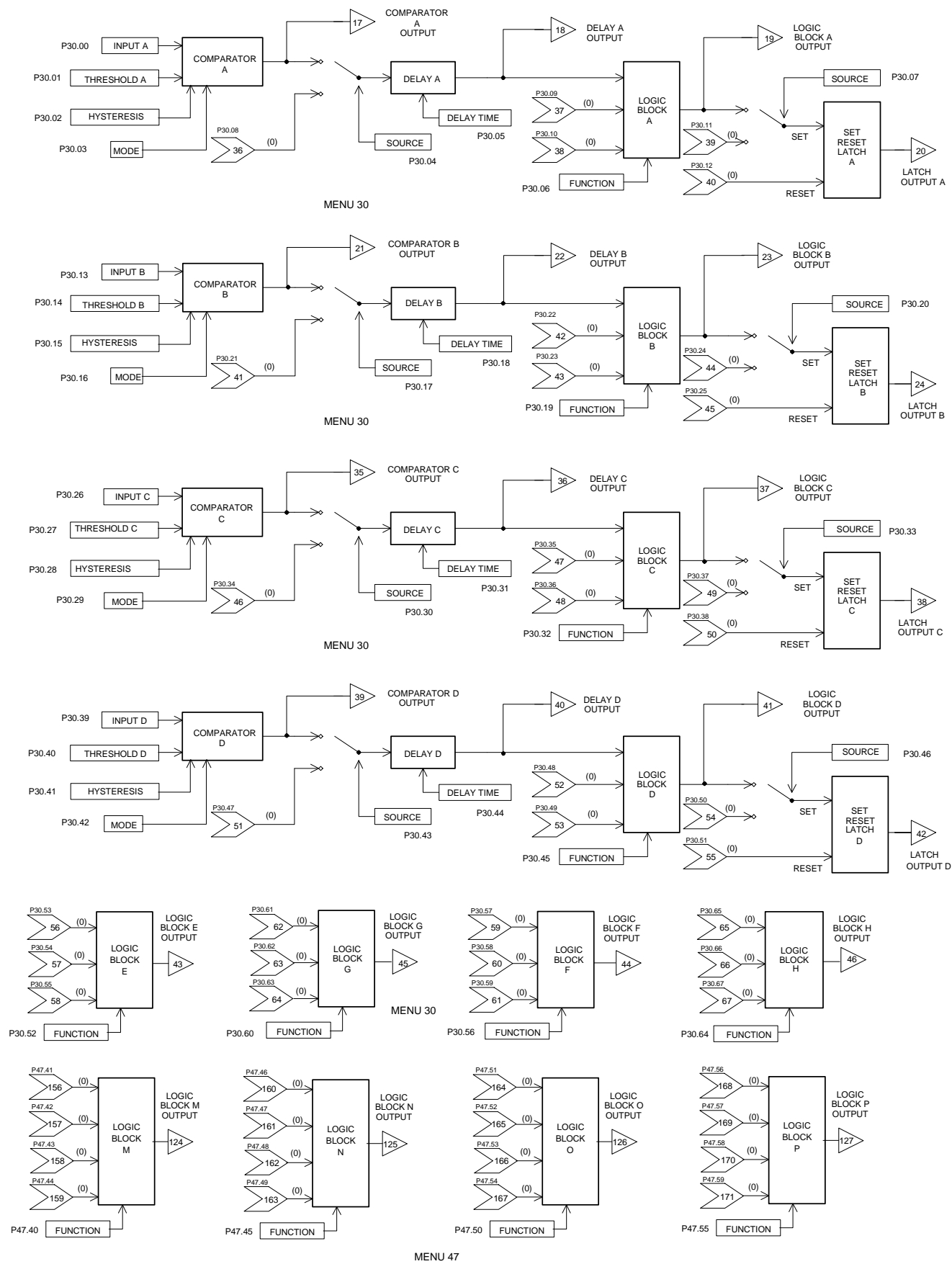


KEY			
	DIGOUT		CONTROL FLAG
	DIGIN		STATUS FLAG
	ANALOG I/O		MONITOR POINT
	(A) DEFAULT SETTING		DEFAULT CONNECTION





Application Logic - General Purpose Logic Blocks



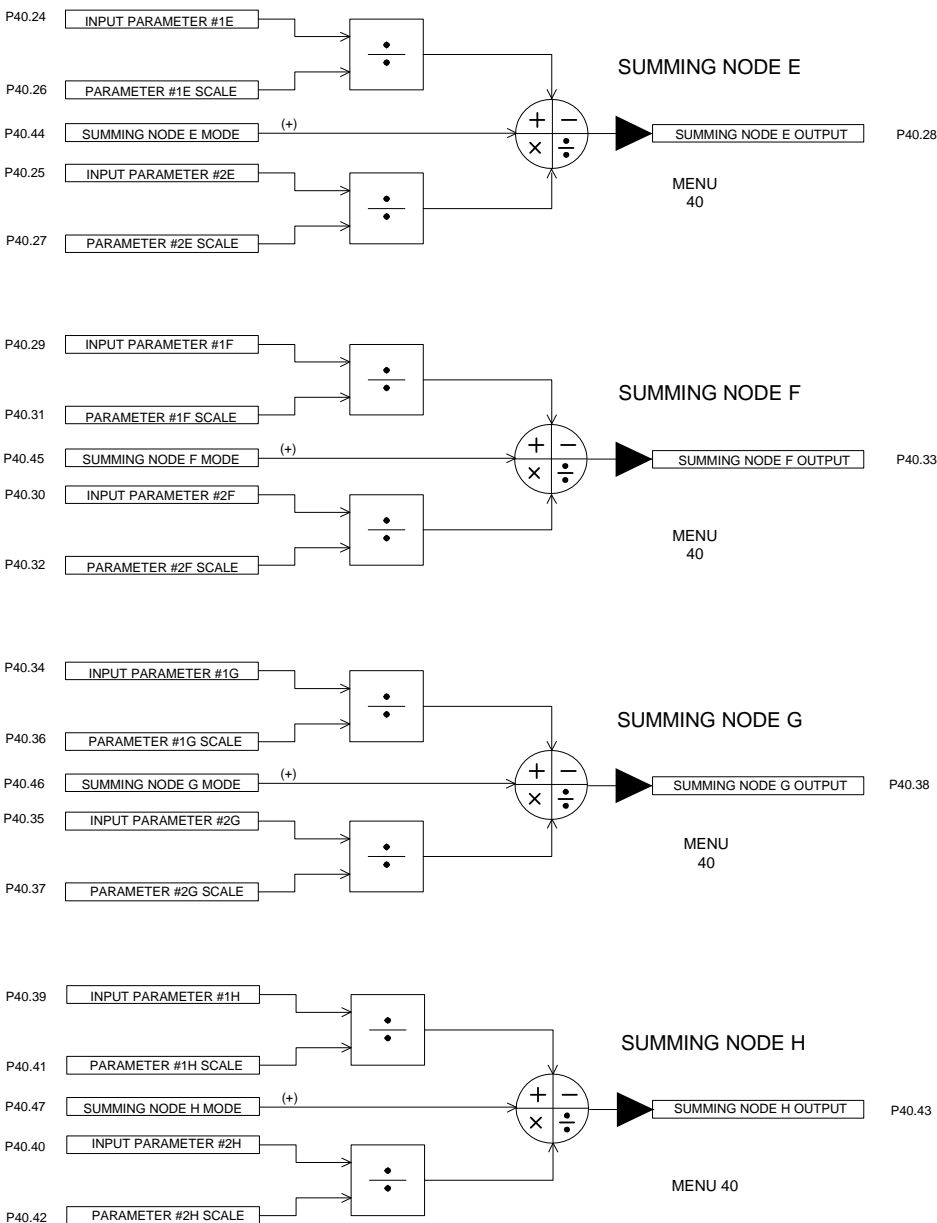
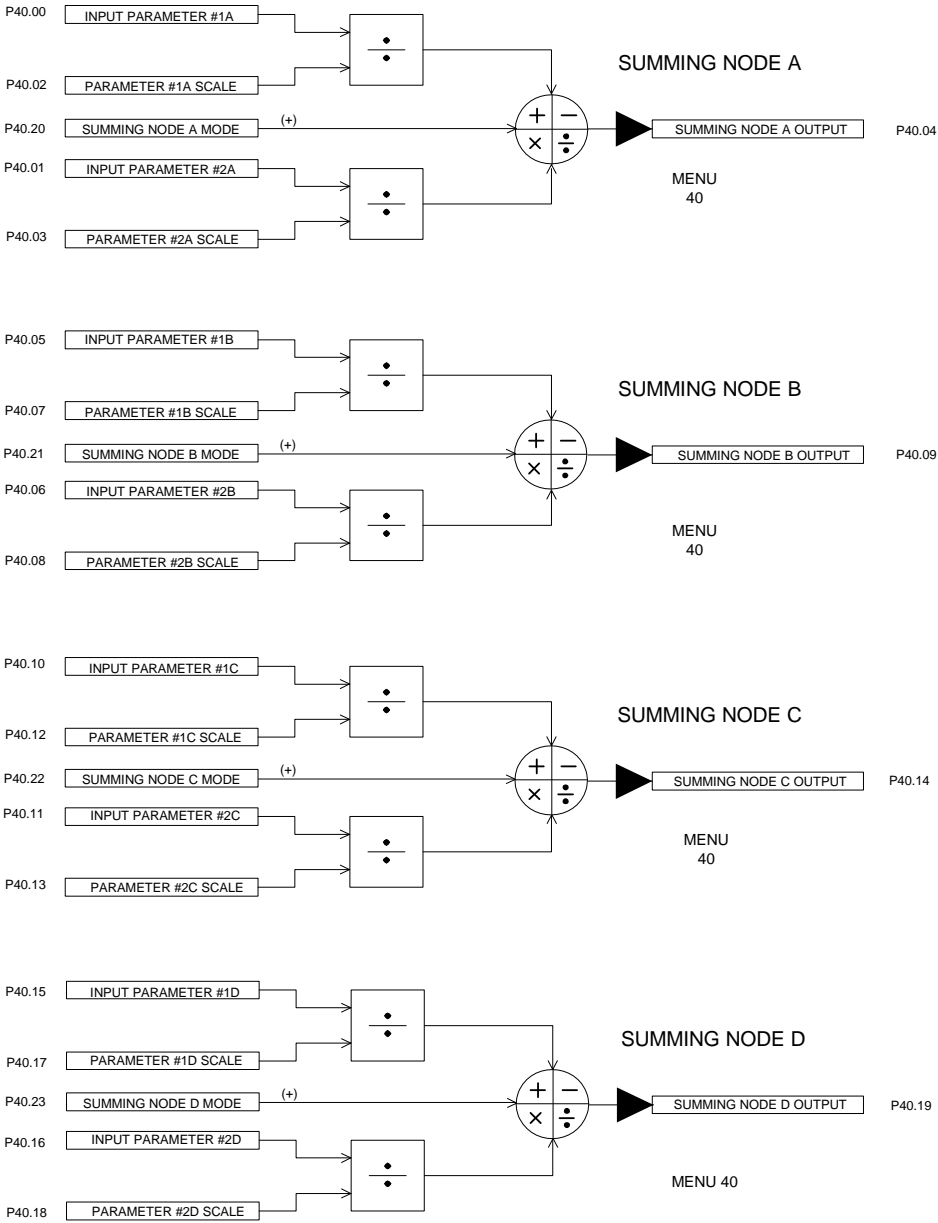
KEY			
	DIGOUT		CONTROL FLAG
	DIGIN		ANALOG I/O
			MONITOR POINT
			DEFAULT SETTING
			DEFAULT CONNECTION

Summing Nodes, Analogue Switches and Square Roots

THE EQUATION BELOW SHOWS HOW SUMMING NODES A, B, C, D, E, F, G & H OPERATE.  
THE EIGHT DIAGRAMS ARE A LOGICAL REPRESENTATION.

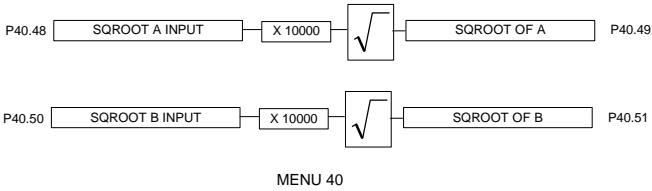
SUMMING NODE OUTPUT =  $\left( \left( \frac{\text{SUMMING NODE INPUT 1}}{\text{SUMMING NODE SCALE 1}} \right) ? \left( \frac{\text{SUMMING NODE INPUT 2}}{\text{SUMMING NODE SCALE 2}} \right) \right) \times 100.00\%$

WHERE ? IS THE CHOSEN MODE (+, -, X or ÷)

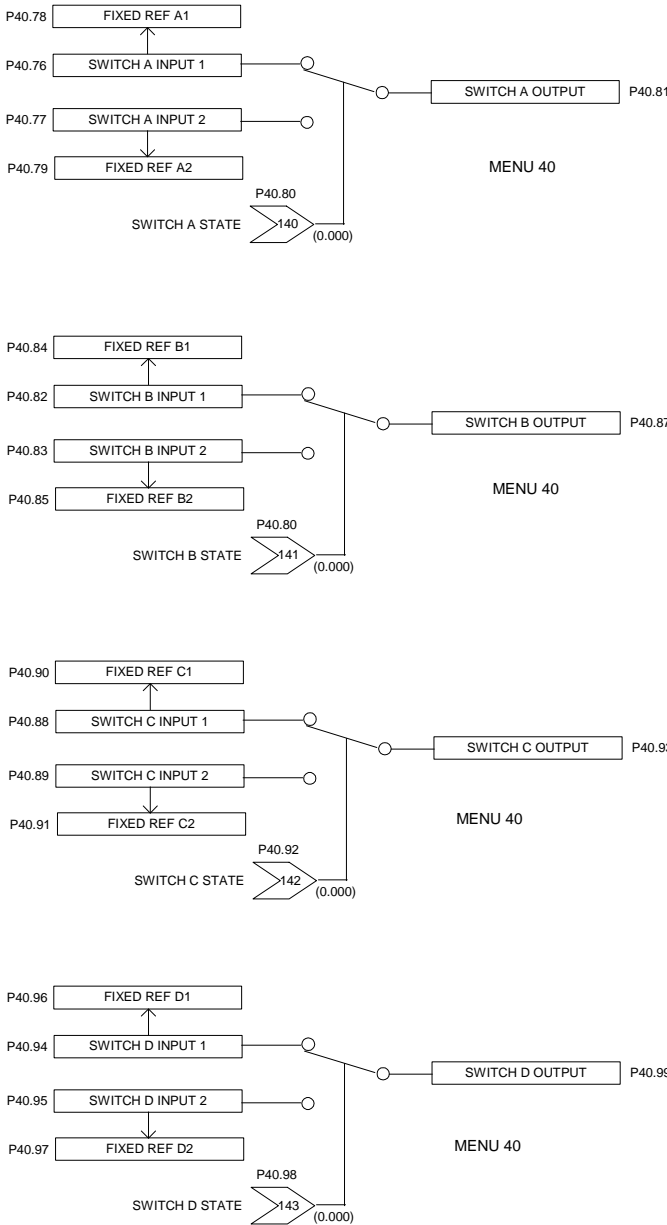


KEY			
	DIGOUT		CONTROL FLAG
	DIGIN		STATUS FLAG
	ANALOG I/O		MONITOR POINT
	DEFAULT SETTING		DEFAULT CONNECTION

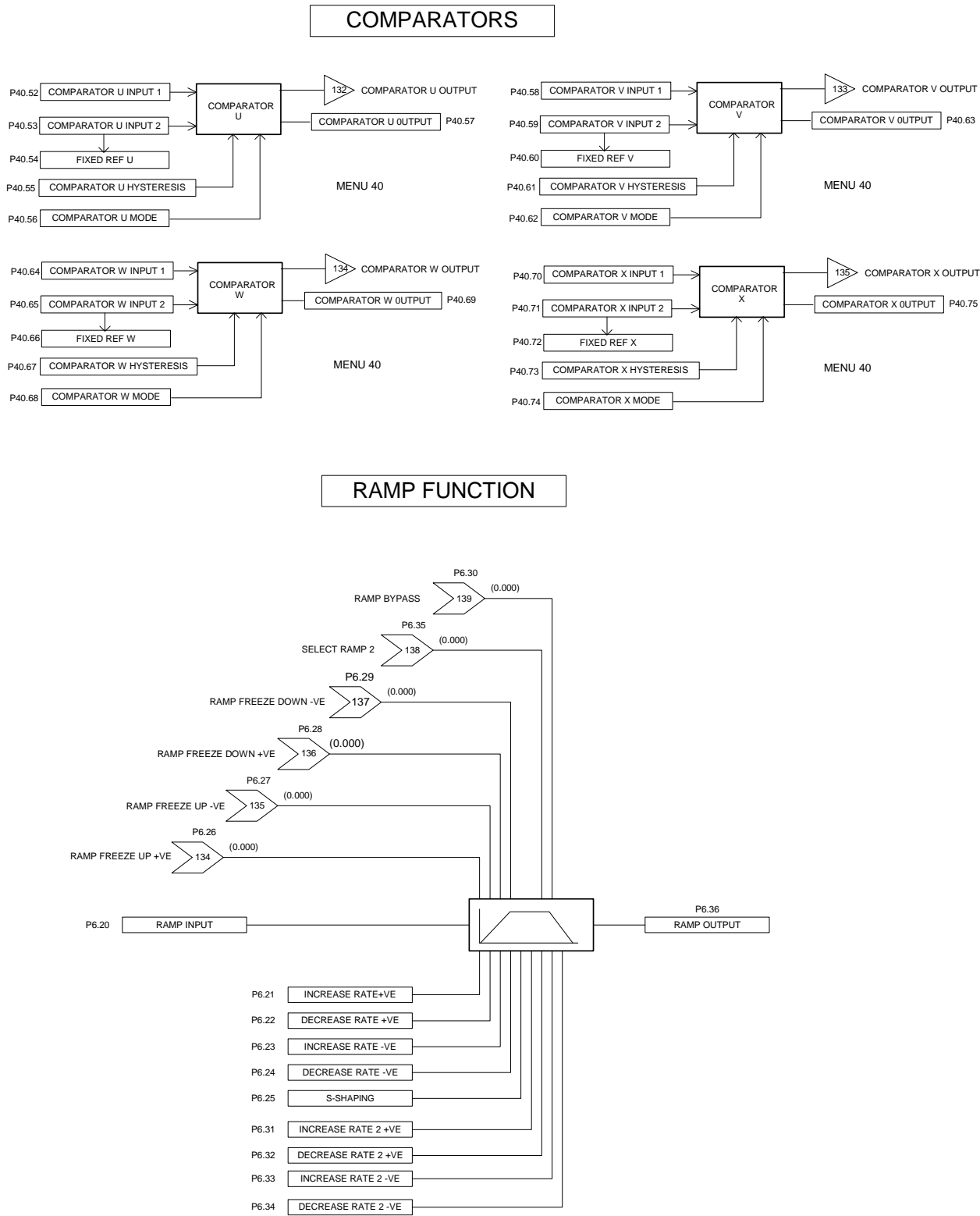
SQUARE ROOTS



ANALOGUE SWITCHES



Comparators, Ramp Function & Brake Logic



MENU 40

P40.58

COMPARATOR V INPUT 1

P40.59

COMPARATOR V INPUT 2

P40.60

FIXED REF V

P40.61

COMPARATOR V HYSTERESIS

P40.62

COMPARATOR V MODE

COMPARATOR V

133

COMPARATOR V OUTPUT

P40.63

COMPARATOR V OUTPUT

MENU 40

P40.64

COMPARATOR W INPUT 1

P40.65

COMPARATOR W INPUT 2

P40.66

FIXED REF W

P40.67

COMPARATOR W HYSTERESIS

P40.68

COMPARATOR W MODE

COMPARATOR W

134

COMPARATOR W OUTPUT

P40.69

COMPARATOR W OUTPUT

MENU 40

P40.70

COMPARATOR X INPUT 1

P40.71

COMPARATOR X INPUT 2

P40.72

FIXED REF X

P40.73

COMPARATOR X HYSTERESIS

P40.74

COMPARATOR X MODE

COMPARATOR X

135

COMPARATOR X OUTPUT

P40.75

COMPARATOR X OUTPUT

MENU 40

RAMP FUNCTION

P6.20

RAMP INPUT

P6.30

RAMP BYPASS

P6.35

SELECT RAMP 2

P6.29

RAMP FREEZE DOWN -VE

P6.28

RAMP FREEZE DOWN +VE

P6.27

RAMP FREEZE UP -VE

P6.26

RAMP FREEZE UP +VE

P6.36

RAMP OUTPUT

P6.21

INCREASE RATE+VE

P6.22

DECREASE RATE +VE

P6.23

INCREASE RATE -VE

P6.24

DECREASE RATE -VE

P6.25

S-SHAPING

P6.31

INCREASE RATE 2 +VE

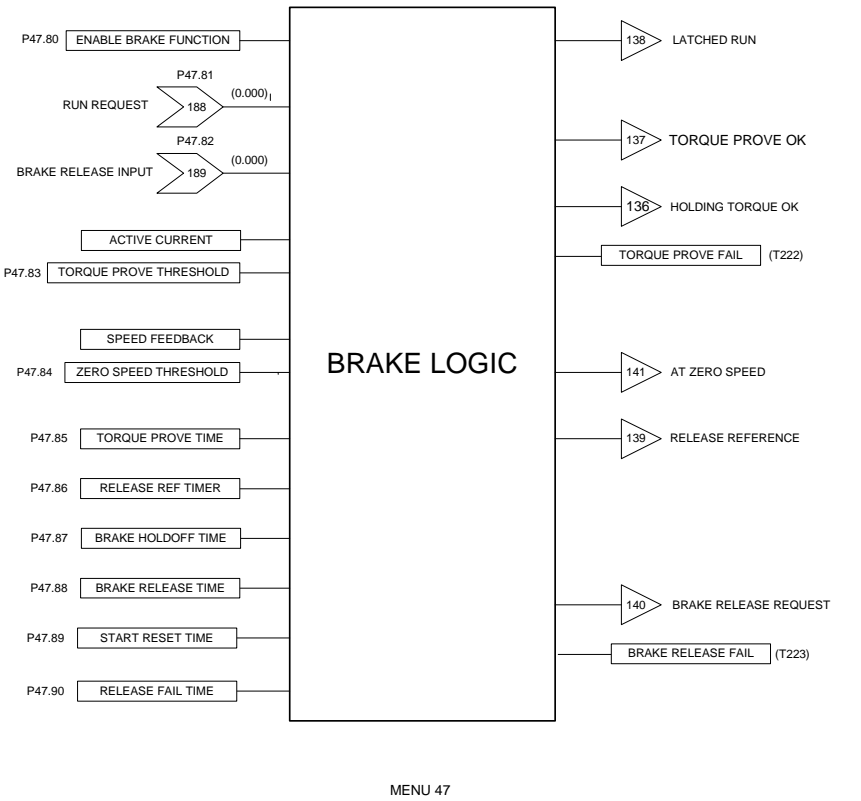
P6.32

DECREASE RATE 2 +VE

P6.33

INCREASE RATE 2 -VE

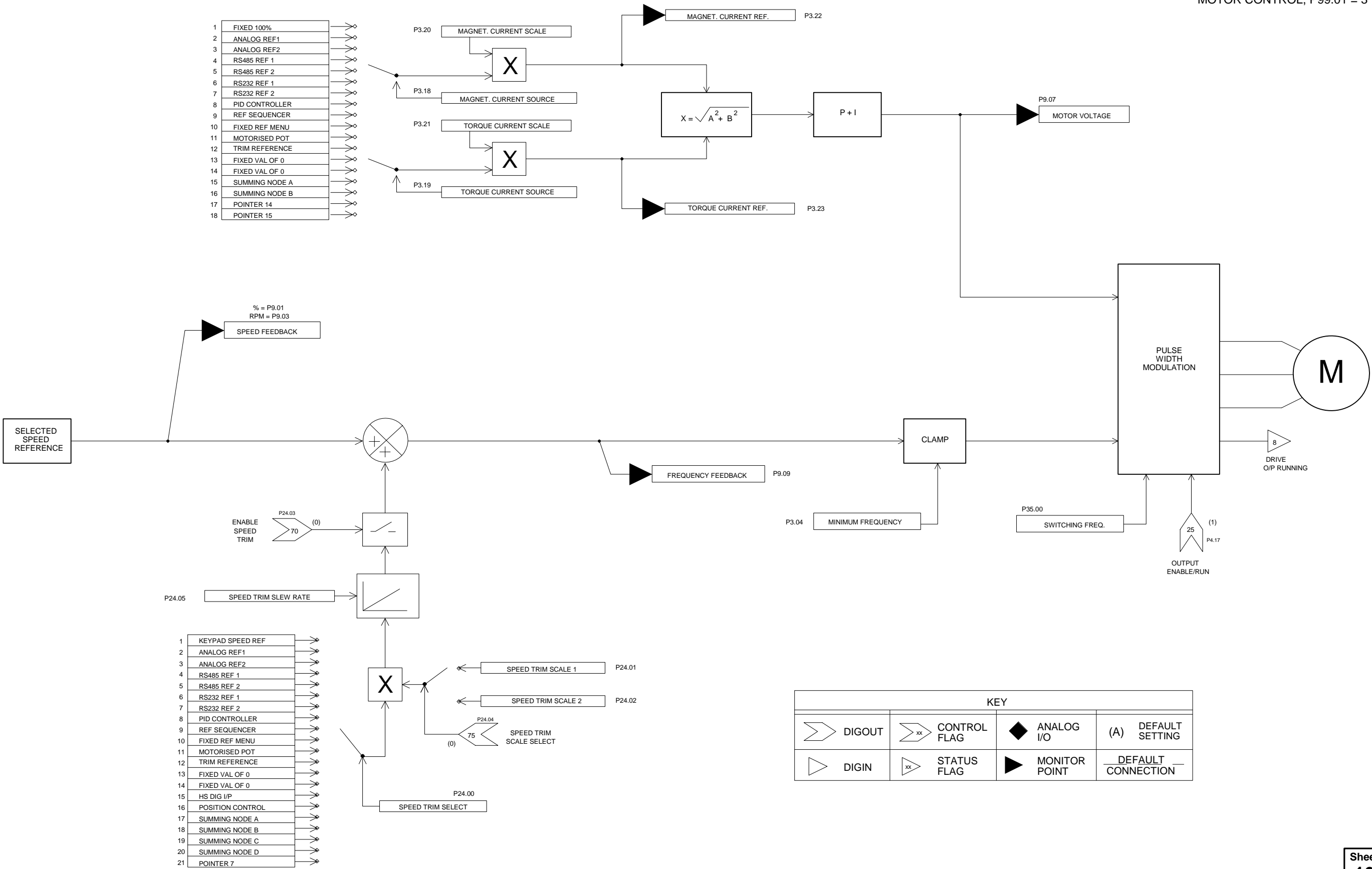
P6.34

DECREASE RATE 2 -VE

KEY			
	DIGOUT		CONTROL FLAG
	DIGIN		STATUS FLAG
	ANALOG I/O		MONITOR POINT
	(A) DEFAULT SETTING		DEFAULT CONNECTION

Scalar Control

ONLY APPLICABLE FOR SCALAR  
MOTOR CONTROL, P99.01 = 3





## 12. CONTACT DETAILS FOR SALES, SERVICE & SUPPORT

[www.ge.com](http://www.ge.com)

Please refer to your local technical support centre if you have any queries about this product.

### Technical Support Centre

#### UK

GE Power Conversion  
West Avenue,  
Kidsgrove  
Stoke-on-Trent, Staffordshire ST7 1TW  
Tel: +44(0)1782 781000  
Fax: +44(0)1782 781001

### Head Offices

#### Brasil

GE Power Conversion  
Av. Álvares Cabral, 1345  
Bairro Lourdes, Belo Horizonte  
Minas Gerais, 30170-001  
Tel: +55 31 3330 5800

#### China

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