AVID CONTROLS®

T1676EN Getting Started Manual Rev 10

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.
Rev 10	March 2016	Updated changes according to IEC 61800-5-1 and UL 61800-5-1 requirements for Voltage Grade 4 & 5 products. Rationalisation to remove non-preferred types.

DEFINITIONS

WARNING

- **"An instruction that draws attention to the risk of injury or death".**

CAUTION

- **"An instruction that draws attention to the risk of damage to the product, process or surroundings".**

NOTE: Notes separate important information from the text and give additional information.

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, UL61800-5-1 and CSA C22.2 No 14 are marked on the product where applicable.

In The European Union:

- Products within the scope of the Low Voltage Directive, 2014/35/EU (from April 20th, 2016) are CE marked.
- The product complies with the essential protection requirements of the EMC Directive 2014/30/EU (from April 20th, 2016), 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.

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 Diode Front End (DFE) 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.

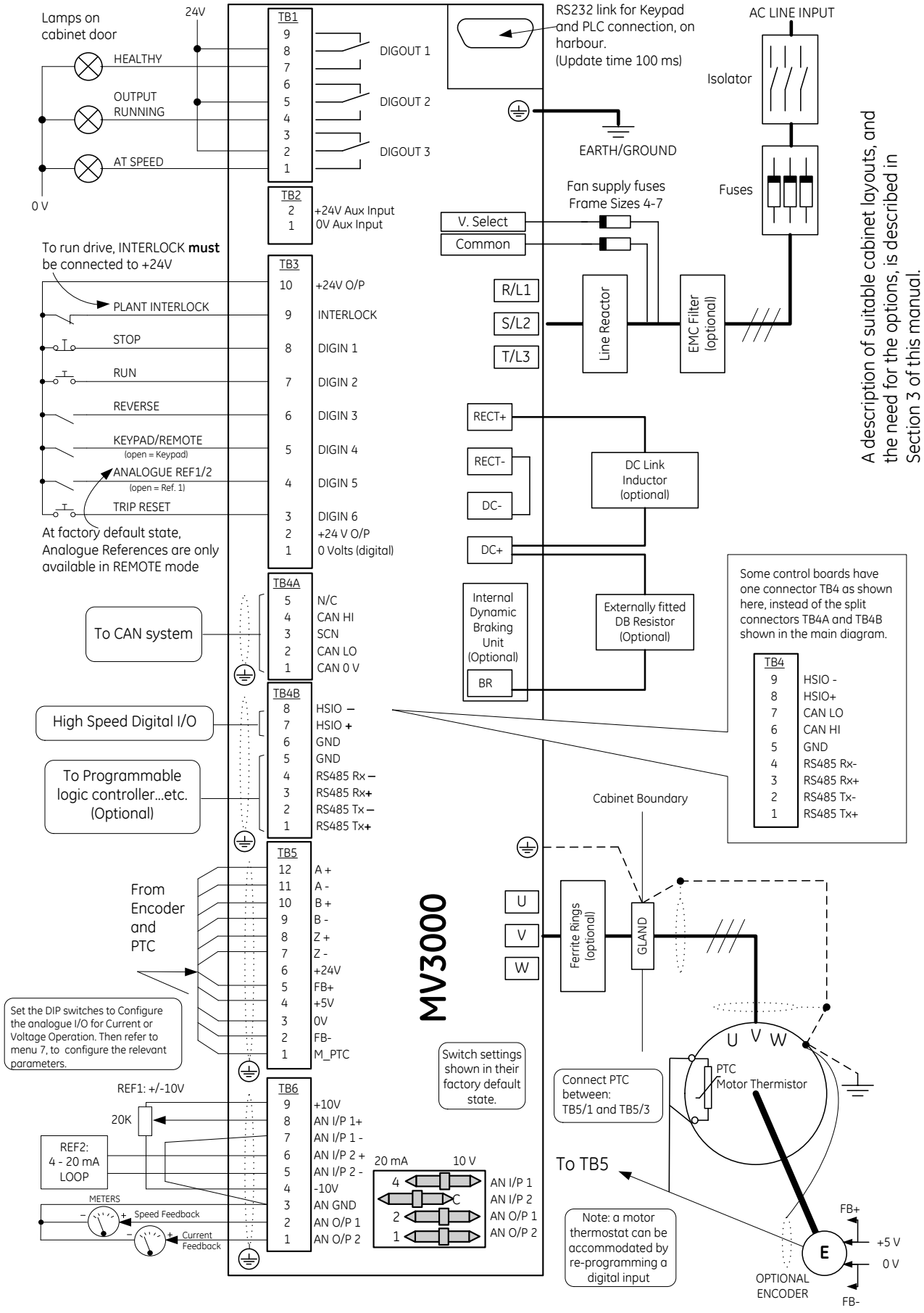
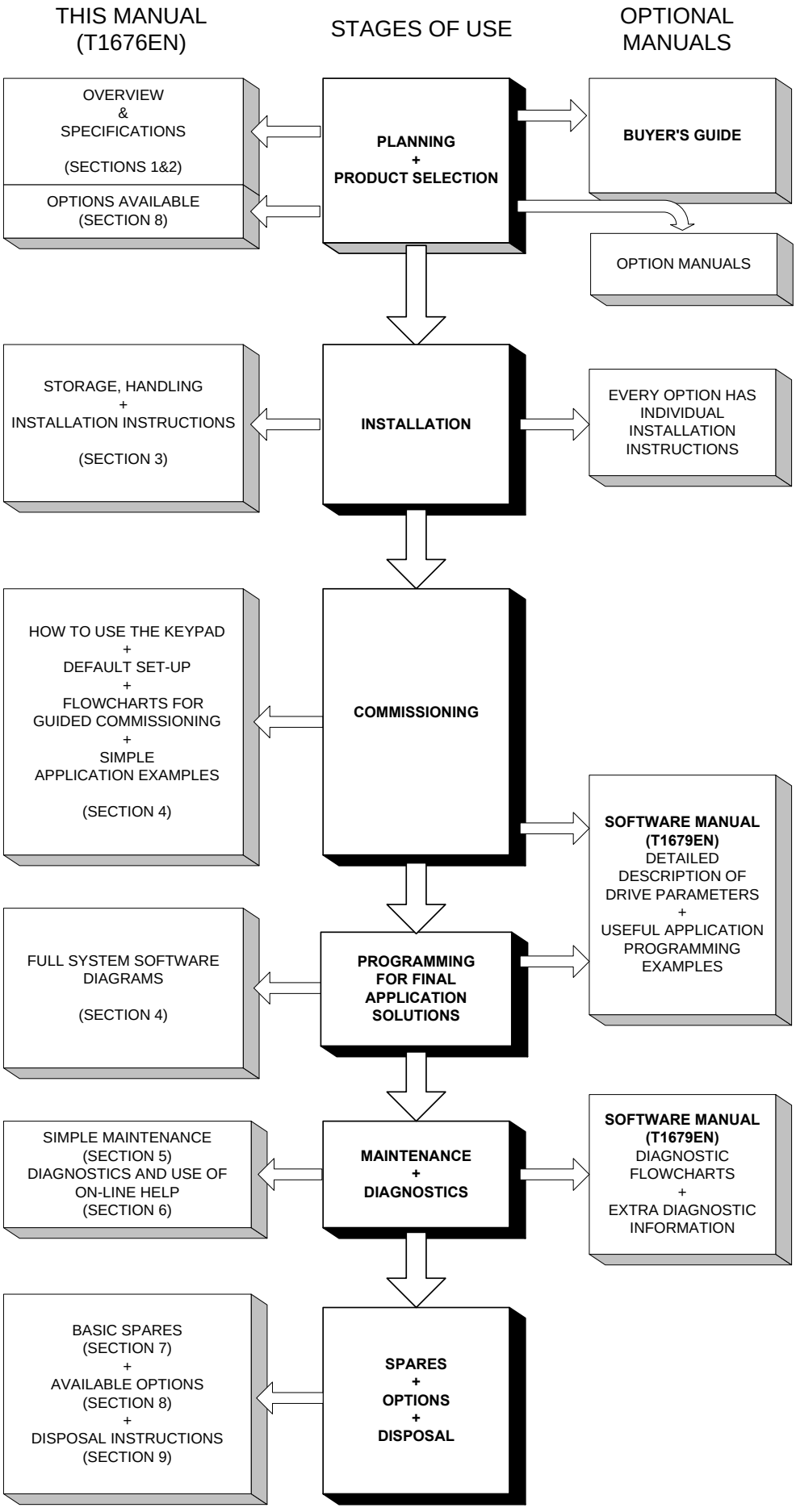


Figure 1-1. – Default Input/Output Diagram

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 3/4		1/2 3/4	RS485 Tx+/– RS485 Rx +/–	Differential link for improved noise immunity (Menu 32).	0 - 2 km range. Update time 10 ms.
5	1	5/6	GND CAN 0 V	Common ground for communications links.	Connected to earth (ground) internally.
6/7	4/2 3		CAN HI/LO SCN	Connection to CANopen or to expanded I/O.	Future
8/9		7/8	HSIO +/–	High speed digital link (Menu 20). (Not available in SFE mode)	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 9 - 12	Z–/Z+ B–/B+, A–/A+			Marker signal from encoder. Encoder position signals.	EIA RS422A, Max edge freq 1.5 MHz, see Section 3.8
TB6				**Analogue Inputs/Outputs**	**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 –10.5 V/+10.5 V			Reference supplies for analogue inputs.	Maximum Load : 5 mA current limited
5/6 7/8	AN I/P 2 –/+ AN I/P 1 –/+			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.

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

DOCUMENT STRUCTURE



OVERVIEW

CONTENTS

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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 37 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 (VVVF), 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.

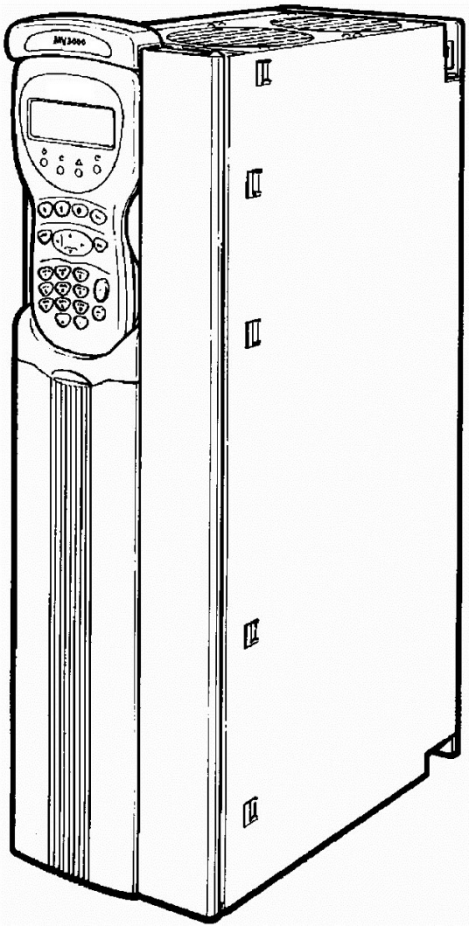

Figure 1-1. – MV3000e MicroCubicle™ Drive with Keypad (option) Fitted

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**
MV3071A4A1	3
MV3140A4A1	4
MV3364A4A1	6
MV3566A4A1	7
Voltage Ratings 460 V - 525 V (480 V nominal)	
Drive	**Frame Size**
MV3065A5A1	3
MV3124A5A1	4
MV3302A5A1	6
MV3477A5A1	7
Voltage Ratings 575 V - 690 V (600 V nominal)	
Drive	**Frame Size**
MV3099A6A1	4
MV3242A6A1	6
MV3336A6A1	7
MV3382A6A1*	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.

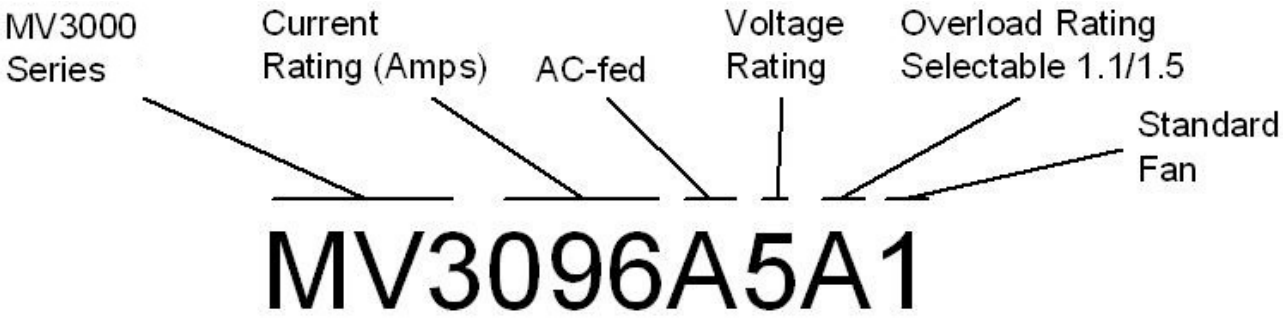

Figure 1-2. – MV3000e Identity Code

1.5 USE OF METRIC UNITS

The MV3000e range of drives has been designed to IEC standards using SI units. In this manual approximate value 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.

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2. DRIVE DATA

2.1 PHYSICAL DIMENSIONS - DRIVE

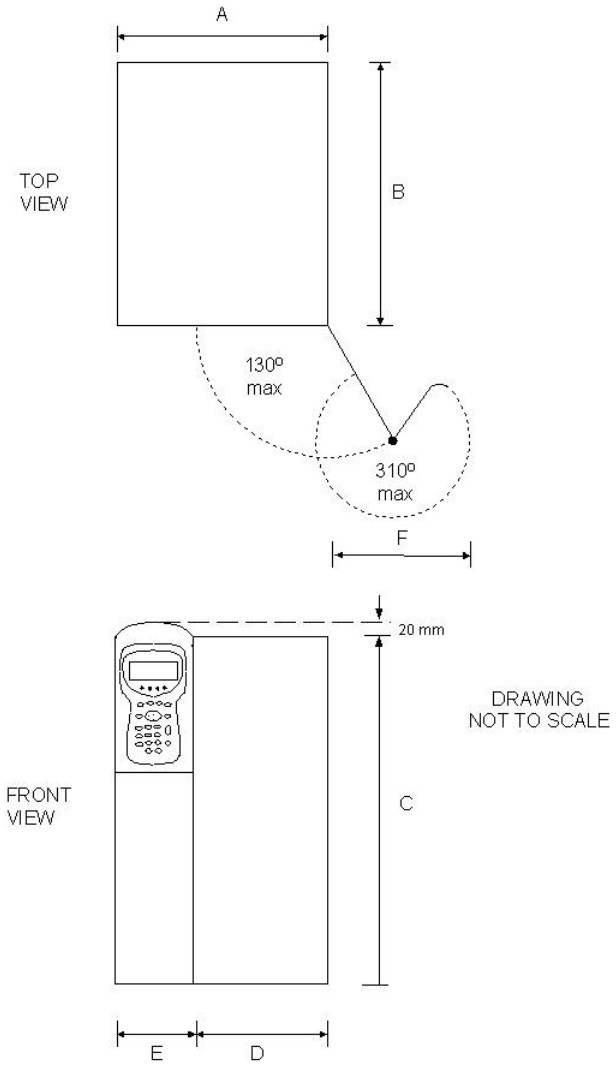


Figure 2-1. – Drive Dimensions

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

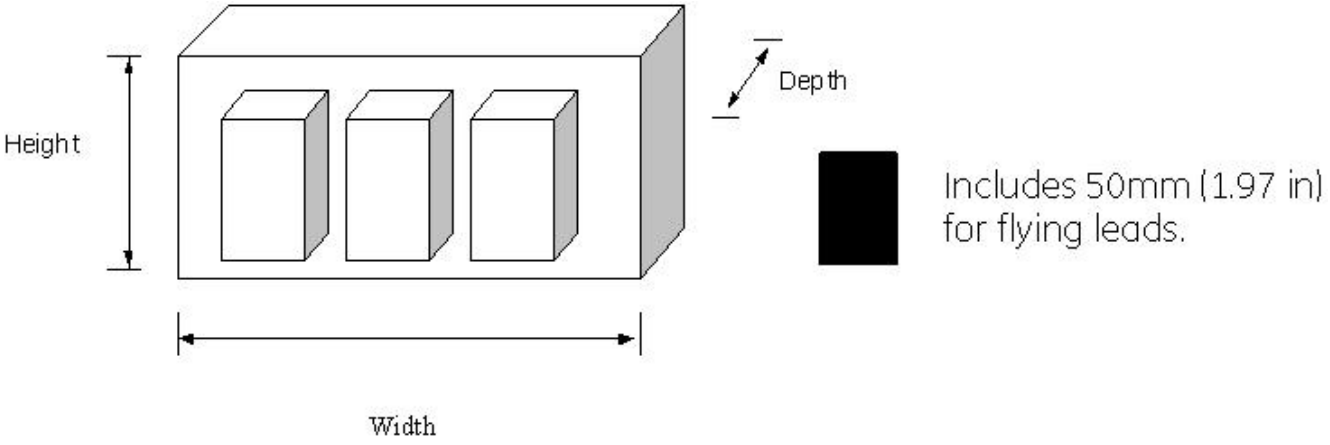
* Overall height, including keypad harbour overhang.

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			
400V						
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
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
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
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
690V						
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
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
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, 2.2 & Appendix B
		-	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, 2.2 & Appendix B
		-	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	-		Protective Class I according to IEC 61140 UL 840, CSA C22-2 No. 0.2, EN 50178: TN or TT network: Overvoltage Category lll. IT network: Overvoltage Category ll. 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.

For detailed rating tables refer to Appendix B

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**
Overvoltage Trip Setting ±5V	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 product complies with the standards detailed below.

Safety

For Voltage Grade 4 products:

EN 61800-5-1: 2007 (IEC 61800-5-1: 2007)	Adjustable speed electrical power drive systems Part 5-1: Safety requirements —Electrical, thermal and energy

For Voltage Grade 5 products:

EN 61800-5-1: 2007 (IEC 61800-5-1: 2007)	Adjustable speed electrical power drive systems Part 5-1: Safety requirements —Electrical, Thermal and Energy
ANSI / UL61800-5-1:2012	Standard for Adjustable Speed Electrical Power Drive Systems Part 5-1: Safety Requirements - Electrical, Thermal and Energy

For Voltage Grade 6 products:

EN 50178:1997	Electronic equipment for use in power installations.
ANSI / UL 508C: 2010	Power conversion equipment.
CAN / CSA C22.2-14: 2013	Industrial control equipment, industrial products.

Electromagnetic Compatibility (EMC), (all products)

EN 61800-3 (IEC 61800-3)	Adjustable speed electrical power drive systems: Part 3 – EMC product standard including specific test methods.

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	80 MHz – 2 GHz, 10 V/m 2 GHz – 2.7 GHz, 1 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
IEC 61000-4-6	Conducted RF	150 kHz to 80 MHz, 10 V

Ratings/Performance (all products)

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.

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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:

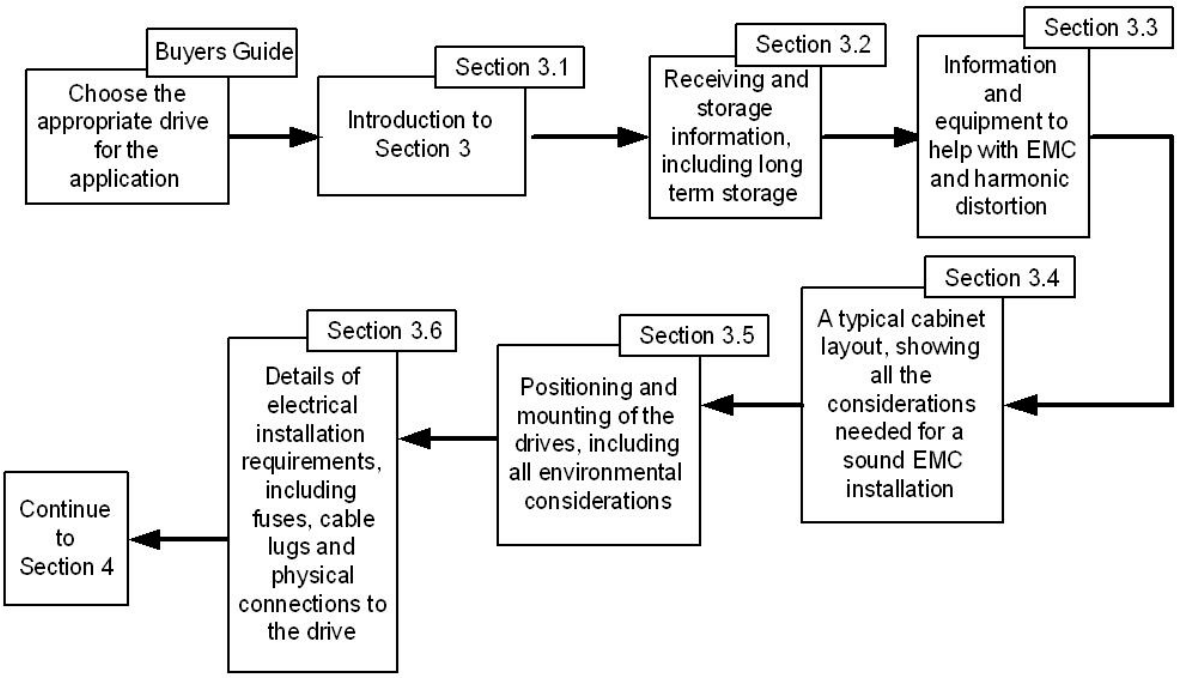


Figure 3-1. – Installation Procedure

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 3.2.2.
- 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 (44lb) 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.

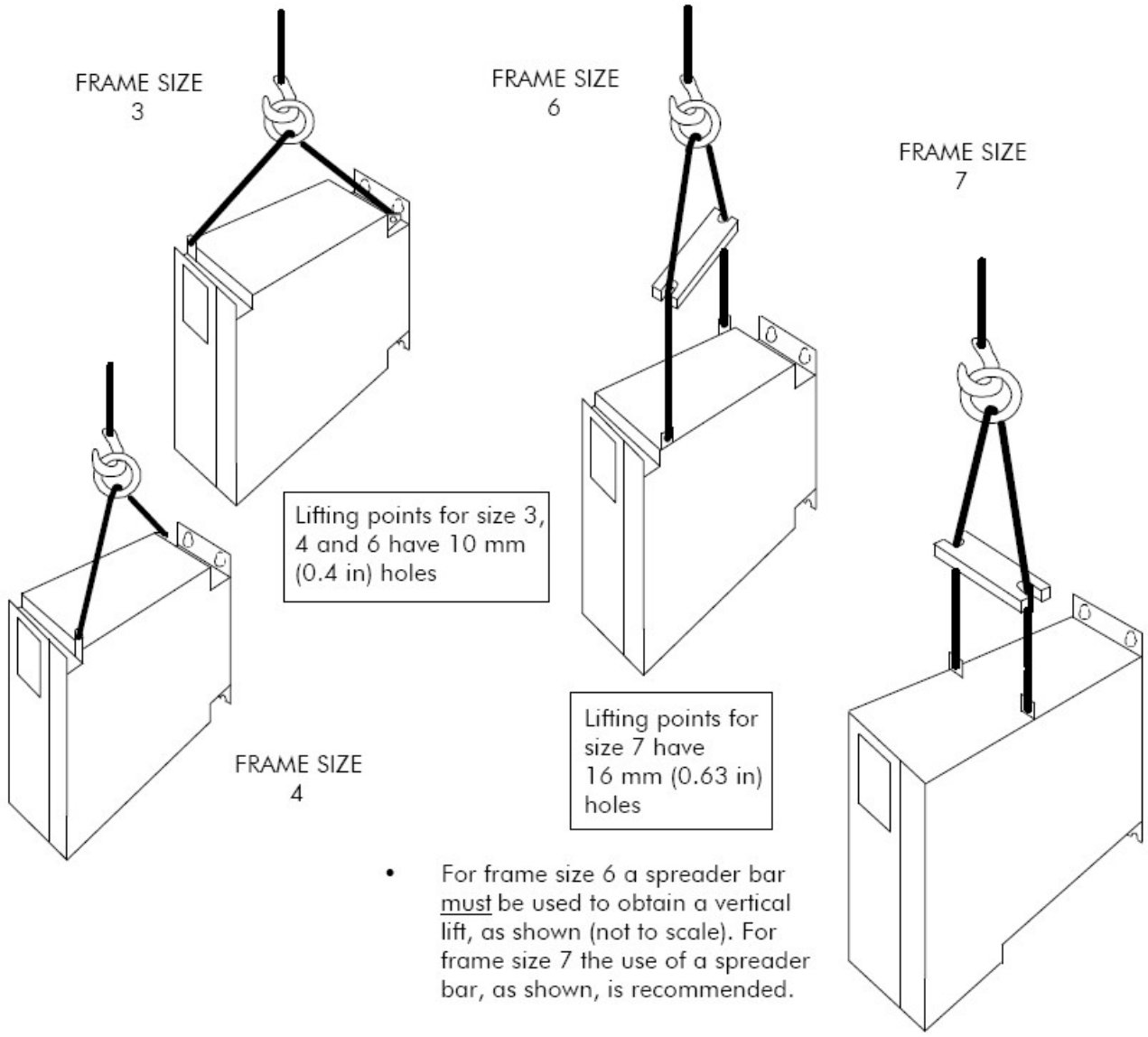


Figure 3-2. – Lifting a Drive

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 2.1and 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 2.7.

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 IEC 61000-6-4 or the Class A limits of CISPR 11 or the Category C2 limits of IEC 61800-3, the following items are used:

EMC filter:

Fitted between the mains supply and the AC line reactor.

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.

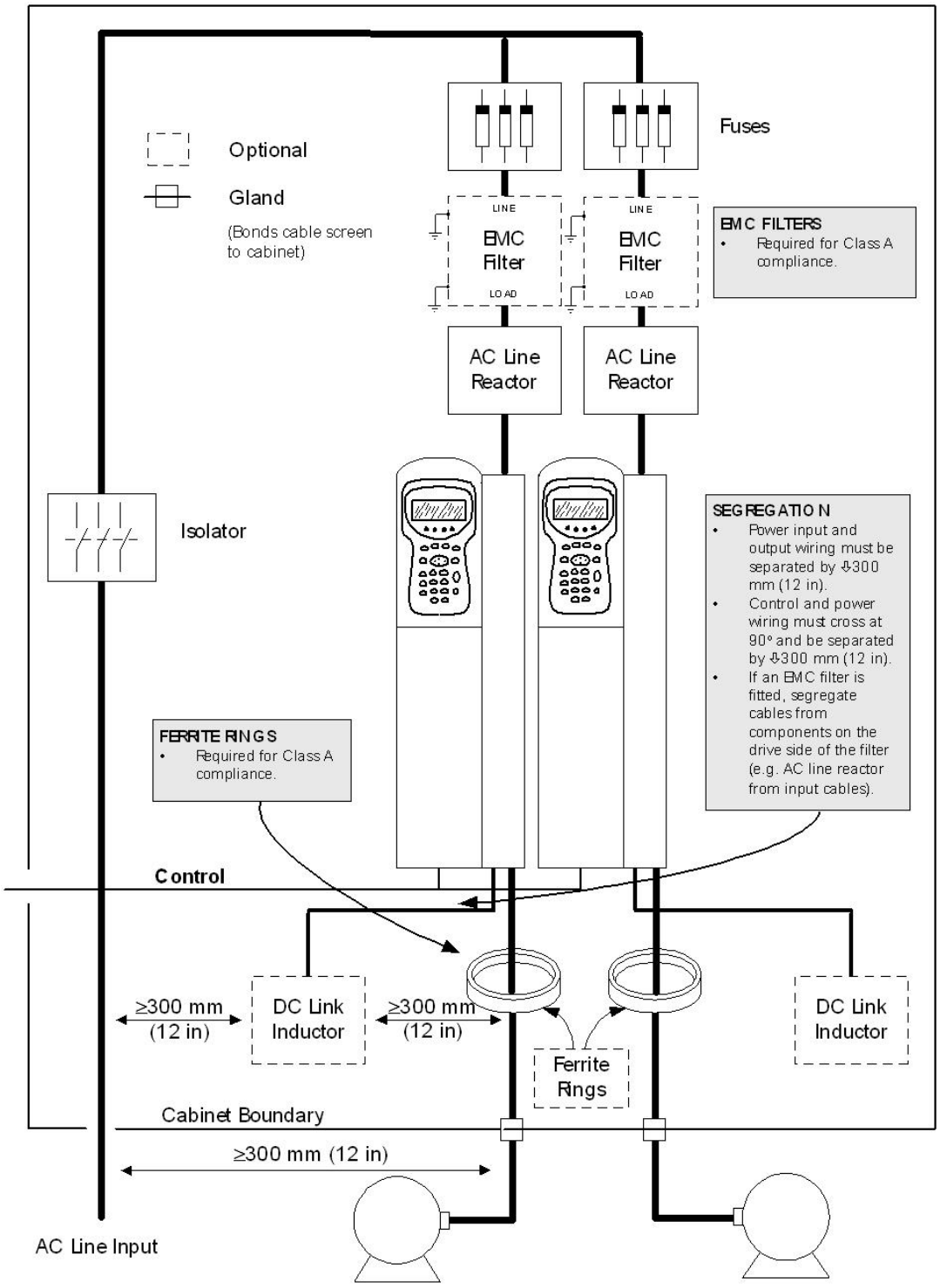


Figure 3-3. – Typical Layout for EMC Compliance

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

NOTE: 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.

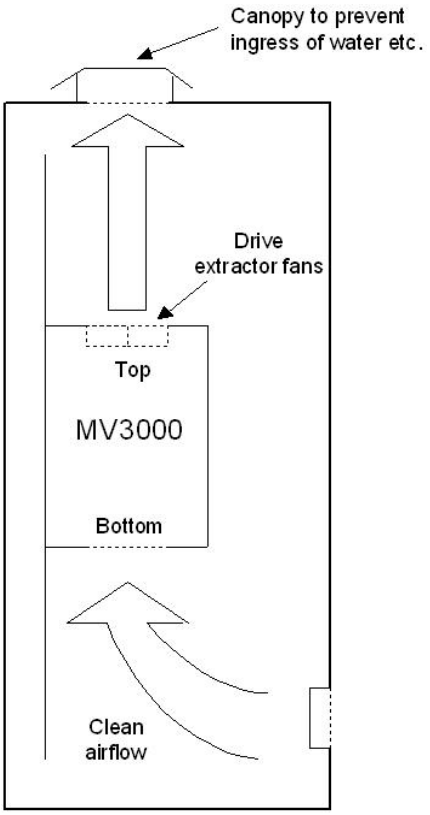


Figure 3-4. – Typical Airflow Arrangement

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.

3.5.2 Clearances & Mounting Distances

NOTE: The 75mm (3in) 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.

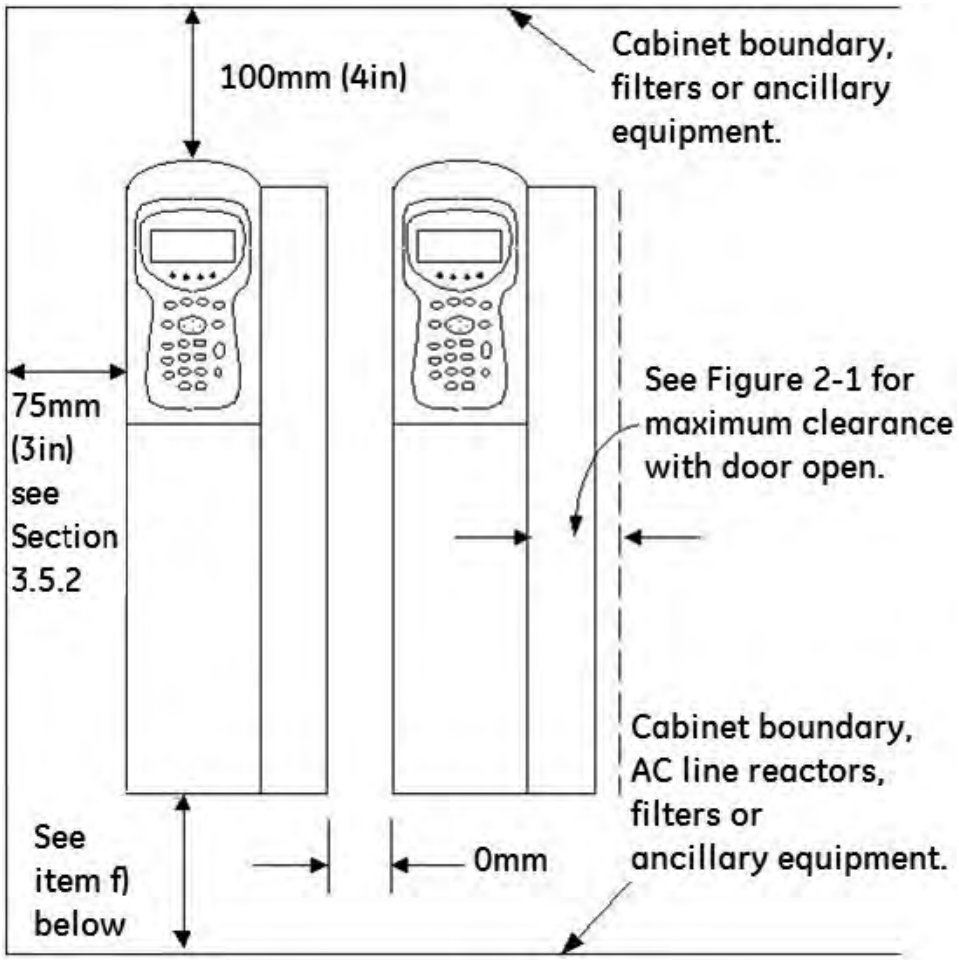


Figure 3-5. – Minimum Recommended Clearances

3.5.3 Mounting Checklist

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

a) The position of mounting studs/bolts for all converter frame sizes are shown in Figure 3-5 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.

b) 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.

c) 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.

d) Install any required options that fit inside the MicroCubicle™. Installation instructions are provided in the associated publications – refer to Section 9 for available options.

e) Mount the converter and ancillary components in the cabinet.

f) A minimum of 100 mm (4 in) for cooling must be allowed. If cabling is to be routed, allowance for the wire bending space required for the cable used must be allowed. All cable sizes must comply with local safety regulations.

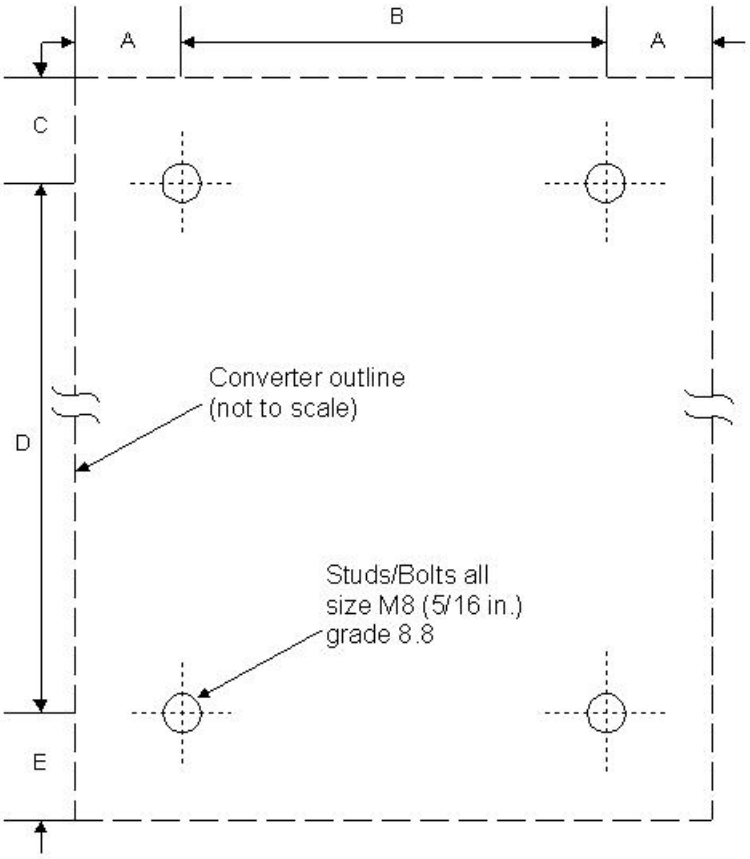


Figure 3-6. – Bolt Stud Locations for Mounting the Converter on a Panel

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

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

3.6.1 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).

The prospective short circuit current of the supply to which the drive is connected must not exceed the maximum values given in Appendix B, fusing and rating data. The upstream circuit breaker or fuses must be selected accordingly.

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

NOTE: This product can cause a d.c. current in the protective earthing conductor. Where a residual current operated protective (RCD) or monitoring (RCM) device is used for protection or monitoring in case of direct or indirect contact, only an RCD or RCM of Type B is allowed on the supply side of this product. The motor and cable characteristics will have an effect on the level of current measured by the RCD or RCM. Because of the level of current, the setting of the RCD/RCM may be above that recommended for Personnel Protection. The level of current may also require an increase in sizing of the protective earthing conductor, in line with local safety regulation.

3.6.2 Recommended Drive Fuses

Sections 2.1and 2.2give 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.

3.6.3 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.

3.6.4 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

3.6.5 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.

3.6.6 Motor Overload Protection

The controller has a fixed motor overload current set to 150% of the motor current. The overload duration can be set through parameter P2.07. Refer to the Software Manual T1679EN for full details.

3.6.7 Encoders & Encoder Cables

3.6.7.1 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 +4.5V to +6.5V. 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.

3.6.7.2 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 $180° \pm x°$ and a quadrature phase shift of $90 \pm y$, then

Min_Edge_Separation = 90 - x - y.

3.6.7.3 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.

3.6.7.4 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.

3.6.8 Power Cable Selection and Control Wiring

3.6.8.1 Power Cables

All cables (power and protective earth) must have copper conductors.

The protective earth cable must be the same size as the power cable (Table 3-3) unless local safety regulations require a larger size.

All 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).A
- 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 (including protective earth cable)

		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**
400 V										
MV3071A4A1	3	50	1	-	25	3	-	16	4	-
MV3140A4A1	4	95	4/0	-	70	3/0	-	50	1/0	-
MV3364A4A1	6	2x240	-	2x500	240	-	2x350	185	-	500
MV3566A4A1	7 (Note 1)	2x300	-	2x600	2x240	(Note 2)		2x185	-	2x500
480 V										
MV3065A5A1	3	50	1	-	25	4	-	16	4	-
MV3124A5A1	4	95	4/0	-	70	2/0	-	35	1	-
MV3302A5A1	6	2x240	-	2x500	240	-	2x250	185	-	400
MV3477A5A1	7 (Note 1)	2x300	-	2x600	2x240	-	2x600	2x185	-	2x500
600 V										
MV3099A6A1	4	95	4/0	-	50	1/0	-	25	3	-
MV3242A6A1	6	2x240	-	2x500	185	-	400	120	-	300
MV3336A6A1	7 (Note 1)	2x300	-	2x600	240	-	2x300	185	-	2x250
690 V										
MV3099A6A1	4	95	4/0	-	35	N/A		35	N/A	
MV3242A6A1	6	2x240	-	2x500	120	N/A		95	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.									

3.6.8.2 Control Wiring

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

Minimum 0.5 mm2 or 20 AWG * (Use a consolidating crimp for smaller wires).

Maximum 2.5 mm2 or 14 AWG.

3.6.8.3 Wire bending Space Clearance

The arrangement for the connection of the power cables within all drive units is such that the power cable runs either directly up or down and does not bend until it has exited the unit, see Section 3.6.7. Once the cable has exited the unit, the installer must ensure that there is sufficient space to allow the bending of the power cable to facilitate its routing within the enclosure.

The installer must ensure that the power cable bending space clearance complies with local safety regulations.

3.6.8.4 Cable Segregation

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

3.6.9 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.

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

All live parts (control connections and power cable connections) are located behind enclosures. No direct access is allowed when equipment is energised. Access to power connections is only possible by use of a tool.

3.6.9.1 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.

3.6.9.2 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.

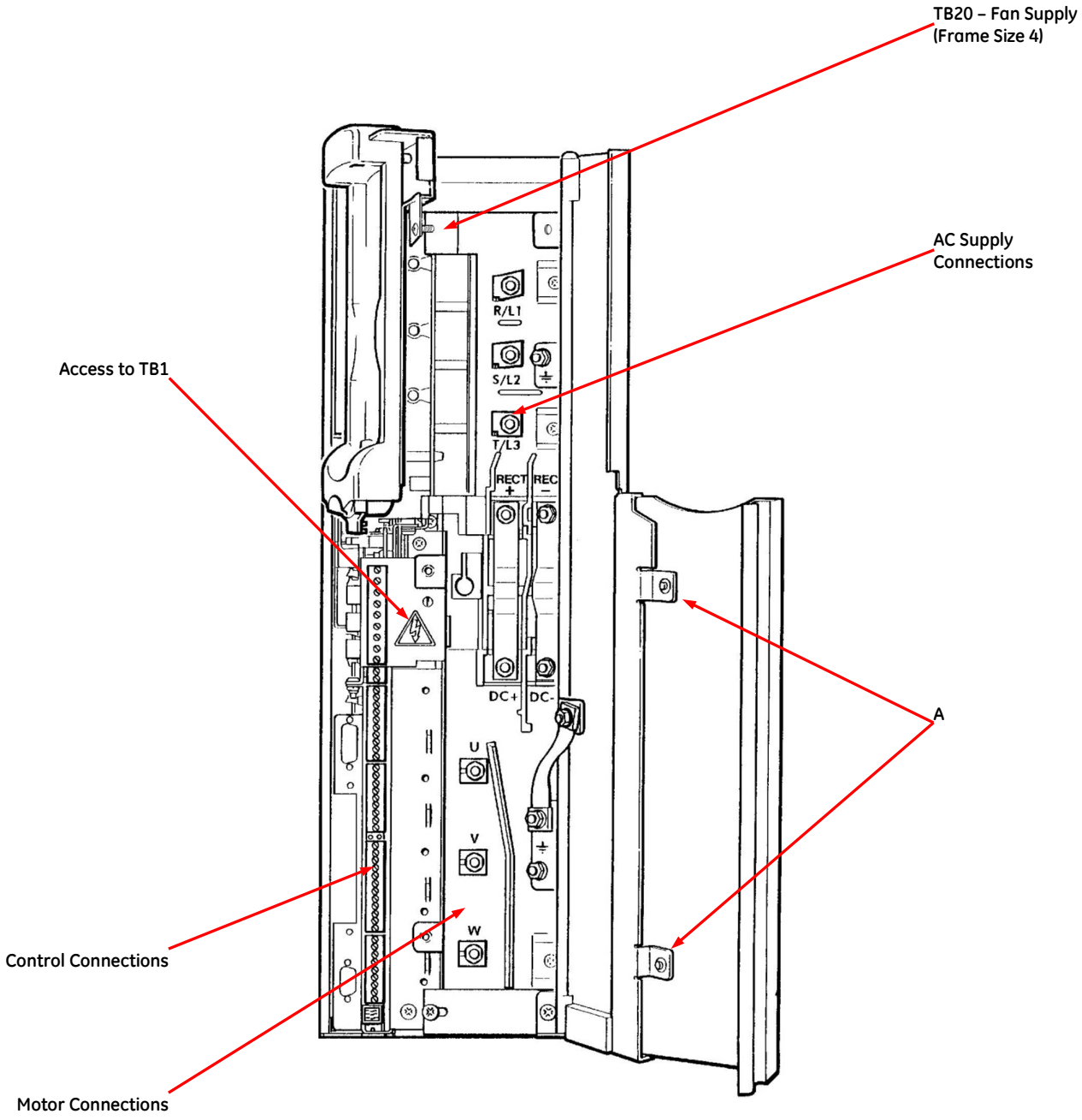


**Figure 3-7. – Typical Front View with doors open
Showing Electrical Connectors**

3.6.10 Control Connections

a) Referring to Figure 1-1 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 IEC 61800-5-1, UL 61800-5-1, UL 508C or CSA C22.2 No. 14 is required, the MicroCubicle™ must be installed in a suitable enclosure with restricted access.

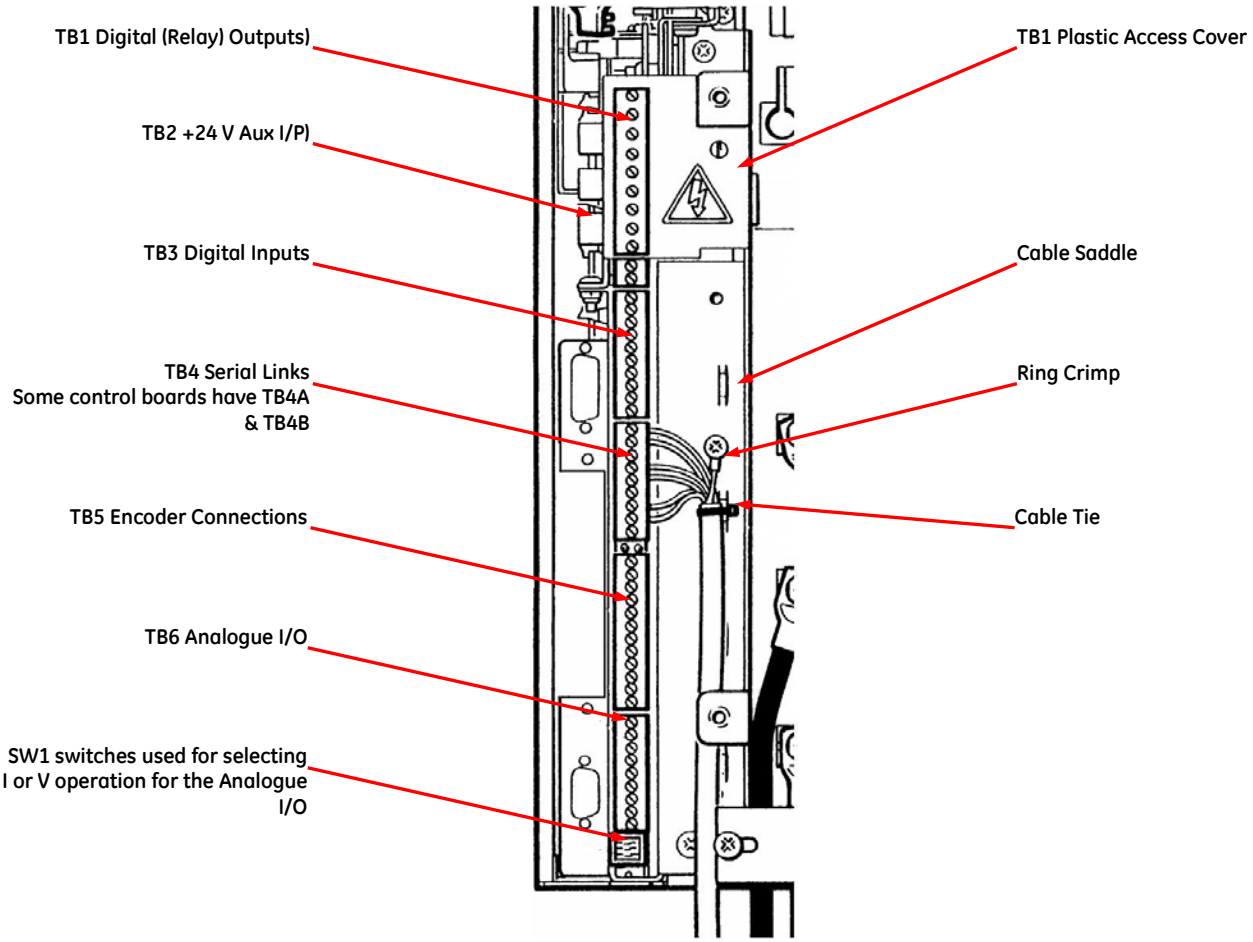


Figure 3-8. – Control Connections

3.6.11 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.

3.6.11.1 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 ⏚ 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.

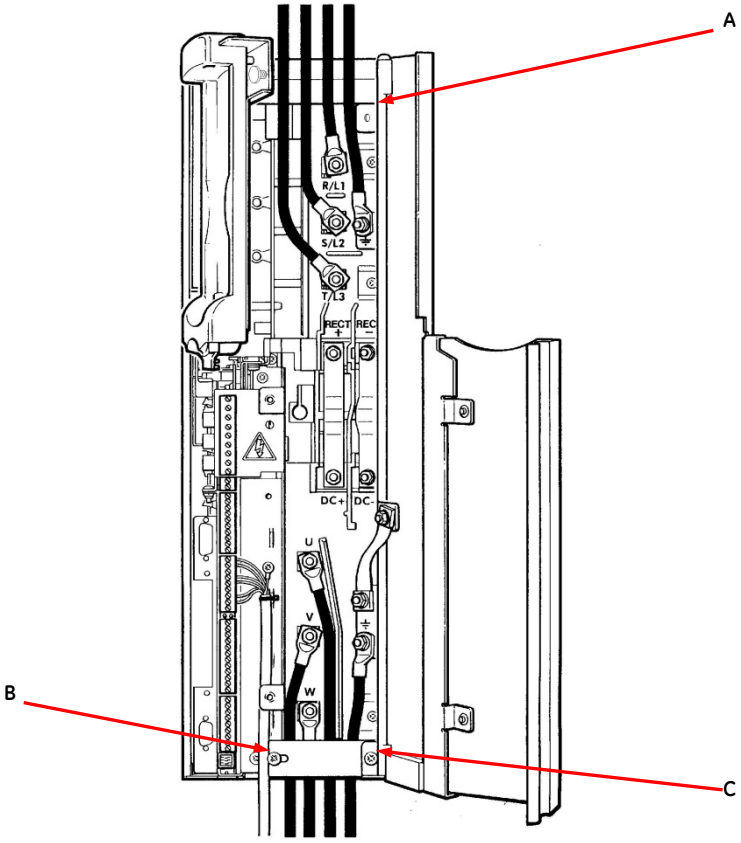


Figure 3-9. – Power Connections for Frame Sizes 3 & 4

3.6.11.2 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 Table 2-1 and Table 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 CablesFor 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 ⏚ 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.

3.6.12 Power Connections – Frame Size 6

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

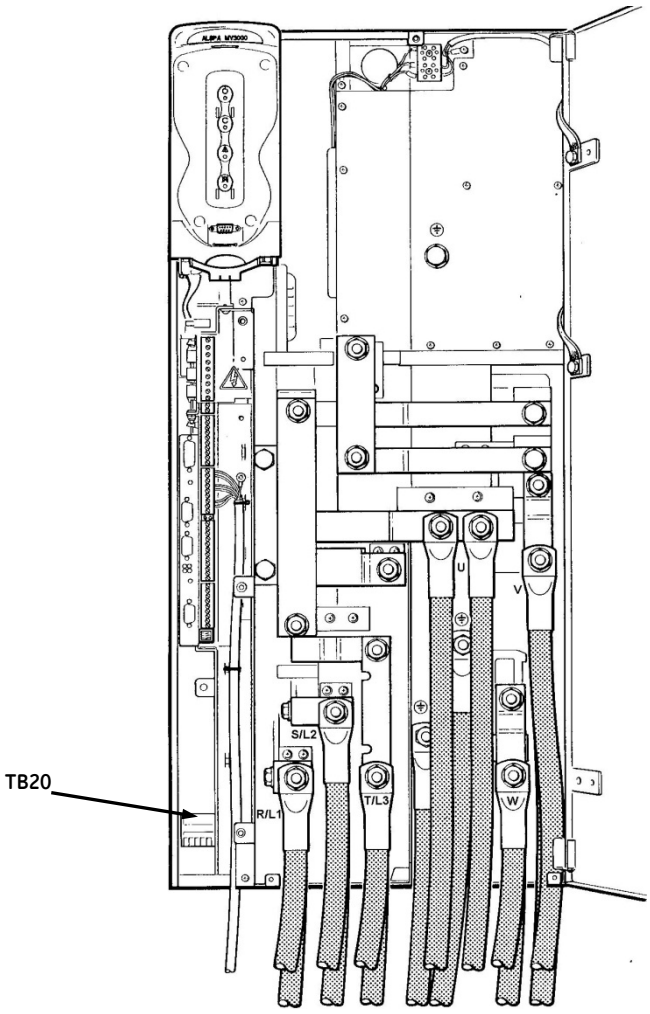


Figure 3-10. – Power Connections for Frame Size 6 Showing Parallel Cabling

3.6.12.1 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.

3.6.12.2 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 also Table 2-1 and Table 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.

3.6.12.3 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..

3.6.13 Power Connections – Frame Size 7

The power connector layout for frame size 7 is shown in Figure 3-11.

3.6.13.1 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.

3.6.13.2 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.

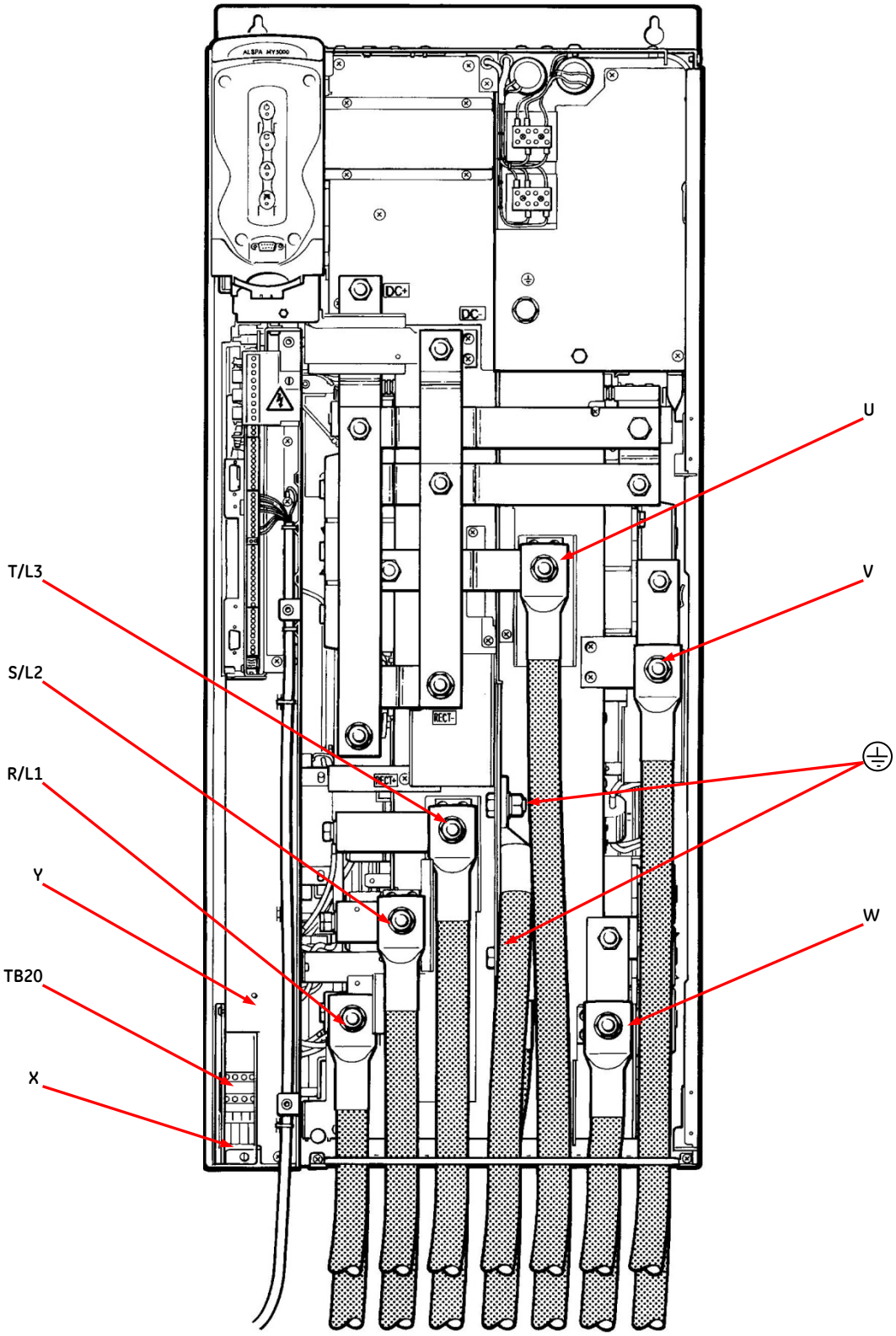


Figure 3-11. – Power Connections for Frame Size 7

3.6.13.3 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^2 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 ⏚ 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.

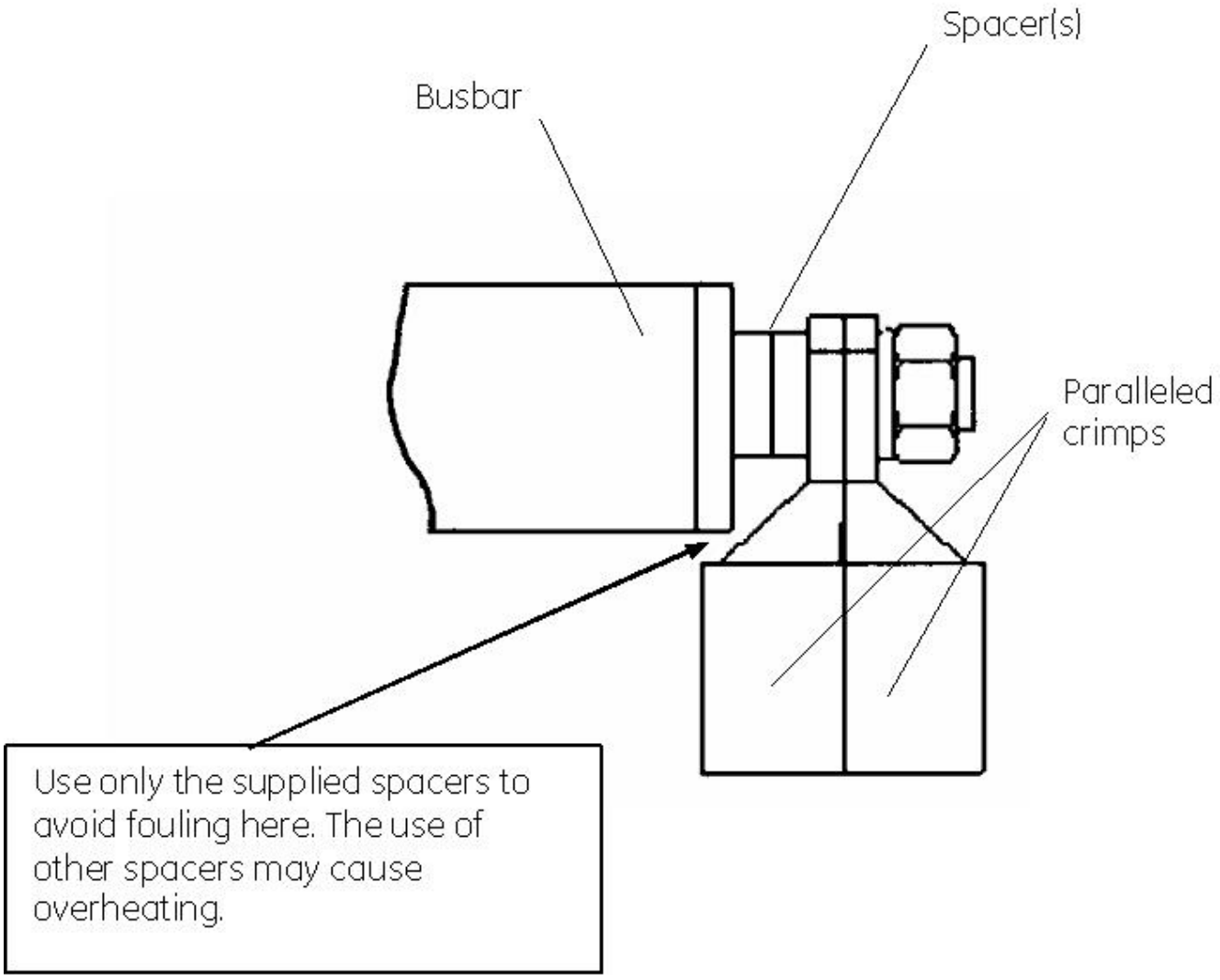


Figure 3-12. – Use of Spacers to Avoid Fouling Busbar

4. COMMISSIONING

WARNING

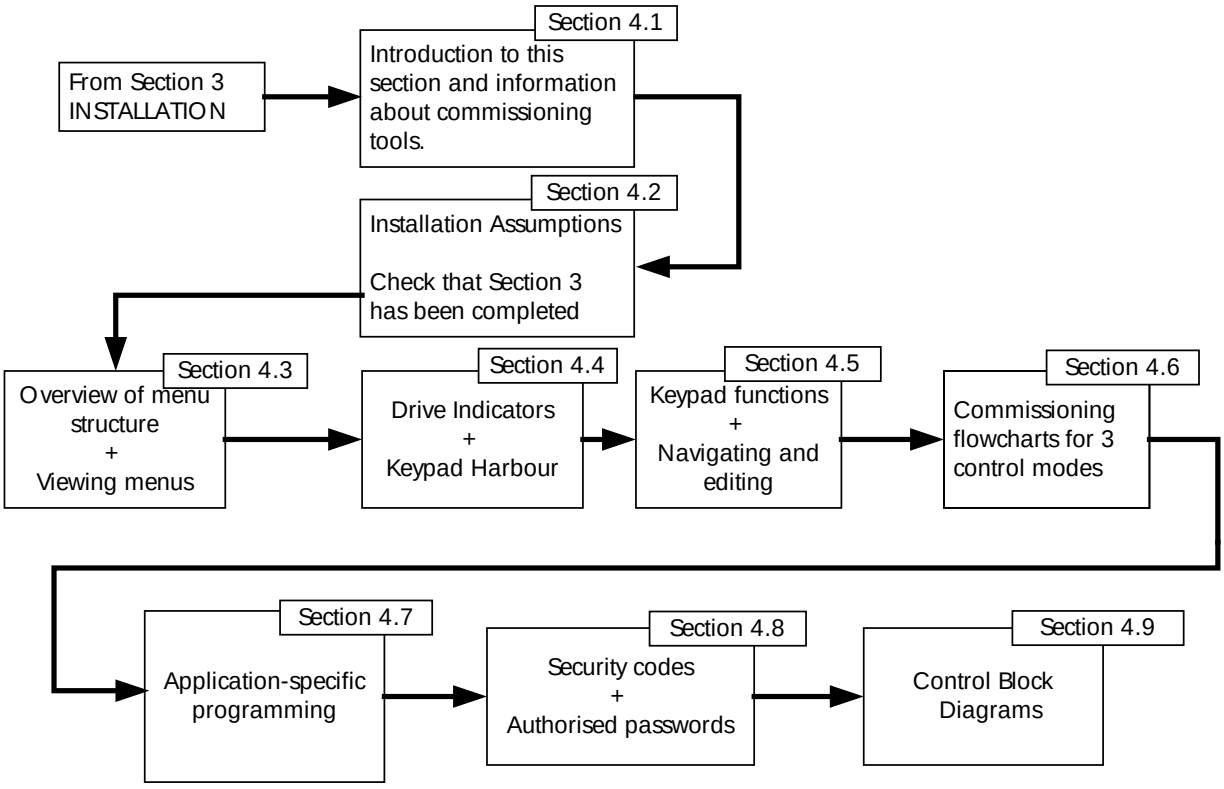
- **This equipment may be connected to more than one live circuit.**
  - Disconnect all supplies before working on the equipment.
- **Wait at least 6 minutes after isolating supplies and check that the voltage between DC+ and DC- has reduced to a safe level before working on this equipment.**
- **All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

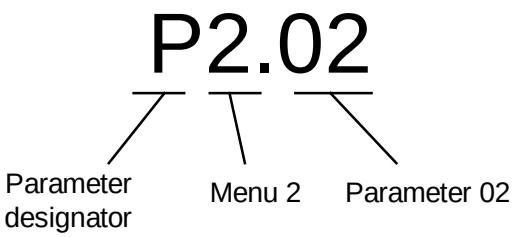
The commissioning procedure assumes that the drive unit has been correctly installed as described in Section 3. Check against the flowchart in Section 3.1.

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 **ALWAYS** 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 and the explanation of Control Flags (CF) and Status Flags (SF) in Section 4.7.1.

	LOCAL CONTROL			
WHEN	**DIGIN4** (Local/Remote)			
IS	OPEN			
IT SELECTS	Keypad Control & Reference Selection #1			
BECAUSE	CF116 is set OFF, as it is connected to **DIGIN4** (P4.09 = 1.004)		CF4 is set ON, as it is connected to the INV of **DIGIN4** (P5.07 = -1.004)	
WHICH MEANS	Keypad has Start/Stop Control		The reference chosen by P5.01 is active, the default for which is Keypad. (P5.01 = 1)	
NOTE	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	**DIGIN4** (Local/Remote)		**DIGIN5** (Remote Reference 1/2 selection)	
IS	CLOSED		OPEN	CLOSED
IT SELECTS	Remote Control & The next priority reference selection becomes active		Reference selection #2 (if **DIGIN4** closed)	Reference selection #3 (if **DIGIN4** closed)
BECAUSE	CF116 is set ON, as it is connected to **DIGIN4** (P4.09 = 1.004)	CF4 is now OFF (INV **DIGIN 4**), thus CF5, CF6 and CF7 become active (P5.08 to P5.10)	CF5 is ON, as it is connected to the INV of **DIGIN5** (P5.08 = -1.005)	CF5 is OFF, and CF6 is ON as it is connected directly to **DIGIN5** (P5.09 = 1.005)
WHICH MEANS	Remote Start/Stop connections become active (**DIGIN1** and **DIGIN 2** at default)	**DIGIN5** 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)
NOTE	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).

a) Set parameter P1.31 = 2.

b) Navigate to P35.03 and edit its value to 1, to set up a review of edits.

c) Press ▶ to scroll through the current user edits; note these values.

d) When P35.03 re-appears all user edits have been displayed. Change P35.03 back to 0.

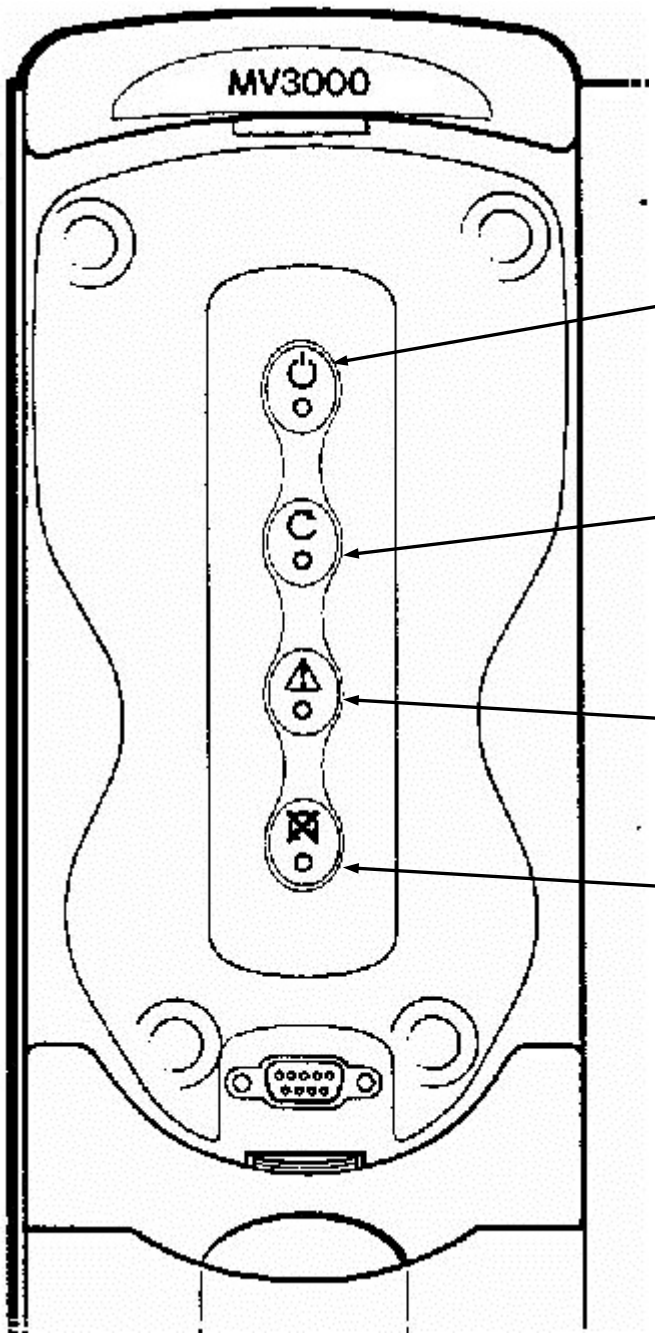
e) Navigate to P99.06 (see Section 4.5) and enter the password for engineer access (see Section 4.8.2).

f) 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.



HEALTHY (STANDBY) (green)
Power is applied to the converter and there are no faults or warnings.

RUNNING (green)
The converter is producing an output.

WARNING (amber)
A warning condition exists, not sufficient to cause the converter to trip.

TRIPPED (red)
A fault condition has caused the converter to trip.
Refer to P1.07, P1.08 or Menu 10 if available.

Refer to Section 6 for a full description of fault indications LEDs on the Keypad and harbour.

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.

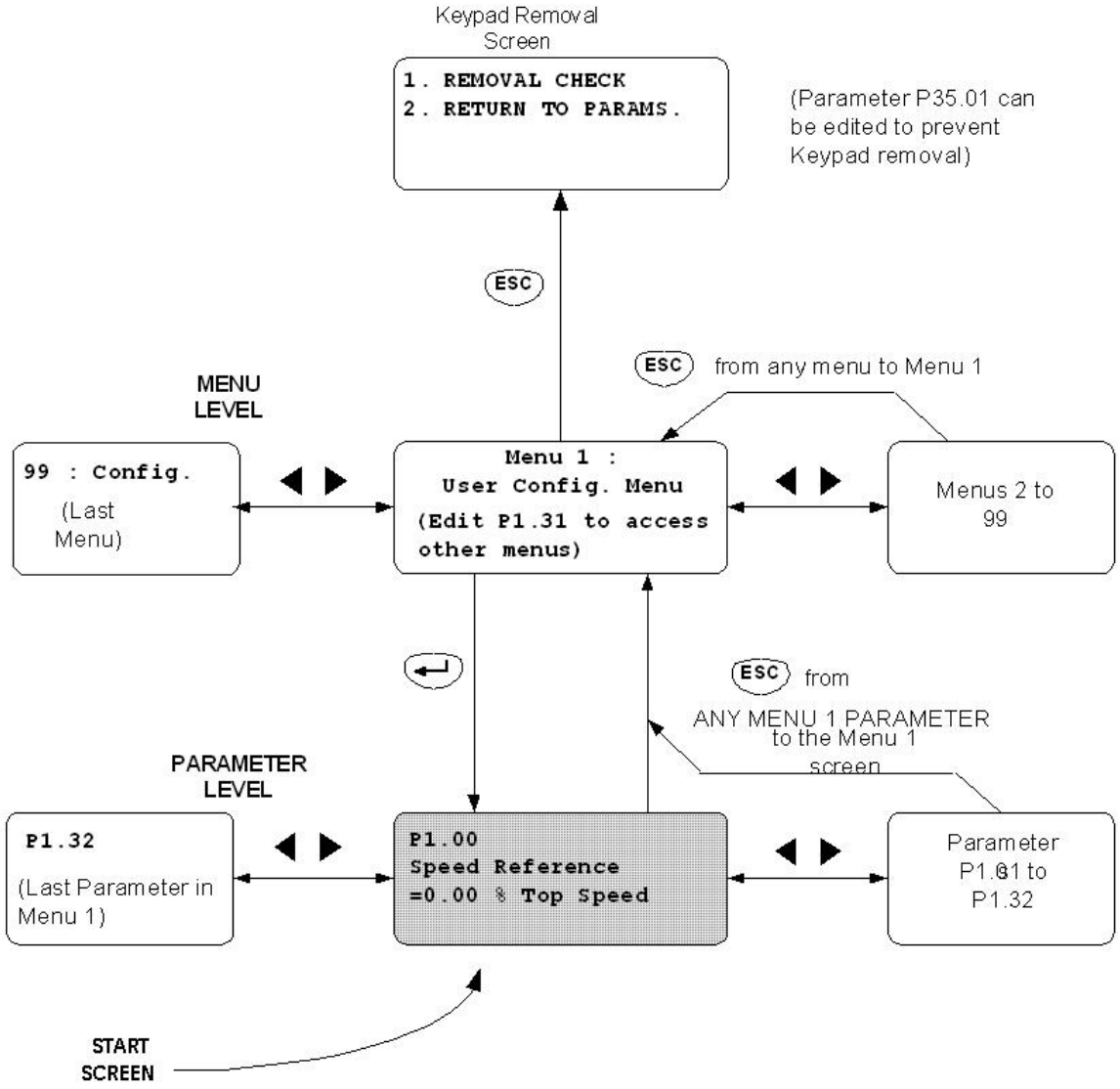


Figure 4-2. – Navigating Menus & Parameters

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.

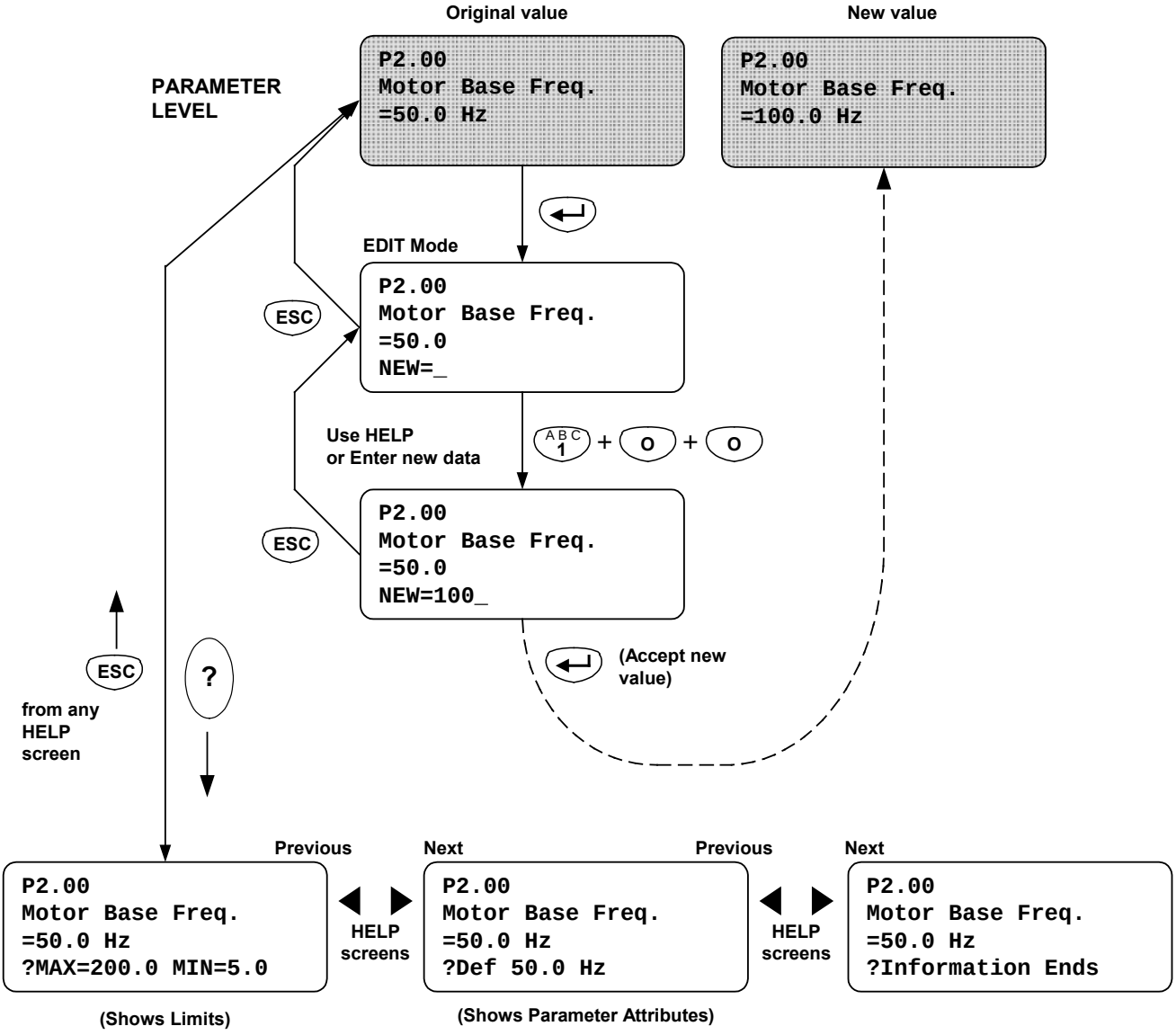


Figure 4-3. – Editing a "Numerical" Parameter

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.

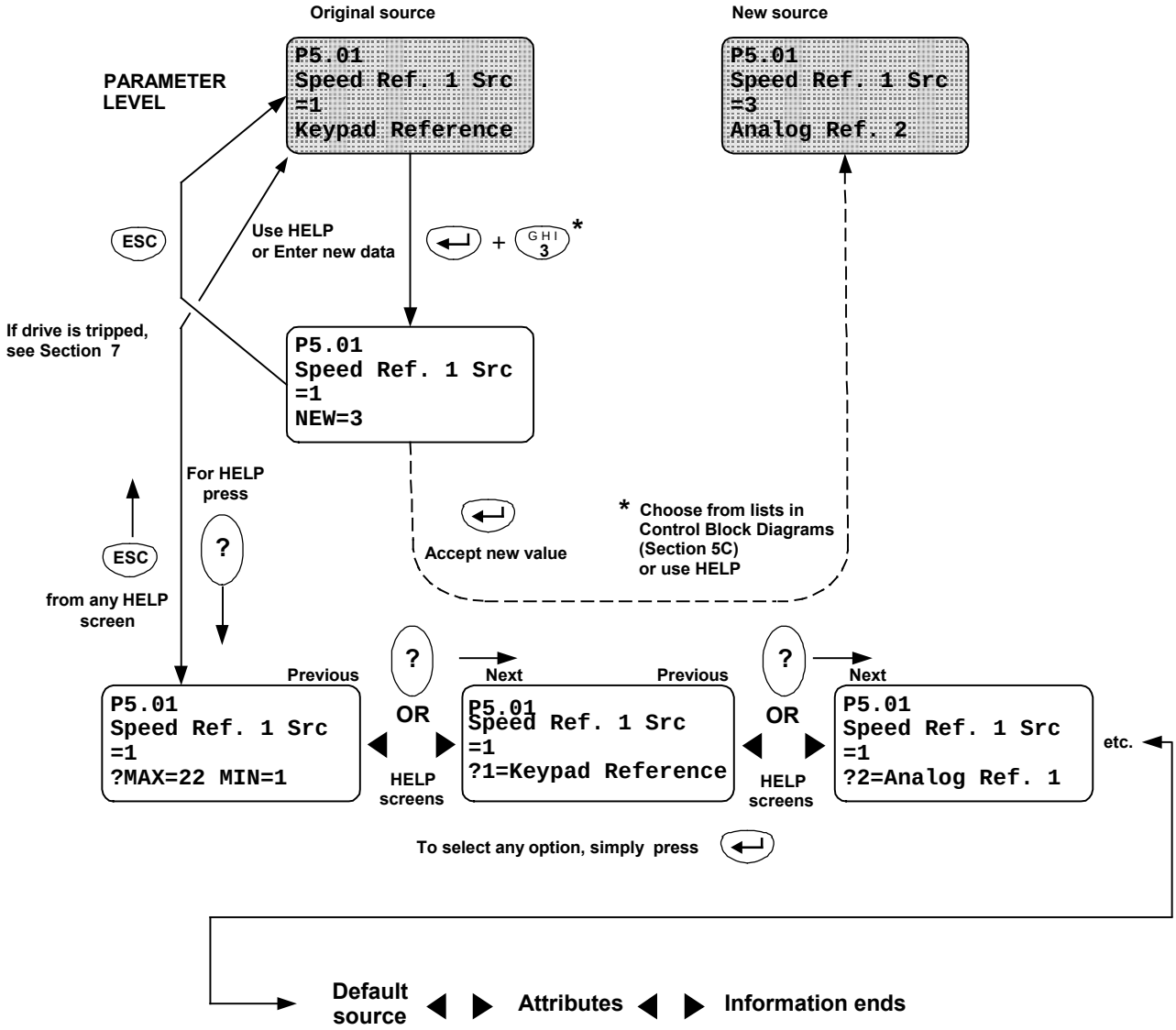


Figure 4-4. – Editing a "List" Parameter

4.5.4 Using The Keypad HELP (?) Key

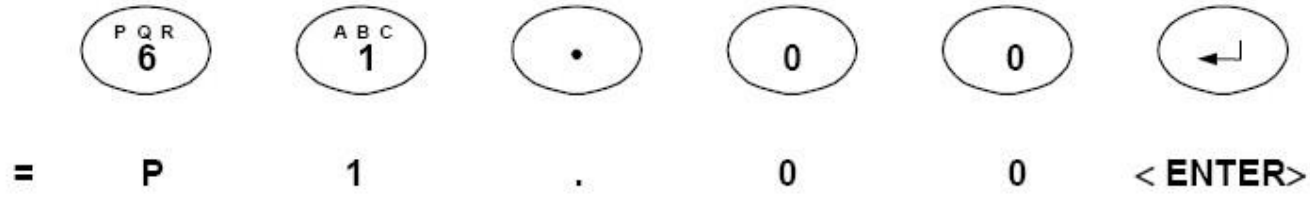
The (?) key can provide diagnostic help or parameter help, this help function is context sensitive.

Section 7 describes the use of the (?) key during diagnostics, and Figure 4-3 and Figure 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	AT DEFAULT: Simply close DIGIN4, this will select Remote. ELSE: **Gain the necessary authorisation before continuing.** a) Make P34.16 = 1, to set CF116 ON, this removes the Start/Stop control from the keypad. b) If a machine bridge, the keypad must not be either the active reference source or the backup 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.
2	Access the keypad removal screen 1. REMOVAL CHECK 2. RETURN TO PARAMS.	Press the "**esc**" key repeatedly.
3	Select "REMOVAL CHECK"	Press the "**1**" key on the keypad 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.
4	Remove keypad if the screen allows: ****KEYPAD READY**** ****FOR REMOVAL****	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 

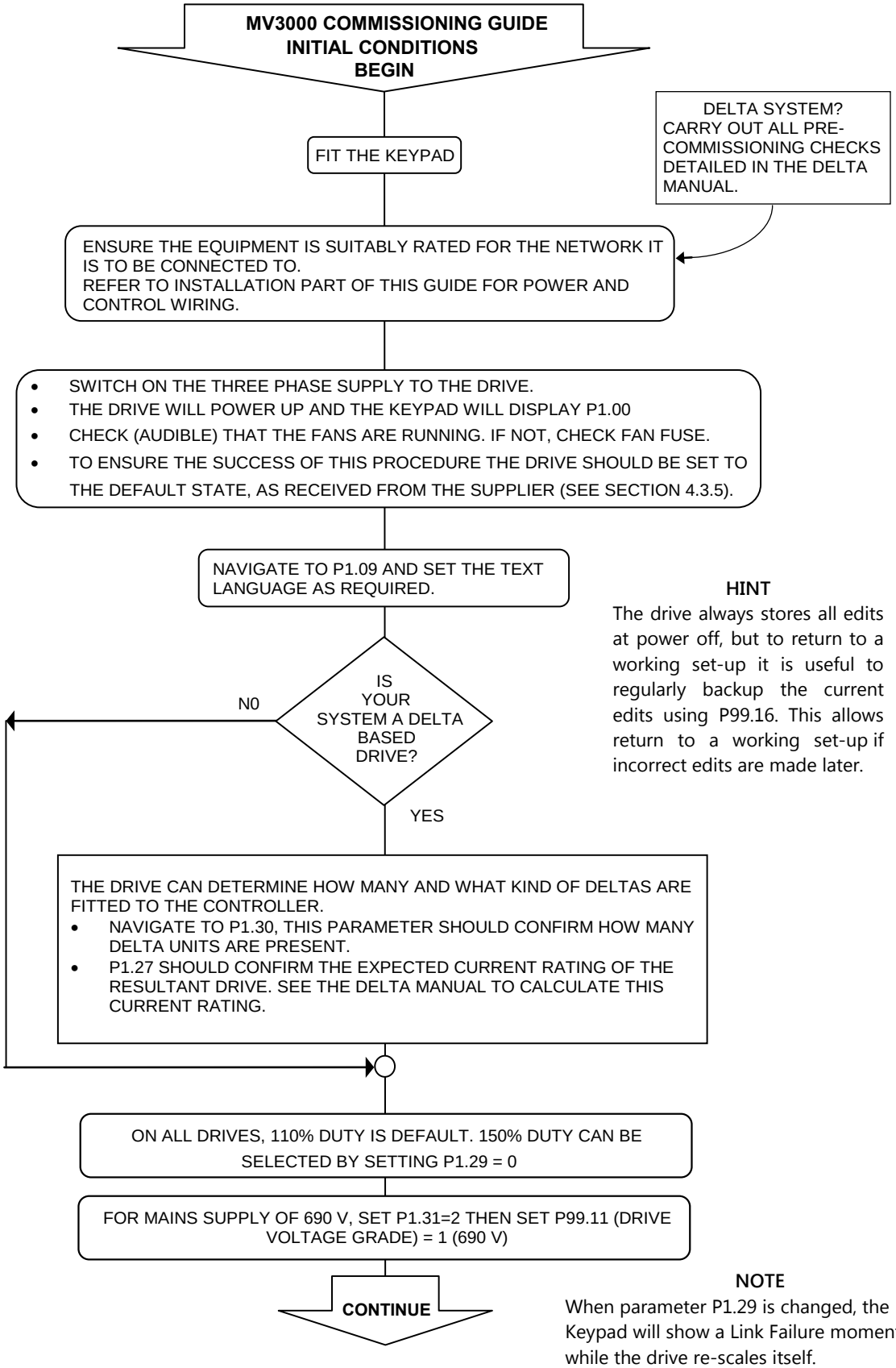
Or without a Keypad

- 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

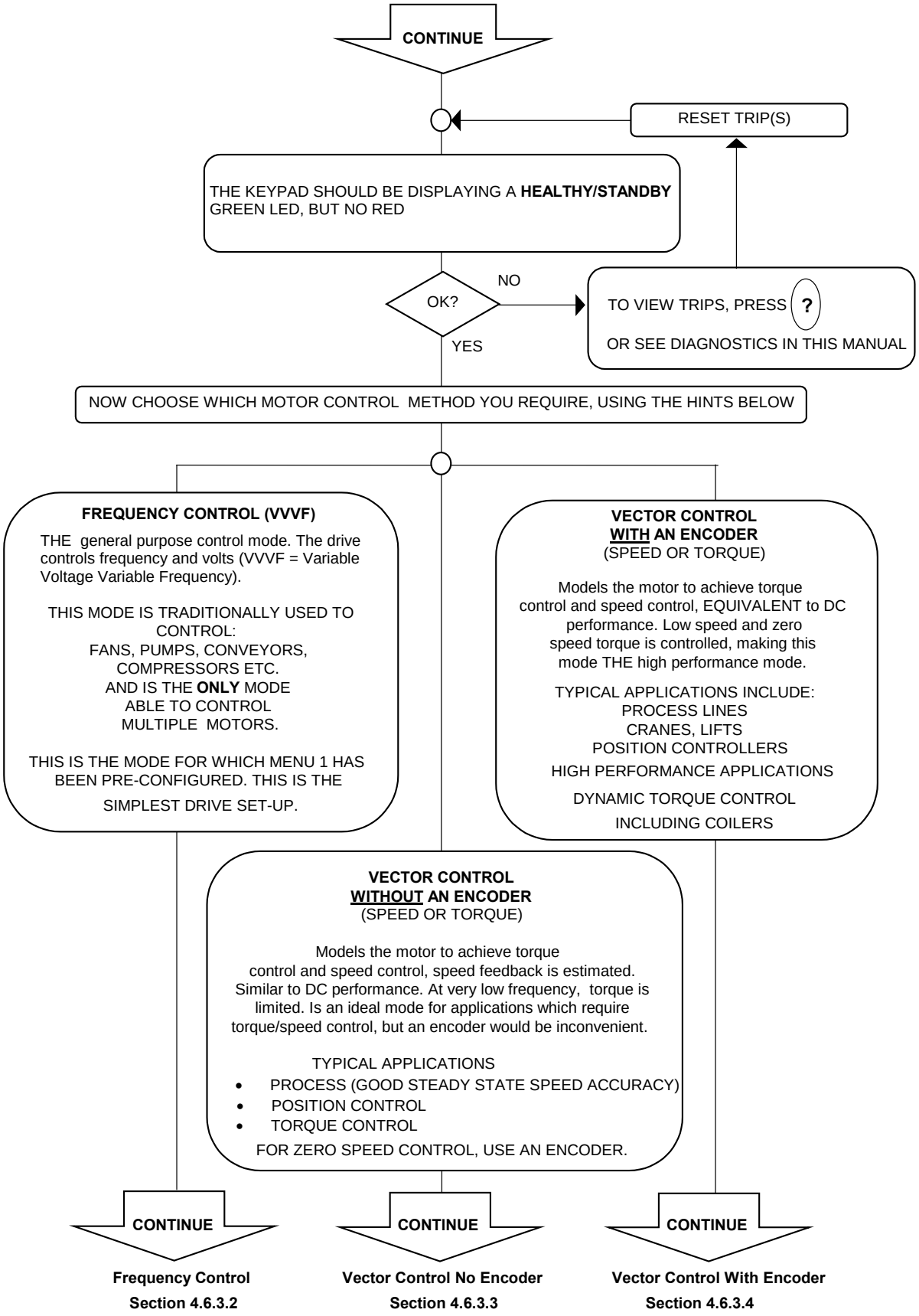


HINT

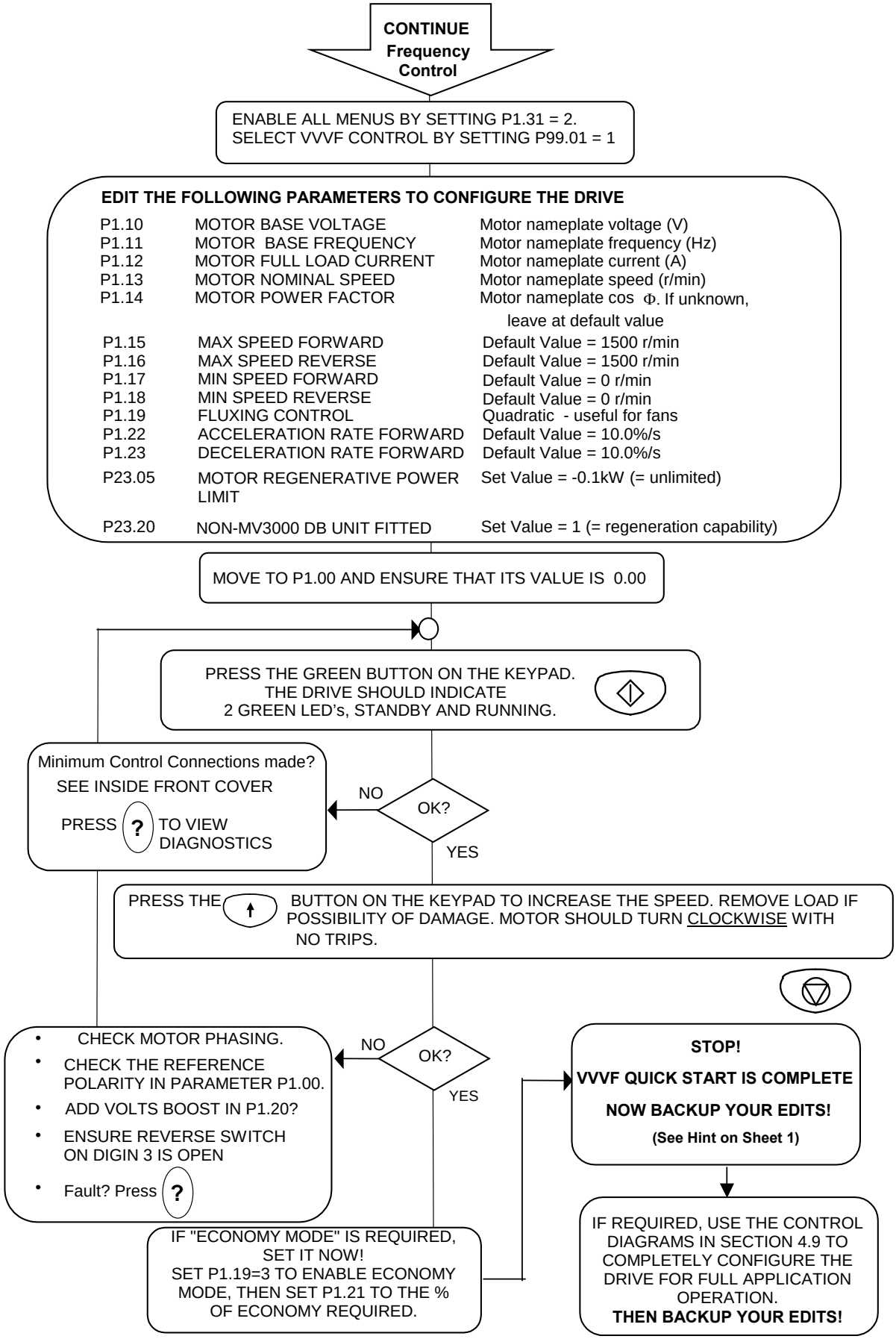
The drive always stores all edits at power off, but to return to a working set-up it is useful to regularly backup the current edits using P99.16. This allows return to a working set-up if incorrect edits are made later.

NOTE

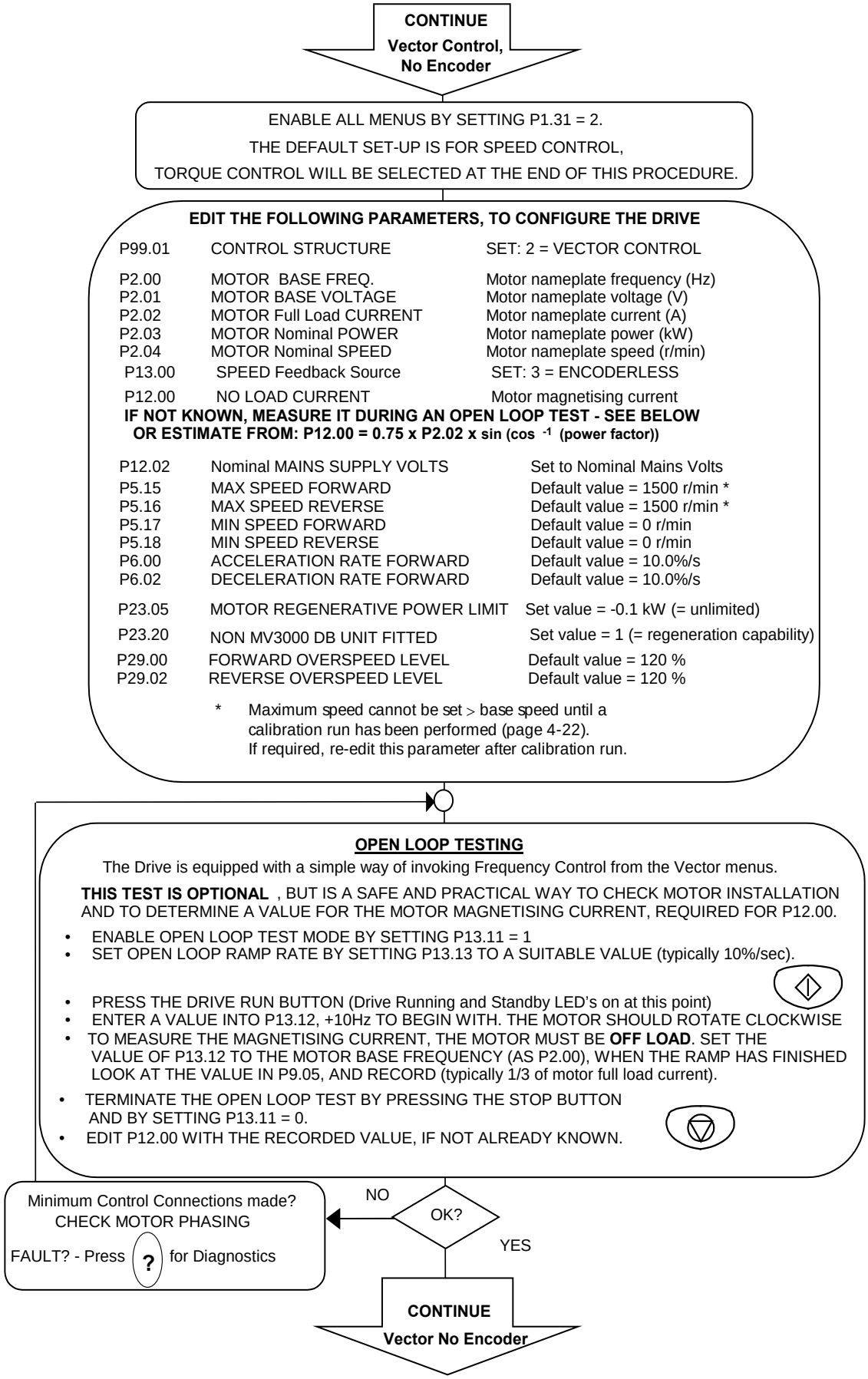
When parameter P1.29 is changed, the Keypad will show a Link Failure momentaril while the drive re-scales itself.

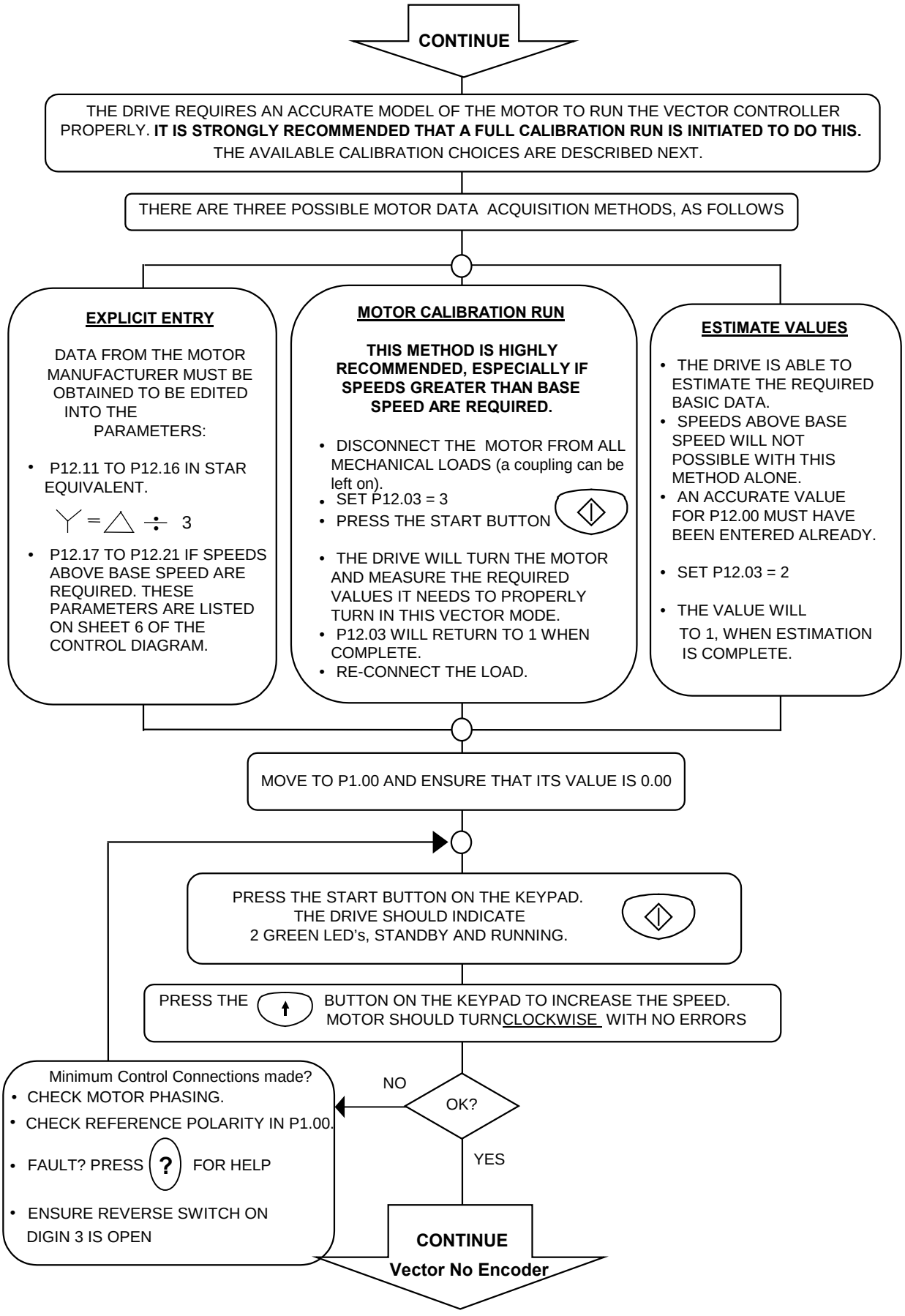

CONTINUE
RESET TRIP(S)
THE KEYPAD SHOULD BE DISPLAYING A HEALTHY/STANDBY GREEN LED, BUT NO RED
OK?
NO
YES
TO VIEW TRIPS, PRESS ?
OR SEE DIAGNOSTICS IN THIS MANUAL
NOW CHOOSE WHICH MOTOR CONTROL METHOD YOU REQUIRE, USING THE HINTS BELOW
FREQUENCY CONTROL (VVVF)
THE general purpose control mode. The drive controls frequency and volts (VVVF = Variable Voltage Variable Frequency).
THIS MODE IS TRADITIONALLY USED TO CONTROL:
FANS, PUMPS, CONVEYORS, COMPRESSORS ETC.
AND IS THE ONLY MODE ABLE TO CONTROL MULTIPLE MOTORS.
THIS IS THE MODE FOR WHICH MENU 1 HAS BEEN PRE-CONFIGURED. THIS IS THE SIMPLEST DRIVE SET-UP.
VECTOR CONTROL WITH AN ENCODER
(SPEED OR TORQUE)
Models the motor to achieve torque control and speed control, EQUIVALENT to DC performance. Low speed and zero speed torque is controlled, making this mode THE high performance mode.
TYPICAL APPLICATIONS INCLUDE:
PROCESS LINES
CRANES, LIFTS
POSITION CONTROLLERS
HIGH PERFORMANCE APPLICATIONS
DYNAMIC TORQUE CONTROL
INCLUDING COILERS
VECTOR CONTROL WITHOUT AN ENCODER
(SPEED OR TORQUE)
Models the motor to achieve torque control and speed control, speed feedback is estimated. Similar to DC performance. At very low frequency, torque is limited. Is an ideal mode for applications which require torque/speed control, but an encoder would be inconvenient.
TYPICAL APPLICATIONS
PROCESS (GOOD STEADY STATE SPEED ACCURACY)
POSITION CONTROL
TORQUE CONTROL
FOR ZERO SPEED CONTROL, USE AN ENCODER.
CONTINUE
Frequency Control
Section 4.6.3.2
CONTINUE
Vector Control No Encoder
Section 4.6.3.3
CONTINUE
Vector Control With Encoder
Section 4.6.3.4

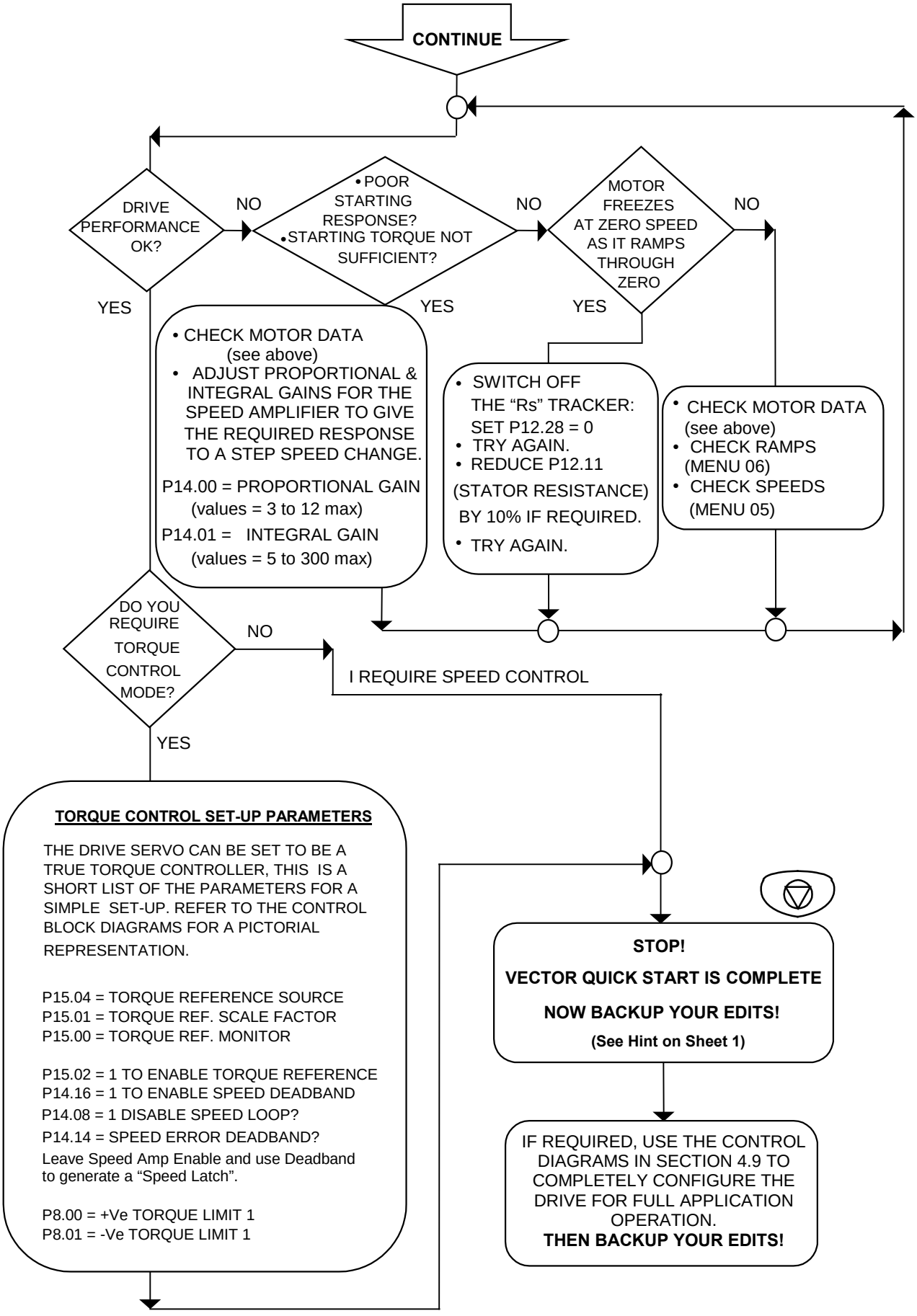
4.6.3.2 Frequency Control (VVVF) Mode



4.6.3.3 Vector Control, No Encoder




CONTINUE
THE DRIVE REQUIRES AN ACCURATE MODEL OF THE MOTOR TO RUN THE VECTOR CONTROLLER PROPERLY. IT IS STRONGLY RECOMMENDED THAT A FULL CALIBRATION RUN IS INITIATED TO DO THIS. THE AVAILABLE CALIBRATION CHOICES ARE DESCRIBED NEXT.
THERE ARE THREE POSSIBLE MOTOR DATA ACQUISITION METHODS, AS FOLLOWS
EXPLICIT ENTRY
DATA FROM THE MOTOR MANUFACTURER MUST BE OBTAINED TO BE EDITED INTO THE PARAMETERS:
• P12.11 TO P12.16 IN STAR EQUIVALENT.
Y = Δ ÷ 3
• P12.17 TO P12.21 IF SPEEDS ABOVE BASE SPEED ARE REQUIRED. THESE PARAMETERS ARE LISTED ON SHEET 6 OF THE CONTROL DIAGRAM.
MOTOR CALIBRATION RUN
THIS METHOD IS HIGHLY RECOMMENDED, ESPECIALLY IF SPEEDS GREATER THAN BASE SPEED ARE REQUIRED.
• DISCONNECT THE MOTOR FROM ALL MECHANICAL LOADS (a coupling can be left on).
• SET P12.03 = 3
• PRESS THE START BUTTON
• THE DRIVE WILL TURN THE MOTOR AND MEASURE THE REQUIRED VALUES IT NEEDS TO PROPERLY TURN IN THIS VECTOR MODE.
• P12.03 WILL RETURN TO 1 WHEN COMPLETE.
• RE-CONNECT THE LOAD.
ESTIMATE VALUES
• THE DRIVE IS ABLE TO ESTIMATE THE REQUIRED BASIC DATA.
• SPEEDS ABOVE BASE SPEED WILL NOT POSSIBLE WITH THIS METHOD ALONE.
• AN ACCURATE VALUE FOR P12.00 MUST HAVE BEEN ENTERED ALREADY.
• SET P12.03 = 2
• THE VALUE WILL TO 1, WHEN ESTIMATION IS COMPLETE.
MOVE TO P1.00 AND ENSURE THAT ITS VALUE IS 0.00
PRESS THE START BUTTON ON THE KEYPAD.
THE DRIVE SHOULD INDICATE
2 GREEN LED's, STANDBY AND RUNNING.
PRESS THE BUTTON ON THE KEYPAD TO INCREASE THE SPEED.
MOTOR SHOULD TURN CLOCKWISE WITH NO ERRORS
OK?
NO
YES
Minimum Control Connections made?
• CHECK MOTOR PHASING.
• CHECK REFERENCE POLARITY IN P1.00.
• FAULT? PRESS ? FOR HELP
• ENSURE REVERSE SWITCH ON DIGIN 3 IS OPEN
CONTINUE
Vector No Encoder


CONTINUE
DRIVE PERFORMANCE OK?
NO
• POOR STARTING RESPONSE?
• STARTING TORQUE NOT SUFFICIENT?
NO
MOTOR FREEZES AT ZERO SPEED AS IT RAMPS THROUGH ZERO
NO
YES
YES
YES
• CHECK MOTOR DATA (see above)
• ADJUST PROPORTIONAL & INTEGRAL GAINS FOR THE SPEED AMPLIFIER TO GIVE THE REQUIRED RESPONSE TO A STEP SPEED CHANGE.
P14.00 = PROPORTIONAL GAIN (values = 3 to 12 max)
P14.01 = INTEGRAL GAIN (values = 5 to 300 max)
• SWITCH OFF THE "Rs" TRACKER: SET P12.28 = 0
• TRY AGAIN.
• REDUCE P12.11 (STATOR RESISTANCE) BY 10% IF REQUIRED.
• TRY AGAIN.
• CHECK MOTOR DATA (see above)
• CHECK RAMPS (MENU 06)
• CHECK SPEEDS (MENU 05)
DO YOU REQUIRE TORQUE CONTROL MODE?
NO
I REQUIRE SPEED CONTROL
YES
TORQUE CONTROL SET-UP PARAMETERS
THE DRIVE SERVO CAN BE SET TO BE A TRUE TORQUE CONTROLLER, THIS IS A SHORT LIST OF THE PARAMETERS FOR A SIMPLE SET-UP. REFER TO THE CONTROL BLOCK DIAGRAMS FOR A PICTORIAL REPRESENTATION.
P15.04 = TORQUE REFERENCE SOURCE
P15.01 = TORQUE REF. SCALE FACTOR
P15.00 = TORQUE REF. MONITOR
P15.02 = 1 TO ENABLE TORQUE REFERENCE
P14.16 = 1 TO ENABLE SPEED DEADBAND
P14.08 = 1 DISABLE SPEED LOOP?
P14.14 = SPEED ERROR DEADBAND?
Leave Speed Amp Enable and use Deadband to generate a "Speed Latch".
P8.00 = +Ve TORQUE LIMIT 1
P8.01 = -Ve TORQUE LIMIT 1
STOP!
VECTOR QUICK START IS COMPLETE
NOW BACKUP YOUR EDITS!
(See Hint on Sheet 1)
IF REQUIRED, USE THE CONTROL DIAGRAMS IN SECTION 4.9 TO COMPLETELY CONFIGURE THE DRIVE FOR FULL APPLICATION OPERATION.
THEN BACKUP YOUR EDITS!

4.6.3.4 Vector Control with Encoder

CONTINUE
Vector Control, with Encoder

THE DEFAULT SET-UP IS FOR SPEED CONTROL,

TORQUE CONTROL WILL BE SELECTED AT THE END OF THIS PROCEDURE.

SWITCH THE DRIVE OFF AND CONNECT THE ENCODER.

THE ENCODER IS CONNECTED TO TB5 ON THE I/O PANEL, SEE DIAGRAM INSIDE FRONT COVER.

CABLING RECOMMENDATIONS CAN BE FOUND BY CONSULTING SECTION 3.6.

SWITCH THE MV3000 BACK ON

EDIT THE FOLLOWING PARAMETERS, TO CONFIGURE THE DRIVE

ENABLE ALL MENUS, BY SETTING P1.31 = 2

P99.01	CONTROL STRUCTURE	Set: 2 Vector Control
P2.00	MOTOR BASE FREQUENCY	Motor nameplate frequency (Hz)
P2.01	MOTOR BASE VOLTAGE	Motor nameplate voltage (V)
P2.02	MOTOR Full Load CURRENT	Motor nameplate current (A)
P2.03	MOTOR Nominal POWER	Motor nameplate power (kW)
P2.04	MOTOR Nominal SPEED	Motor nameplate speed (r/min)
P13.00	SPEED FEEDBACK Source	SET 1 = ENCODER
P13.01	BACKUP SPEED FEEDBACK	Default Value =1 = Encoder
P13.02	Encoder LOSS ACTION	Default value = 1 = Warning
P13.04	Encoder LINE COUNT	Pulses of your encoder, eg 2500
P13.05	Encoder 10000 LINES	X10K pulses for your encoder

Overall line count = P13.04 + (P13.05 x 10,000) e.g. for 11,000 lines : P13.04 = 1000
P13.05 = 1

P12.00	NO LOAD CURRENT	Motor magnetising current

IF NOT KNOWN, MEASURE IT DURING AN OPEN LOOP TEST - SEE BELOW
OR ESTIMATE FROM: P12.00 = 0.75 x P2.02 x sin (cos^{1} (power factor))

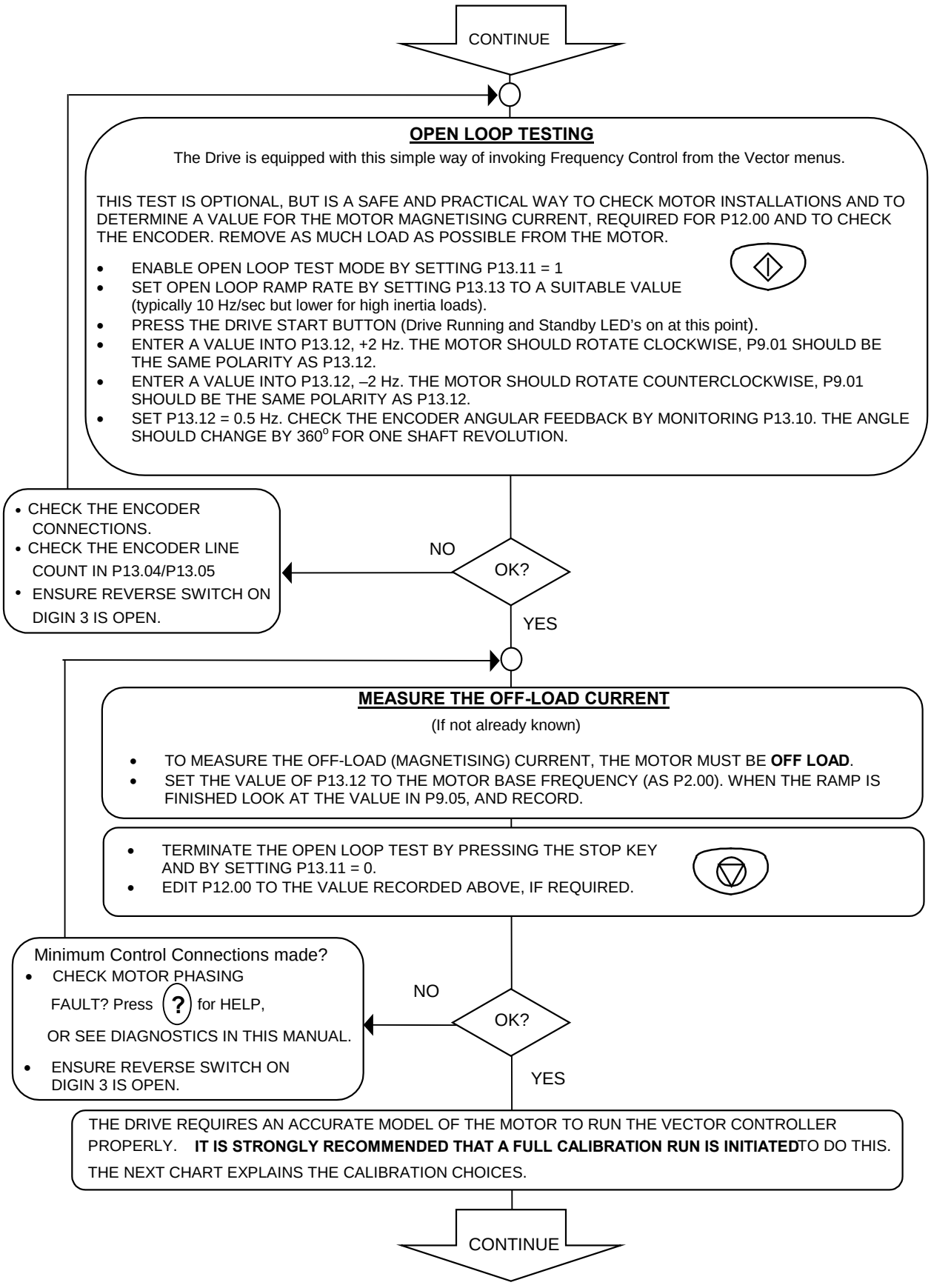
P12.02	Nominal MAINS SUPPLY VOLTS	Set to Nominal Mains Volts
P5.15	MAXIMUM SPEED FORWARD	Default value = 1500 r/min *
P5.16	MAXIMUM SPEED REVERSE	Default value = 1500 r/min
P5.17	MINIMUM SPEED FORWARD	Default value = 0 r/min
P5.18	MINIMUM SPEED REVERSE	Default value = 0 r/min
P6.00	ACCELERATION RATE FORWARD	Default value = 10.0%/s
P6.01	ACCELERATION RATE REVERSE	Default value = 0%/s or as Fwd. Accel.
P6.02	DECELERATION RATE FORWARD	Default value = 10.0%/s
P6.03	DECELERATION RATE REVERSE	Default value = 0%/s or as Fwd. Decel.
P23.05	MOTOR REGENERATIVE POWER LIMIT	Set value = -0.1 kW (= unlimited)
P23.20	NON MV3000 DB UNIT FITTED	Set value = 1 (= regeneration capability)
P29.00	FORWARD OVERSPEED LEVEL	Default value = 120 %
P29.01	REVERSE OVERSPEED LEVEL	Default value = 120 %

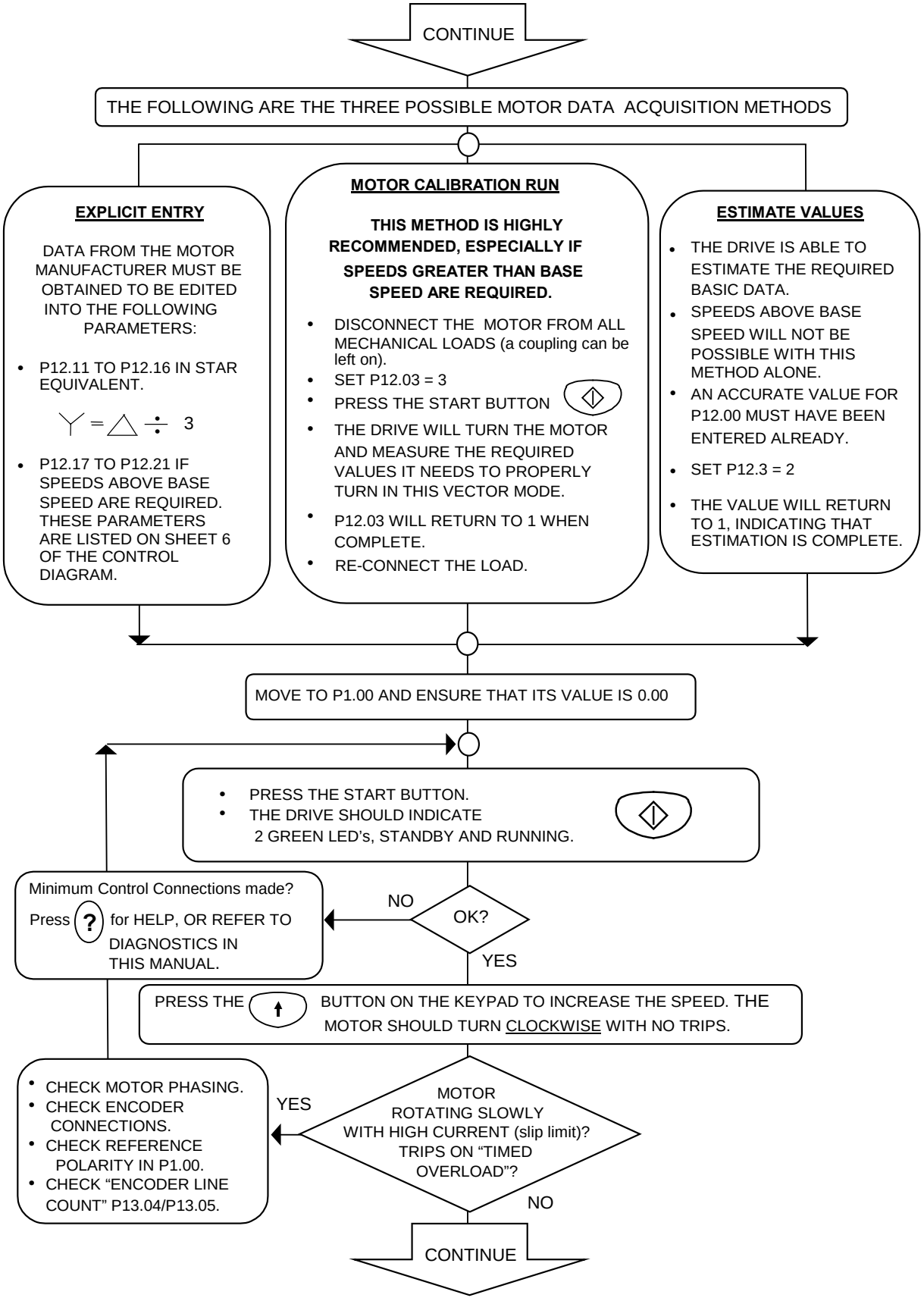
* Maximum speed cannot be set > base speed until a calibration run has been performed (page 4-22). If required, re-edit this parameter after calibration run.

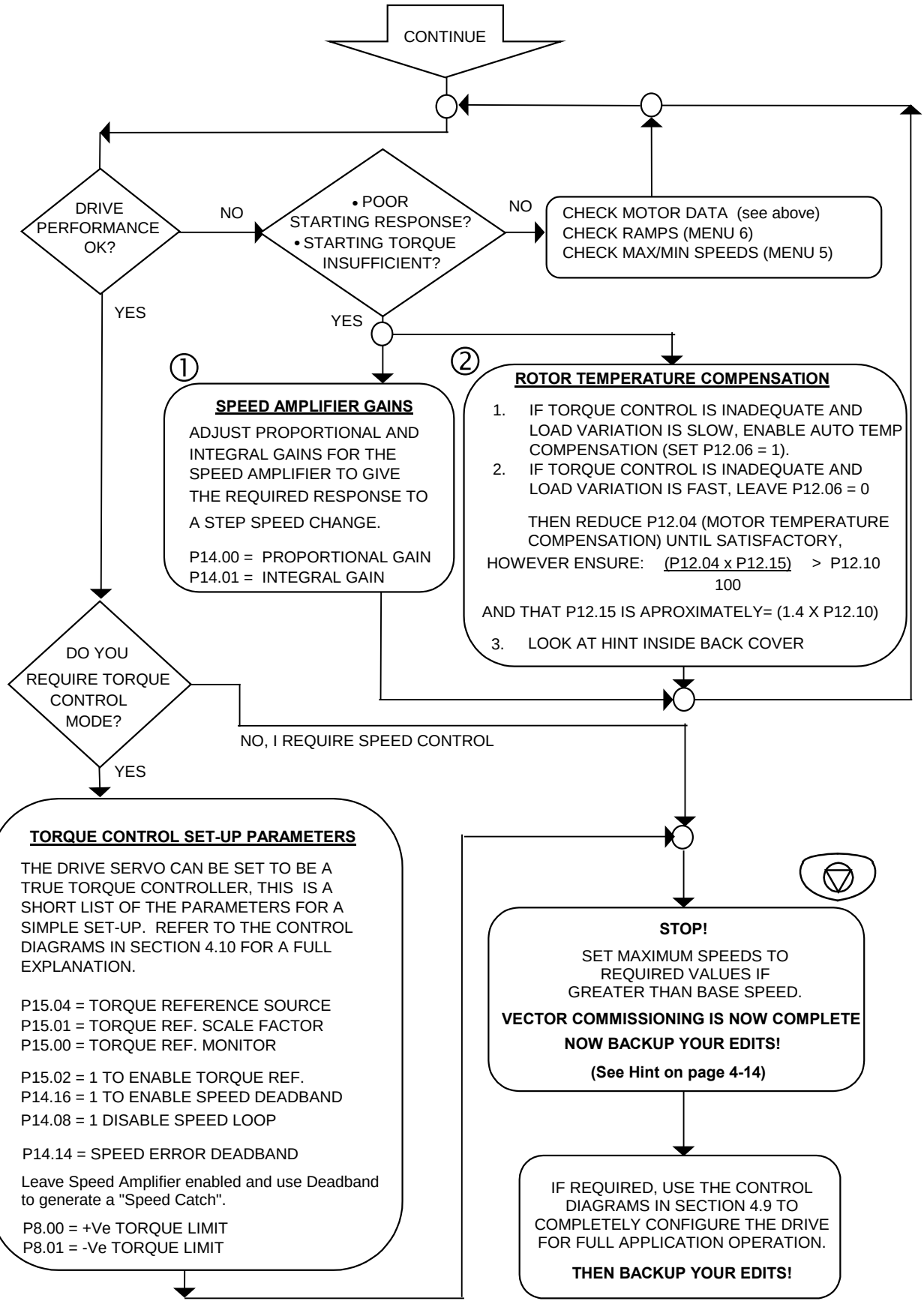
For encoders supplied from +5 V :

The Encoder sense wires FB+, FB-, connected at the Encoder end of the supply, allow the drive to sense the voltage. Set P13.06 to the supply volts of the Encoder and the drive will compensate for cable volts drop.

CONTINUE


CONTINUE
OPEN LOOP TESTING
The Drive is equipped with this simple way of invoking Frequency Control from the Vector menus.
THIS TEST IS OPTIONAL, BUT IS A SAFE AND PRACTICAL WAY TO CHECK MOTOR INSTALLATIONS AND TO DETERMINE A VALUE FOR THE MOTOR MAGNETISING CURRENT, REQUIRED FOR P12.00 AND TO CHECK THE ENCODER. REMOVE AS MUCH LOAD AS POSSIBLE FROM THE MOTOR.
• ENABLE OPEN LOOP TEST MODE BY SETTING P13.11 = 1
• SET OPEN LOOP RAMP RATE BY SETTING P13.13 TO A SUITABLE VALUE (typically 10 Hz/sec but lower for high inertia loads).
• PRESS THE DRIVE START BUTTON (Drive Running and Standby LED's on at this point).
• ENTER A VALUE INTO P13.12, +2 Hz. THE MOTOR SHOULD ROTATE CLOCKWISE, P9.01 SHOULD BE THE SAME POLARITY AS P13.12.
• ENTER A VALUE INTO P13.12, –2 Hz. THE MOTOR SHOULD ROTATE COUNTERCLOCKWISE, P9.01 SHOULD BE THE SAME POLARITY AS P13.12.
• SET P13.12 = 0.5 Hz. CHECK THE ENCODER ANGULAR FEEDBACK BY MONITORING P13.10. THE ANGLE SHOULD CHANGE BY 360° FOR ONE SHAFT REVOLUTION.
• CHECK THE ENCODER CONNECTIONS.
• CHECK THE ENCODER LINE COUNT IN P13.04/P13.05
• ENSURE REVERSE SWITCH ON DIGIN 3 IS OPEN.
NO
OK?
YES
MEASURE THE OFF-LOAD CURRENT
(If not already known)
• TO MEASURE THE OFF-LOAD (MAGNETISING) CURRENT, THE MOTOR MUST BE OFF LOAD.
• SET THE VALUE OF P13.12 TO THE MOTOR BASE FREQUENCY (AS P2.00). WHEN THE RAMP IS FINISHED LOOK AT THE VALUE IN P9.05, AND RECORD.
• TERMINATE THE OPEN LOOP TEST BY PRESSING THE STOP KEY AND BY SETTING P13.11 = 0.
• EDIT P12.00 TO THE VALUE RECORDED ABOVE, IF REQUIRED.
Minimum Control Connections made?
• CHECK MOTOR PHASING
FAULT? Press ? for HELP,
OR SEE DIAGNOSTICS IN THIS MANUAL.
• ENSURE REVERSE SWITCH ON DIGIN 3 IS OPEN.
NO
OK?
YES
THE DRIVE REQUIRES AN ACCURATE MODEL OF THE MOTOR TO RUN THE VECTOR CONTROLLER PROPERLY. IT IS STRONGLY RECOMMENDED THAT A FULL CALIBRATION RUN IS INITIATED TO DO THIS.
THE NEXT CHART EXPLAINS THE CALIBRATION CHOICES.
CONTINUE


CONTINUE
THE FOLLOWING ARE THE THREE POSSIBLE MOTOR DATA ACQUISITION METHODS
EXPLICIT ENTRY
DATA FROM THE MOTOR MANUFACTURER MUST BE OBTAINED TO BE EDITED INTO THE FOLLOWING PARAMETERS:
• P12.11 TO P12.16 IN STAR EQUIVALENT.
Y = Δ ÷ 3
• P12.17 TO P12.21 IF SPEEDS ABOVE BASE SPEED ARE REQUIRED. THESE PARAMETERS ARE LISTED ON SHEET 6 OF THE CONTROL DIAGRAM.
MOTOR CALIBRATION RUN
THIS METHOD IS HIGHLY RECOMMENDED, ESPECIALLY IF SPEEDS GREATER THAN BASE SPEED ARE REQUIRED.
• DISCONNECT THE MOTOR FROM ALL MECHANICAL LOADS (a coupling can be left on).
• SET P12.03 = 3
• PRESS THE START BUTTON
• THE DRIVE WILL TURN THE MOTOR AND MEASURE THE REQUIRED VALUES IT NEEDS TO PROPERLY TURN IN THIS VECTOR MODE.
• P12.03 WILL RETURN TO 1 WHEN COMPLETE.
• RE-CONNECT THE LOAD.
ESTIMATE VALUES
• THE DRIVE IS ABLE TO ESTIMATE THE REQUIRED BASIC DATA.
• SPEEDS ABOVE BASE SPEED WILL NOT BE POSSIBLE WITH THIS METHOD ALONE.
• AN ACCURATE VALUE FOR P12.00 MUST HAVE BEEN ENTERED ALREADY.
• SET P12.3 = 2
• THE VALUE WILL RETURN TO 1, INDICATING THAT ESTIMATION IS COMPLETE.
MOVE TO P1.00 AND ENSURE THAT ITS VALUE IS 0.00
• PRESS THE START BUTTON.
• THE DRIVE SHOULD INDICATE 2 GREEN LED's, STANDBY AND RUNNING.
OK?
NO
Minimum Control Connections made?
Press ? for HELP, OR REFER TO DIAGNOSTICS IN THIS MANUAL.
YES
PRESS THE BUTTON ON THE KEYPAD TO INCREASE THE SPEED. THE MOTOR SHOULD TURN CLOCKWISE WITH NO TRIPS.
MOTOR ROTATING SLOWLY WITH HIGH CURRENT (slip limit)? TRIPS ON "TIMED OVERLOAD"?
YES
• CHECK MOTOR PHASING.
• CHECK ENCODER CONNECTIONS.
• CHECK REFERENCE POLARITY IN P1.00.
• CHECK "ENCODER LINE COUNT" P13.04/P13.05.
NO
CONTINUE


CONTINUE
DRIVE PERFORMANCE OK?
NO
• POOR STARTING RESPONSE?
• STARTING TORQUE INSUFFICIENT?
NO
CHECK MOTOR DATA (see above)
CHECK RAMPS (MENU 6)
CHECK MAX/MIN SPEEDS (MENU 5)
YES
YES
①
SPEED AMPLIFIER GAINS
ADJUST PROPORTIONAL AND INTEGRAL GAINS FOR THE SPEED AMPLIFIER TO GIVE THE REQUIRED RESPONSE TO A STEP SPEED CHANGE.
P14.00 = PROPORTIONAL GAIN
P14.01 = INTEGRAL GAIN
②
ROTOR TEMPERATURE COMPENSATION
1. IF TORQUE CONTROL IS INADEQUATE AND LOAD VARIATION IS SLOW, ENABLE AUTO TEMP COMPENSATION (SET P12.06 = 1).
2. IF TORQUE CONTROL IS INADEQUATE AND LOAD VARIATION IS FAST, LEAVE P12.06 = 0
THEN REDUCE P12.04 (MOTOR TEMPERATURE COMPENSATION) UNTIL SATISFACTORY,
HOWEVER ENSURE: (P12.04 x P12.15) / 100 > P12.10
AND THAT P12.15 IS APROXIMATELY= (1.4 X P12.10)
3. LOOK AT HINT INSIDE BACK COVER
DO YOU REQUIRE TORQUE CONTROL MODE?
NO, I REQUIRE SPEED CONTROL
YES
TORQUE CONTROL SET-UP PARAMETERS
THE DRIVE SERVO CAN BE SET TO BE A TRUE TORQUE CONTROLLER, THIS IS A SHORT LIST OF THE PARAMETERS FOR A SIMPLE SET-UP. REFER TO THE CONTROL DIAGRAMS IN SECTION 4.10 FOR A FULL EXPLANATION.
P15.04 = TORQUE REFERENCE SOURCE
P15.01 = TORQUE REF. SCALE FACTOR
P15.00 = TORQUE REF. MONITOR
P15.02 = 1 TO ENABLE TORQUE REF.
P14.16 = 1 TO ENABLE SPEED DEADBAND
P14.08 = 1 DISABLE SPEED LOOP
P14.14 = SPEED ERROR DEADBAND
Leave Speed Amplifier enabled and use Deadband to generate a "Speed Catch".
P8.00 = +Ve TORQUE LIMIT
P8.01 = -Ve TORQUE LIMIT
STOP!
SET MAXIMUM SPEEDS TO REQUIRED VALUES IF GREATER THAN BASE SPEED.
VECTOR COMMISSIONING IS NOW COMPLETE
NOW BACKUP YOUR EDITS!
(See Hint on page 4-14)
IF REQUIRED, USE THE CONTROL DIAGRAMS IN SECTION 4.9 TO COMPLETELY CONFIGURE THE DRIVE FOR FULL APPLICATION OPERATION.
THEN BACKUP YOUR EDITS!

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.

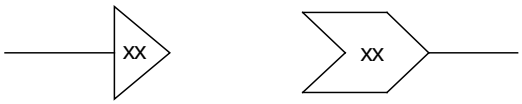
The MV3000e software contains a large number of pre-defined special functions and a range of freely connectable logic, which, when combined, will allow the user to solve many application problems and generally enhance the final application solution.

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.



Status Flag (SF) Control Flag (CF)

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 & 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:

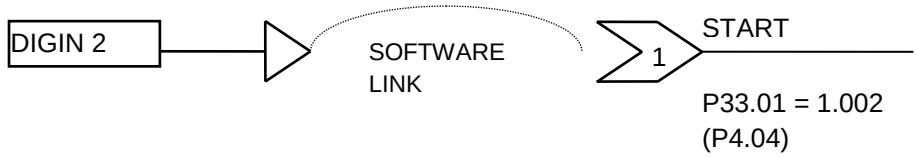
P33.01 = 1.002, then control flag 1 will be connected to digital input 2

or if

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

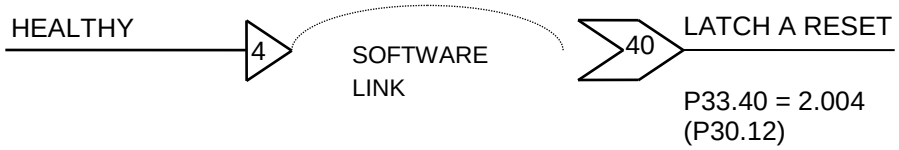
Example 1: How the Start Flag is connected

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

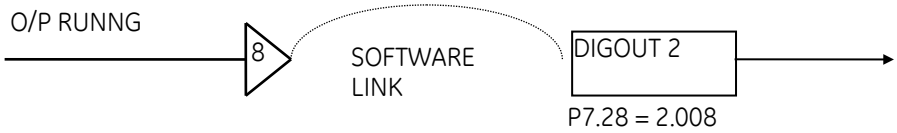


4.7.2 Programming Digital I/O

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% offset P7.02 = $\frac{1500 - 150}{1500}$ = 0.9 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	**E**ngineer accessible - only accessible if the engineering password has been entered in P99.06 or P1.32, see Section 4.5.2.
L	**L**ist parameter, value selected from a pre-defined list.
N	↵ (e**N**ter) has to be pressed to update.
O	**O**perator accessible - only accessible if the operator password has been entered in P99.06 or P1.32, see Section 4.5.2.
R	**R**ead only (monitoring parameters).
S	**S**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

a) The Engineer's password is stored in P99.08 (a 4-digit code).

b) The Operator's password is stored in P99.07 (a 4-digit code).

c) 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.

d) 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.

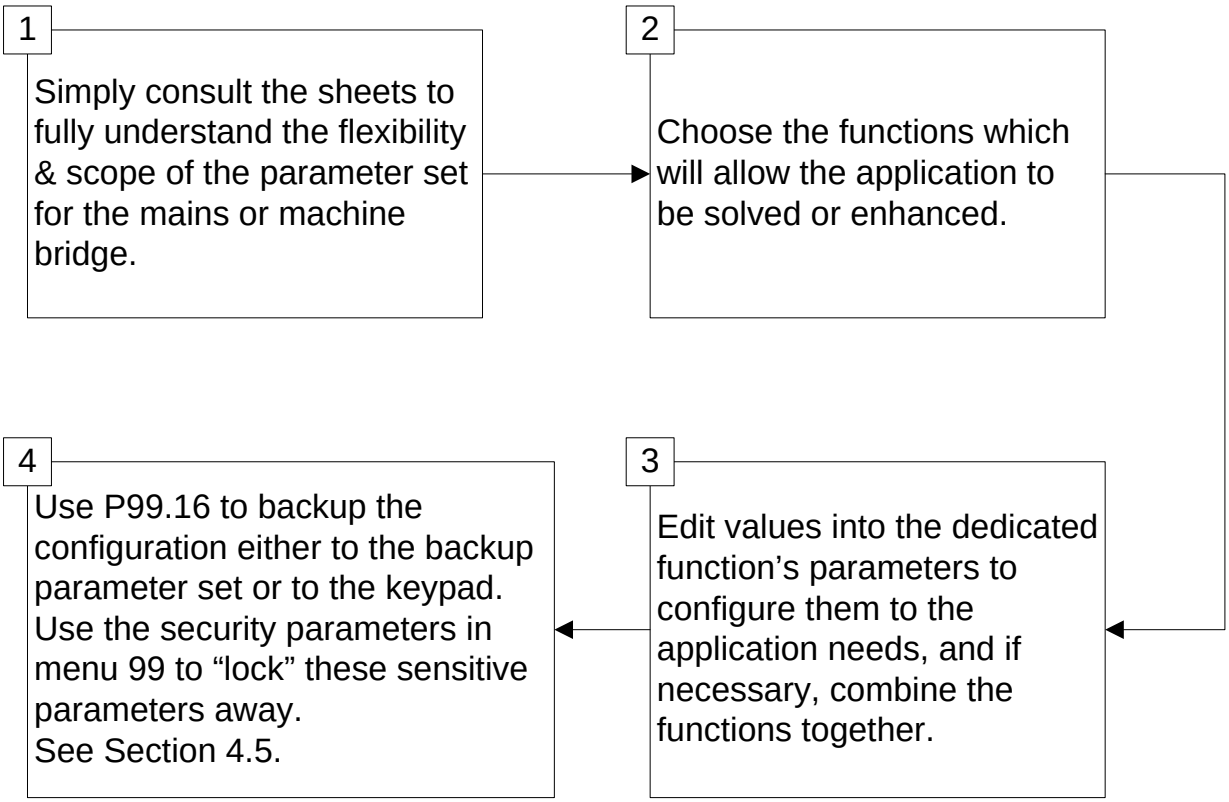


Figure 4-5. – Use of Control Block Diagrams

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.

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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 6.7.

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

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

Viewing using "help" key

a) When the converter is showing either a Trip or Warning, press (?).

b) 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:

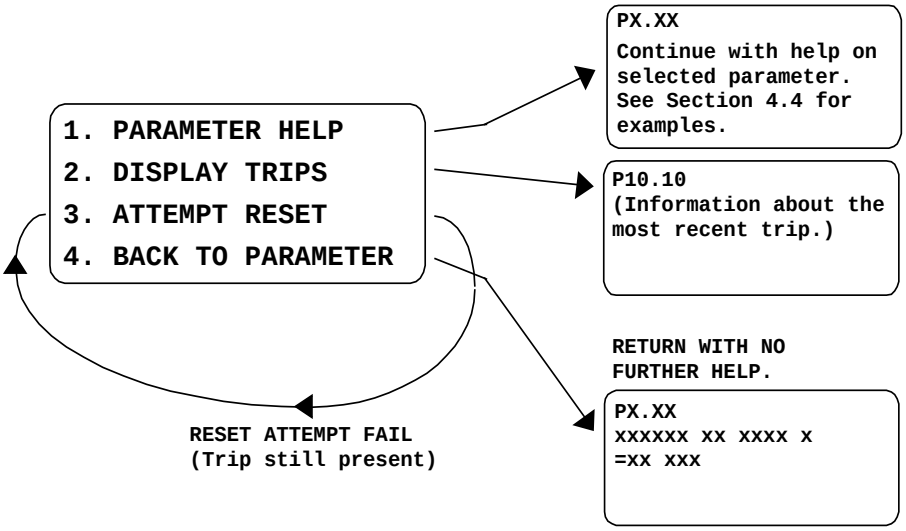

Figure 6-1. – Help Screen For Trips

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

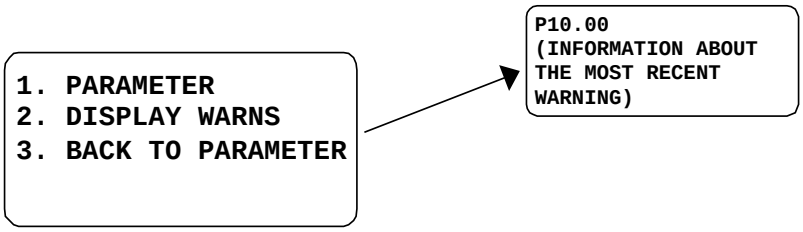

Figure 6-2. – Help Screen For Warnings

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/'98, NT4.0, 2000 or XP

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.

6.6.3.3 Using Windows™ VISTA, 7.0, 8.0 & 8.1

Hyper Terminal is not a default application on the PC and must be installed.

Locate and install HYPERTERM.DLL & HYPERTERM.EXE onto the PC.

a) Run HYPERTERM.EXE

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^2t
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^2T		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		**VIEWING WARNINGS AND TRIPS MENU 10**	
30	Drive ID Violation		**Parameter**	**View**
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		**HISTORY**	
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		**WARNING/TRIP code annotations :**	
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 31-56 74-92 153-199	(Relate to DELTA systems. Refer to Software Manual T1679EN)
151	DB Overcurrent Trip			
152	DB Hardware Overtemp Trip			
200	CAN,1,Loss, - see P61.43			

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)
400 V nominal voltage rating		
3	2	Bussmann KTK-2
4	4	Bussmann KTK-4
6	6	Bussmann KTK-6
7	6	Bussmann KTK-6
480 V nominal voltage rating		
3	2	Littelfuse KLKD002.T
4	3	Bussmann KTK-3
6	3	Bussmann KTK-3
7	5	Bussmann KTK-5
600/690 V nominal voltage rating		
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.

7.1.1.1 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.

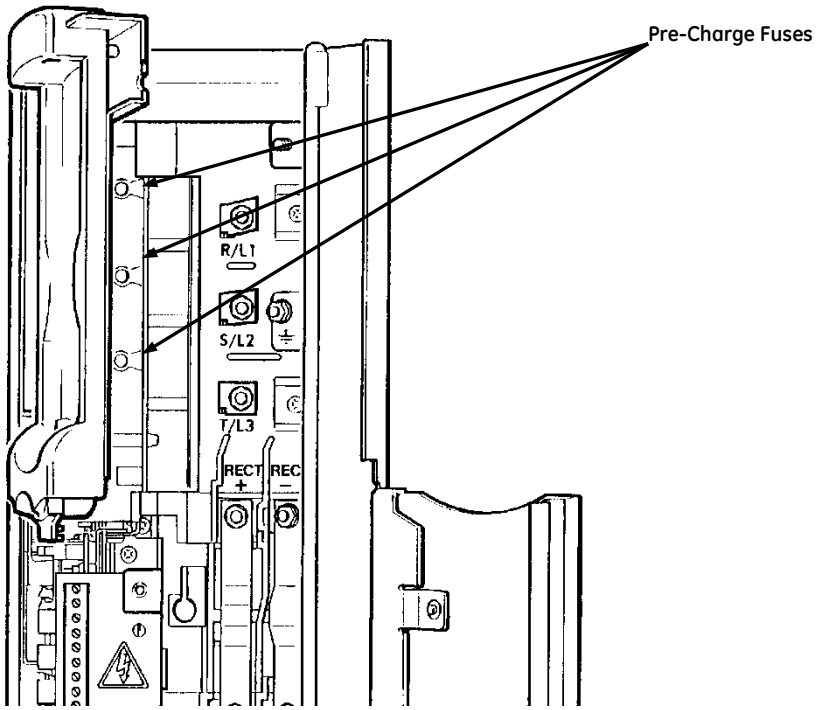

Figure 7-1. – Frame Size 3 & 4 Pre-charge Fuse Access

7.1.1.2 Procedure For Frame Sizes 6 & 7

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

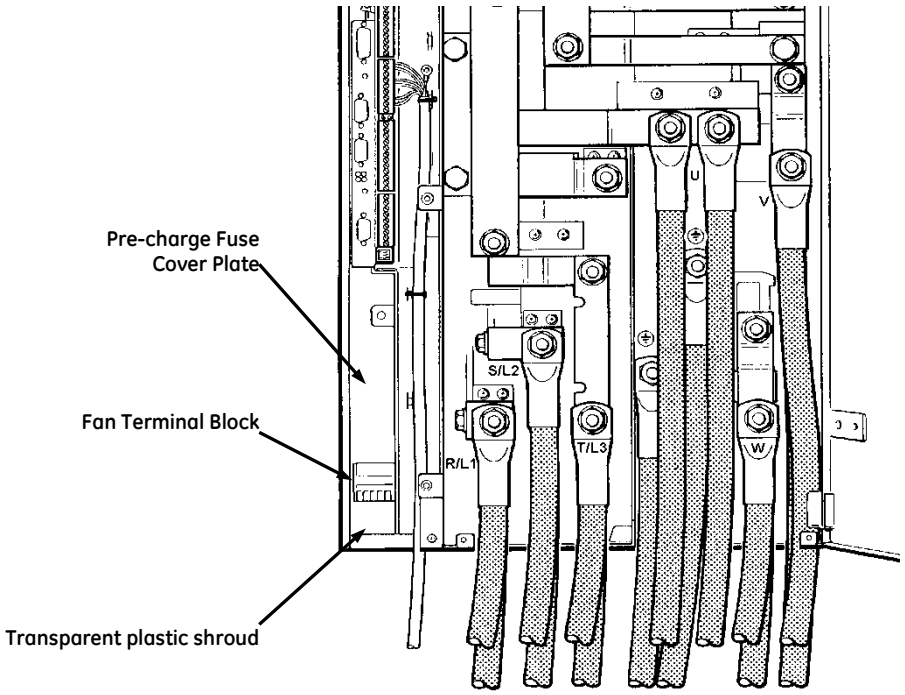

Figure 7-2. – Frame Size 6 & 7 Pre-charge Fuse Access

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 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)
400 V								
MV3071A4A1	3	S41Y7784/40	S41Y7786/10	S41Y7782/20			S20X4320/10	S82028/220
MV3140A4A1	4	S41Y7784/40	S98101/153	S41Y8008/10			S20X4320/10	S82028/260
MV3364A4A1	6	S41Y7784/40	SMV98101/170		S41Y7770/10	S41Y7771/70	S20X4321/20	S82028/280
MV3566A4A1	7	S41Y7784/40	SMV98101/170		S41Y8081/30	S41Y8082/20	S20X4321/20	S82028/280
480 V								
MV3065A5A1	3	S41Y7784/40	S41Y7786/10	S41Y7782/30			S20X4320/20	S82030/366
MV3124A5A1	4	S41Y7784/40	S98101/153	S41Y8008/50			S20X4320/20	S82028/240
MV3302A5A1	6	S41Y7784/40	SMV98101/170		S41Y7770/20	S41Y7771/40	S20X4321/30	S82028/240
MV3477A5A1	7	S41Y7784/40	SMV98101/170		S41Y8081/60	S41Y8082/40	S20X4321/30	S82028/270
600/690 V								
MV3099A6A1	4	S41Y7784/40	S98101/153	S41Y8008/60			S20X4321/10	S82028/240
MV3242A6A1	6	S41Y7784/40	SMV98101/170		S41Y8036/10	S41Y8045/10	S20X4321/10	S82028/260
MV3336A6A1	7	S41Y7784/40	SMV98101/170		S41Y8081/70	S41Y8082/60	S20X4321/10	S82028/270
MV3382A6A1*	7	S41Y7784/40	SMV98101/170		S41Y8081/80	S41Y8082/60	S20X4321/10	S82028/270

* 690 V only

Table 7-2. – Spares Listing for MV3000 AC-Fed MictoCubicle™ 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 2nd 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	MVS3004-4002 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™ '95/'98, NT 4.0, 2000, XP, 7.0 and 8.0/8.1. 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.

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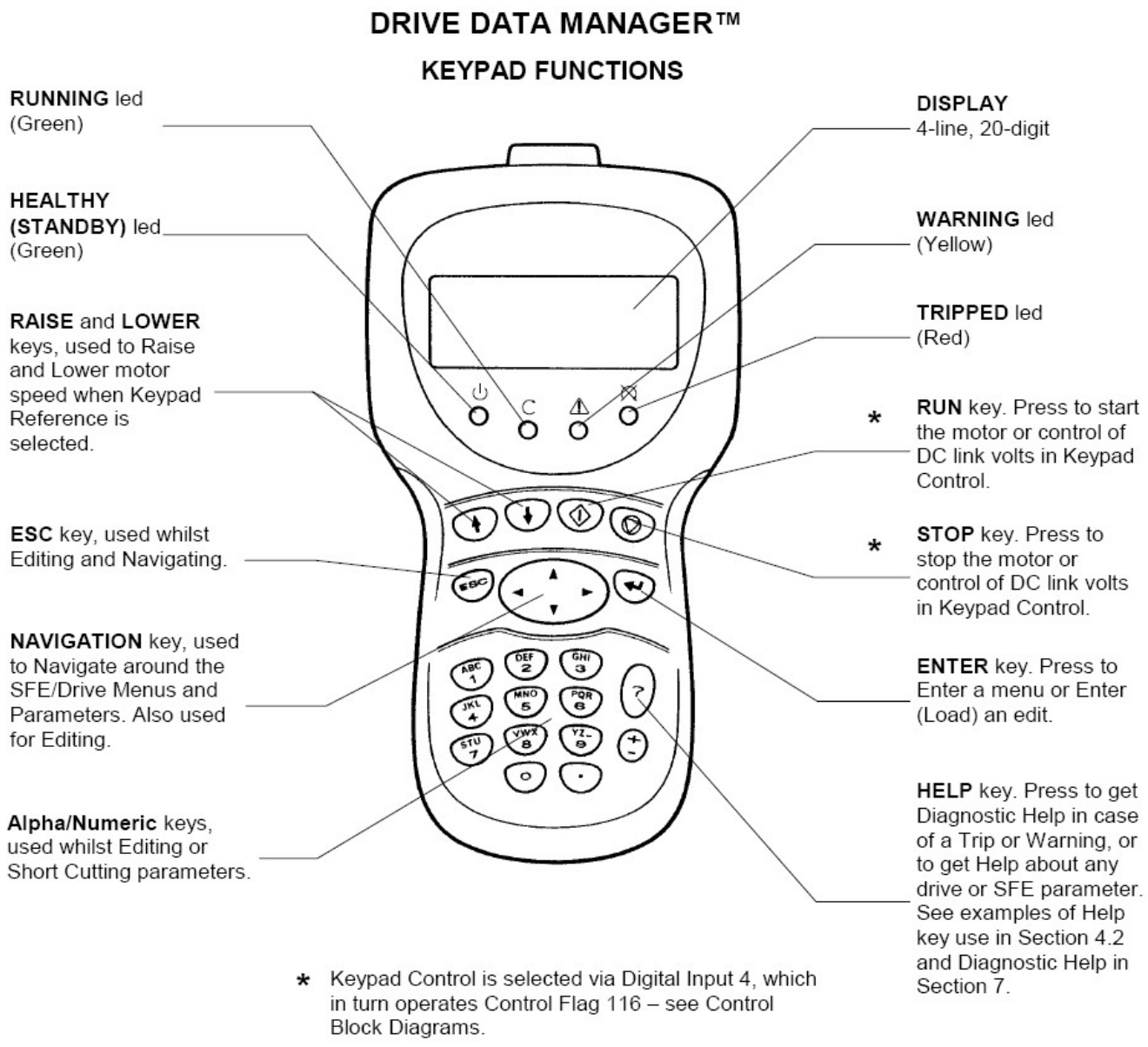
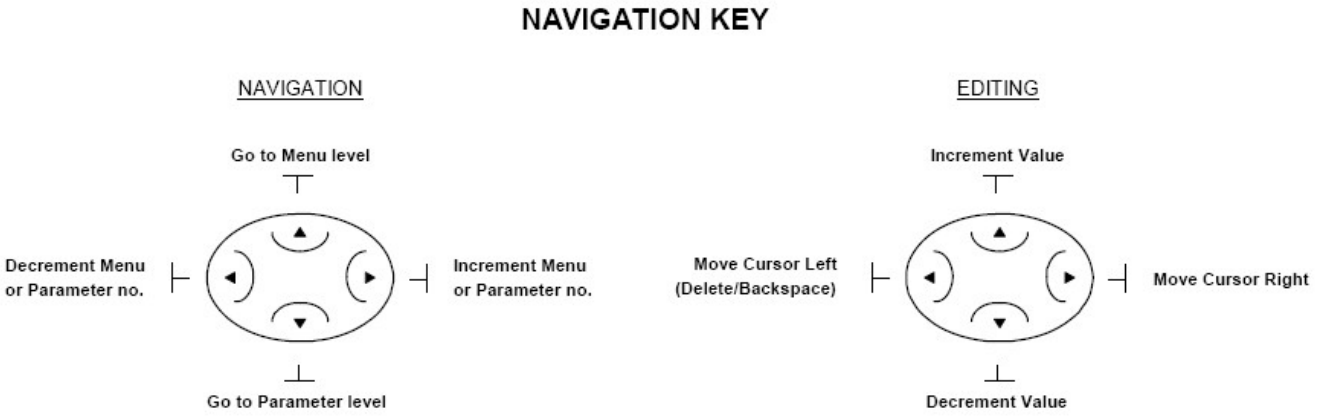
9. APPENDIX A

9.1 DRIVE DATA MANAGER™

9.1.1 Keypad Functions





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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	Mains I/P Current (1.1/1.5)	IEC Rated Fuse ** (1.1/1.5)	UL Rated Fuse ** (1.1/1.5)	Maximum Prospective Short Circuit Current Rating	Approx. Maximum Losses		Typical Drive Airflow		Rating **
		Rating (1.1/1.5)	(1.1/1.5) kW ◊	(1.1/1.5) HP ◊◊	(1.1) A	(1.5) A	V	A	A	A	kA	Clean Air Configuration kW	With Dirty Air Kit Fitted W	m3/h	cu ft/min	A
MV3071A4A1	3	MV3ACL037A4 / MV3ACL030A4	37/30	50/40	71 (78)	58 (87)	**400 @ 50 Hz (380 V to 440 V)**	73/59	80/63	100/80	5	1.3	201	140	85	N/A
MV3140A4A1	4	MV3ACL075A4 / MV3ACL055A4	75/55	101/74	140 (154)	105 (158)		145/107	160/125	200/150	10	2.4	263	255	150	2
MV3364A4A1	6	MV3ACL200A4 / MV3ACL160A4	200/160	268/214	364 (401)	292 (438)		379/304	400/315	500/400	18	5.6	436	680	400	4
MV3566A4A1	7	MV3ACL315A4 / MV3ACL280A4	315/250	422/335	566 (623)*	449 (674)*		595/473	630/500	750/600	30	8.8	572	850	500	4
MV3099A6A1	4	MV3ACL090A7 / MV3ACL075A7	90/75	121/101	98 (108)	82 (123)	**690§ @ 50 Hz (data valid for 690 V only)**	100/84	100/100		10	2.4	331	255	150	2
MV3242A6A1	6	MV3ACL200A7 / MV3ACL160A7	200/160	268/214	211 (232)	170 (255)		220/176	250/200		18	4.6	437	680	400	4
MV3336A6A1	7	MV3ACL280A7 / MV3ACL250A7	280/250	375/335	292 (320)	260 (390)		307/274	315/315		18	6.2	548	850	500	4
MV3382A6A1	7	MV3ACL315A7 / MV3ACL280A7	315/280	422/375	328 (360)	292 (438)		345/307	400/315		30	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

*** Only permitted up to 30 °C ambient temp. De-rate for high ambient temp.**

** 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	Mains I/P Current	IEC Rated Fuse **	UL Rated Fuse **	Maximum Prospective Short Circuit Current Rating	Approx. Maximum Losses		Typical Drive Airflow		Rating **
		Rating (1.1/1.5)	(1.1/1.5) kW ◊	(1.1/1.5) HP ◊◊	(1.1) A	(1.5) A	V	(1.1/1.5) A	(1.1/1.5) A	(1.1/1.5) A	kA	Clean Air Configuration kW	With Dirty Air Kit Fitted W	m3/h	cu ft/min	A
MV3065A5A1	3	MV3ACL050B5 / MV3ACL040B5	37/30	50/40	65 (72)	52 (78)	480 @ 60 Hz (460 V to 525 V)	66/53	80/63	90/70	5	1.2	226	140	85	N/A
MV3124A5A1	4	MV3ACL100B5 / MV3ACL075B5	75/56	100/75	124 (137)	96 (144)		130/98	160/100	175/125	10	2.2	286	255	150	2
MV3302A5A1	6	MV3ACL250B5 / MV3ACL200B5	187/149	250/200	302 (332)	240 (360)		321/258	400/315	450/350	18	4.7	436	680	400	4
MV3477A5A1	7	MV3ACL400B5 / MV3ACL350B5	298/261	400/350	477 (525)	414 (621)		512/448	630/500	650/600	18	7.6	575	850	500	4
MV3099A6A1	4	MV3ACL100B6 / MV3ACL075B6	75/56	100/75	99 (109)	77 (116)	600§ @ 60 Hz (575V to 690V)	105/79	125/80	150/100	10	2.4	331	255	150	2
MV3242A6A1	6	MV3ACL250B6 / MV3ACL200B6	187/149	250/200	242 (266)	192 (288)		258/207	315/250	350/300	18	5.0	437	680	400	4
MV3336A6A1	7	MV3ACL350B6 / MV3ACL300B6	261/224	350/300	336 (370)	289 (434)		359/309	400/315	450/400	18	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

*** Only permitted up to 30 °C ambient temp. De-rate for high ambient temp**

** 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

ANALOGUE INPUTS
DIGITAL INPUTS
KEYPAD REFS & ON/OFF

PROPORTIONAL DB CONTROL OVERVIEW SHEET 2

REFERENCE SELECTOR
DB CONTROL MODE
ANALOGUE AND DIGITAL INPUTS
ANALOGUE AND DIGITAL OUTPUTS
KEYPAD REFERENCE
STARTING AND STOPPING
TRIPS/WARNINGS
MONITORING
APPLICATION LOGIC

CONTROL MODE SELECTOR P99.01

0. NO MOTOR CONTROL
1. VVVF CONTROL
2. VECTOR CONTROL
3. SCALAR CONTROL
4. SFE MODE

Note: Option 4 is displayed only if the bridge is a bi-directional converter, or a DELTA with a Mains Voltage Monitor unit connected.

DB Resistors

0 → 0. NO MOTOR CONTROL (DB MODE)

DB CONTROL MODE

ANALOGUE INPUTS
DIGITAL INPUTS
KEYPAD SPEED REFS & START/STOP

MACHINE BRIDGE CONTROL SYSTEM OVERVIEW SHEET 3

REFERENCE SELECTOR
SPEED CONTROL
DIRECTION CONTROL
POSITION CONTROL
ANALOGUE AND DIGITAL INPUTS
ANALOGUE AND DIGITAL OUTPUTS
KEYPAD SPEED REFERENCE
STARTING AND STOPPING
TRIPS/WARNINGS
MONITORING
APPLICATION LOGIC

1 → 1. FREQUENCY CONTROL (VVVF) MODE
2 → 2. VECTOR CONTROL MODE
3 → 3. SCALAR CONTROL MODE

M
U V W
+ −
DC LINK

MACHINE CONTROL MODES

SFE MODE (MAINS CONTROL)

4 → 4. SFE MODE

OR

R S T
Mains Network

R S T
Mains Network

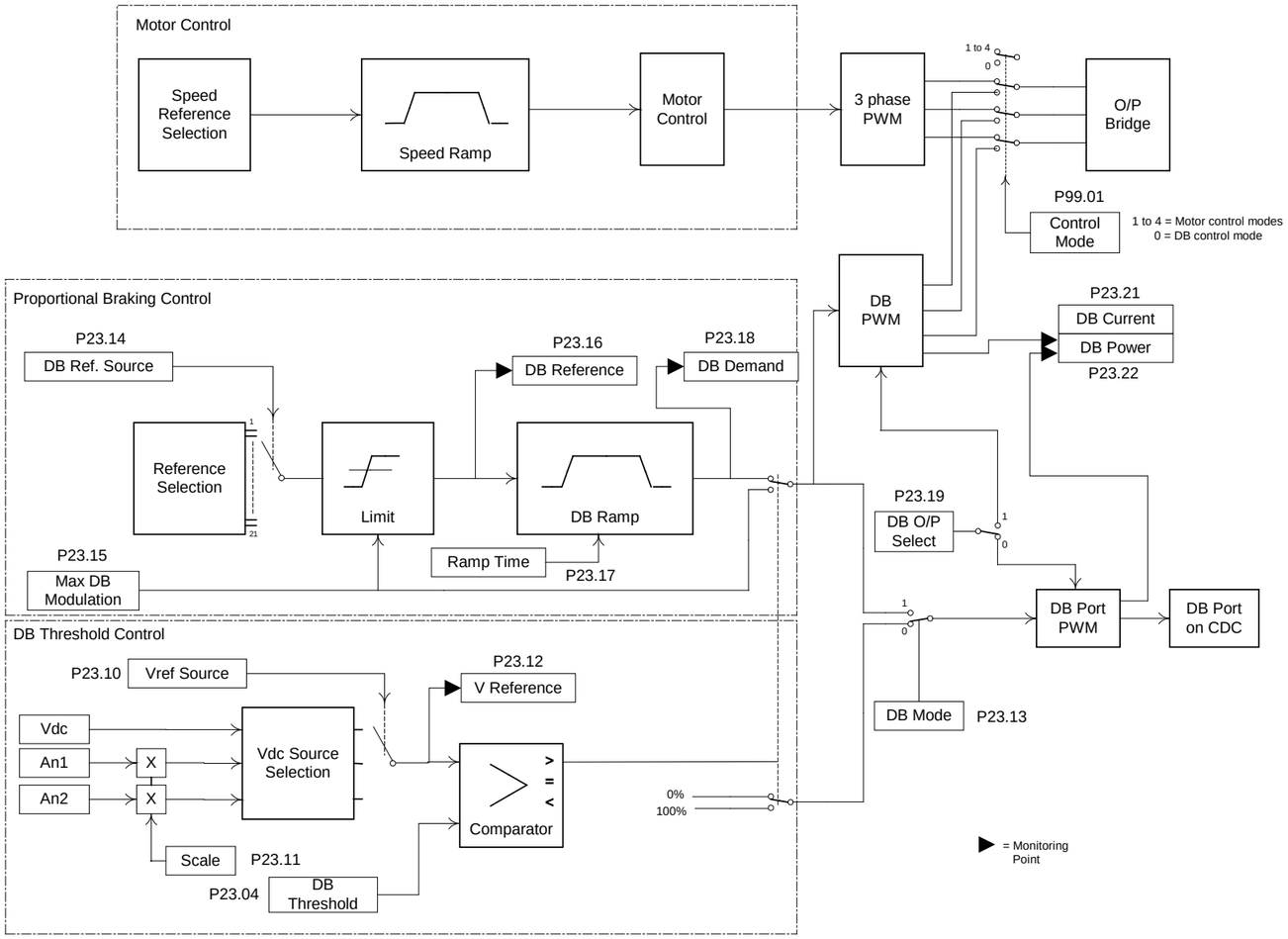
ANALOGUE INPUTS
DIGITAL INPUTS
KEYPAD START/STOP

SFE CONTROL SYSTEM OVERVIEW SHEET 17

REFERENCE SELECTOR
DC LINK VOLTAGE CONTROL
CURRENT CONTROL
MAINS MONITORING
LOAD POWER FEEDFORWARD
ANALOGUE AND DIGITAL INPUTS
ANALOGUE AND DIGITAL OUTPUTS
KEYPAD REFERENCE
STARTING AND STOPPING
TRIPS/WARNINGS
MONITORING
APPLICATION LOGIC

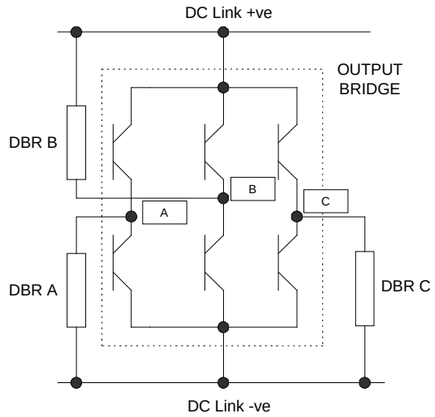
KEY			
DIGOUT	CONTROL FLAG	ANALOG I/O	(A) DEFAULT SETTING
DIGIN	STATUS FLAG	MONITOR POINT	DEFAULT CONNECTION

Sheet 1

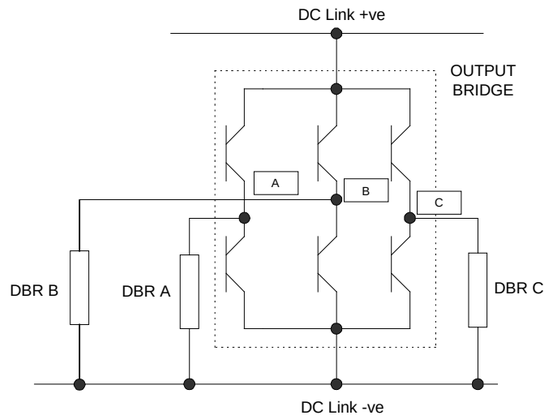


MENU 23

PROPORTIONAL DB CONTROL



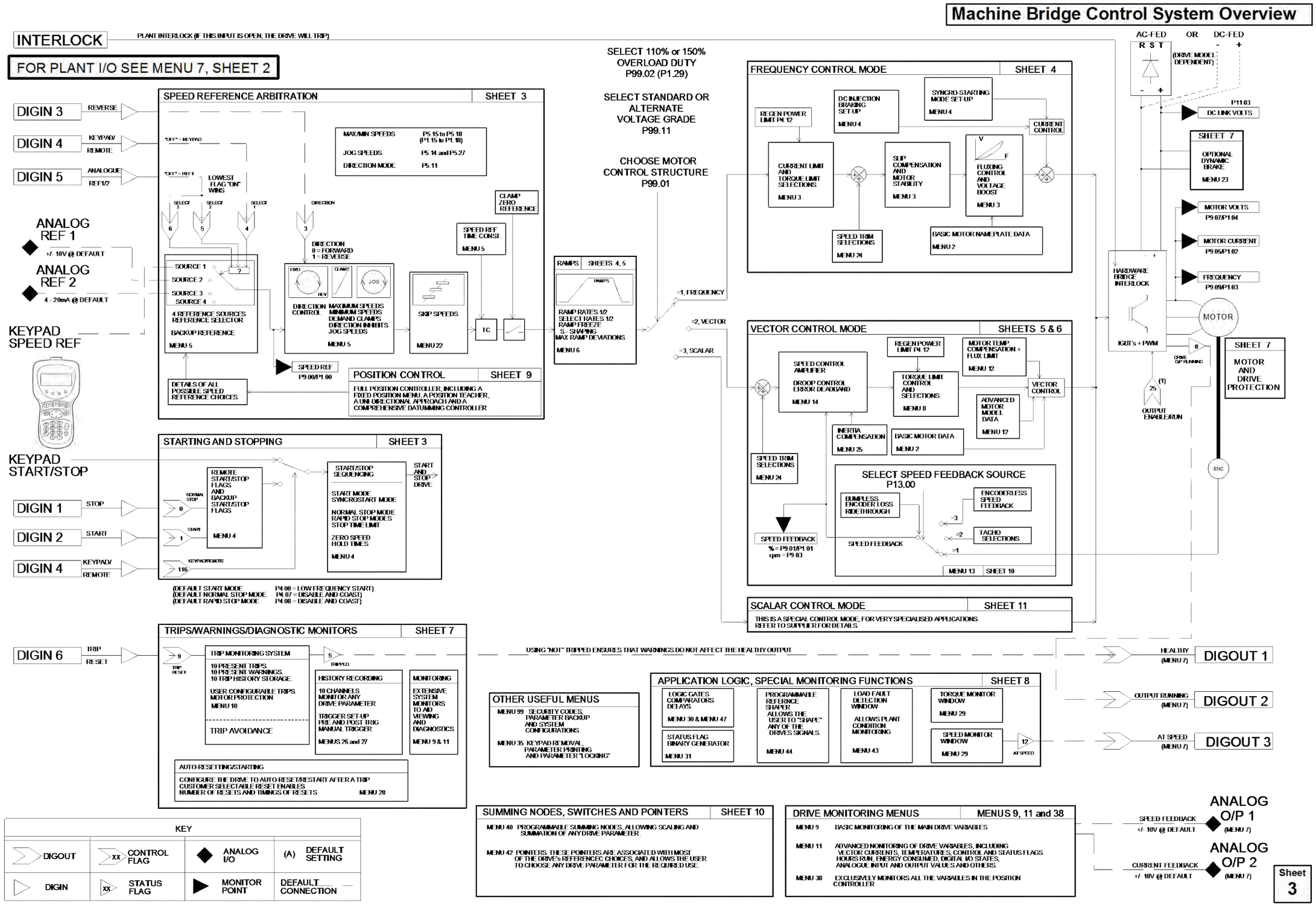
Output Bridge Connections For Proportional DB Control



Output Bridge Connections For Threshold DB Control

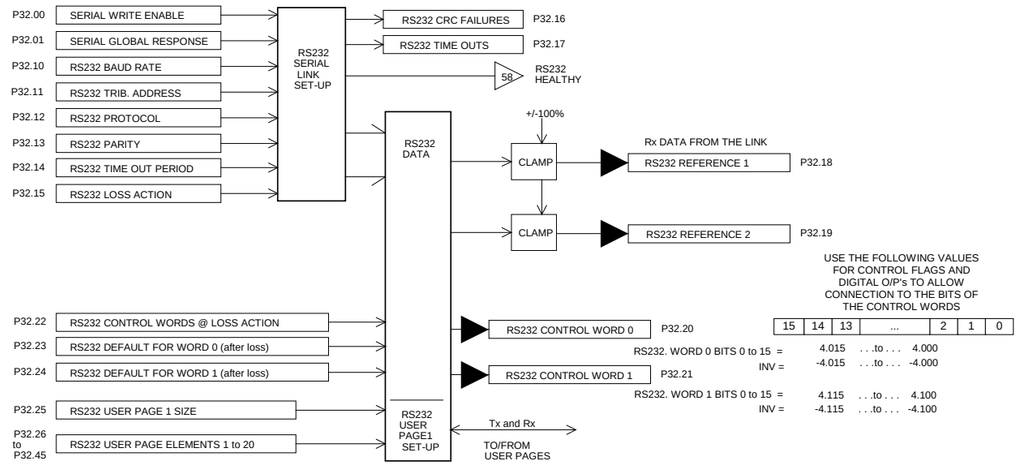
Sheet 2

Machine Bridge Control System Overview

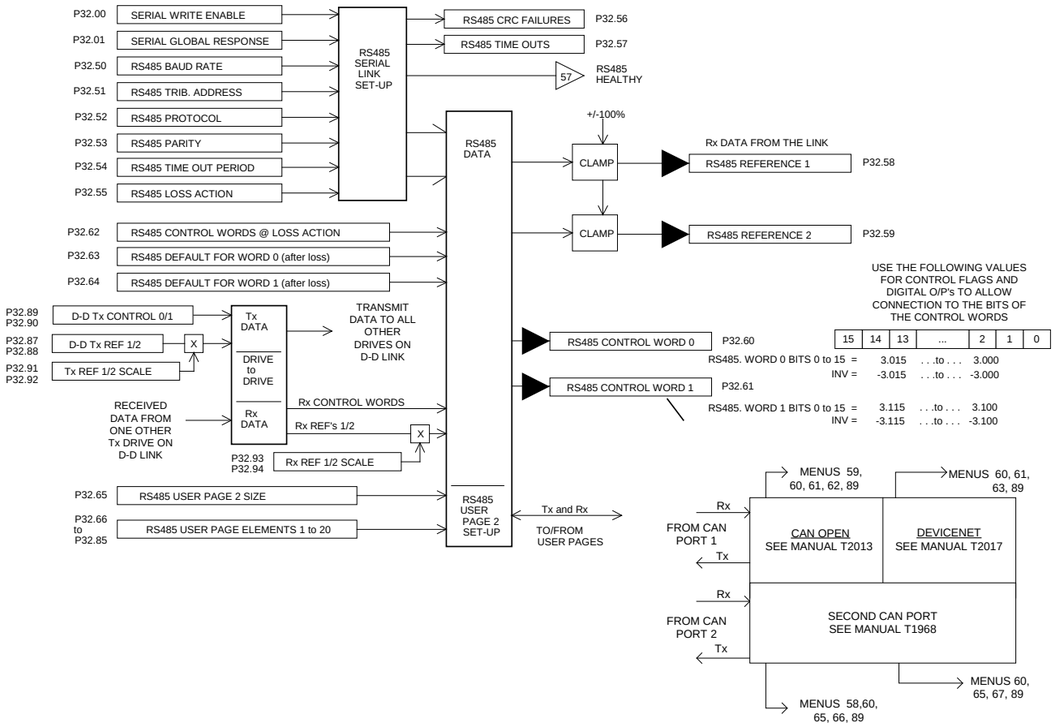


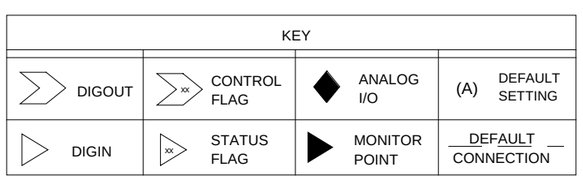
Plant I/O and Serial Links

RS232 SERIAL LINK

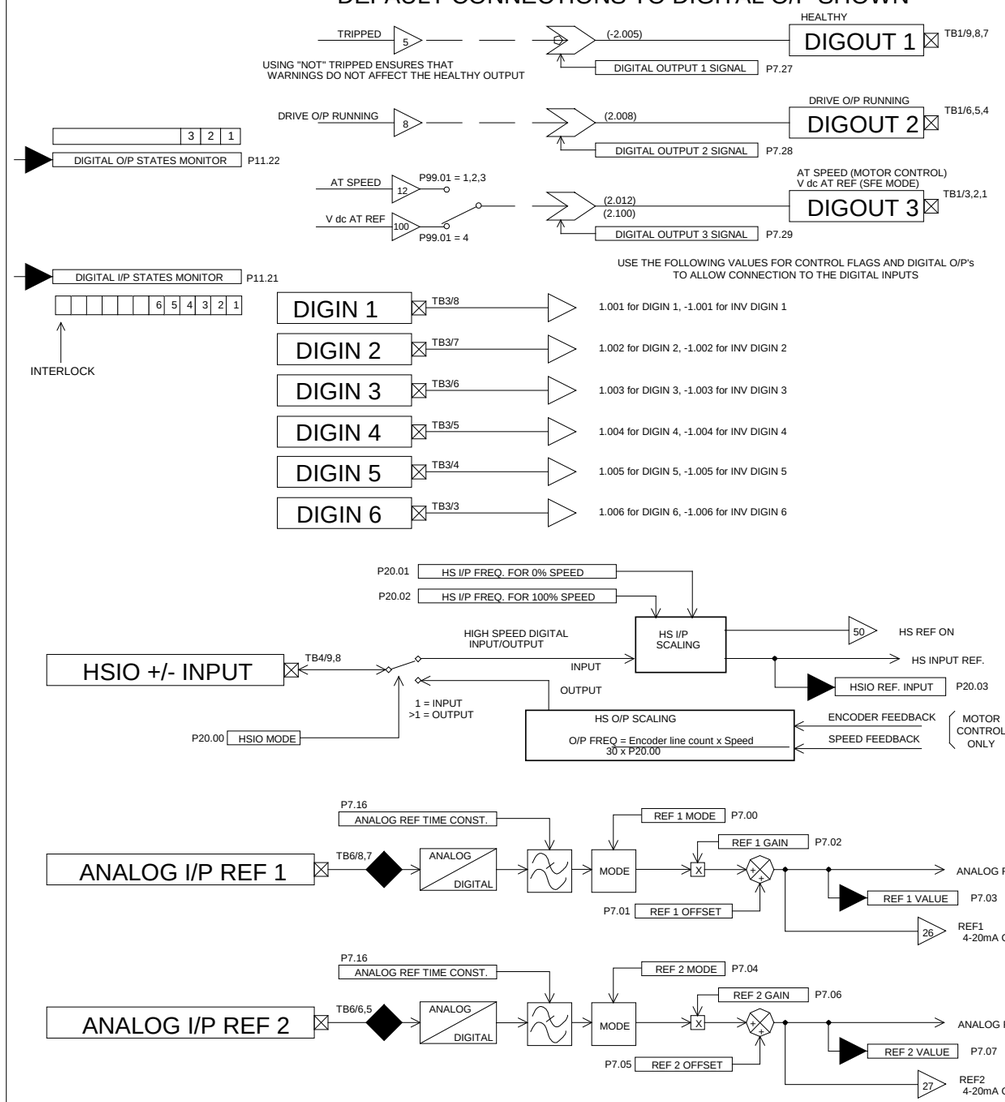


RS485 SERIAL LINK

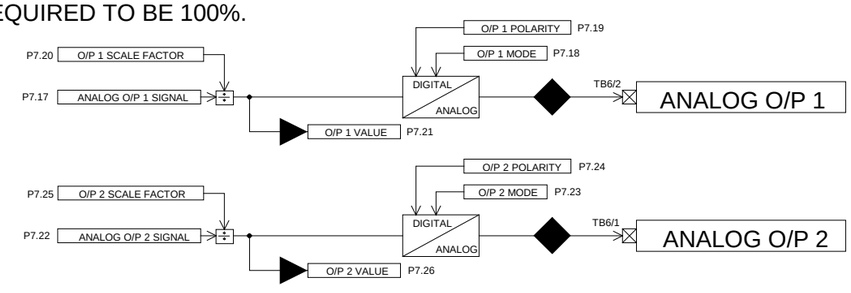




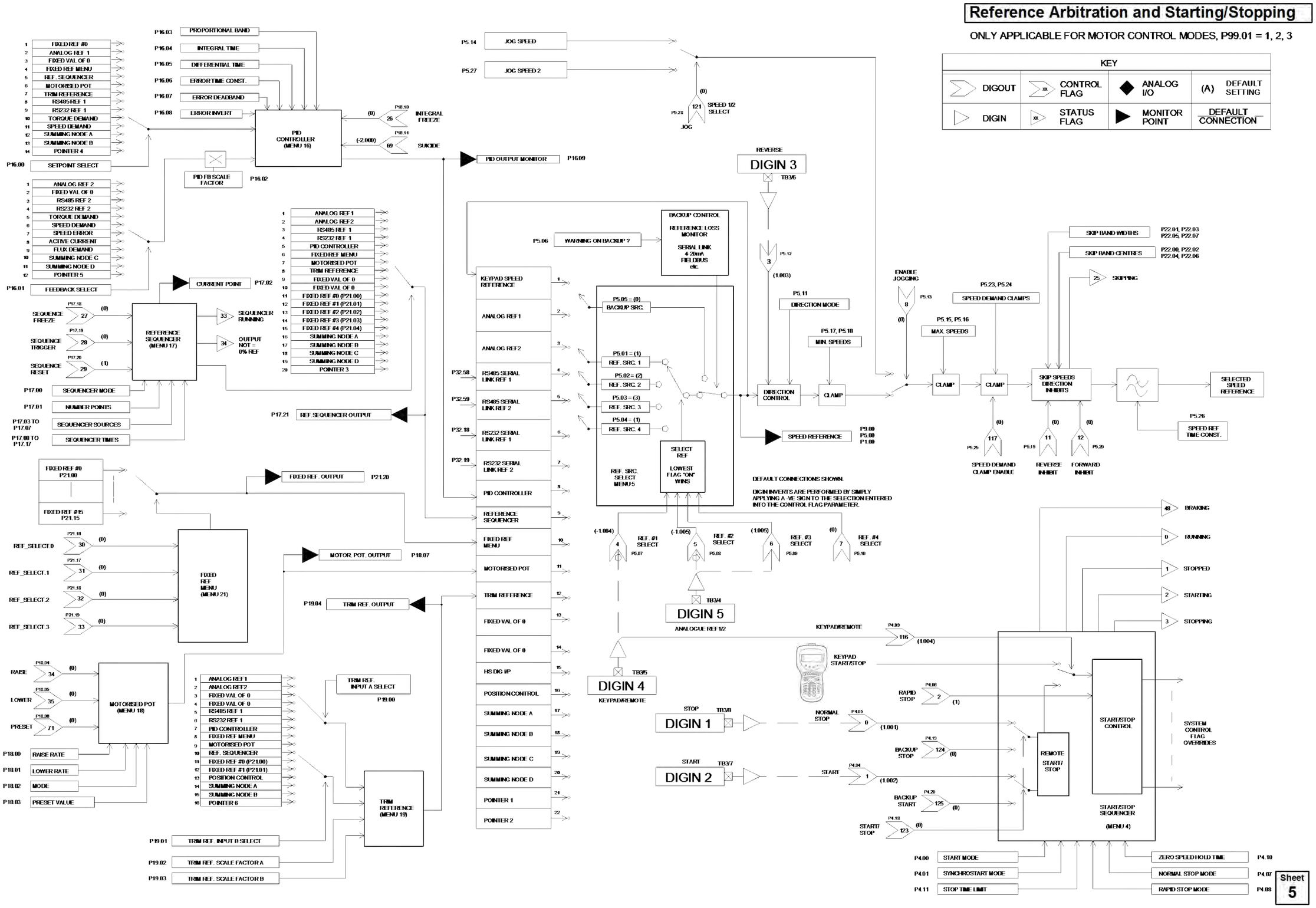
DEFAULT CONNECTIONS TO DIGITAL O/P SHOWN

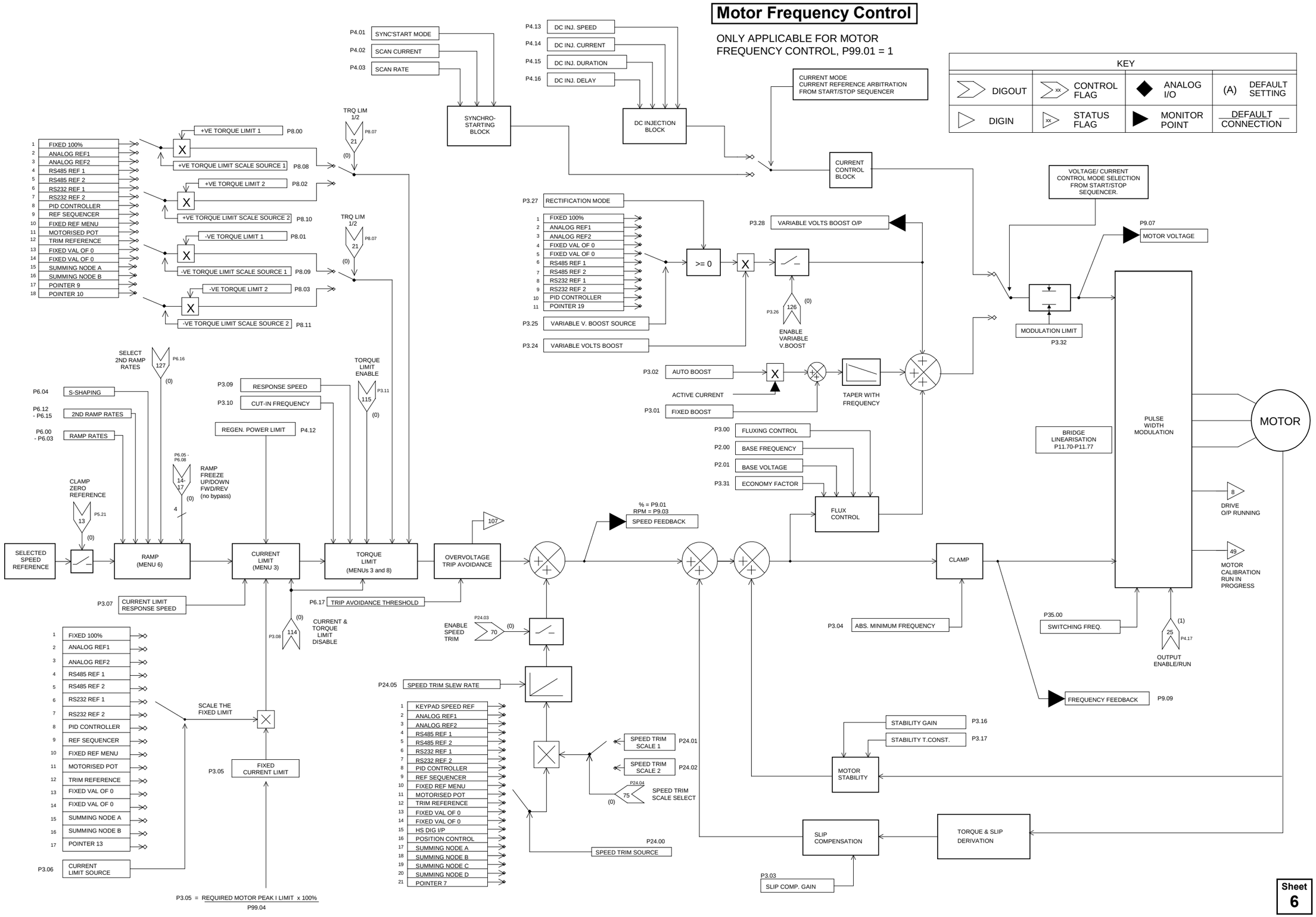


WHEN USING THE O/P SCALERS, SIMPLY EDIT IN THE VALUE THAT IS REQUIRED TO BE 100%.



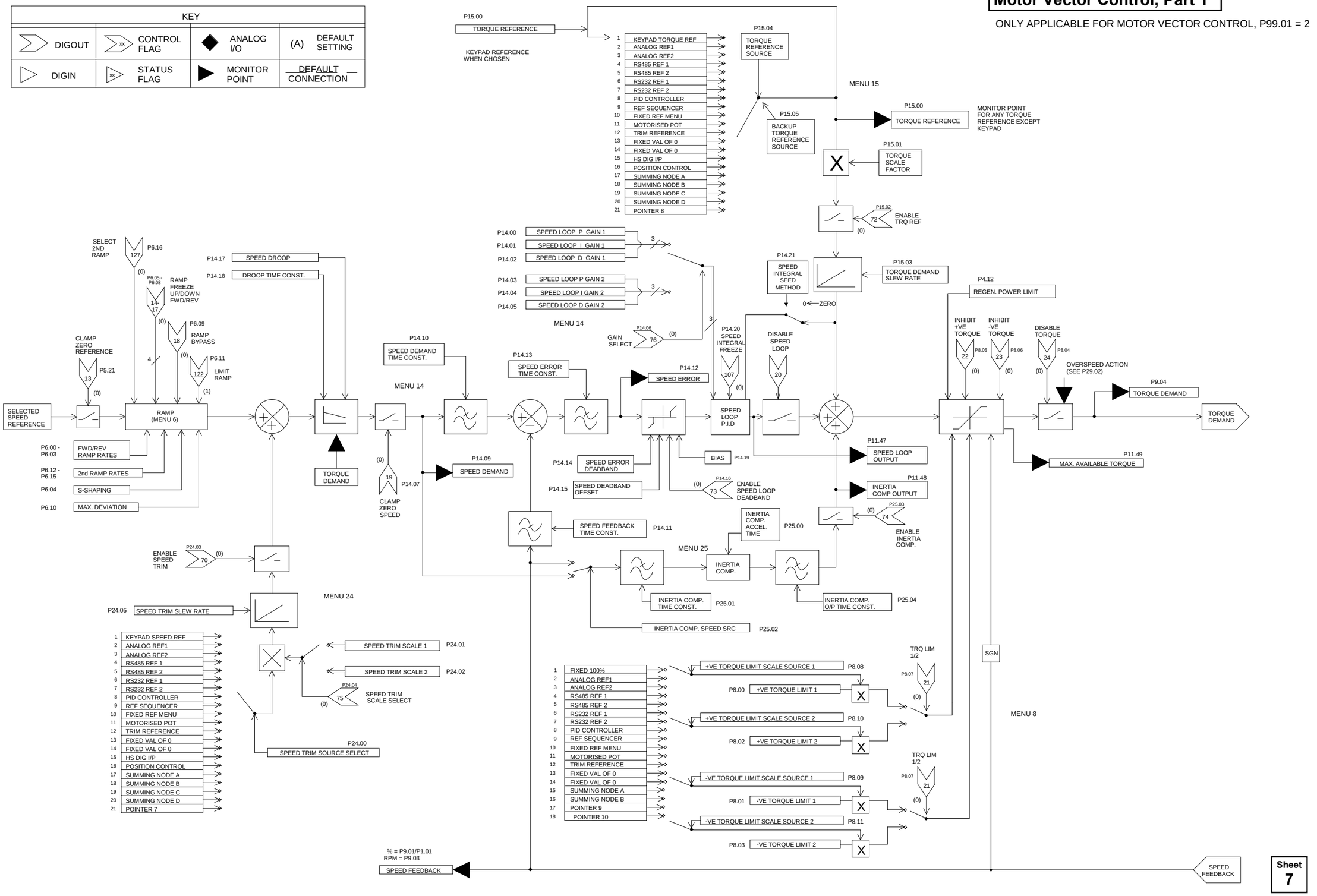
Sheet 4


Reference Arbitration and Starting/Stopping
ONLY APPLICABLE FOR MOTOR CONTROL MODES, P99.01 = 1, 2, 3
KEY
DIGOUT
CONTROL FLAG
ANALOG I/O
(A) DEFAULT SETTING
DIGIN
STATUS FLAG
MONITOR POINT
DEFAULT CONNECTION
PID CONTROLLER (MENU 16)
PROPORTIONAL BAND
INTEGRAL TIME
DIFFERENTIAL TIME
ERROR TIME CONST.
ERROR DEADBAND
ERROR INVERT
SETPOINT SELECT
PID FB SCALE FACTOR
PID OUTPUT MONITOR
INTEGRAL FREEZE
SUICIDE
JOG SPEED
JOG SPEED 2
SPEED 1/2 SELECT
JOG
REVERSE
DIGIN 3
REFERENCE SEQUENCER (MENU 17)
SEQUENCE FREEZE
SEQUENCE TRIGGER
SEQUENCE RESET
SEQUENCER RUNNING
OUTPUT NOT = 0% REF
SEQUENCER MODE
NUMBER POINTS
SEQUENCER SOURCES
SEQUENCER TIMES
CURRENT POINT
FEEDBACK SELECT
REF SEQUENCER OUTPUT
BACKUP CONTROL
REFERENCE LOSS MONITOR
SERIAL LINK 4-20mA FIELDBUS etc.
WARNING ON BACKUP ?
KEYPAD SPEED REFERENCE
ANALOG REF 1
ANALOG REF 2
RS485 SERIAL LINK REF 1
RS485 SERIAL LINK REF 2
RS232 SERIAL LINK REF 1
RS232 SERIAL LINK REF 2
PID CONTROLLER
REFERENCE SEQUENCER
FIXED REF MENU
MOTORISED POT
TRIM REFERENCE
FIXED VAL OF 0
HS DIG I/P
POSITION CONTROL
SUMMING NODE A
SUMMING NODE B
SUMMING NODE C
SUMMING NODE D
POINTER 1
POINTER 2
REF. SRC. SELECT MENU 5
SELECT REF LOWEST FLAG "ON" WINS
DIRECTION MODE
MIN. SPEEDS
DIRECTION CONTROL
CLAMP
SPEED REFERENCE
ENABLE JOGGING
MAX. SPEEDS
SPEED DEMAND CLAMPS
SKIP BAND WIDTHS
SKIP BAND CENTRES
SKIPPING
SKIP SPEEDS DIRECTION INHIBITS
SELECTED SPEED REFERENCE
SPEED REF TIME CONST.
SPEED DEMAND CLAMP ENABLE
REVERSE INHIBIT
FORWARD INHIBIT
DEFAULT CONNECTIONS SHOWN.
DIGIN INVERTS ARE PERFORMED BY SIMPLY APPLYING A -VE SIGN TO THE SELECTION ENTERED INTO THE CONTROL FLAG PARAMETER.
FIXED REF #0 P21.00
FIXED REF #15 P21.15
FIXED REF. OUTPUT
FIXED REF MENU (MENU 21)
MOTOR. POT. OUTPUT
TRIM REF. OUTPUT
MOTORISED POT (MENU 18)
RAISE RATE
LOWER RATE
MODE
PRESET VALUE
TRIM REFERENCE (MENU 19)
TRIM REF. INPUT A SELECT
TRIM REF. INPUT B SELECT
TRIM REF. SCALE FACTOR A
TRIM REF. SCALE FACTOR B
DIGIN 5
ANALOGUE REF 1/2
DIGIN 4
KEYPAD/REMOTE
DIGIN 1
STOP
DIGIN 2
START
KEYPAD START/STOP
RAPID STOP
NORMAL STOP
BACKUP STOP
BACKUP START
START/ STOP
REMOTE START/ STOP
START/STOP CONTROL
START/STOP SEQUENCER (MENU 4)
SYSTEM CONTROL FLAG OVERRIDES
BRAKING
RUNNING
STOPPED
STARTING
STOPPING
START MODE
SYNCHRO START MODE
STOP TIME LIMIT
ZERO SPEED HOLD TIME
NORMAL STOP MODE
RAPID STOP MODE
Sheet 5


Motor Frequency Control
ONLY APPLICABLE FOR MOTOR FREQUENCY CONTROL, P99.01 = 1
KEY
DIGOUT
CONTROL FLAG
ANALOG I/O
(A) DEFAULT SETTING
DIGIN
STATUS FLAG
MONITOR POINT
DEFAULT CONNECTION
P4.01 SYNC'START MODE
P4.02 SCAN CURRENT
P4.03 SCAN RATE
SYNCHRO-STARTING BLOCK
P4.13 DC INJ. SPEED
P4.14 DC INJ. CURRENT
P4.15 DC INJ. DURATION
P4.16 DC INJ. DELAY
DC INJECTION BLOCK
CURRENT MODE
CURRENT REFERENCE ARBITRATION
FROM START/STOP SEQUENCER
CURRENT CONTROL BLOCK
VOLTAGE/ CURRENT CONTROL MODE SELECTION FROM START/STOP SEQUENCER.
P9.07 MOTOR VOLTAGE
MODULATION LIMIT P3.32
P3.27 RECTIFICATION MODE
1 FIXED 100%
2 ANALOG REF1
3 ANALOG REF2
4 FIXED VAL OF 0
5 FIXED VAL OF 0
6 RS485 REF 1
7 RS485 REF 2
8 RS232 REF 1
9 RS232 REF 2
10 PID CONTROLLER
11 POINTER 19
>= 0
P3.28 VARIABLE VOLTS BOOST O/P
P3.26 126 (0)
ENABLE VARIABLE V.BOOST
P3.25 VARIABLE V. BOOST SOURCE
P3.24 VARIABLE VOLTS BOOST
P3.02 AUTO BOOST
ACTIVE CURRENT
P3.01 FIXED BOOST
TAPER WITH FREQUENCY
P3.00 FLUXING CONTROL
P2.00 BASE FREQUENCY
P2.01 BASE VOLTAGE
P3.31 ECONOMY FACTOR
FLUX CONTROL
BRIDGE LINEARISATION P11.70-P11.77
PULSE WIDTH MODULATION
MOTOR
8 DRIVE O/P RUNNING
49 MOTOR CALIBRATION RUN IN PROGRESS
1 FIXED 100%
2 ANALOG REF1
3 ANALOG REF2
4 RS485 REF 1
5 RS485 REF 2
6 RS232 REF 1
7 RS232 REF 2
8 PID CONTROLLER
9 REF SEQUENCER
10 FIXED REF MENU
11 MOTORISED POT
12 TRIM REFERENCE
13 FIXED VAL OF 0
14 FIXED VAL OF 0
15 SUMMING NODE A
16 SUMMING NODE B
17 POINTER 10
+VE TORQUE LIMIT 1 P8.00
+VE TORQUE LIMIT SCALE SOURCE 1 P8.08
+VE TORQUE LIMIT 2 P8.02
+VE TORQUE LIMIT SCALE SOURCE 2 P8.10
-VE TORQUE LIMIT 1 P8.01
-VE TORQUE LIMIT SCALE SOURCE 1 P8.09
-VE TORQUE LIMIT 2 P8.03
-VE TORQUE LIMIT SCALE SOURCE 2 P8.11
TRQ LIM 1/2 P8.07 21 (0)
TRQ LIM 1/2 P8.07 21 (0)
SELECT 2ND RAMP RATES P6.16 127 (0)
P6.04 S-SHAPING
P6.12 - P6.15 2ND RAMP RATES
P6.00 - P6.03 RAMP RATES
P3.09 RESPONSE SPEED
P3.10 CUT-IN FREQUENCY
REGEN. POWER LIMIT P4.12
TORQUE LIMIT ENABLE P3.11 115 (0)
P6.05 - P6.08 RAMP FREEZE UP/DOWN FWD/REV (no bypass) 14-17 (0) 4
CLAMP ZERO REFERENCE P5.21 13 (0)
SELECTED SPEED REFERENCE
RAMP (MENU 6)
CURRENT LIMIT (MENU 3)
TORQUE LIMIT (MENUs 3 and 8)
OVERVOLTAGE TRIP AVOIDANCE
107
% = P9.01
RPM = P9.03
SPEED FEEDBACK
CLAMP
P3.07 CURRENT LIMIT RESPONSE SPEED
P6.17 TRIP AVOIDANCE THRESHOLD
P3.08 114 (0) CURRENT & TORQUE LIMIT DISABLE
ENABLE SPEED TRIM P24.03 70 (0)
P3.04 ABS. MINIMUM FREQUENCY
P35.00 SWITCHING FREQ.
25 P4.17 (1) OUTPUT ENABLE/RUN
FREQUENCY FEEDBACK P9.09
P24.05 SPEED TRIM SLEW RATE
1 KEYPAD SPEED REF
2 ANALOG REF1
3 ANALOG REF2
4 RS485 REF 1
5 RS485 REF 2
6 RS232 REF 1
7 RS232 REF 2
8 PID CONTROLLER
9 REF SEQUENCER
10 FIXED REF MENU
11 MOTORISED POT
12 TRIM REFERENCE
13 FIXED VAL OF 0
14 FIXED VAL OF 0
15 HS DIG I/P
16 POSITION CONTROL
17 SUMMING NODE A
18 SUMMING NODE B
19 SUMMING NODE C
20 SUMMING NODE D
21 POINTER 7
SPEED TRIM SCALE 1 P24.01
SPEED TRIM SCALE 2 P24.02
P24.04 75 (0) SPEED TRIM SCALE SELECT
P24.00 SPEED TRIM SOURCE
STABILITY GAIN P3.16
STABILITY T.CONST. P3.17
MOTOR STABILITY
SLIP COMPENSATION
TORQUE & SLIP DERIVATION
P3.03 SLIP COMP. GAIN
SCALE THE FIXED LIMIT
P3.05 FIXED CURRENT LIMIT
1 FIXED 100%
2 ANALOG REF1
3 ANALOG REF2
4 RS485 REF 1
5 RS485 REF 2
6 RS232 REF 1
7 RS232 REF 2
8 PID CONTROLLER
9 REF SEQUENCER
10 FIXED REF MENU
11 MOTORISED POT
12 TRIM REFERENCE
13 FIXED VAL OF 0
14 FIXED VAL OF 0
15 SUMMING NODE A
16 SUMMING NODE B
17 POINTER 13
P3.06 CURRENT LIMIT SOURCE
P3.05 = REQUIRED MOTOR PEAK I LIMIT x 100% / P99.04
Sheet 6

Motor Vector Control, Part 1

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



Motor Vector Control, part 2

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

KEY

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

P12.04 MOTOR TEMP. COMPENSATION
P12.08 TEMP. COMP. SOURCE
1 FIXED 100%
2 ANALOG REF1
3 ANALOG REF2
4 FIXED VAL OF 0
5 FIXED VAL OF 0
6 RS485 REF 1
7 RS485 REF 2
8 RS232 REF 1
9 RS232 REF 2
10 PID CONTROLLER
11 SUMMING NODE C
12 SUMMING NODE D
13 POINTER 11

ENABLE MANUAL TEMPERATURE COMPENSATION
P12.05 77 (1)

EFFECTIVE ROTOR RESISTANCE =
P12.15-P12.15 x (100%-P12.04 / 100%) x (TEMP. COMP. SCALE / 100%)

MENU 12

P12.07 TEMPERATURE COMPENSATION GAIN
AUTOMATIC Rr IDENTIFICATION
Rr > 0.5xP12.15
Rr < 1.5xP12.15
P12.09 ESTIMATED TEMPERATURE COMPENSATION

AUTO MANUAL
AUTO TEMP. COMP.
P12.06 0 = DISABLED (MANUAL)
1 = ENABLED (AUTO)

NOTE: CLAMPED TO RANGE 20%-100%

FLUX LIMIT SRC. P12.24
1 P12.23-FLUX LIMIT
2 ANALOG REF1
3 ANALOG REF2
4 RS485 REF 1
5 RS485 REF 2
6 RS232 REF 1
7 RS232 REF 2
8 PID CONTROLLER
9 REF SEQUENCER
10 FIXED REF MENU
11 MOTORISED POT
12 TRIM REFERENCE
13 FIXED VAL OF 0
14 FIXED VAL OF 0
15 SUMMING NODE A
16 SUMMING NODE B
17 POINTER 12

MENU 12

BASIC MOTOR NAMEPLATE DATA
MENU 2
MOTOR BASE FREQ. P2.00
MOTOR BASE VOLTS P2.01
MOTOR FULL LOAD I P2.02
MOTOR NOM. POWER P2.03
MOTOR NOM. SPEED P2.04
MOTOR POWER FACTOR P2.05

FLUX LIMIT ENABLE
P12.25 68 (0)

MAX. POSSIBLE MOTOR FLUX CALCULATION
MOTOR PEAK I @ NOM. SPEED P12.01
MOTOR PEAK I @ 0% SPEED P12.29
MOTOR PEAK I @ 100% SPEED P12.30
OUTPUT FREQUENCY
DC LINK VOLTAGE

P4.02 SYNCR-START FLUX
P4.00 START MODE
P4.01 SYNCRO-START MODE
P4.03 SYNCRO-START RATE
SYNCR-STARTING BLOCK
SYNCRO-STARTING

MOTOR MODEL
P12.00 - MOTOR MAGNETISING CURRENT
P12.01 - MOTOR PEAK CURRENT @ NOMINAL SPEED
P12.02 - NOMINAL MAINS SUPPLY VOLTS
IF AEM THEN = Vdc/1.35
ELSE = nominal mains voltage
P12.11 - STATOR RESISTANCE
P12.12 - STATOR LEAKAGE INDUCTANCE
P12.13 - MAGNETISING RESISTANCE
P12.14 - MAGNETISING INDUCTANCE
P12.15 - ROTOR RESISTANCE
P12.16 - ROTOR LEAKAGE INDUCTANCE
P12.17 - MOTOR MAGNETISING CURRENT @ 50% BASE VOLTS
P12.18 - MOTOR MAGNETISING CURRENT @ 60% BASE VOLTS
P12.19 - MOTOR MAGNETISING CURRENT @ 70% BASE VOLTS
P12.20 - MOTOR MAGNETISING CURRENT @ 80% BASE VOLTS
P12.21 - MOTOR MAGNETISING CURRENT @ 90% BASE VOLTS
P12.22 - LEAKAGE VOLTS

P11.70-P11.77 BRIDGE LINEARISATION

TORQUE DEMAND

VECTOR CONTROL

PULSE WIDTH MODULATION

M

8 DRIVE O/P RUNNING
49 MOTOR CALIBRATION RUN IN PROGRESS

P12.27 HIGH DYNAMIC CURRENT BANDWIDTH
P12.35 VECTOR FLUXING MODE
P12.36 OPTIMUM VOLT MOD LIMIT
P12.37 OPTIMUM VOLT MODE CURRENT CONTROL BANDWIDTH

Vdc FEEDFORWARD FILTER TIME CONSTANT P12.38
CURRENT CONTROLLER Kp FACTOR P12.39
CURRENT CONTROLLER Ki FACTOR P12.40
ORIENTATION CONTROLLER Kp P12.41
ORIENTATION CONTROLLER Ki P12.42

P35.00 SWITCHING FREQ.

25 (1) P4.17 OUTPUT ENABLE/RUN

ENCODER LOSS 59

(0) 119 P13.17 FORCE ENCODER LOSS
(0) 120 P13.18 RESET ENCODER LOSS

ACTION ON LOSS 13.02
MAX. SPEED CHANGE 13.08
MAX. REVERSALS 13.19
REVERSALS THRESH. 13.20

ENCODER LINE COUNT P13.04/P13.05
MAX. SPEED FWD P5.15
MAX. SPEED REV P5.16

SELECT BACKUP FEEDBACK
P13.03 118 (0)

MENU 13

ENCODER MONITOR
ENC. ANGLE 13.10
ENC. REVERSALS 13.07

ENCODER SPEED FEEDBACK & SCALING

ENC

P13.00 SPEED FB SOURCE
P13.01 SPEED FB BACKUP SRC
SPEED FEEDBACK SELECT

SPEED FEEDBACK

TACHO SPEED FEEDBACK & SCALING

ANALOG REF1 1
ANALOG REF2 2
FIXED VAL OF 0 3
FIXED VAL OF 0 4
RS485 REF 1 5
RS485 REF 2 6
RS232 REF 1 7
RS232 REF 2 8
HI SPEED INPUT 9
POINTER 18 10

TACHO FEEDBACK SRC. P13.14
TACHO FEEDBACK SCALE P13.15
TACHO FEEDBACK T.CONST. P13.16

SPEED FEEDBACK
% = P9.01,P1.01
RPM = P9.03
P11.51 (%) ENCODER SPEED
THIS PARAMETER IS ACTIVE IN FREQUENCY CONTROL MODE TO ALLOW SAFE ENCODER CHECKING

SGN
9 REVERSE SPEED (motor going in reverse)

NOTE: Speed feedback, speed reference etc are in % of TOP SPEED
TOP SPEED = Max of P5.15 P5.16

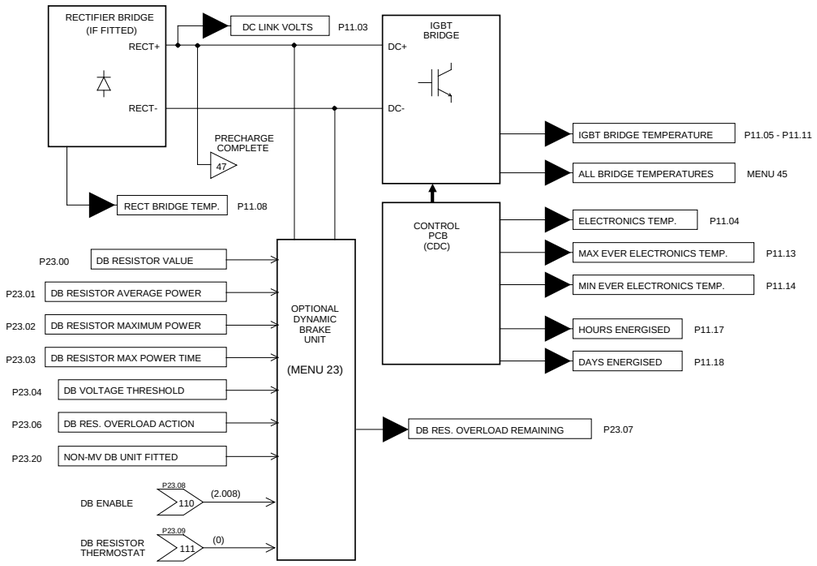
ENCODERLESS SPEED ESTIMATION & SCALING

MATHEMATICAL MOTOR MODEL

ENABLE Rs TRACKER P12.28

Sheet 8

Trips/Warnings and Diagnostic Monitoring



MORE MONITORING

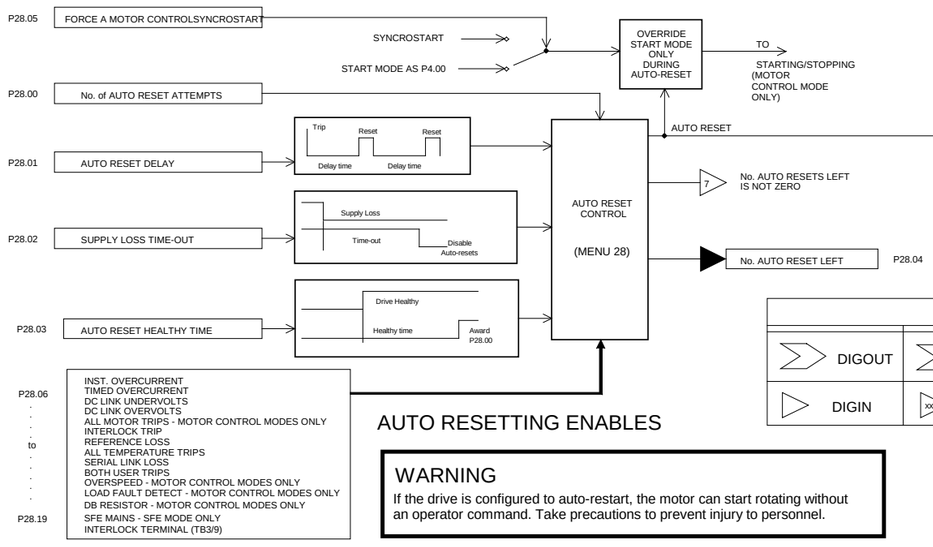
MENU 9 AND MENU 11 CONTAIN MANY OTHER MONITORING PARMETERS. INCLUDING....

STATUS FLAG AND CONTROL FLAG MONITORS

16 BIT "WORDS" FOR MONITORING

- CONTROL FLAGS 0 - 15 — P11.23
- ....to....
- CONTROL FLAGS 112 - 127 — P11.28
- CONTROL FLAGS 80 - 111 — P38.10, P38.11
- STATUS FLAGS 0 - 15 — P11.30
- ....to....
- STATUS FLAGS 96 - 111 — P11.35

AUTO RESETTING CONTROL

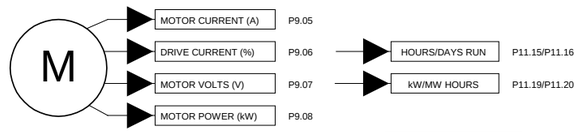


AUTO RESETTING ENABLES

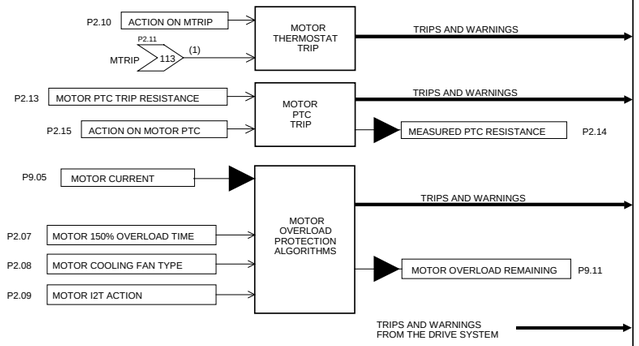
WARNING

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

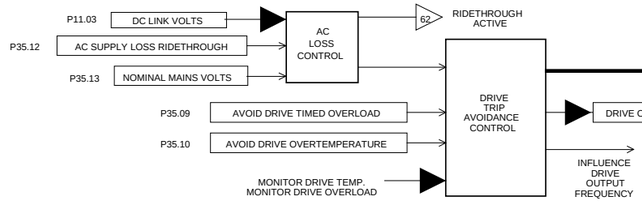
MOTOR MONITORING (MOTOR CONTROL MODES ONLY)



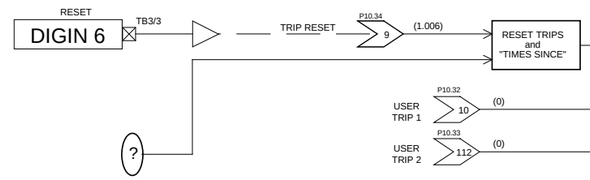
MOTOR PROTECTION/TRIP AVOIDANCE (MOTOR CONTROL MODES ONLY)



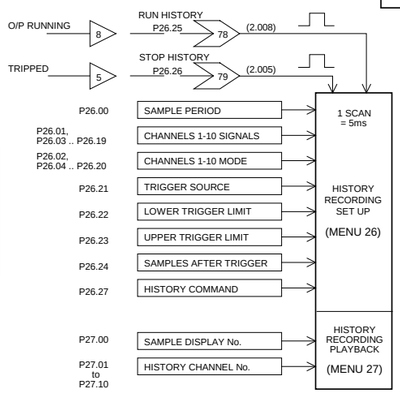
DRIVE TRIP AVOIDANCE (MOTOR CONTROL MODES ONLY)



TRIP RESETTING and USER TRIPS (ALL CONTROL MODES)



ON BOARD DIAGNOSTIC HISTORY CHART RECORDER



KEY

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

DRIVE TRIP MONITORING SYSTEM

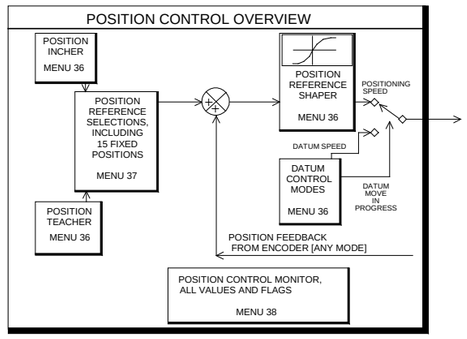
(MENU 10)

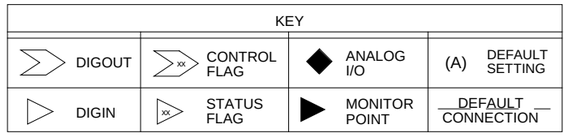
- 4 — HEALTHY (NO TRIPS OR WARNINGS)
- 5 — TRIPPED
- 6 — WARNING
- SECONDS SINCE TRIP — P10.30
- HOURS SINCE TRIP — P10.31

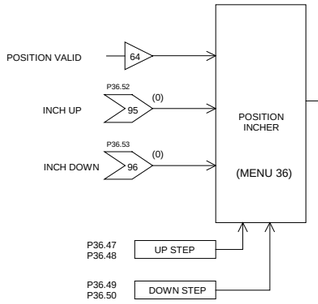
Sheet 9

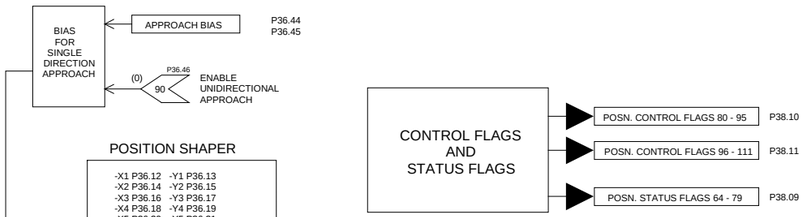
Motor Position Controller

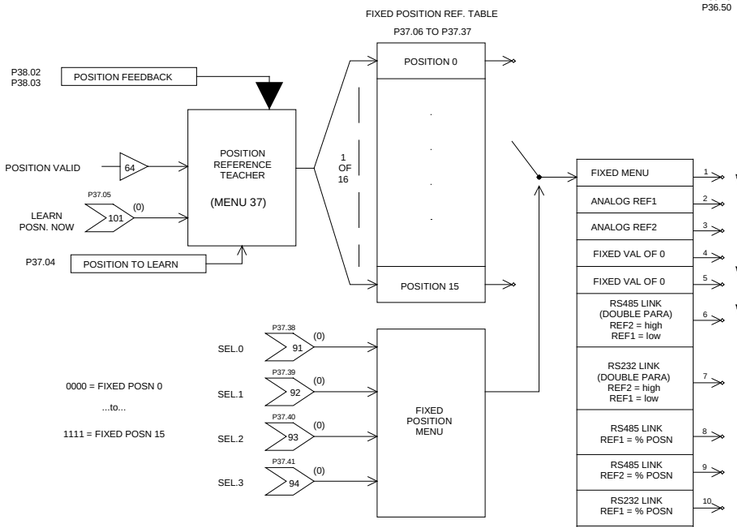
ONLY APPLICABLE FOR MOTOR CONTROL MODES, P99.01 = 1, 2, 3

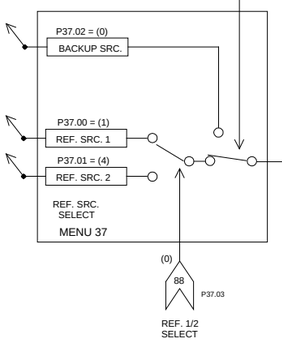


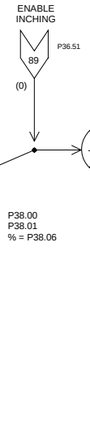


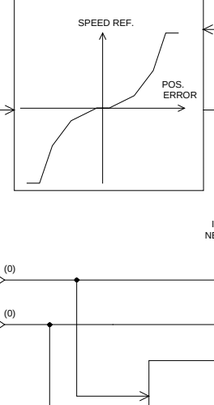


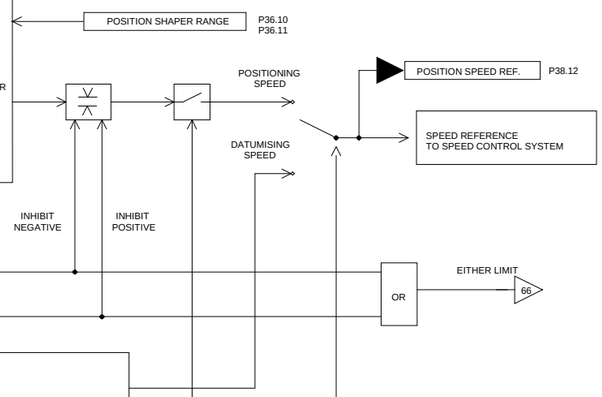


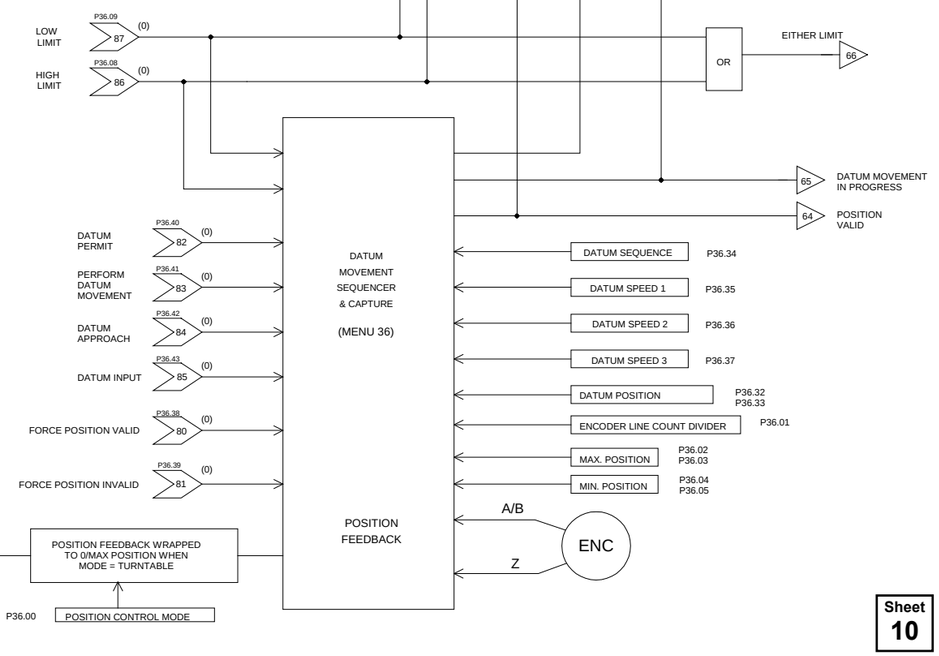


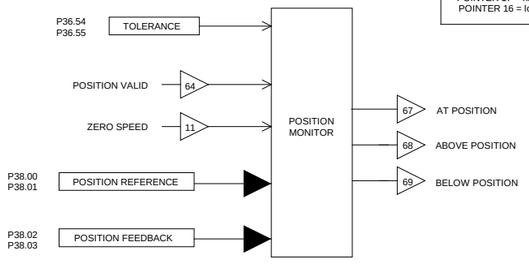


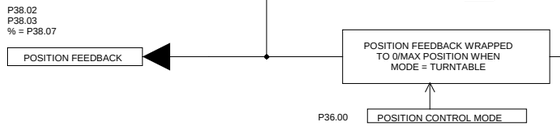










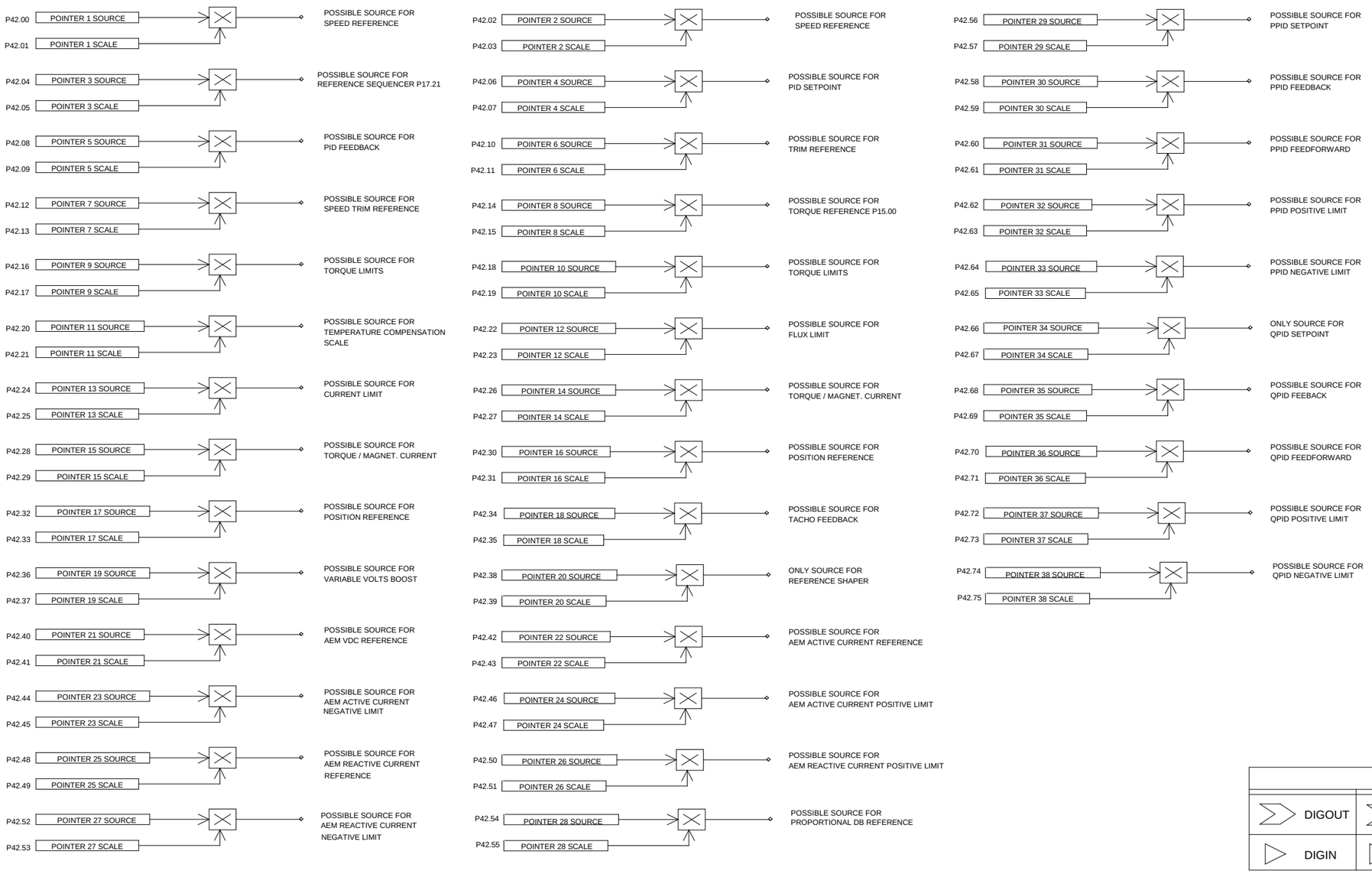


Sheet 10

Pointers

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

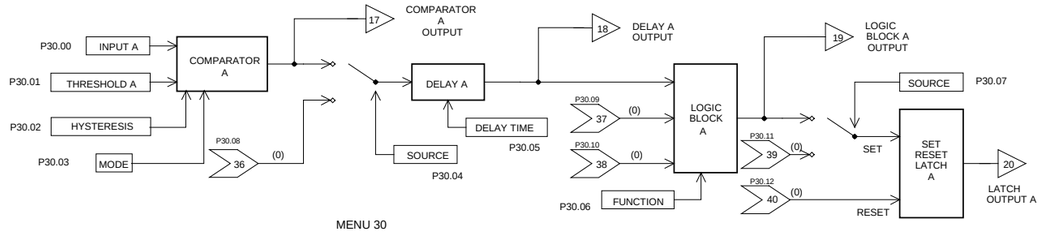
E.G. CHOOSE POINTER 1 FROM THE SPEED REFERENCE CHOICE SELECTION (SHEET 2) THEN CONFIGURE POINTER 1 BELOW.
THE POINTER SOURCES CAN BE ANY DRIVE PARAMETER.

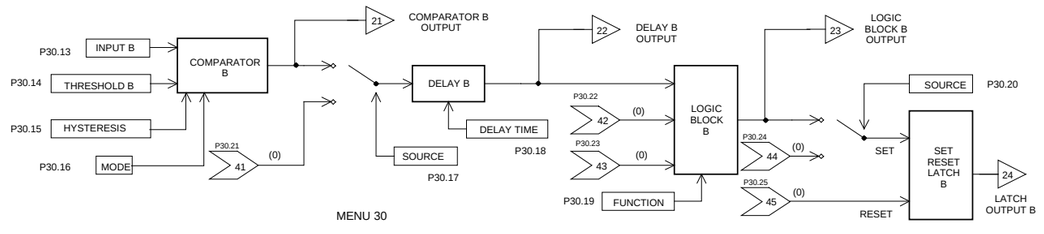


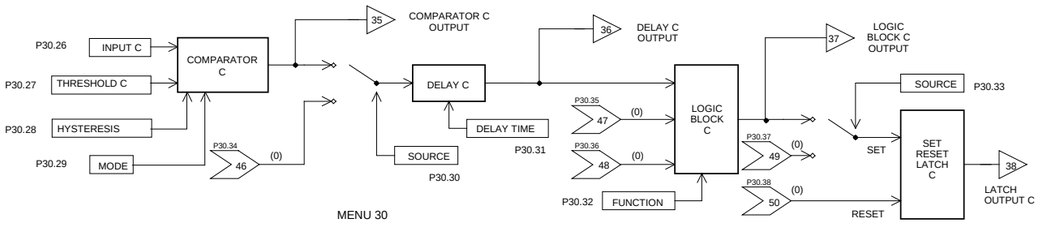
KEY			
DIGOUT	CONTROL FLAG (xx)	ANALOG I/O	(A) DEFAULT SETTING
DIGIN	STATUS FLAG (xx)	MONITOR POINT	DEFAULT CONNECTION

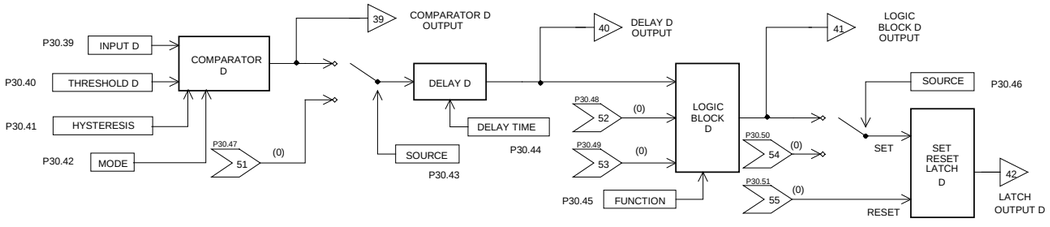
Sheet 11

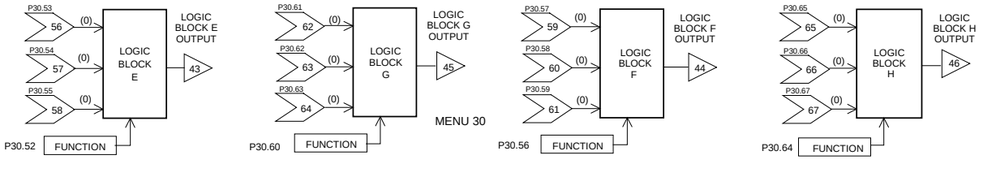
Application Logic - General Purpose Logic Blocks

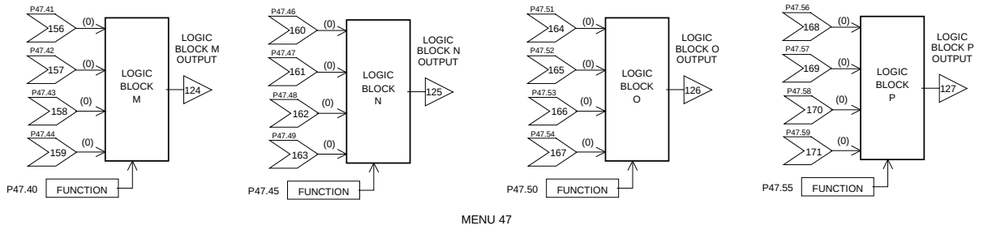


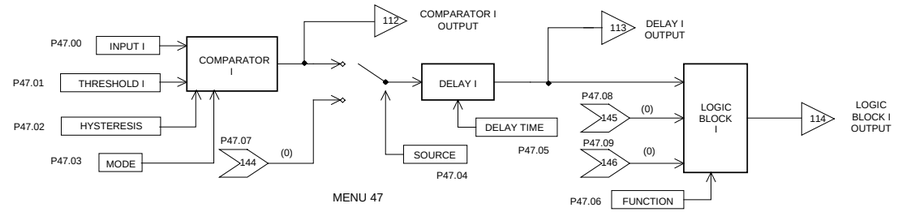


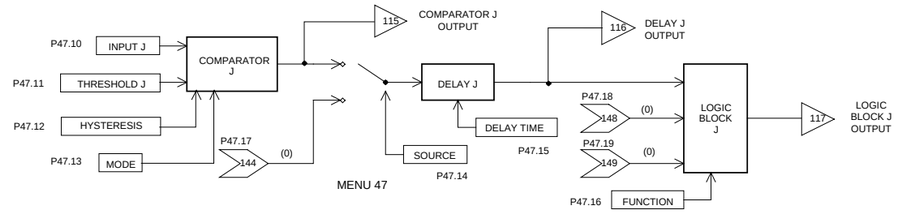


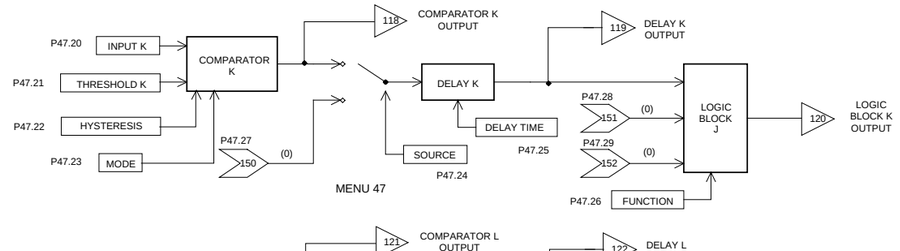


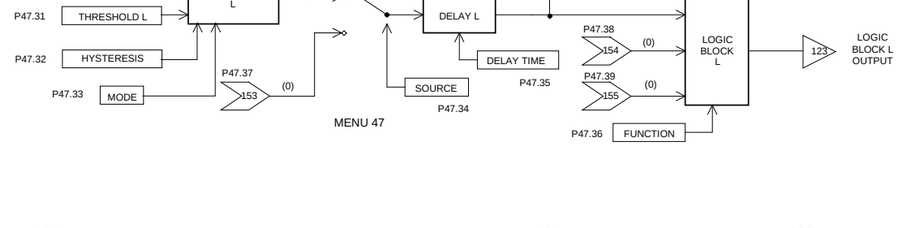


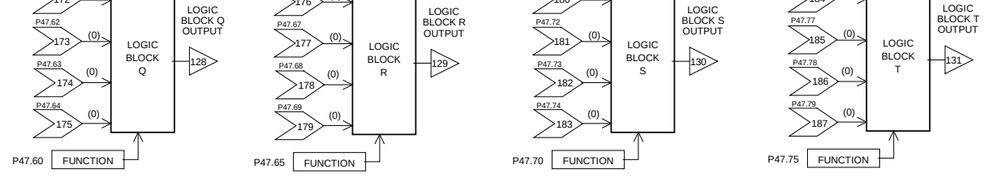












KEY			
DIGOUT	CONTROL FLAG (xx)	ANALOG I/O	(A) DEFAULT SETTING
DIGIN	STATUS FLAG (xx)	MONITOR POINT	DEFAULT CONNECTION

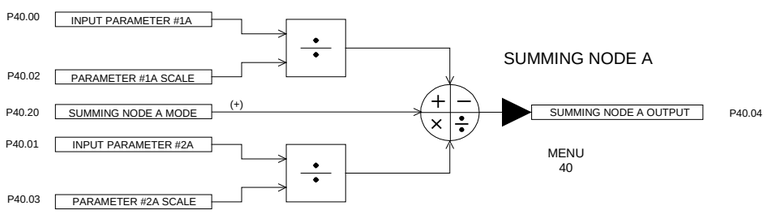
Sheet 13

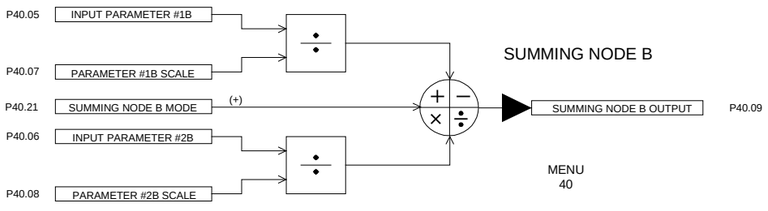
Summing Nodes, Analogue Switches and Square Roots

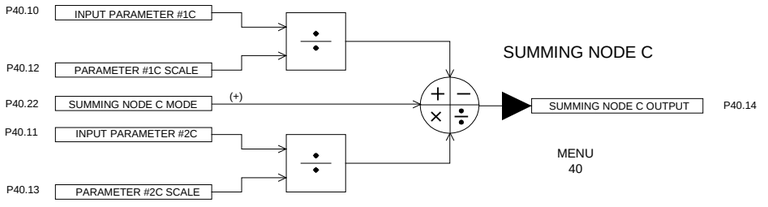
THE EQUATION BELOW SHOWS HOW SUMMING NODES A, B, C, D, E, F, G & H OPERATE.
THE EIGHT DIAGRAMS ARE A LOGICAL REPRESENTATION.

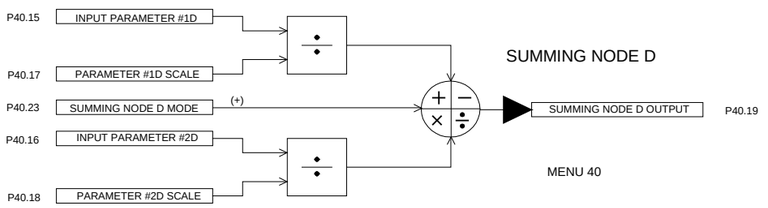
$$\text{SUMMING NODE OUTPUT} = \left(\left(\frac{\text{SUMMING NODE INPUT 1}}{\text{SUMMING NODE SCALE 1}} \right) ? \left(\frac{\text{SUMMING NODE INPUT 2}}{\text{SUMMING NODE SCALE 2}} \right) \right) \times 100.00\%$$

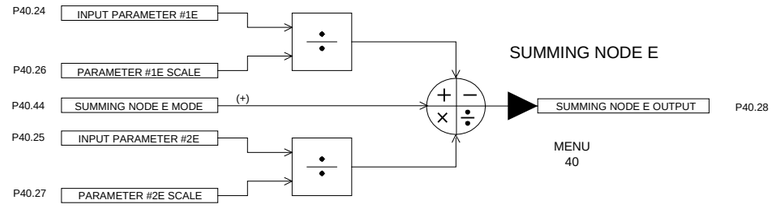
WHERE ? IS THE CHOSEN MODE (+, −, X or ÷)

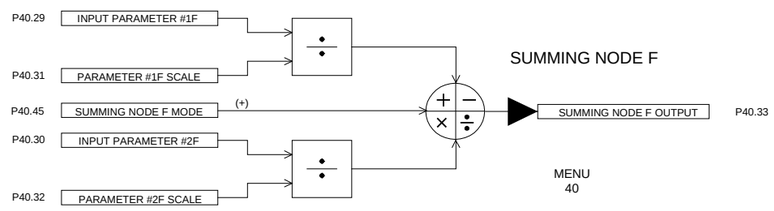


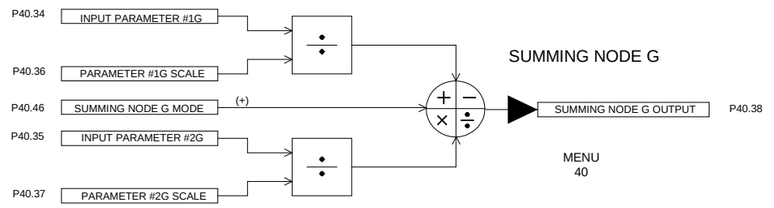


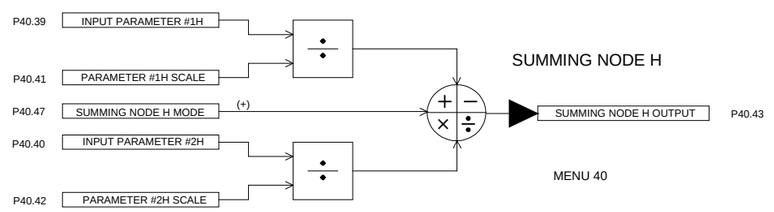


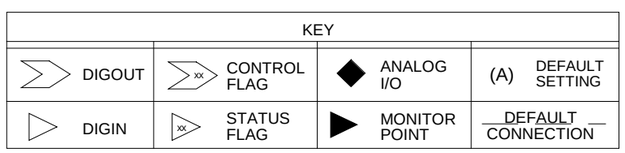




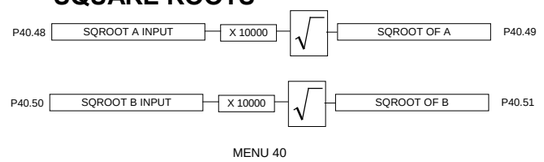




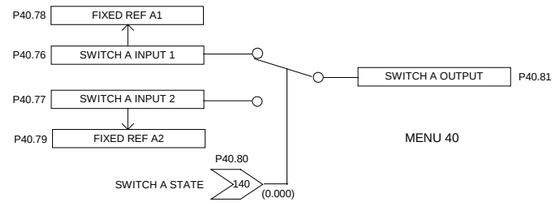


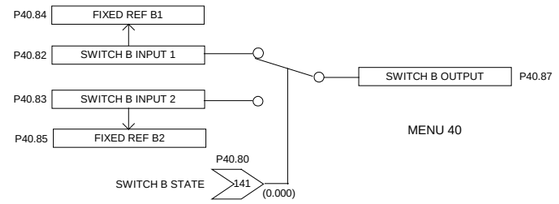


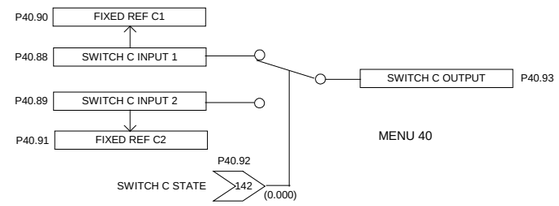
SQUARE ROOTS

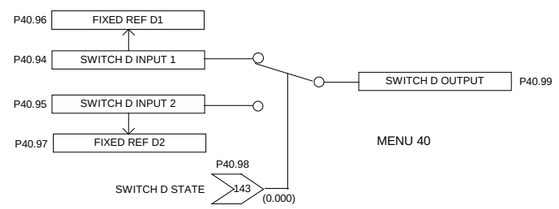


ANALOGUE SWITCHES





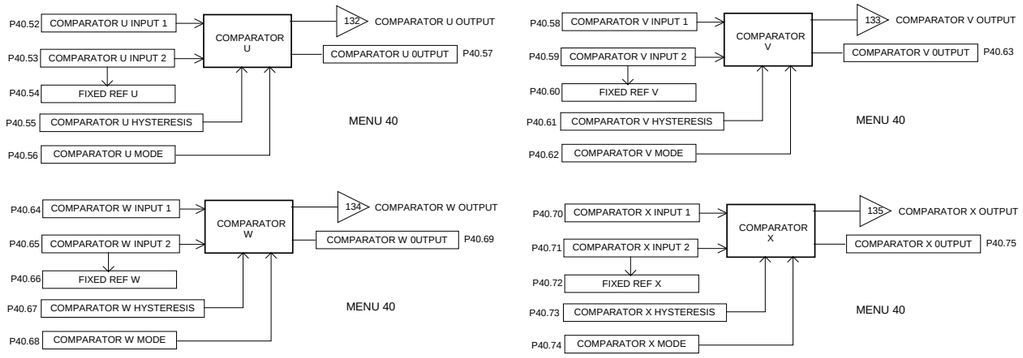




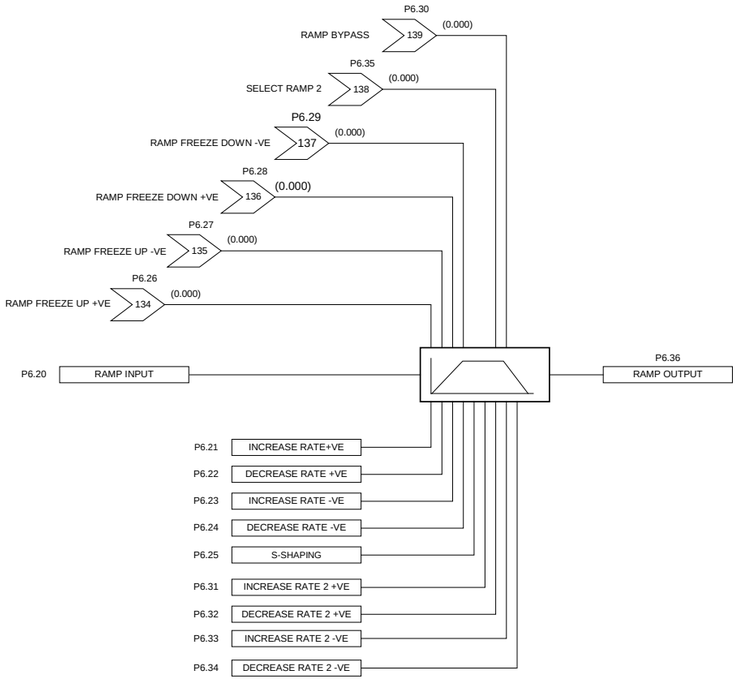
Sheet
14

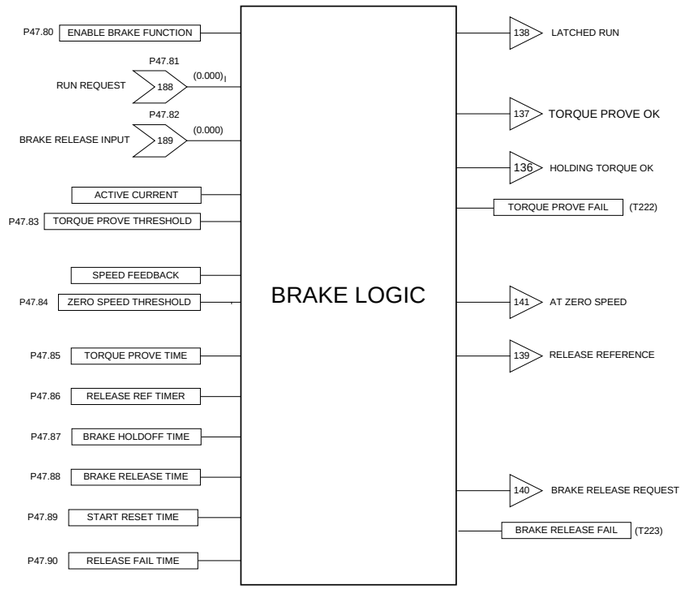
Comparators, Ramp Function & Brake Logic

COMPARATORS



RAMP FUNCTION





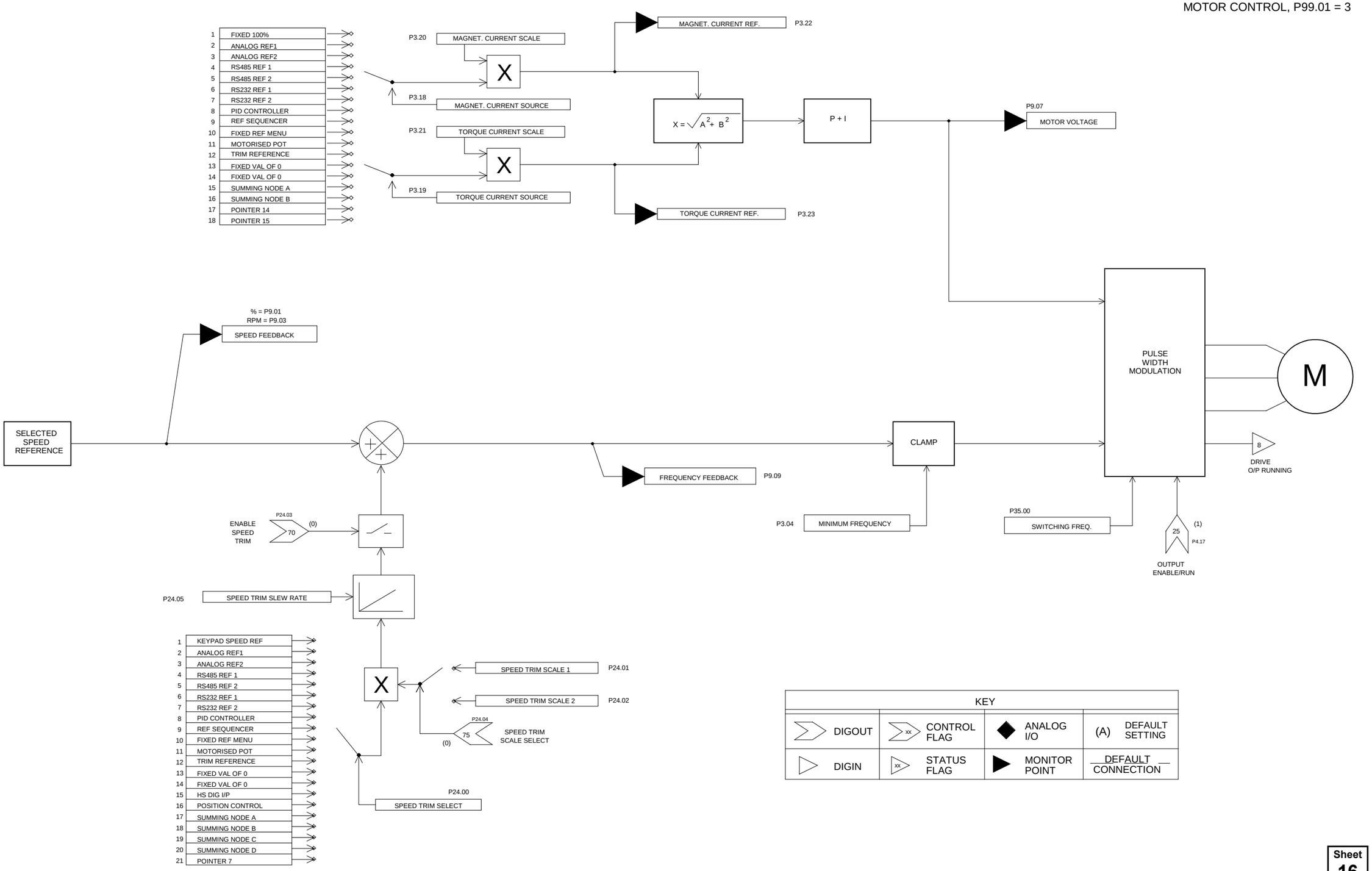
MENU 47

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

Sheet 15

Scalar Control

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



Sheet 16

12. CONTACT DETAILS FOR SALES, SERVICE & SUPPORT

www.avidcontrolsinc.com

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

Technical Support Center

USA
Avid Controls, Inc.
41261 Park 290 Dr
Waller, TX 77484 USA
Tel: +1(281)640-8600

For all parts inquiries:
Email: www.avidcontrolsinc.com