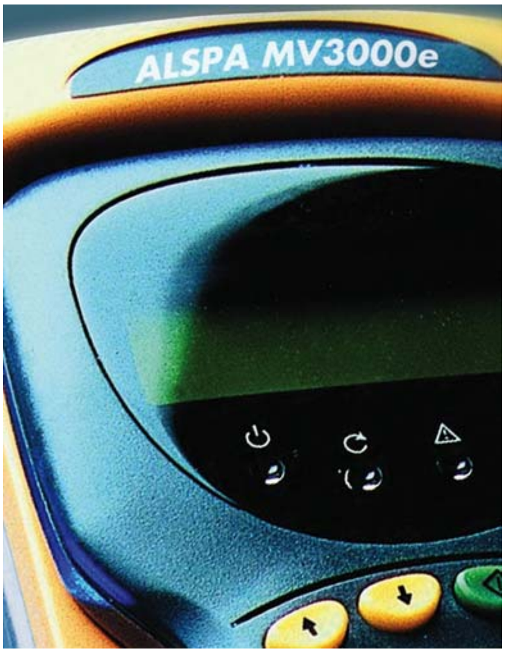


ALSPA MV3000e

Active Energy Management Drives (MicroCubicle™ Style Products Only)

Publication No. T2002EN Rev. 0006 (06/06)

Getting Started Manual

CONVERTEAM

THE POWER CONVERSION COMPANY

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 UL 508C and CSA C22.2 No 14 are marked on the product.

In the European Union:

- Products within the scope of the Low Voltage Directive, 73/23/EEC as amended are CE marked.
- The product complies with the essential protection requirements of the EMC directive 89/336/EEC as amended, 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, 98/37/EEC.

CHANGES FROM PREVIOUS EDITION	
Previous edition:	Rev. 0005 (01/03) ratings in Tables 2-1 and 2-2 updated Options in Section 9 updated to include EMC Filters and ferrites, 2nd CAN port and new PROFIBUS module
This edition:	Rev. 0006 (06/06) New Control Diagrams and Company name change. In Section 9 Ethernet Module added and FIP modules deleted.

Acknowledgements

Microsoft Windows is a registered trademark of the Microsoft Corporation.

See over for default input/output diagram

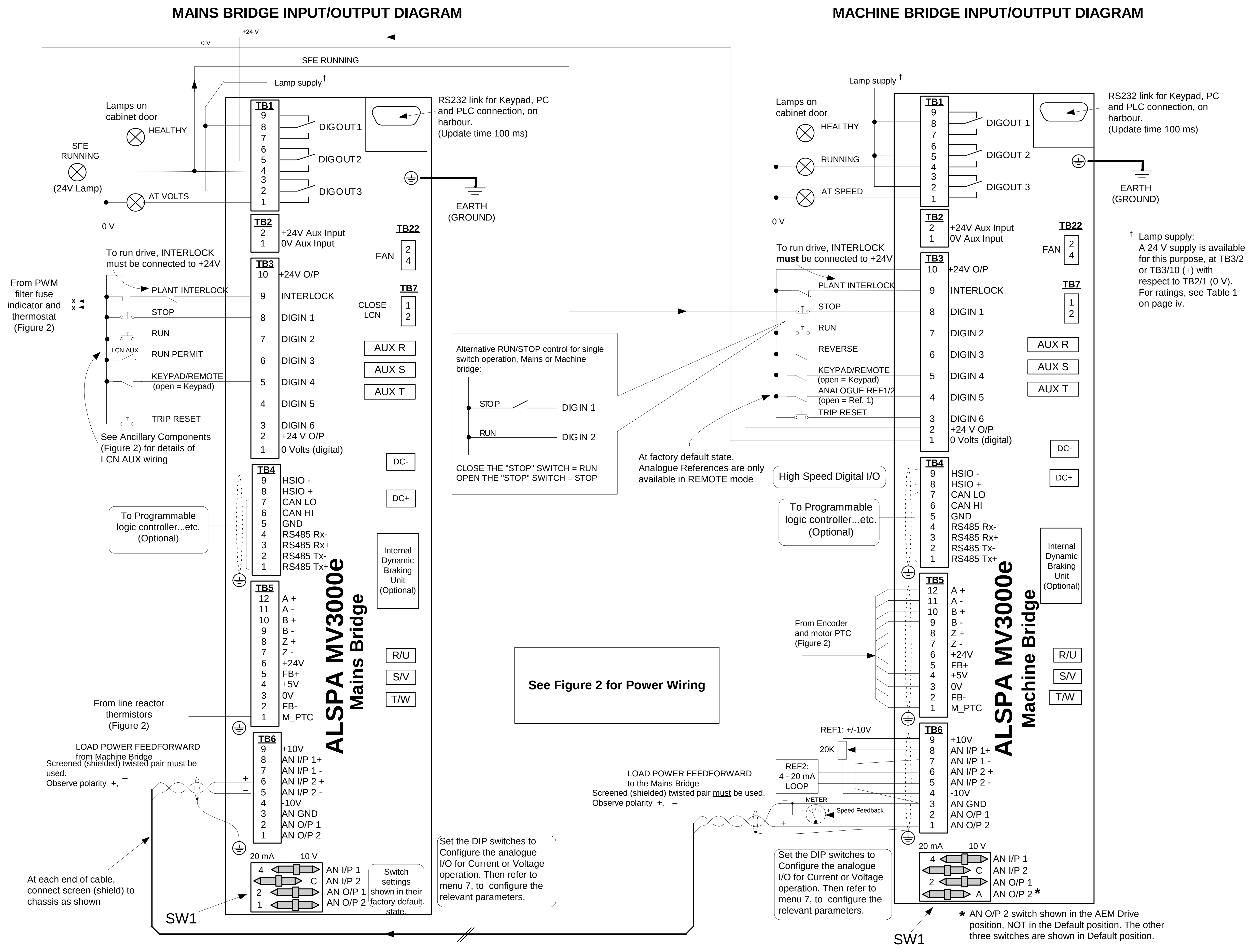


Figure 1 Bi-directional converter input/output diagram (default)

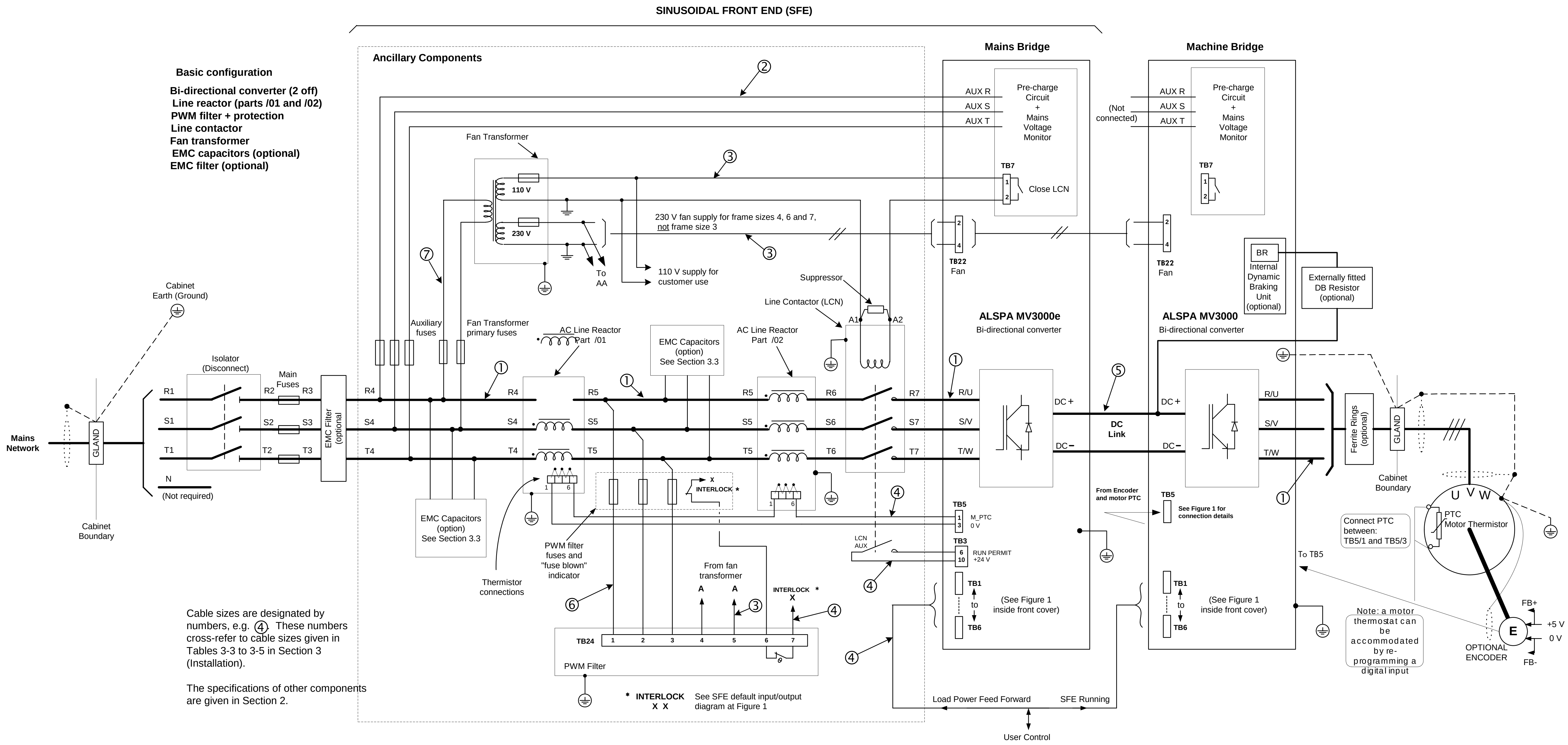
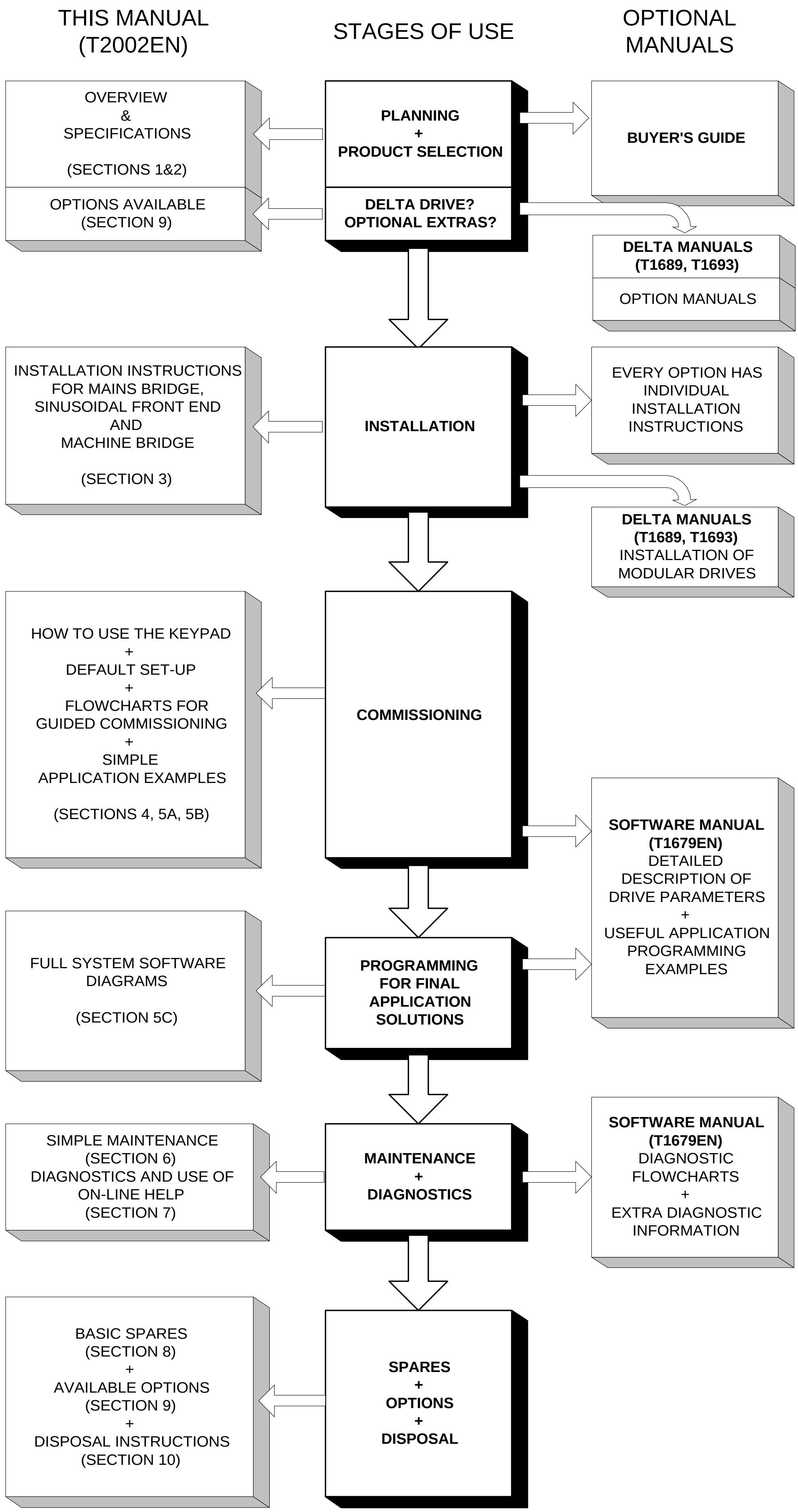


Figure 2 Interconnection diagram for an AEM drive

Table 1 I/O panel, connector specifications

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 1/2 RS485 Tx +/– 3/4 3/4 RS485 Rx +/–	Differential link for improved noise immunity (Menu 32).	0 - 2 km range. Update time 10 ms.
5 5/6 GND 1 CAN 0 V	Common ground for communications links.	Connected to earth (ground) internally.
6/7 4/2 CAN HI/LO 3 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 thermistor (machine bridge) Input from line reactor (mains bridge).	Resistive: Trip: 0 Ω to 10 kΩ (P2.13 motor PTC, P52.19 SFE choke PTC) Reset: (Value in parameter) –0.1 kΩ
2/5 FB –/FB+	Encoder power supply feedback for accurate setting.	
4/6 +5 V/+24 V	Power supply outputs for the encoder.	+5 V: Adjustable, 4.5 - 6.5 V, 350 mA maximum +24 V: Fixed, 350 mA maximum
3 0 V	Common return line for encoder power supply and the PTC.	Connected to earth (ground) internally.
7/8 Z–/Z+ 9 - 12 B–/B+, A–/A+	Marker signal from encoder. Encoder position signals.	EIA RS422A, Max edge freq 1.5 MHz, see Section 3.9
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, .. 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	Reference supplies for analogue inputs.	Maximum Load : 5 mA current limited
5/6 AN I/P 2 –/+ 7/8 AN I/P 1 –/+	Differential analogue input 2 Differential analogue input 1	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.
TB7 (pre-charge pcb)	**Relay Output**	**Specifications**
Pin Signal		
1/2 CLOSE LCN	Line contactor pilot relay output (volts free)	D.1.1 Maximum volts : 500 Vac Maximum current : 8 A


THIS MANUAL
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SPARES
+
OPTIONS
+
DISPOSAL

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OVERVIEW

CONTENTS

Section **Page**

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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 simple Active Energy Management (AEM) systems, based on the MV3000e series of bi-directional 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.

1.2 About ALSPA MV3000e MicroCubicle™ Bi-directional Converters

Active Energy Management systems are based on the MV3000e bi-directional converter, which is a MicroCubicle™ style product that can be configured by the user as a mains bridge or as a machine bridge:

The mains bridge is combined with ancillary components to form a Sinusoidal Front End (SFE). The SFE accurately controls the bi-directional flow of power between the AC mains supply and a DC bus (normally referred to as the "DC Link"). The current drawn from, or regenerated to, the mains supply is at unity power factor and is substantially free from harmonics.

The machine bridge controls a motor and the bi-directional power flow between the DC bus and the motor or generator.

When a SFE and a machine bridge are connected at their DC terminals, an AEM drive (Active Energy Management Drive) is created, also sometimes referred to as a "4-quadrant AC drive". This is illustrated in Figure 1-1.

For simplicity, in this manual most examples assume a configuration comprising a bi-directional converter configured as a mains bridge, connected via a DC link to an identical bi-directional converter configured as a machine bridge.

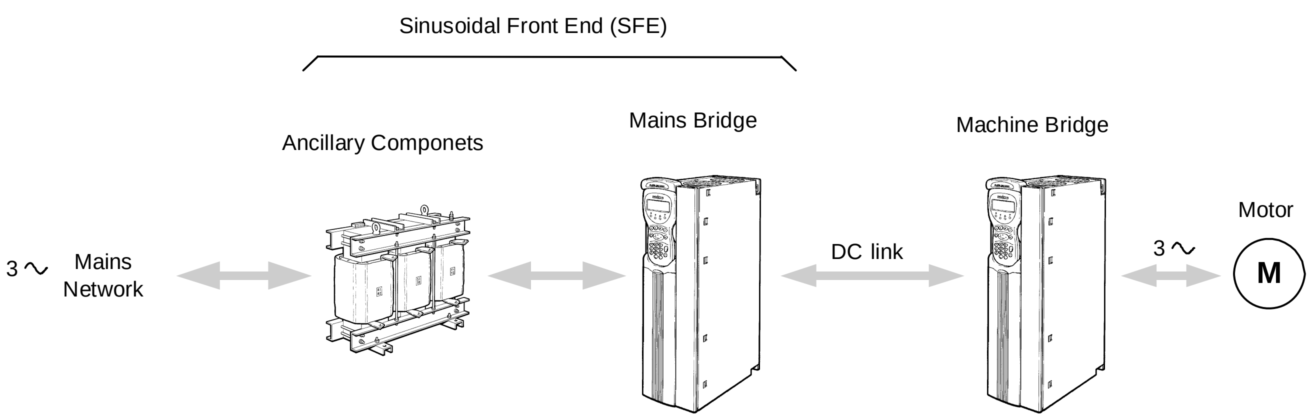

Figure 1-1 AEM Drive arrangement

1.1 Drive Data Manager™ (Keypad)

The converter can be configured for use by means of an optional Drive Data Manager™ (keypad) and a simple menu system. The keypad can be mounted directly to the front of the converter, or may be panel mounted using an optional mounting kit and connected to the converter via a cable.

1.2 Explanation of Product Code

The MicroCubicle™ bi-directional converters covered by this manual are listed in Tables 2-1 and 2-2 in Section 2. The code used to identify bi-directional converters is illustrated in Figure 1-2, using the code for an ALSPA MV3000e bi-directional converter, rated at 140 A with a nominal supply voltage of 400 V.

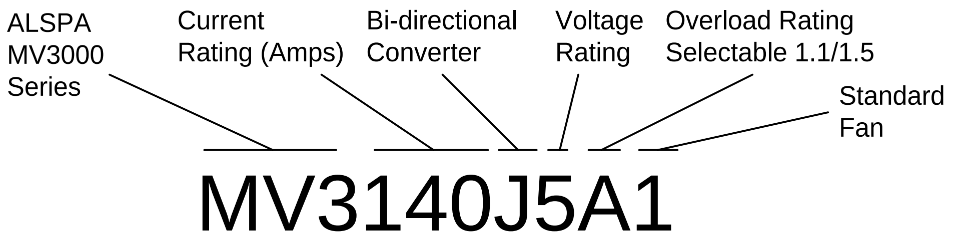

Figure 1-2 ALSPA MV3000eJ bi-directional converter identity code

The voltage and current ratings are given in Section 2, Tables 2-1 and 2-2. Dimensions and weights are provided in Section 2.3.

1.3 Terminology

1.3.1 Bi-directional Converter

A MicroCubicle™ style product that can be configured (in both hardware and software) to operate as a mains bridge (a component of a SFE**)** or as a **machine bridge**.

Identifiable by the letter **J** in the part number, e.g. MV3071**J**5A1.

Contains mains voltage monitoring circuits to allow synchronisation to the mains when operating as a mains bridge.

The default software operating mode is **SFE** mode, in which it functions as a mains bridge.

A simplified representation of the bi-directional converter is illustrated in Figure 1-3.

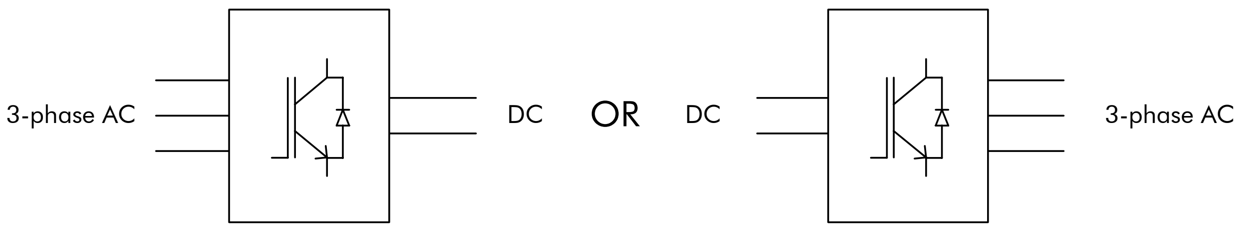

Figure 1-3 Simplified representation of a Bi-directional converter

1.2.1 Rectifier-fed Drive

Also sometimes referred to as an "AC in AC out drive" or "AC-fed drive", the Rectifier-fed drive:

Comprises a MicroCubicle™ style product which combines the functions of a diode rectifier bridge and a **machine bridge**, as shown in Figure 1-4.

Identifiable by the letter A in the part number, e.g. MV3065**A**5A1

Typically AC-fed and as such provides unidirectional power flow from the mains to an AC induction motor, but can alternatively be DC-fed to allow bidirectional power flow between DC and an AC induction machine.

Can form part of an AEM drive or a common DC link scheme.

Covered by manual T1676.

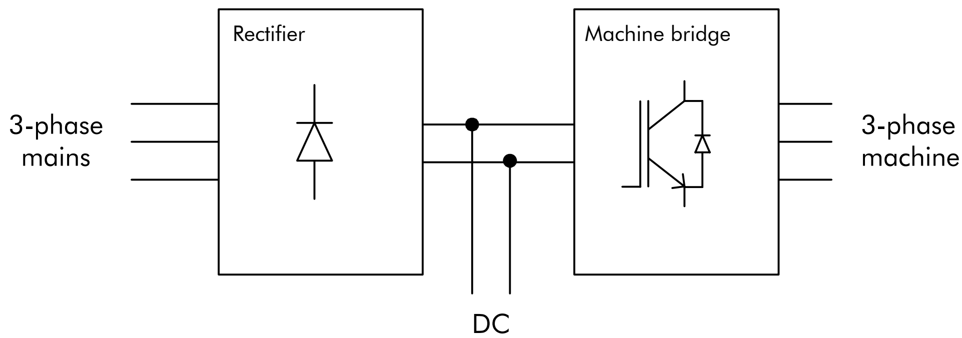

Figure 1-4 Simplified representation of a rectifier-fed drive

1.2.2 Mains Bridge

The mains bridge forms part of the Sinusoidal Front End (SFE), described in Section 1.2.3.

1.2.3 Sinusoidal Front End (SFE)

Also sometimes referred to as a "DC feeder", the SFE:

Converts electrical energy from AC mains to DC, or vice versa. Its primary function is to actively control the voltage at its DC terminals. To achieve this it can sink or source near sinusoidal current to or from the AC mains.

Consists of a **bi-directional converter** configured with software to function as a mains bridge, plus ancillary components as shown in Figure 2 at the front of this manual.

Can form part of an **AEM drive** or a **common DC link scheme**, described later.

The DC link is automatically precharged as soon as a voltage is applied to the AUX terminals. If a "Run" signal is not applied, or if the mains bridge is stopped or tripped, the SFE functions as a diode rectifier.

Figure 1-5 shows a simplified block diagram of a SFE.

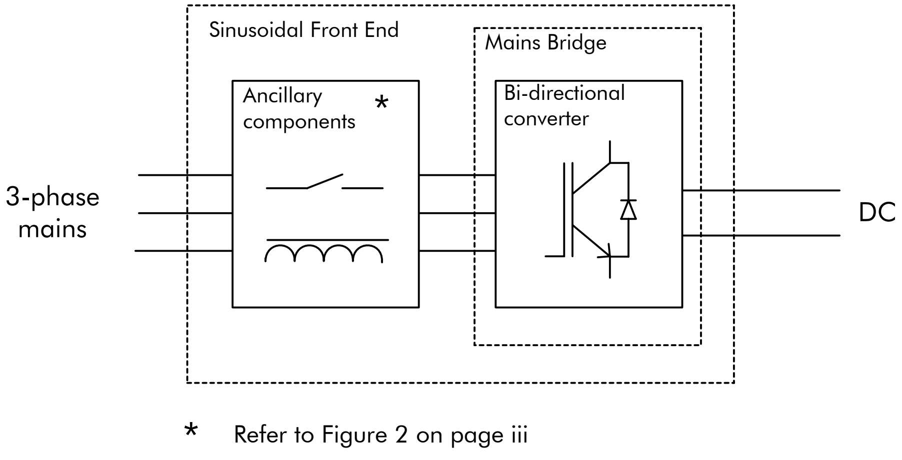

Figure 1-5 Simplified representation of a Sinusoidal Front End

1.2.4 Machine Bridge

Also sometimes referred to as a "DC-fed drive", the **machine bridge**:

Converts electrical energy from DC into AC, or vice versa. Its primary function is to perform speed or torque control of an AC induction motor or generator.

May consist of a bi-directional converter which has been software configured to operate in one of several possible **drive modes**, including **frequency control (VVVF)**, **vector control** (with or without encoder), or **scalar** control.

Alternatively may consist of a **rectifier-fed drive** with its rectifier bridge unused.

Can form part of an **AEM drive** or a **common DC link scheme**, described later.

Figure 1-6 shows a simplified block diagram of a machine bridge.

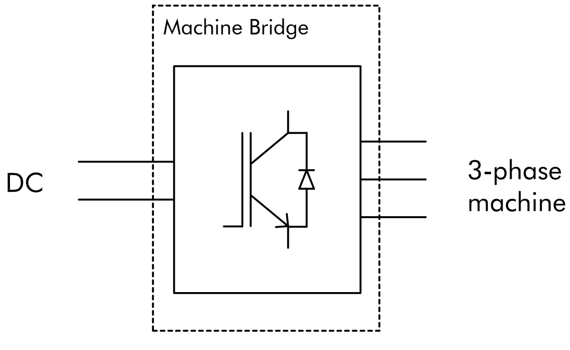

Figure 1-6 Simplified representation of a bi-directional converter configured as a machine bridge

1.4 Typical Applications Using Bi-directional Converters

1.4.1 AEM Drive using two identical Bi-directional Converters

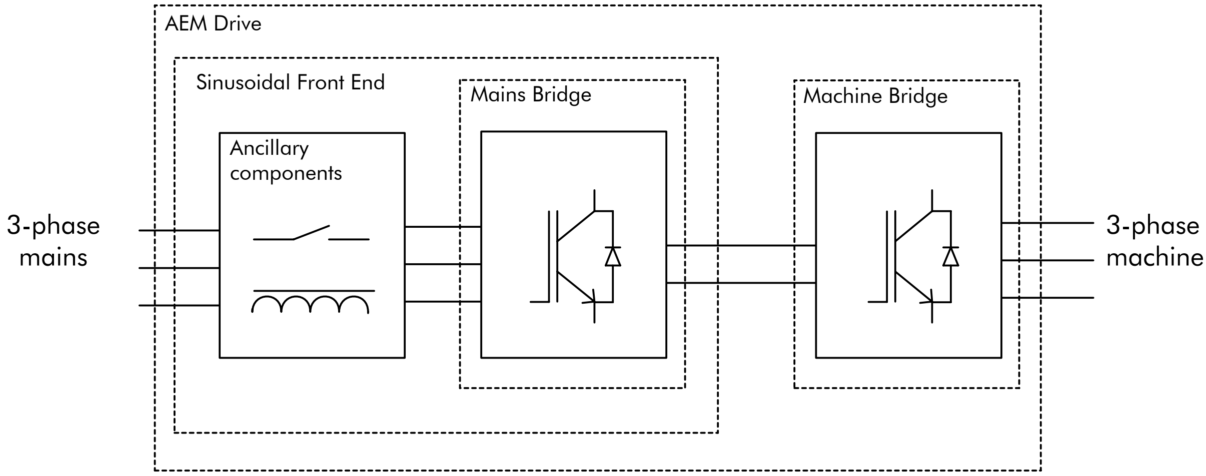

Figure 1-7 Simplified representation of an AEM drive using two identical bi-directional conveters

See Section 2 for rating details.

1.2.5 AEM Drive using a Bi-directional Converter and a Rectifier-fed Drive

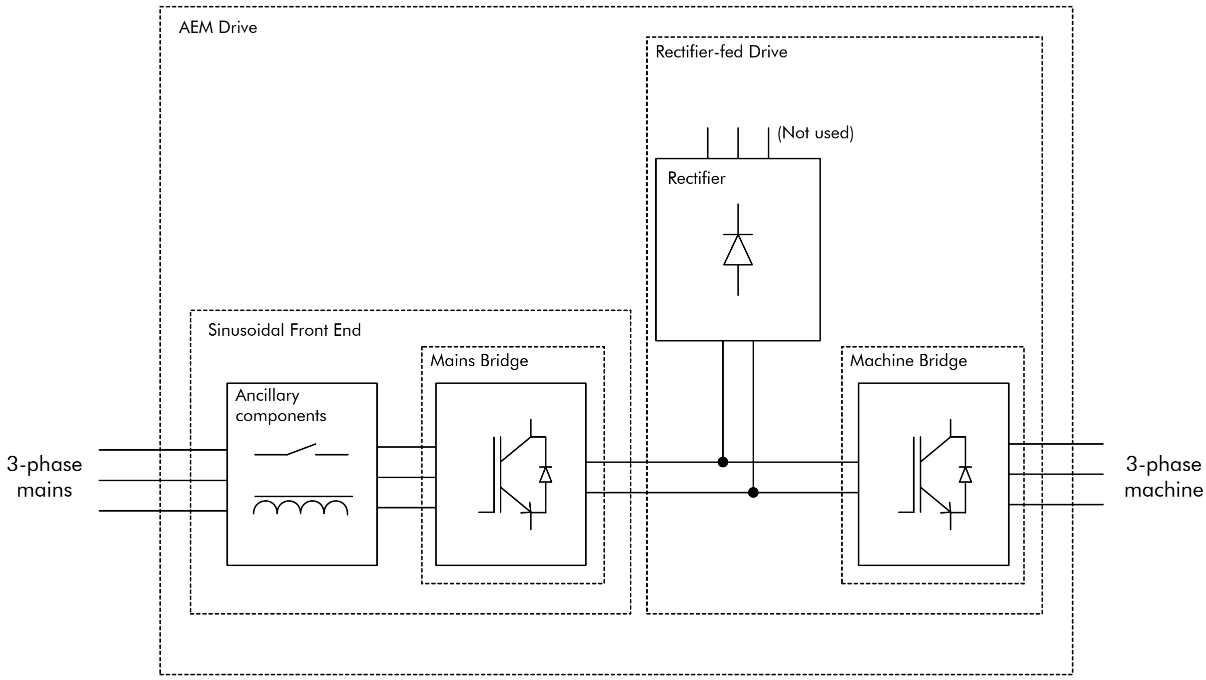

Figure 1-8 Simplified representation of an AEM drive using a SFE and a rectifier fed drive

Table 1-1 shows the model numbers of mains bridges and rectifier-fed drives which may be used together to make an AEM drive.

Table 1-1 MV3000e Compatibility table for AEM drive creation

Mains bridge	Compatible rectifier-fed drives for use as machine bridges *			
MV3071J5A1	MV3065A5A1	MV3052A5A1		
MV3140J5A1	MV3124A5A1	MV3096A5A1	MV3077A5A1	
MV3364J5A1	MV3302A5A1	MV3240A5A1	MV3180A5A1	MV3156A5A1
MV3566J5A1	MV3477A5A1	MV3414A5A1	MV3361A5A1	
MV3099J6A1	MV3099A6A1	MV3077A6A1	MV3062A6A1	
MV3242J6A1	MV3242A6A1	MV3192A6A1	MV3144A6A1	MV3125A6A1
MV3382J6A1	MV3382A6A1	MV3336A6A1	MV3289A6A1	

* Refer to **Converteam** manual T1676 for ratings of MV3000e Rectifier-fed products.

1.2.6 Common DC Link Scheme with Several Machine Bridges

The bi-directional converter can be used in a common DC link scheme in which a SFE and several machine bridges of various ratings drive a number of motors, as shown in Figure 1-9. These motors may draw or regenerate power independently and thereby increase the system efficiency by reducing the current drawn from the mains. Further information may be obtained from the supplier.

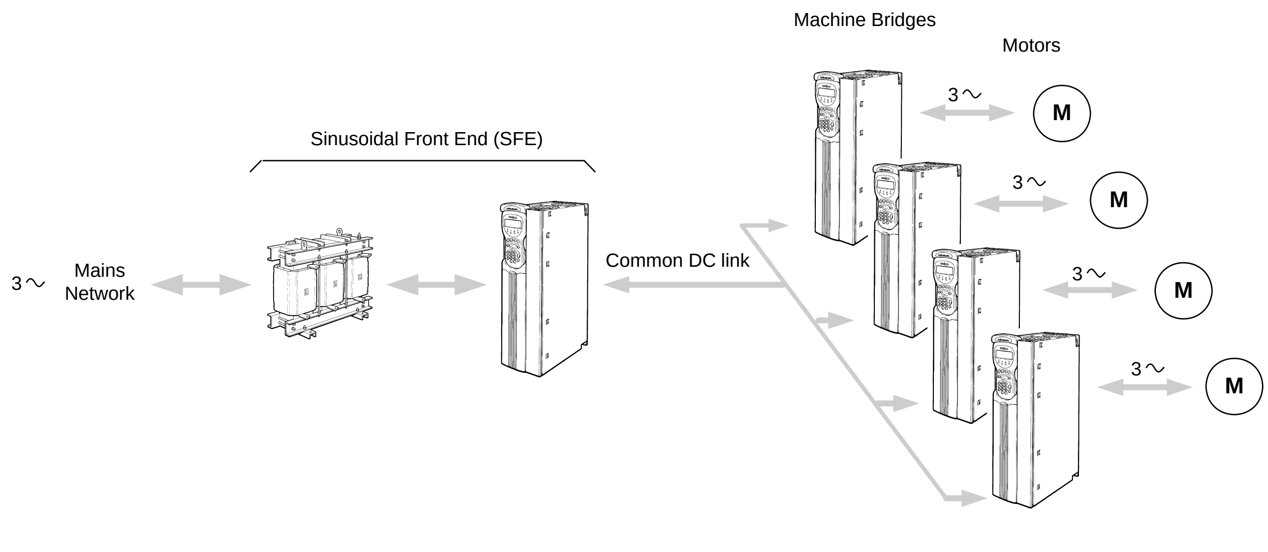

Figure 1-9 Common DC link scheme with several machine bridges

1.3 Use of Metric Units

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

1.5 Customer Support and Training

Converteam provides comprehensive telephone technical support, application planning, service and trsaining for customers.

Contact **Converteam** at the address and telephone numbers shown at the end of this manual.

1.6 Associated Publications

1.6.1.1.1 T1676 ALSPA MV3000e Getting Started Manual for AC-fed Drives

This manual provides a competent user trained in electrical installation practice with sufficient information to safely install, commission, operate, maintain and dispose of a simple AC-fed drive installation.

1.3.1.1.1 T1679 ALSPA MV3000e Software Technical Manual

This manual includes full descriptions of the menu structure and parameters and also the serial communications systems.

1.3.1.1.2 T1684 ALSPA 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.

1.3.1.1.3 T2013 ALSPA 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.

1.3.1.1.4 T1689 ALSPA MV DELTA, Technical Manual for MV3000e DELTA
T1693 ALSPA 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 ALSPA 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.

1.3.1.1.5 T1933 ALSPA MV3000e MicroPEC Application Processor

This instruction sheet enables a competent user trained in drives to install the MicroPEC facility and use it to add complex processor-based functions to the simple logic functions provided as standard with the drive.

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2. Product Data

2.1 Rating Data for Bi-directional Converters Configured as Machine Bridges

Note: The data in Table 2-1 is correct for a PWM switching frequency of 1.25 kHz. For data at other switching frequencies refer to **Converteam**.

Table 2-1 Rating data for bi-directional converters configured as machine bridges

Converter			DC Link		Motor Rating					Drive Output Current		Heat Losses to Cabinet[†]		Ventilation		AEM Drive
Model	Grade	Frame Size	Voltage V	Current 1.1/1.5 O/L A	Nominal Voltage V	Nominal Power 1.1 O/L kW	Nominal Power 1.5 O/L kW	Nominal Power 1.1 O/L HP	Nominal Power 1.5 O/L HP	Continuous Current (Maximum Current) 1.1 O/L A	Continuous Current (Maximum Current) 1.5 O/L A	Approx. Maximum Losses Clean Air Configuration kW	Approx. Maximum Losses With Dirty Air Kit Fitted W	Airflow required by cabinet m^3/h	Airflow required by cabinet cu ft/min	Suitable SFE to produce an AEM Drive
MV3071J5A1	STD	3	450 - 850	88/72	**400** @ 50 Hz (380 V to 440 V)	37	30	50	40	71 (78)	58 (87)	1.1	200	140	85	MV3071J5A1
MV3140J5A1		4	450 - 850	176/130		75	55	101	74	140 (154)	105 (158)	1.6	260	255	150	MV3140J5A1
MV3364J5A1		6	450 - 850	462/370		200	160	268	214	364 (401)	292 (438)	3.3	440	680	400	MV3364J5A1
MV3566J5A1		7	450 - 850	672/552		309	248	413	330	524 (576)	407 (611)	5.1	580	850	500	MV3566J5A1
MV3071J5A1	ALT	3	450 - 850	81/65	**480** @ 60 Hz (460 V to 525 V)	37	30	50	40	65 (72)	52 (78)	1.1	200	140	85	MV3071J5A1
MV3140J5A1		4	450 - 850	159/120		75	56	100	75	124 (137)	96 (144)	1.6	260	255	150	MV3140J5A1
MV3364J5A1		6	450 - 850	391/314		187	149	250	200	302 (332)	240 (360)	3.3	440	680	400	MV3364J5A1
MV3566J5A1		7	450 - 850	673/526		364	291	486	388	516 (568)	400 (601)	5.1	580	850	500	MV3566J5A1
MV3099J6A1	STD	4	600 - 1100	127/96	**600** @ 60 Hz (500 V to 690 V)	75	56	100	75	99 (109)	77 (116)	1.6	260	255	150	MV3099J6A1
MV3242J6A1		6	600 - 1100	314/252		187	149	250	200	242 (266)	192 (288)	3.3	440	680	400	MV3242J6A1
MV3382J6A1		7	600 - 1100	460/369		309	249	412	332	352 (387)	284 (425)	5.1	580	850	500	MV3382J6A1
MV3099J6A1	ALT	4	600 - 1140	122/102	**690** @ 50 Hz (data valid for 690 V only)	90	75	121	101	98 (108)	82 (123)	1.6	260	255	150	MV3099J6A1
MV3242J6A1		6	600 - 1140	268/215		200	160	268	214	211 (232)	170 (255)	3.3	440	680	400	MV3242J6A1
MV3382J6A1		7	600 - 1140	435/400		342	276	456	368	339 (373)	273 (410)	5.1	580	850	500	MV3382J6A1

. [δ]**AC Voltage Grade - Selectable by parameter P99.11**

STD = Standard AC Voltage Grade (P99.11 = 0)
ALT = Alternate AC Voltage Grade (P99.11 = 1)

.**Overload (O/L) ratings - Selectable by parameter P99.02 (P1.29)**

1.1 rating = 1.1 overload, i.e. 1.1 x full load current (P99.02 = 1)
1.5 rating = 1.5 overload, i.e. 1.5 x full load current (P99.02 = 0)

Section 2.8 gives maximum permitted overload repetition rate.

t These are heat losses from the bi-directional converter. Losses from other components are given with the component data elsewhere in Section 2.

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.

2.2 Rating Data for Bi-directional Converters Configured as Mains Bridges

Note: The data in Table 2-2 is correct for a PWM switching frequency of 2.5 kHz. For data at other switching frequencies refer to **Converteam**.

Table 2-2 Fusing and rating data for bi-directional converters configured as mains bridges

Converter			Mains Rating				Input Line Reactor	PWM Filter	PWM Filter Fuses		DC Link	Heat Losses in Cabinet†		Ventilation		Fan Transformer ✠	Fan Transformer Primary Fuses		Auxiliary Fuses	
Model	Grade δ	Frame Size	Nominal Voltage V	Mains Current (1.1/1.5 O/L) A	IEC Rated Fuse ** (1.1/1.5 O/L) A	UL Rated Fuse ** (1.1/1.5 O/L) A	Model Number (Parts /01 and /02)	Model Number	Rating ** IEC A	Rating ** UL/CSA A	DC Link * Voltage V	Approx. Maximum Losses: Clean Air Configured kW	Approx. Maximum Losses: With Dirty Air Kit Fitted W	Airflow required by cabinet m^3/h	Airflow required by cabinet cu ft/min	Model No.	Rating *** IEC A	Rating *** UL/CSA A	Rating ** IEC A	Rating ** UL/CSA A
MV3071J5A1	STD	3	400 @ 50 Hz (380 V to 440 V)	71/58	80/63	90/80	MV3SRL037A5	MV3PWM071A5	16	12	Range 550 - 850 Default 710	1.1	200	140	85	MV3FTX0350A4	4	3.5	10	8
MV3140J5A1		4		140/105	160/125	175/150	MV3SRL075A5	MV3PWM140A5	20	20		1.6	260	255	150	MV3FTX0350A4	4	3.5	10	8
MV3364J5A1		6		364/292	400/315	500/400	MV3SRL200A5	MV3PWM364A5	40	40		3.3	440	680	400	MV3FTX0750A4	10	6.25	16	12
MV3566J5A1		7		475/374	630/500	750/600	MV3SRL315A5	MV3PWM566A5	80	70		5.1	580	850	500	MV3FTX1306A4	10	10	16	12
MV3071J5A1	ALT	3	480 @ 60 Hz (440 V to 480 V)	65/52	80/63	90/70	MV3SRL037A5	MV3PWM071A5	16	12	Range 550 - 850 Default 780	1.1	200	140	85	MV3FTX0350A4	4	3.5	10	8
MV3140J5A1		4		124/96	125/100	175/125	MV3SRL075A5	MV3PWM140A5	20	20		1.6	260	255	150	MV3FTX0350A4	4	3.5	10	8
MV3364J5A1		6		302/240	315/250	400/300	MV3SRL200A5	MV3PWM364A5	40	40		3.3	440	680	400	MV3FTX0750A4	10	6.25	16	12
MV3566J5A1		7		460/365	500/500	600/600	MV3SRL315A5	MV3PWM566A5	80	70		5.1	580	850	500	MV3FTX1306A4	10	10	16	12
MV3099J6A1	STD	4	600 @ 60 Hz (500 V to 600 V)	99/77	100/80	125/100	MV3SRL090A7	MV3PWM099A6	10	10	Range 700 - 1100 Default 1000	1.6	260	255	150	MV3FTX0350A6	4	3	10	8
MV3242J6A1		6		242/192	250/200	350/250	MV3SRL200A7	MV3PWM242A6	32	35		3.3	440	680	400	MV3FTX0750A6	6	5	16	12
MV3382J6A1		7		289/234	400/400	500/450	MV3SRL315A7	MV3PWM382A6	50	50		5.1	580	850	500	MV3FTX1306A6	10	8	16	12
MV3099J6A1	ALT	4	690 @ 50 Hz (500 V to 690 V)	98/82	100/100	125/110	MV3SRL090A7	MV3PWM099A6	10	10	Range 700 - 1140 Default 1100	1.6	260	255	150	MV3FTX0350A6	4	3	10	8
MV3242J6A1		6		211/170	250/200	300/225	MV3SRL200A7	MV3PWM242A6	32	35		3.3	440	680	400	MV3FTX0750A6	6	5	16	12
MV3382J6A1		7		272/221	400/315	450/400	MV3SRL315A7	MV3PWM382A6	50	50		5.1	580	850	500	MV3FTX1306A6	10	8	16	12

.δAC Voltage Grade - Selectable by parameter P99.11 (P1.28)

STD = Standard AC Voltage Grade (P99.11 = 0)
ALT = Alternate AC Voltage Grade (P99.11 = 1)

.Overload (O/L) ratings - Selectable by parameter P99.02 (P1.29)

1.1 rating = 1.1 overload, i.e. 1.1 x full load current (P99.02 = 1)
1.5 rating = 1.5 overload, i.e. 1.5 x full load current (P99.02 = 0)

Section 2.8 gives maximum permitted overload repetition rate.

* DC link volts configured by user and must be greater than √2 x ac mains voltage. UL/CSA approval only up to 1100 V.

** For fuse type see Section 3.6.1. These fuses may not prevent damage to the pre-charge circuit in the event of short circuits on the DC link and other components.

*** Fuse type as in Section 3.6.1.

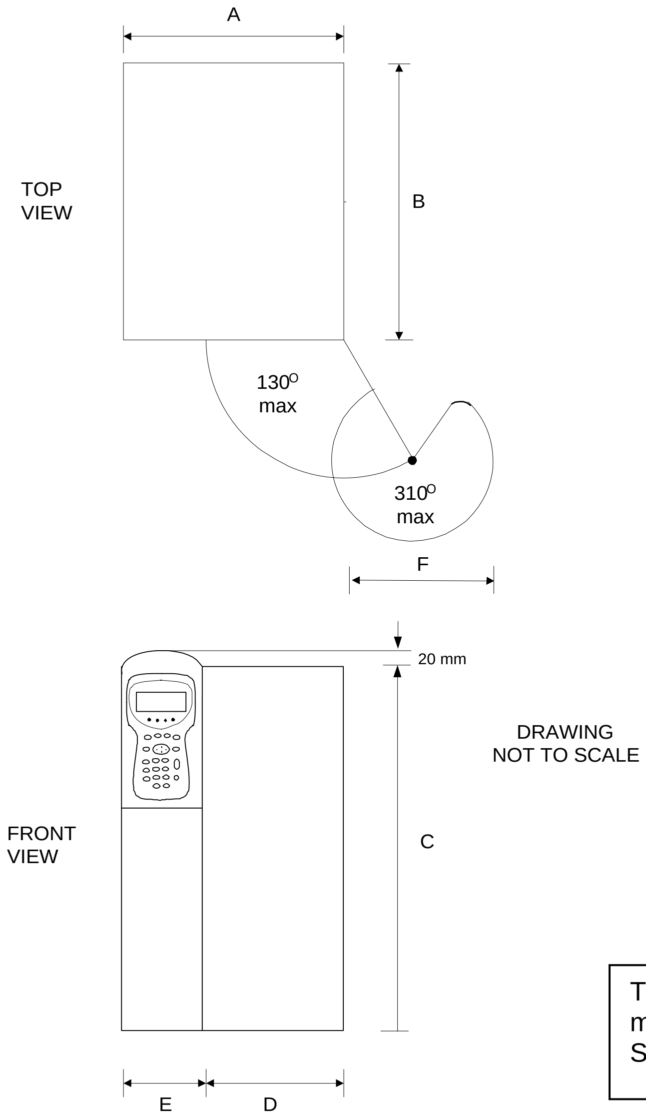
t These are heat losses from the bi-directional converter. Losses from other components are given with the component data elsewhere in Section 2.

✠ For secondary fuse ratings, refer to Section 2.6.2.

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.

2.3 MicroCubicle™ Dimensions



Template drilling dimensions for mounting are provided in Section 3.5.

Figure 2-1 MicroCubicle™ dimensions

Table 2-3 MicroCubicle™ physical dimensions

Frame Size	Dimensions mm (in)						Weight kg (lb)
	A	B	C	D	E	F (max)	
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)

* Overall height, including keypad harbour overhang

2.4 AC Line Reactor

Note: This is a required ancillary item as shown in Figure 2, page iii.

The AC line reactor is constructed in two parts to allow the PWM filter to be connected between them. These parts are designated /01 and /02, and are typically as shown in Figure 2-2. Part /02 is considerably larger than part /01. Physical dimensions are given in Tables 2-4 and 2-5, fixing dimensions are given in Table 2-6.

2.4.1 Physical Dimensions, Inductance and Losses
(See Figure 2-2)

Table 2-4 AC Line reactor (part /01) dimensions, inductance and losses

Reactor Part No.	Overall Dimensions			Cable Fixing Hole Dia.	Earth Stud Lug	Weight	Inductance	Losses
	Height A mm (in)	Width B mm (in)	Length C mm (in)	mm (in)	mm (in)	kg (lb)	µH	W
400 V @ 50 Hz / 480 V @ 60 Hz								
MV3SRL037A5/01	245 (9.65)	174 (6.85)*	240 (9.45)	Flying Leads	M6 (1/4)	22 (49)	583	170
MV3SRL075A5/01	295 (11.8)	180 (7.1)*	300 (11.8)	Flying Leads	M8 (5/16)	36 (79)	318	270
MV3SRL200A5/01	455 (17.9)	200 (7.9)	420 (16.5)	11 (0.43)	M8 (5/16)	110 (242)	126	450
MV3SRL315A5/01	465 (18.3)	210 (8.3)	390 (15.35)	13 (0.5)	M8 (5/16)	130 (286)	74	490
600 V @ 60 Hz / 690 V @ 50 Hz								
MV3SRL090A7/01	295 (11.6)	190 (7.48)*	300 (11.8)	Flying Leads	M8 (5/16)	36 (79)	638	280
MV3SRL200A7/01	455 (17.9)	200 (7.87)	420 (16.5)	11 (0.43)	M8 (5/16)	110 (242)	308	480
MV3SRL315A7/01	485 (19.1)	230 (9.1)	480 (18.9)	11 (0.43)	M8 (5/16)	160 (352)	180	540

* Includes 30 mm for flying leads

Table 2-5 AC Line reactor (part /02) dimensions, inductance and losses

Reactor Part No.	Overall Dimensions			Cable Fixing Hole Dia.	Earth Stud Lug	Weight	Inductance	Losses
	Height A mm (in)	Width B mm (in)	Length C mm (in)	mm (in)	mm (in)	kg (lb)	µH	W
400 V @ 50 Hz / 480 V @ 60 Hz								
MV3SRL037A5/02	400 (15.8)	300 (11.8)*	360 (14.2)	Flying Leads	M10 (3/8)	78 (172)	1,749	335
MV3SRL075A5/02	515 (20.3)	310 (12.2)*	480 (18.9)	Flying Leads	M10 (3/8)	130 (286)	953	850
MV3SRL200A5/02	660 (26.0)	316 (12.5)	660 (26.0)	11 (0.43)	M12 (1/2)	280 (616)	379	2,400
MV3SRL315A5/02	765 (30.1)	362 (14.3)	720 (28.4)	13 (0.5)	M12 (1/2)	410 (902)	223	2,800
600 V @ 60 Hz / 690 V @ 50 Hz								
MV3SRL090A7/02	515 (20.3)	380 (15.0)*	480 (18.9)	Flying Leads	M10 (3/8)	135 (297)	1,914	1,050
MV3SRL200A7/02	660 (26.0)	316 (12.5)	660 (26.0)	11 (0.43)	M12 (1/2)	280 (616)	923	2,050
MV3SRL315A7/02	755 (30.0)	362 (14.3)	720 (28.4)	11 (0.43)	M12 (1/2)	460 (1014)	537	3,200

* Includes 30 mm (1.2 in) for flying leads

Note: Flying leads are 1,000 mm (39 in) long.

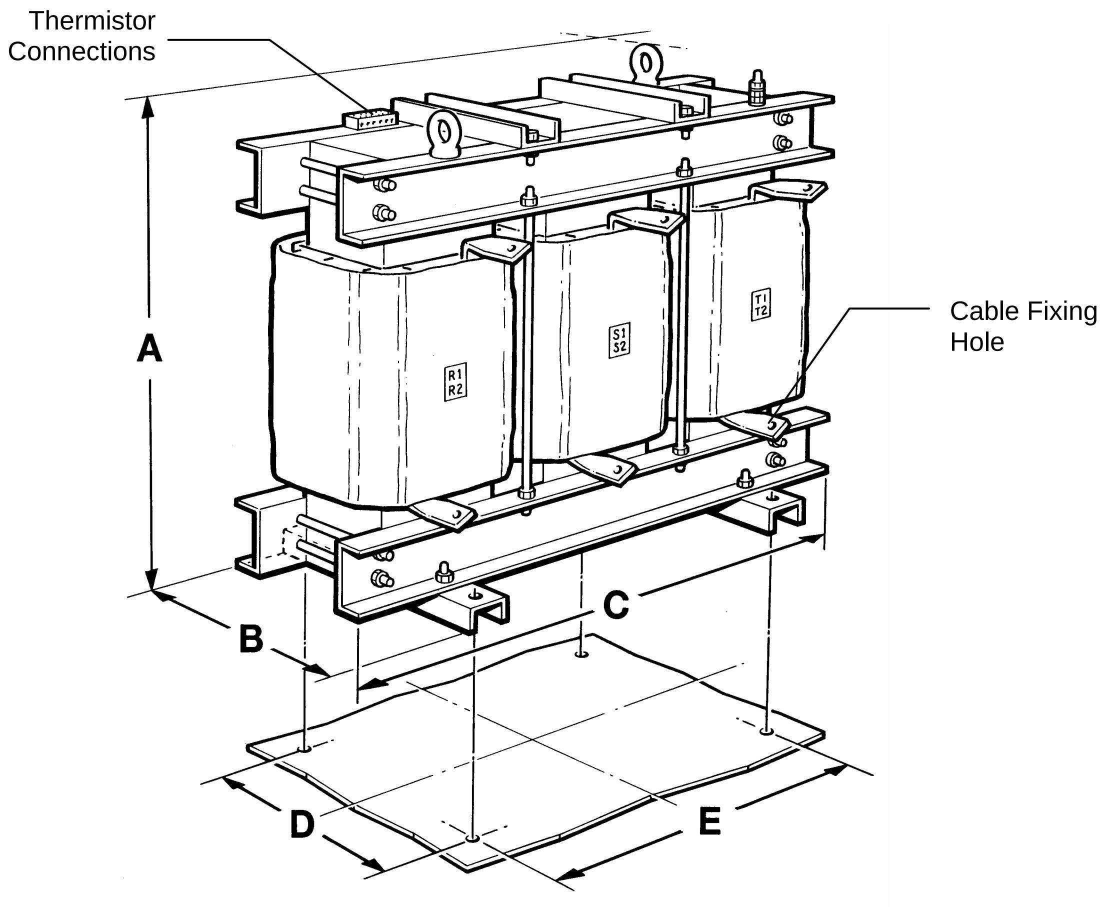


Figure 2-2 Line reactor (typical)

2.4.2 Fixing Dimensions

(See Figure 2-2)

Table 2-6 Line reactor fixing dimensions (between centres)

Model No.	Part /01			Part /02		
	Width D mm (in)	Length E mm (in)	Hole dia. mm (in)	Width D mm (in)	Length E mm (in)	Hole dia. mm (in)
MV3SRL037A5	114 (4.5)	200 (7.9)	10 (0.4)*	230 (9.1)	120 (4.75)	11 (0.5)
MV3SRL075A5	120 (4.8)	204 (8.0)	10 (0.4)*	230 (9.1)	160 (6.3)	14 (0.6)
MV3SRL200A5	170 (6.7)	270 (10.7)	12 (0.5)	266 (10.5)	440 (17.4)	14 (0.6)
MV3SRL315A5	180 (7.1)	300 (11.8)	12 (0.5)	312 (12.3)	480 (18.9)	14 (0.6)
MV3SRL090A7	130 (5.2)	204 (8.0)	10 (0.4)*	300 (11.8)	160 (6.3)	14 (0.6)
MV3SRL200A7	170 (6.7)	270 (10.7)	12 (0.5)	266 (10.5)	440 (17.4)	14 (0.6)
MV3SRL315A7	190 (7.5)	320 (12.6)	14 (0.6)	312 (12.3)	480 (18.9)	14 (0.6)

* Slot width

2.5 PWM Filter

Note: This is a required ancillary item as shown in Figure 2, page iii.

The PWM filter for frame sizes 3 and 4 is shown in Figure 2-3. The filters for frame sizes 6 and 7 are shown in Figure 2-4.

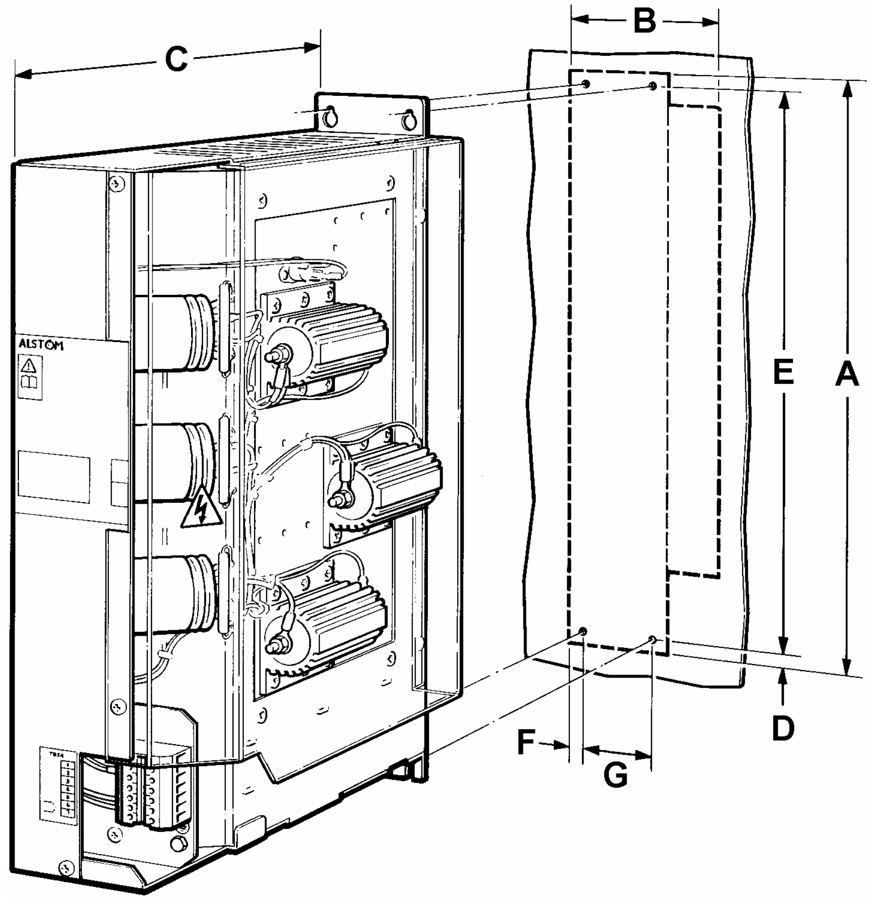


Figure 2-3 PWM filter for frame sizes 3 and 4

2.5.1 Physical Dimensions and Losses

(See Figures 2-3 and 2-4)

Table 2-7 PWM filter, overall dimensions, weights and losses

Model	for Frame Size	Overall Dimensions			Weight Kg (lb)	Losses	
		Height A mm (in)	Width B mm (in)	Depth C mm (in)		Typical W	Maximum W
MV3PWM071A5	3	487.4 (19.2)	133.4 (5.3)	399.6 (15.8)	15 (33)	56	115
MV3PWM140A5	4	487.4 (19.2)	133.4 (5.3)	399.6 (15.8)	16 (36)	108	188
MV3PWM099A6	4	487.4 (19.2)	133.4 (5.3)	399.6 (15.8)	16 (36)	114	121
MV3PWM242A6	6	539.1 (21.3)	311.0 (12.3)	305.6 (12.0)	36 (84)	128	468
MV3PWM364A5	6	539.1 (21.3)	311.0 (12.3)	305.6 (12.0)	36 (84)	333	613
MV3PWM382A6	7	539.1 (21.3)	601.3 (23.7)	305.6 (12.0)	54 (119)	485	1018
MV3PWM566A5	7	539.1 (21.3)	601.3 (23.7)	305.6 (12.0)	54 (119)	520	1167

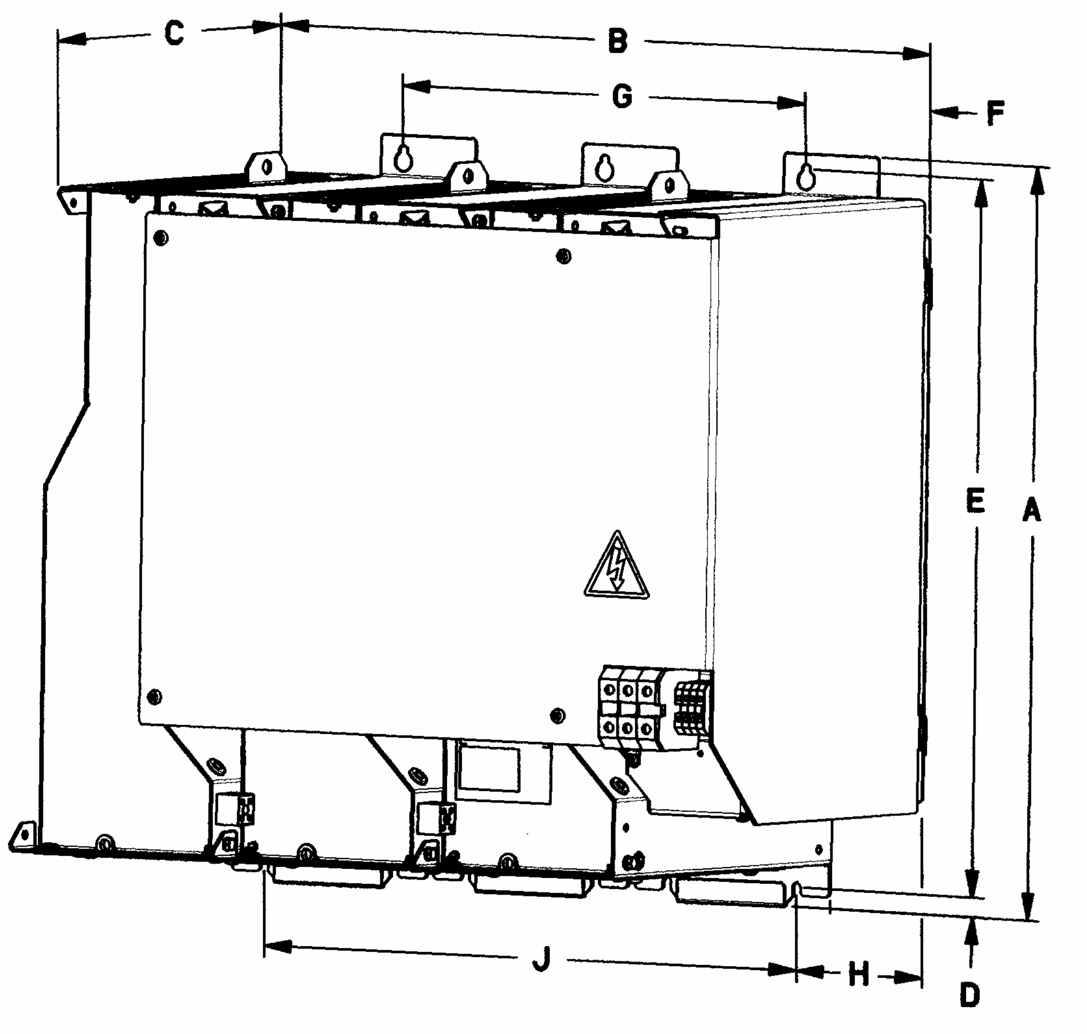


Figure 2-4 PWM filter for frame size 6 or 7 (size 7 shown)

2.5.2 Fixing Dimensions

(See Figures 2-3 and 2-4)

Table 2-8 PWM filter fixing dimensions

Model	for Frame Size	Fixing Dimensions						
		D mm (in)	E mm (in)	F mm (in)	G mm (in)	H mm (in)	J mm (in)	Slot Width mm (in)
MV3PWM071A5	3	13.0 (0.51)	464.4 (18.3)	16.4 (0.65)	55.0 (2.2)	–	–	6.0 (0.24)
MV3PWM140A5	4	13.0 (0.51)	464.4 (18.3)	16.4 (0.65)	55.0 (2.2)	–	–	6.0 (0.24)
MV3PWM099A6	4	13.0 (0.51)	464.4 (18.3)	16.4 (0.65)	55.0 (2.2)	–	–	6.0 (0.24)
MV3PWM242A6	6	13.7 (0.54)	514.4 (20.3)	119.6 (4.7)	170.8 (6.7)	119.6 (4.7)	280.8 (11.1)	7.0 (0.28)
MV3PWM364A5	6	13.7 (0.54)	514.4 (20.3)	119.6 (4.7)	170.8 (6.7)	119.6 (4.7)	280.8 (11.1)	7.0 (0.28)
MV3PWM382A6	7	13.7 (0.54)	514.4 (20.3)	119.6 (4.7)	341.6 (13.5)	119.6 (4.7)	451.6 (17.8)	7.0 (0.28)
MV3PWM566A5	7	13.7 (0.54)	514.4 (20.3)	119.6 (4.7)	341.6 (13.5)	119.6 (4.7)	451.6 (17.8)	7.0 (0.28)

2.6 Fan Transformer

Note: This is a required ancillary item as shown in Figure 2, page iii.

2.6.1 Physical Dimensions and Losses

(See Figure 2-5)

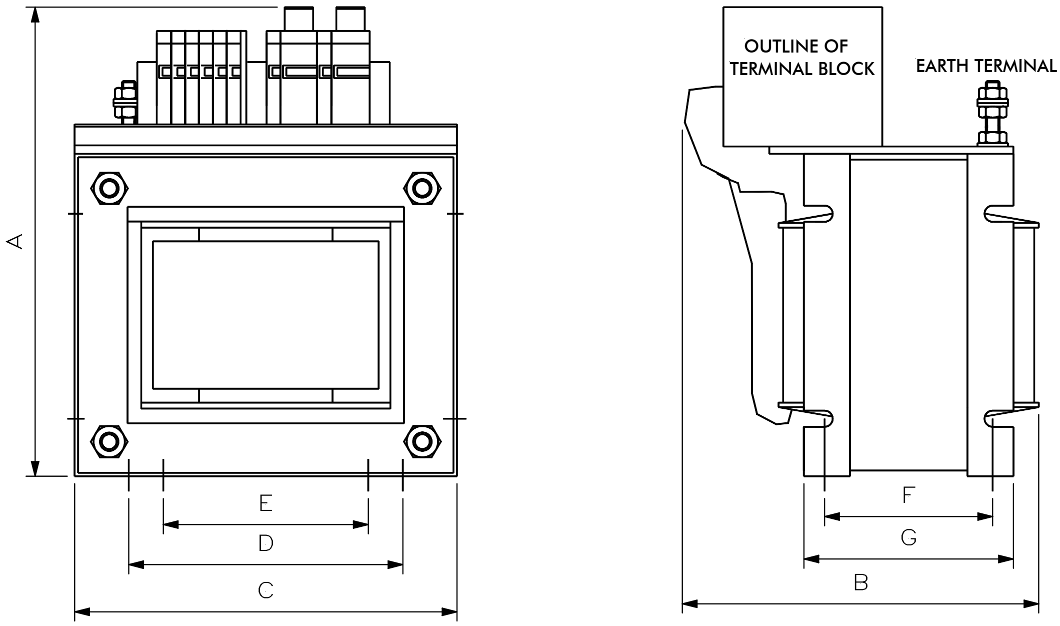


Figure 2-5 Fan transformer dimensions

Table 2-9 Fan transformer overall dimensions and losses

Model	Overall Dimensions			Weights	Losses
	Height A mm (in)	Width B mm (in)	Length C mm (in)	kg (lb)	W
MV3FTX0350A4	210 (8.3)	170 (6.7)	170 (6.7)	13 (5.9)	40
MV3FTX0750A4	210 (8.3)	220 (8.7)	170 (6.7)	21 (9.5)	60
MV3FTX1306A4	250 (9.9)	200 (7.9)	220 (8.7)	23 (10.5)	90
MV3FTX0350A6	210 (8.3)	170 (6.7)	170 (6.7)	13 (5.9)	40
MV3FTX0750A6	210 (8.3)	220 (8.7)	170 (6.7)	21 (9.5)	60
MV3FTX1306A6	250 (9.9)	200 (7.9)	220 (8.7)	23 (10.5)	90

Table 2-10 Fan transformer fixing dimensions

Model	Centres D mm (in)	Centres E mm (in)	Centres F mm (in)	G mm (in)	Slot Width mm (in)
MV3FTX0350A4	119 (4.7)	89 (3.5)	75 (3.0)	91 (3.6)	7.0 (0.28)
MV3FTX0750A4	119 (4.7)	89 (3.5)	125 (4.9)	141 (5.6)	7.0 (0.28)
MV3FTX1306A4	–	114 (4.5)	100 (3.9)	127 (5.0)	9.5 (0.37)
MV3FTX0350A6	119 (4.7)	89 (3.5)	75 (3.0)	91 (3.6)	7.0 (0.28)
MV3FTX0750A6	119 (4.7)	89 (3.5)	125 (4.9)	141 (5.6)	7.0 (0.28)
MV3FTX1306A6	–	114 (4.5)	100 (3.9)	127 (5.0)	9.5 (0.37)

2.6.2 Electrical Data for Fan Transformer

Table 2-11 Fan transformer electrical data *

Model	Secondary Fuses **		Continuous VA Ratings	
	Fan (230 V) A	Auxiliary (110 V) A	@ 230 V	@ 110 V
MV3FTX0350A4	1	6	172.5	177.5
MV3FTX0750A4	2	10	460	290
MV3FTX1306A4	7	12.5	920	386
MV3FTX0350A6	1	6	172.5	177.5
MV3FTX0750A6	2	10	460	290
MV3FTX1306A6	7	12.5	920	386

A4 products have primary tappings at 380 – 400 – 415 – 440 – 480 V

A6 products have primary tappings at 500 – 525 – 600 – 660 – 690 V

* For primary fuse ratings see Section 2.2, for fuse types see Section 3.6.1.
** Supplied fitted internally, type T fuses, 32 mm x 6.35 mm (1¼ in x ¼ in).

2.7 Line Contactor LCN

The main contacts of LCN should be rated for the mains current for the relevant voltage grade shown in Table 2-2 against each mains bridge type.

To use the standard fan transformer, the LCN coil must be rated for 110 VAC and must be within the VA rating of the 110 V winding of the fan transformer, refer to Table 2-11 above.

As an example, part numbers for suitable Telemecanique contactors are given in Table 2-12.

Table 2-12 Line Contactor LCN – rating of main contacts and suitable example

Converter	Part Numbers for Telemecanique (example contactor)								
	Contactor type	Rating Standard	AC1 Rating (A) 55°C	AC1 Rating (A) UL	Coil type	Auxiliary contacts	RC Suppressor	Suppressor bracket	Set of 6 shrouds
MV3071J5A1	LC1-D5011F7	IEC	80	70	–	–	LA4-DA2G	–	–
	LC1-D6511F7	UL/CSA	80	80	–	–	LA4-DA2G	–	–
MV3140J5A1	LC1-D11500F7	IEC	200		–	LA1D	LA4-DA	–	–
	LC1-F115	UL/CSA		175	LX1-FF110	LA1-DN11	LA9-F980	LA-D09981	LA9-F701
MV3364J5A1	LC1-F400	IEC	430	420	LX1-FJ110	LA1-DN11	LA9-D09980	LA-D09981	LA9-F703
	LC1-F400	UL/CSA	430	420	LX1-FJ110	LA1-DN11	LA9-D09980	LA-DO9981	LA9-F703
MV3566J5A1	LC1-F500	IEC	580	700	LX1-FK110	LA1-DN11	LA9-D09980	LA-D09981	LA9-F703
	LC1-F500	UL/CSA	580	700	LX1-FK110	LA1-DN11	LA9-D09980	LA-D09981	LA9-F703
MV3099J6A1	LC1-D8011F7	IEC	125	110	–	–	LA4-DA2G	–	–
	LC1-D8011F7	UL/CSA	125	110	–	–	LA4-DA2G	–	–
MV3242J6A1	LC1-F185	IEC	275	200	LX1-FG110	LA1-DN11	LA9-F980	LA-D09981	LA9-F702
	LC1-F265	UL/CSA	300	285	LX1-FJ110	LA1-DN11	LA9-F980	LA-D09981	LA9-F703
MV3382J6A1	LC1-F400	IEC	430	420	LX1-FJ110	LA1-DN11	LA9-D09980	LA-D09981	LA9-F703
	LC1-F400	UL/CSA	430	420	LX1-FJ110	LA1-DN11	LA9-D09980	LA-D09981	LA9-F703

2.8 Electrical and Environmental Specifications

2.8.1 Common Specifications

Table 2-13 Environmental data

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 m, 1000 m to 2000 m with derating, Refer to Section 2.1
	–	Temperature range	0° C to 40° C (+32° F to +104° F); 40° C to 50° C (+104° F to +122° F) with derating, Refer to Sections 2.1 and 2.2
	–	Relative humidity	5% to 95%, non-condensing
	–	Vibration	IEC 60721-3-3 Class 3M1 & EN50178
	–	Cooling air (pollution and dust)	Pollution Degree 2 (IEC 60664-1, UL 840, CSA C22.2 No. 0.2-93) i.e. clean, free from dust, condensation and conductive or corrosive gases. If optional dirty air kit is fitted, the main heatsink can be exposed to unfiltered air that does not contain corrosive, conductive or explosive dust or gases.
Ingress protection			IP20, (NEMA 1). Ancillary items are IP00 (unprotected) IP21 with Drip Option

2.8.2 Specifications for Machine Bridges

Table 2-14 Electrical data for Machine Bridges

Supply	–	Voltage range *	450 V – 850 VDC, for 400 V 50 Hz or 480 V 60 Hz nominal outputs 600 V – 1100 VDC, for 600 V 60 Hz nominal output 600 V – 1140 VDC, for 690 V 50 Hz nominal output
Insulation	–		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 (default)			1.25 kHz for all Machine Bridges.
Output	–	Overload current	50% or 10% for one minute, as selected, with a maximum of six equally spaced overloads in any hour.

* These DC supply voltages are absolute limits. If there is ripple on the supply, it must not cause excursions outside these limits.

2.8.3 Specifications for Sinusoidal Front End (SFE)

Table 2-15 Electrical data for SFE

Supply	–	Standard voltage range (as selected)	380 V – 440 V (400 V nominal), 50 Hz 500 V – 690 V (690 V nominal), 50 Hz 440 V – 480 V (480 V nominal), 60 Hz 500 V – 600 V (600 V nominal), 60 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.
	–	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.
	–	Notching immunity	Immunity to commutation notches up to 40% as defined by IEC 60164-1-1
Insulation	–		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	**–**	Default	2.5 kHz for all SFE.
Output	–	Overload current	50% or 10% for one minute, as selected, with a maximum of six equally spaced overloads in any hour.

2.9 Product Performance Data

2.9.1 Product performance data for Machine Bridges

Table 2-16 Product performance data for Machine Bridges

Frequency	–	Resolution	0.01%
	–	Control accuracy	0.1%
Speed	–	Resolution	0.01%
	–	Accuracy (absolute)	0.01%

	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 %	≅ 0.5 %	≅ 0.02 %

2.9.2 Product performance data for Sinusoidal Front End

Table 2-17 Performance data for Sinusoidal Front End

DC link voltage control	–	Resolution	1 V
	–	Accuracy	±1%
	–	Bandwidth	200 rad/s
AC current control	–	Resolution	0.01% rated current
	–	Accuracy	±1%
	–	Bandwidth	>500 rad/s

2.9.3 Mains Impedance

The SFE produces currents at the switching frequency and its harmonics. The PWM filters listed in Section 2.5 are used to reduce the switching frequency currents injected into the mains supply and thus prevent damage to other equipment.

The PWM filter is designed to enable the SFE to comply with voltage harmonic performance limits (class 3 supplies) of 1% of fundamental for any individual frequency and 1.5% for the rms sum of individual frequencies in any 200 Hz band at the in-plant point of common coupling. This is achieved when the SFE is operated with a mains supply having a fault level equal to or greater than the value shown in Table 2-18 for each product.

Table 2-18 Mains supply minimum fault levels

MV3000e Product	Minimum Fault Levels for compliance with Voltage Distortion Specification MVA
MV3071J5A1	13
MV3140J5A1	25
MV3364J5A1	13
MV3566J5A1	20
MV3099J6A1	26
MV3242J6A1	13
MV3382J6A1	20

2.10 DC Link Overvoltage Trip Levels

The SFE will attempt to maintain accurate control of the DC link voltage under all conditions. However, a shock load to the motor can cause a disturbance of the DC voltage. The DC link overvoltage trip levels for the J5 and J6 series products covered by this manual are shown in Table 2-19.

Table 2-19 DC link overvoltage trip levels

	Nominal AC Voltage	
	J5 series 400 V/480 V	**J6 series 600 V/690 V**
Overvoltage Trip Setting	868 V – 891 V	1155 V – 1184 V

2.11 Acoustic Noise Levels

The maximum acoustic noise levels generated by the products covered in this manual are shown in Table 2-20 and 2-21.

Table 2-20 Acoustic noise generated by bi-directional converters

Frame size	Maximum noise level 1.0 m (39.4 in) in any direction from converter dBA
3	70 *
4	66
6	73 *
7	80 *

* Refer to WARNING in Sections 3.5, 5A and 5B.

Table 2-21 Acoustic noise generated by PWM filter fans

PWM filter	Maximum noise level 1.0 m (39.4 in) in any direction from PWM filter dBA
MV3PWM071A5 MV3PWM140A5 MV3PWM099A6	30
MV3PWM242A6 MV3PWM364A5	61
MV3PWM382A6 MV3PWM566A5	62.5

2.12 Standards

The ALSPA MV3000e AEM product complies with the standards listed below.

Safety

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

Electromagnetic Compatibility (EMC)

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

In particular, this includes the following immunity requirements:

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

Ratings/Performance

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

3. Installation

3.1 Introduction

This section covers everything which should be considered for the successful installation of a basic ALSPA MV3000e AEM drive, to ensure long and trouble-free operation. The AEM drive considered here is a Sinusoidal Front End (SFE), comprising a bi-directional converter used as a mains bridge, feeding an identical bi-directional converter connected as a machine bridge. The procedures given here will also enable the easy installation of other configurations.

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

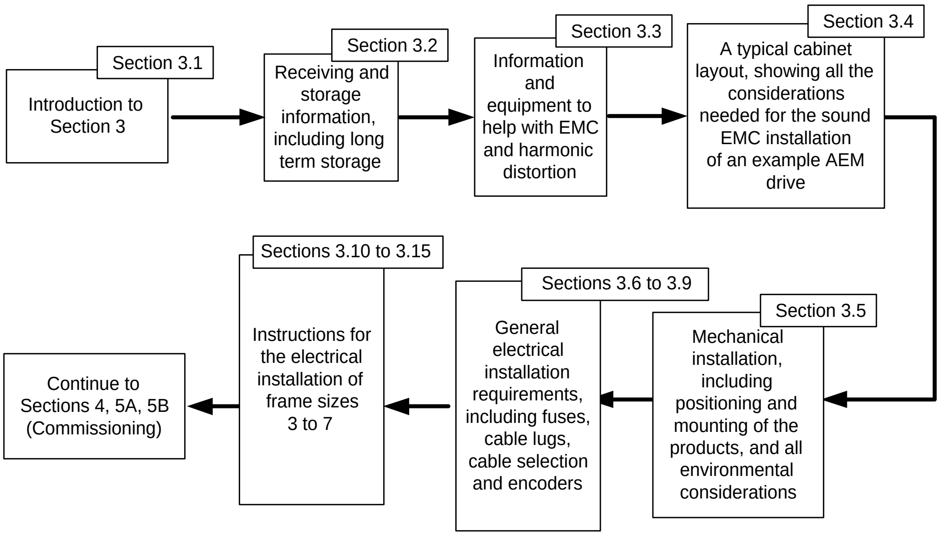


Figure 3-1 Installation overview

3.2 Receipt of Equipment

3.2.1 Inspection and 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 **Converteam** 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.

If the product is not to be installed immediately:

- Re-pack it in its original packaging material. If this is not possible it should be enclosed in polythene sheet to protect it from the ingress of dust.
- Store it in a clean, dry atmosphere, preferably at room temperature, ensuring that the storage environment meets the requirements of Section 2.8.
- 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.

Note: PWM filter modules MV3PWM071A5, MV3PWM140A5 and MV3PWM099A6 should not be left unsupported in an upright position. When not in use, they should be laid on their left hand face (when viewed from the front).

3.2.2 Handling

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

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

Frame size 7 converters 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).

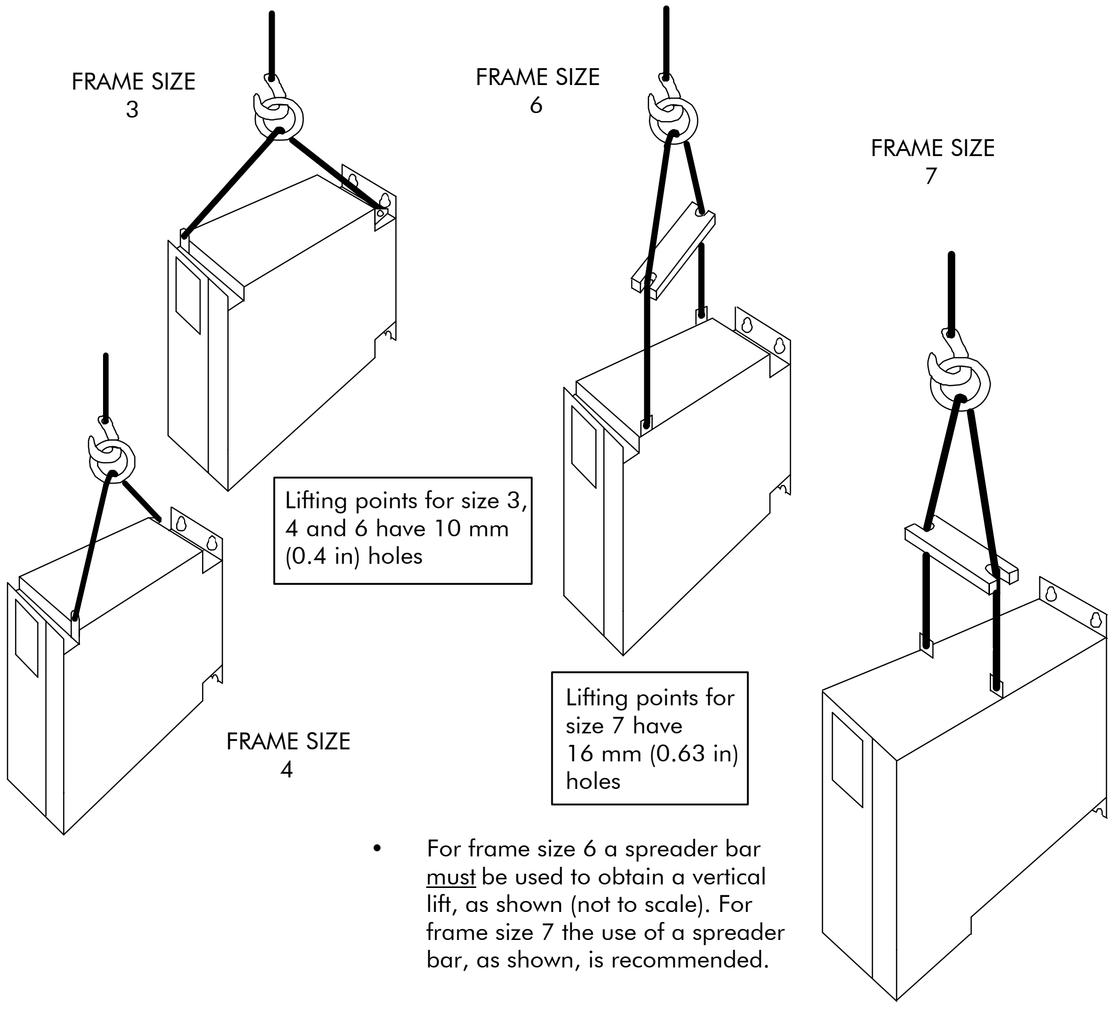


Figure 3-2 Lifting a MicroCubicle™

3.3 Harmonic Recommendations

3.3.1 AC Line Reactors

When the bi-directional converter is configured as a mains bridge, it must be used with ancillary components to form a Sinusoidal Front End, as shown in Figure 2 at the front of this manual. The input AC line reactors (part /01 and part /02) are mandatory functional elements and must be fitted. In conjunction with the PWM filter they reduce the harmonics generated by the SFE. Types and specifications are given in Section 2.

The line reactors are fitted with thermistors to protect them against overheating in the event of malfunction. The thermistors in reactors part /01 and /02 should be wired in series as shown in Figure 2 and connected to the converter PTC input.

3.3.2 PWM Filters

The 3-phase PWM filter functions in conjunction with the AC line reactor to prevent the MV3000e PWM switching frequency and its harmonics from being impressed on the mains supply. The PWM filter must not be used for any other purpose.
The PWM filter is required to achieve compliance with the distortion specification in Section 2.9.3. It is connected as shown in Figure 2 on Page iii at the front of this manual. The filter is enclosed and is force-cooled to prevent overheating.

The filter connections are fused to protect the filter and cables in the event of filter malfunction. The fuse indicator switch is wired back into the interlock circuit to shut down the converter.

Note: The various units have slightly different circuit configurations of resistors and capacitors. Failure of a component within a unit may or may not blow fuses.
In the cases where a component failure does not cause fuses to blow, the filter would provide some filtering depending on which component had failed. In some cases there would still be a degree of filtering between all three phases, while in others there would be filtering only between one pair of phases.
The result would be that more PWM ripple than normal could be imposed on the mains supply. See Section 6 for details of monthly protective maintenance checks on PWM filters.

A thermostat is fitted within the PWM filter to protect against excessive overheating. This is wired to the converter interlock in series with the PWM filter fuse indicator switch, so that if the filter temperature is excessive the converter will shut down to prevent damage. The thermostat is rated at 240 V, 10 Amps AC.

Mechanical and electrical data for the PWM filters is given in Section 2.5. Details of typical fuse holders with integral "fuse blown" indicators are provided in Section 3.6.

3.4 EMC Recommendations

The ALSPA MV3000e AEM drive products comply with the requirements of IEC 61800-3 (EN 61800-3), EMC product standard for power drive systems, provided that they are installed and used in accordance with the instructions in this manual.

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

For compliance with the limits of EN 50081-2 or the Class A limits of CISPR 11 or the “first environment” limits of IEC 61800-3, an EMC filter is fitted between the mains network and the AC line reactor part /01, as shown in Figure 2 at the front of this manual.

3.4.1 EMC Filter and Capacitors

EMC capacitors and an EMC filter may optionally be fitted.

EMC filtering will be required if the mains bridge is installed on a public low voltage supply which also supplies domestic premises (“first environment” according to IEC 61800-3). 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 filtering 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 network, any commutation notches from these converters must not exceed 40% depth.

Refer to the AEM MicroCubicle™ buyers' guide for details.

3.4.2 Cabinet Layout for EMC Compliance

The layout for a typical cabinet installation of an AEM drive, for EMC compliance, is shown in Figure 3-3. Wiring should obey the following segregation rules where possible:

1. Power input and output wiring must be separated by ≥300 mm (12 in).
2. Control and power wiring must be separated by ≥300 mm (12 in) except when crossing, which must be at 90^{o}.
3. If an EMC filter is fitted, cables on the input side of the filter must be separated from cables and components on the drive side of the filter (e.g. AC line reactor from input cables).

The mains bridge, ancillary components and machine bridge must be mounted in the same metallic enclosure. If, due to size constraints this is not possible, the enclosures should be metallically bonded to each other or connected via screened cable or conduit.

If an EMC filter is fitted, it must be in direct metallic contact with the panel on which the bi-directional converters are mounted. The gland for the motor cable screen must also have a direct metallic contact to this panel.

Note: Figure 3-3 is a mechanical representation. Refer to Figure 2 at the front of this manual for the electrical interconnection diagram, including motor earthing (grounding) and bonding etc.

The layout shown in Figure 3-3 is suitable for smaller size systems, with only the line reactor (part /02) floor mounted. Larger systems have other large auxiliary components which may also require floor mounting.

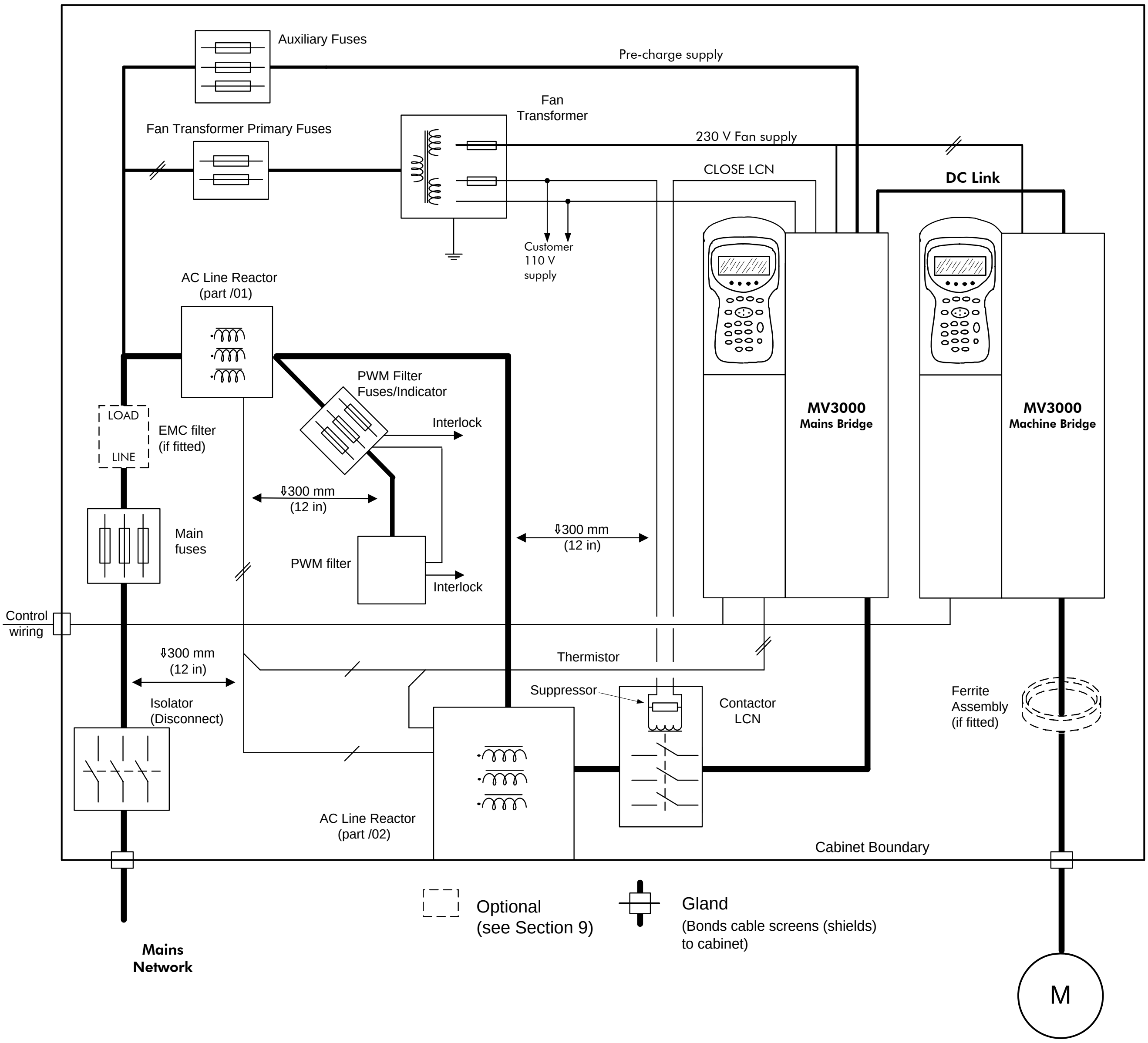


Figure 3-3 Typical cabinet layout for EMC compliance

3.5 Mechanical Installation

WARNING

All items exposing high voltage must be placed in a suitable enclosure with restricted access.

Note: A list of ancillary items exposing high voltage is given in Section 3.15.

WARNING

- **Air used to cool the product is unfiltered. Air ejected from the product may contain foreign particles. Air outlets should deflect the air away from the eyes.**
- **The combined audible noise emitted by fans in an installation can be greater than 70 dB(A), dependent on the air flow path.**
  Measure the audible noise level in the installation.
  When the audible noise level exceeds 70 dB(A), appropriate warning notices should be displayed.
- **Items marked with weights greater than 20 kg should only be moved with lifting apparatus.**

3.5.1 Cooling and 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.

All converters comply 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 2.8, which includes requirements where a dirty air kit is to be fitted.

Environment

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

The operating environment must comply with the requirements in Section 2.8.

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.

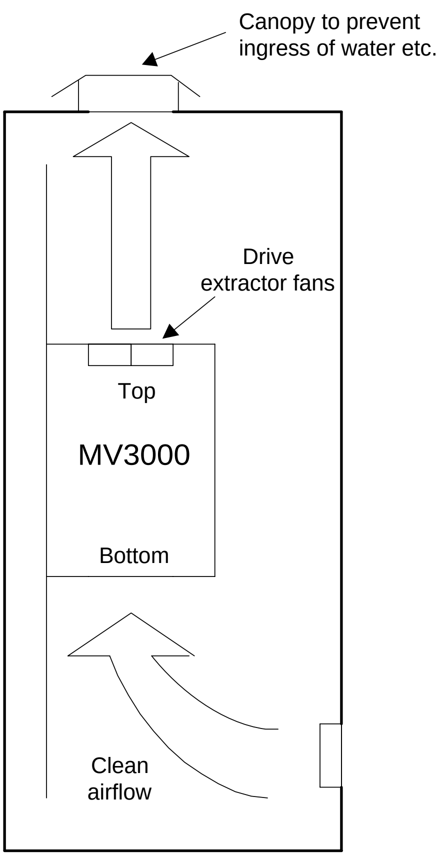


Figure 3-4 Typical airflow arrangement

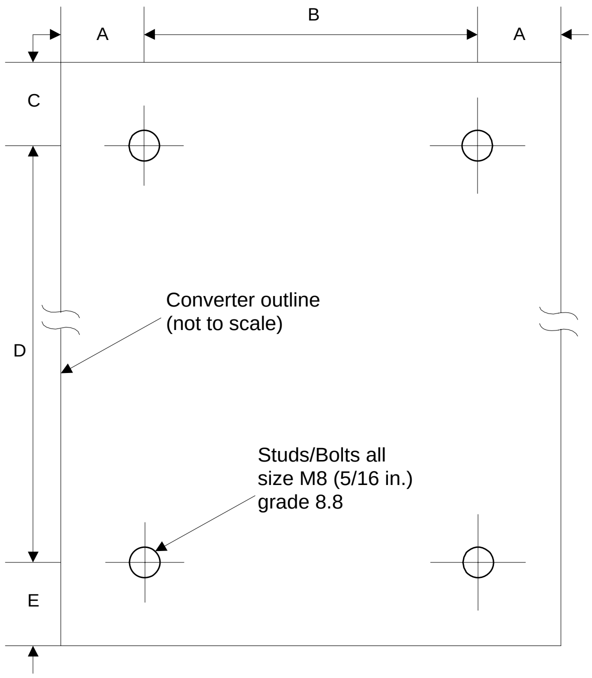


Figure 3-6 Bolt/stud locations for mounting the converter on a panel

Noise Levels

The maximum acoustic noise levels generated by ALSPA MV3000e converters are shown in Section 2.11.

3.5.2 Clearances and Mounting Distances

The minimum acceptable clearances for ventilation are shown in Figure 3-5.

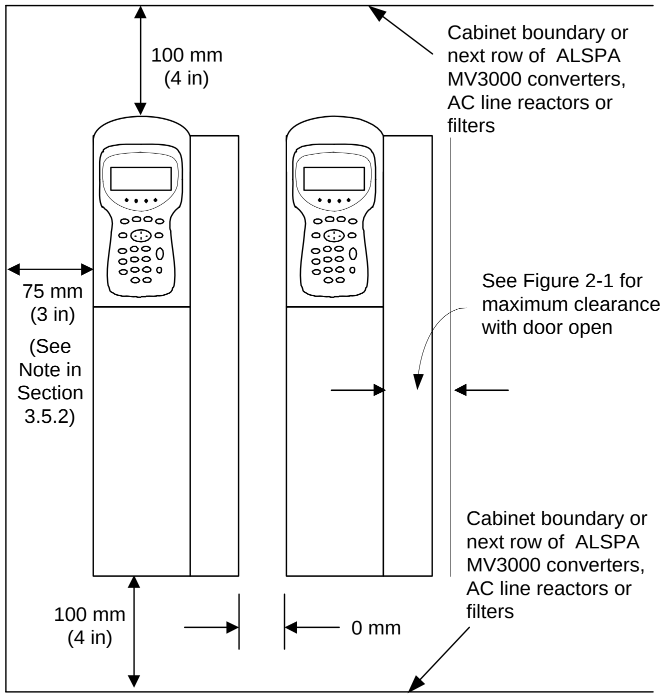


Figure 3-5 Minimum recommended clearances

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

3.5.3 Mounting Checklist

When mounting the product the following five items should be considered, in the order shown:

1. The position of mounting studs/bolts for all converter frame sizes are shown in Figure 3-6 and Table 3-1. If “dirty air” ventilation is to be used with cabinet mounting, allow space for ducting cut-outs in the panel, above and below the converter. See step (2).
2. 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.
3. 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.
4. Install any required options that fit inside the MicroCubicle™. Installation instructions are provided in the associated publications – refer to Section 9 for available options
5. Mount the converter and ancillary components in the cabinet.

3.6 Electrical Installation - General

This section contains details on connecting an AEM drive, comprising a SFE connected to a machine bridge, for a basic application. Details include:

- Fuse ratings, cable sizes and selection.
- Power wiring, mains network and DC link wiring, torque settings.
- Control wiring, for control and monitoring.

Table 3-1 Position of mounting studs/bolts

Dimension mm (in)	Frame Size			
	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)

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

he front of this manual a simple wiring diagram (Figure 1) and a brief description of input/output (I/O) (Table 1) are located, together with the interconnection diagram of a typical AEM drive (Figure 2).

3.6.1 Protection devices

WARNING
High leakage current
This equipment and the driven motor(s) must be earthed (grounded).

CAUTION
Ensure that all conductors connected to this equipment are mechanically restrained.

Product Isolation

The AEM 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 Section 2.2).

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

Recommended Fuses

Section 2.2 gives the current rating of fuses recommended to protect the power and auxiliary cables connected to the mains network. Section 2.6.2 gives the current rating of fuses recommended to protect the cables connected to the primary of the fan transformer. The fuses are shown in 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

Examples - Bussmann LPS_RK_SP
- Bussmann LPJ_SP

248-12, or class J fuses
according to UL 248-8

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.

PWM Filter Fuses

The PWM filter fuses protect the filter under fault conditions. Ratings for the fuses are given in Section 2, Table 2-2.

While these fuses have the utilisation categories given above, they must be monitored by a normally closed blown fuse indicator wired into the mains bridge interlock line (see Section 3.3.2). This may be achieved by either:

- striker pin fuses in a special fuseholder.

Example: Ferraz Shawmut "French ferrule" gG fuse with striker in a Ferraz Shawmut CMS fuse block with trip indicator;

OR

- by connecting a fuse monitoring breaker across the fuses.

Example: Siemens 3RV3611-0BD10 fuse monitoring breaker.

3.6.2 Cable Lugs and 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.

Table 3-2 Suitable stud sizes, cable lugs and torque settings

Frame Size	Stud Size	Use Lug Size	Torque Settings Nm	Torque Settings 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

3.7 Cable Selection

All cables must have copper conductors.

Cable sizes must comply with local safety regulations.

Power cables are annotated ① and ⑤ in the interconnection diagram Figure 2, at the front of this manual. Cables rated 70°C (158°F) to 120°C (248°F) can be used. Converters rated below 100 A mains or motor current (frame size 3 and some in frame size 4) can also accept cables rated at 60°C (140°F).

Cables annotated ② to ④, ⑥ and ⑦ in Figure 2 can be rated 60°C (140°F) to 90°C (194°F). However, the PWM filter can also accept cables rated 120°C (248°F).

3.7.1 AC Power Cable Selection

AC power cables are annotated ① on the interconnection diagram Figure 2.

Table 3-3 shows the maximum permitted and typical cable sizes for each converter.
In the table, converters are grouped by voltage grade as given in Sections 2.1 and 2.2.
The cable data shown for each voltage grade is valid for that voltage grade only. The typical cable sizes are based on 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 AC Power cable sizes for SFE power wiring and for motor connection to machine bridges

Drive	Frame Size	Max. Permitted Cable Sizes (Physical Limitation)			Typical Sizes (1.1 overload duty)			Typical Sizes (1.5 overload duty)		
		Metric Sizes	AWG/MCM Sizes		Metric Sizes	AWG/MCM Sizes		Metric Sizes	AWG/MCM Sizes	
		mm^2	AWG	MCM	mm^2	AWG	MCM	mm^2	AWG	MCM
400 V										
MV3071J5A1	3	50	1	-	25	3	-	16	4	-
MV3140J5A1	4	95	4/0	-	70	2/0	-	50	1/0	-
MV3364J5A1	6	2x240	-	2x500	240	-	2x300	185	-	500
MV3566J5A1	7 (Note 1)	2x300	-	2x600	2x240	(Note 2)		2x185	-	2x500
480 V										
MV3071J5A1	3	50	1	-	25	4	-	16	6	-
MV3140J5A1	4	95	4/0	-	50	2/0	-	35	1	-
MV3364J5A1	6	2x240	-	2x500	185	-	500	120	-	350
MV3566J5A1	7	2x300	-	2x600	2x185	-	2x500	2x185	-	2x400
600 V										
MV3099J6A1	4	95	4/0	-	35	1	-	25	3	-
MV3242J6A1	6	2x240	-	2x500	120	-	350	95	-	250
MV3382J6A1	7	2x300	-	2x600	240	-	2x350	240	-	2x300
690 V										
MV3099J6A1	4	95	4/0	-	35	1	-	35	2	
MV3242J6A1	6	2x240	-	2x500	120		300	95	4/0	
MV3382J6A1	7	2x300	-	2x600	240		2x300	185		500

(continued)

Drive	Frame Size	Max. Permitted Cable Sizes (Physical Limitation)			Typical Sizes (1.1 overload duty)			Typical Sizes (1.5 overload duty)		
		Metric Sizes	AWG/MCM Sizes		Metric Sizes	AWG/MCM Sizes		Metric Sizes	AWG/MCM Sizes	
		mm^2	AWG	MCM	mm^2	AWG	MCM	mm^2	AWG	MCM
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.									

3.7.2 DC Link Cable Selection

DC link cables are annotated ⑤ on the interconnection diagram, Figure 2 (Page iii).

Note: To minimise circuit inductance and radiated noise, the DC+ and DC– cables must be bound together.

Table 3-4 shows maximum permitted and typical DC link cable sizes for each converter. In the table, converters are grouped by order of AC voltage grade as given in Sections 2.1 and 2.2. The cable data shown for each voltage grade is valid for that voltage grade only.

The cable rating conditions are the same as detailed for AC power cable selection in Section 3.7.1.

Table 3-4 DC link cable sizes

Drive	Frame Size	Max. Permitted Cable Sizes (Physical Limitation)			Typical Sizes (1.1 overload duty)			Typical Sizes (1.5 overload duty)		
		Metric Sizes	AWG/MCM Sizes		Metric Sizes	AWG/MCM Sizes		Metric Sizes	AWG/MCM Sizes	
		mm^2	AWG	MCM	mm^2	AWG	MCM	mm^2	AWG	MCM
400 V										
MV3071J5A1	3	50	1	-	25	2	-	16	3	-
MV3140J5A1	4	95	4/0	-	70	4/0	-	35	2/0	-
MV3364J5A1	6	2x240	-	2x500	2x120	-	2x500	185	-	2x350
MV3566J5A1	7 (Note 1)	2x300	-	2x600	2x240	(Note 2)		2x150	(Note 2)	
480 V										
MV3071J5A1	3	50	1	-	16	2	-	16	4	-
MV3140J5A1	4	95	4/0	-	50	3/0	-	35	1/0	-
MV3364J5A1	6	2x240	-	2x500	185	-	2x350	150	-	2x250
MV3566J5A1	7	2x300	-	2x600	2x185	(Note 2)		2x150	(Note 2)	
600 V										
MV3099J6A1	4	95	4/0	-	35	2/0	-	25	1	-
MV3242J6A1	6	2x240	-	2x500	150	-	2x250	95	-	400
MV3382J6A1	7	2x300	-	2x600	2x120	-	2x600	240	-	2x500
690 V										

(continued)

Drive	Frame Size	Max. Permitted Cable Sizes (Physical Limitation)			Typical Sizes (1.1 overload duty)			Typical Sizes (1.5 overload duty)		
		Metric Sizes	AWG/MCM Sizes		Metric Sizes	AWG/MCM Sizes		Metric Sizes	AWG/MCM Sizes	
		mm^2	AWG	MCM	mm^2	AWG	MCM	mm^2	AWG	MCM
MV3099J6A1	4	95	4/0	-	35	2/0	-	25	1	
MV3242J6A1	6	2x240	-	2x500	120	-	400	95	-	300
MV3382J6A1	7	2x300	-	2x600	240	-	2x400	185	-	2x350
Notes 1 and 2: See Notes 1 and 2 to Table 3-3.										

3.7.3 DC Link Cable Screening and Segregation

Inside the MicroCubicle™ the DC link cables need not be screened.

Outside the MicroCubicle™, to avoid EMC problems, the DC link cables 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 AEM cabinet and the converters.

Outside the MicroCubicle™ the DC link cables must be segregated from other cables by at least 300 mm (12 in).

3.7.4 Ancillary and Control Cable Selection

The size of ancillary and control cables is shown in Table 3-5, which gives typical sizes and the range of sizes that will fit into the terminals. The typical sizes are for metric sizes rated 70˚C (158˚F) and AWG sizes rated 75˚C (167˚F). The symbols ② to ④, ⑥ and ⑦ cross-refer to annotations on the interconnection diagram Figure 2.

Table 3-5 Ancillary and control cable sizes

Cable Function		Terminal Capability: Range mm² from *	to	Range AWG from *	to	Typical mm²	AWG
Auxiliary Supply ②	Frame size 3 and 4	+		+			1 14
	Frame size 6 and 7		0.5 2.5		22 12		2.5 14
Control wiring ④			0.5 2.5		20 14		1 16
PWM filter ⑥☞ for	MV3PWM071A5	0.5	4	22	12	2.5	14
	MV3PWM140A5	1.5	4	22	8	2.5	10
	MV3PWM364A5	2.5	35	12	2	10	8
	MV3PWM566A5	2.5	35	12	2	25	4
	MV3PWM099A6	0.5	4	22	12	1	14
	MV3PWM242A6	2.5	35	12	2	6	8
	MV3PWM382A6	2.5	35	12	2	16	6
Fan transformer	⑦ Primary winding	0	4	22	10	1	14
	③ Secondary (110 V)	1	2.5	18	14	1.5 (both secondaries)	14
	③ Secondary (230 V)	1	4	18	10		

\+ Size limits depend on crimps used for Auxiliary terminals AUX R, AUX S and AUX T. See Table 3-2.

* While the minimum sizes quoted will fit in the terminal, cable rating conditions will usually dictate a larger size.

☞ The length of cable between the filter and R5, S5 and T5 (see page iii) should not exceed 4 m (13 ft).

The earth (ground) cable should be the same size as one of the filter input cables unless local regulations state that a larger size must be used.

3.7.5 Cable Segregation

Control and encoder cables must be segregated from power cables as shown in Section 3.4.2.

3.8 Suitability of Motors and 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).

The DC link voltage in a MV3000e AEM drive is higher than the DC link in a diode rectifier-fed drive. For the default DC link voltage, motors with Insulation Peak Voltage Withstand ratings of

1420 V (400 V motors), 1560 V (480 V motors), 2000 V (600 V motors) and 2250 V (690 V motors) can be operated with ALSPA MV3000e AEM drives 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 415 V and with an enhanced insulation system for voltages greater than 415 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 ALSPA MV3000e, dv/dt filters cannot be used. Cable the motor directly to the drive.

If (outside the drive enclosure) parallel motor cables or parallel motors 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 **Converteam** for details.

3.9 Encoders and Encoder Cables

Encoder Selection

Only RS422A type encoders can be used (a marker pulse is only required when using the drive's position controller). The ALSPA MV3000e is equipped with two power supplies to power various encoders which may be used. There are two acceptable types of encoder:

1. Encoders requiring +5 V supply and producing RS422 output.

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

2. Encoders requiring +24 V supply and producing RS422 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 ALSPA MV3000e, the pulse train must be RS422.

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:

1. The line count must be less than or equal to 64 000 pulses per revolution (due to the drive software).

2. The time delay between an edge on encoder channel A and an edge on channel B must be greater than 333 ns at the required top speed of the motor.

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

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

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

   where :

Min_Edge_Separation is in electrical degrees
Required_Top_Speed is in rev/min.

If the encoder manufacturer quotes a "scribing error" in electrical degrees, then Min_Edge_Separation = 90 - Scribing_Error.

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

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.

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 earthed (grounded) at both ends, as shown in Figure 1 inside the front cover.

3.10 Access to Electrical Connections

(Refer to **Error! Reference source not found.**)

WARNING

- **Wait at least 5 minutes after isolating supplies and check that voltage between DC+ and DC- has reduced to a safe level before working on this equipment.**
- **This equipment may be connected to more than one live circuit. Disconnect all supplies before working on the equipment.**

CAUTION

- **Where nuts, bolts and washers are supplied fitted to the terminal busbar, remove these fasteners, place the user's crimp (or busbar) directly against the terminal busbar of the unit and re-fit 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 following warning, adjacent to the enclosure isolator (disconnect switch):

WARNING
Wait at least 5 minutes after isolating supplies and check that the voltage between DC+ and DC– has reduced to a safe level before working on this equipment.

The location (typical) of electrical connectors is shown in Figure 3-7. All converters have two doors, for accessing control and power connections. A left-hand yellow "control" door gives access to the control connections and a right-hand grey "power" door gives access to the power connections.

Sections 3.11 and onwards show how to connect control and power wiring to the mains and machine bridges.

Access to Control Connections

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

Access to Power Cable Connections

1. Open the control door as above.
2. Release the two screws "A" securing the "power" door. Swing the door open.

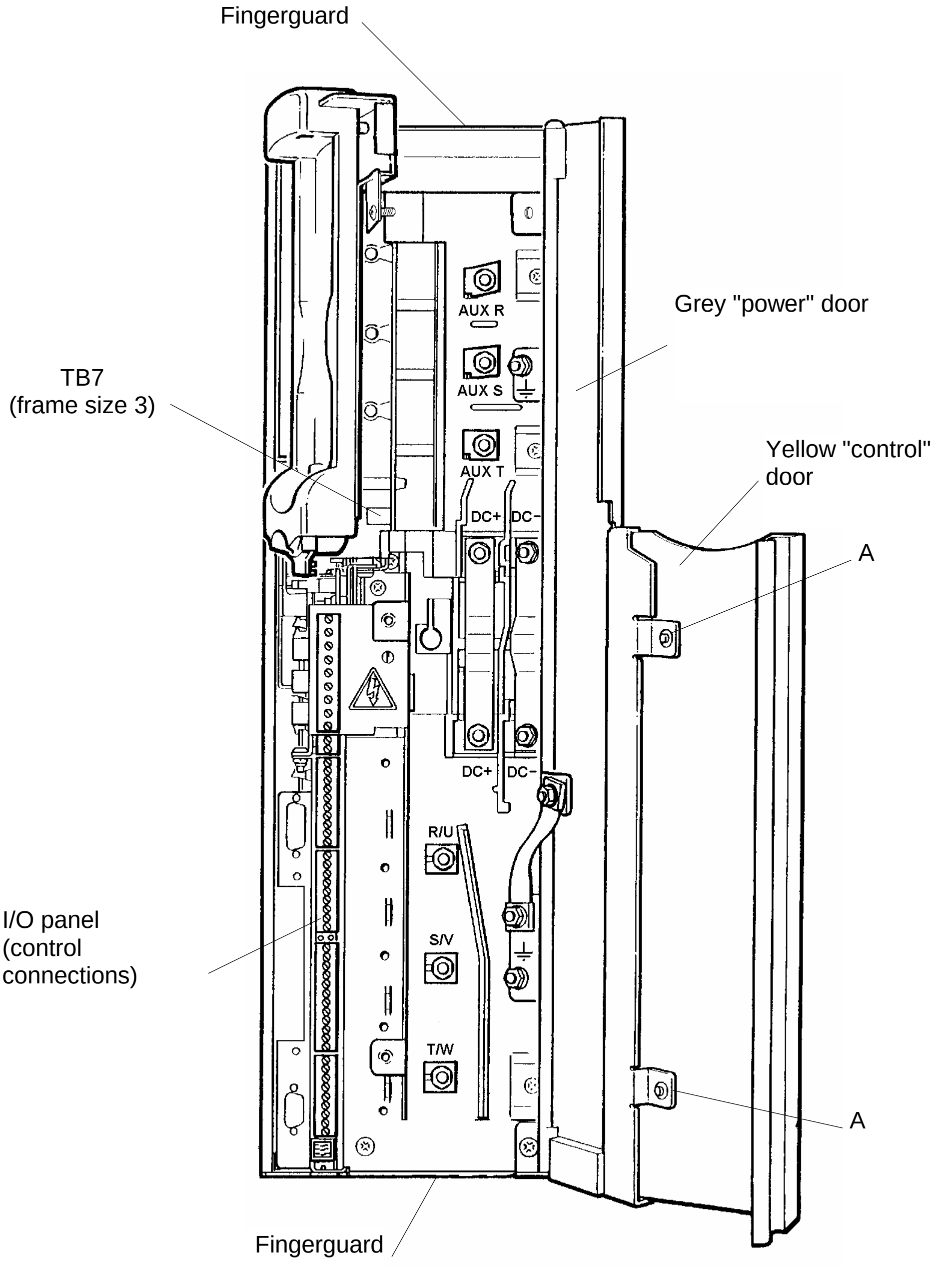


Figure 3-7 Typical front view with doors open, showing electrical connectors (frame size 3 shown)

3.11 Control Connections

(Refer to Figure 3-8)

Note: Use wiring size as specified in Section 3.7.4.

Mains and Machine Bridges
1. Refer to Figure 3-8 for the I/O panel layout, and to the default wiring diagrams and I/O table at the front of this manual for specific connections. Connect control cables to the I/O panels of both bridges as required. Multicore screened cables should always be used, except for TB1, TB2 and TB3, where screened cable is not mandatory.
2. 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.
Note: The cable screen must always be connected to the MV3000e. The other end of the cable screen should also normally be earthed (grounded) at the associated equipment. If the other equipment does not provide galvanic isolation, the cable screen must be earthed at both ends.
3. Use cable ties to secure all cables to cable saddles.
4. Secure the plastic access cover over TB1 using the screw provided.
5. The control door cannot be locked. However, the user may connect voltages in excess of 42.4 V d.c. to TB3. If this is done and compliance with UL508C or CSA C22.2 No. 14 is required, the MicroCubicle™ must be installed in a suitable enclosure with restricted access.
6. External cables must be secured as close as possible to the MicroCubicle™.

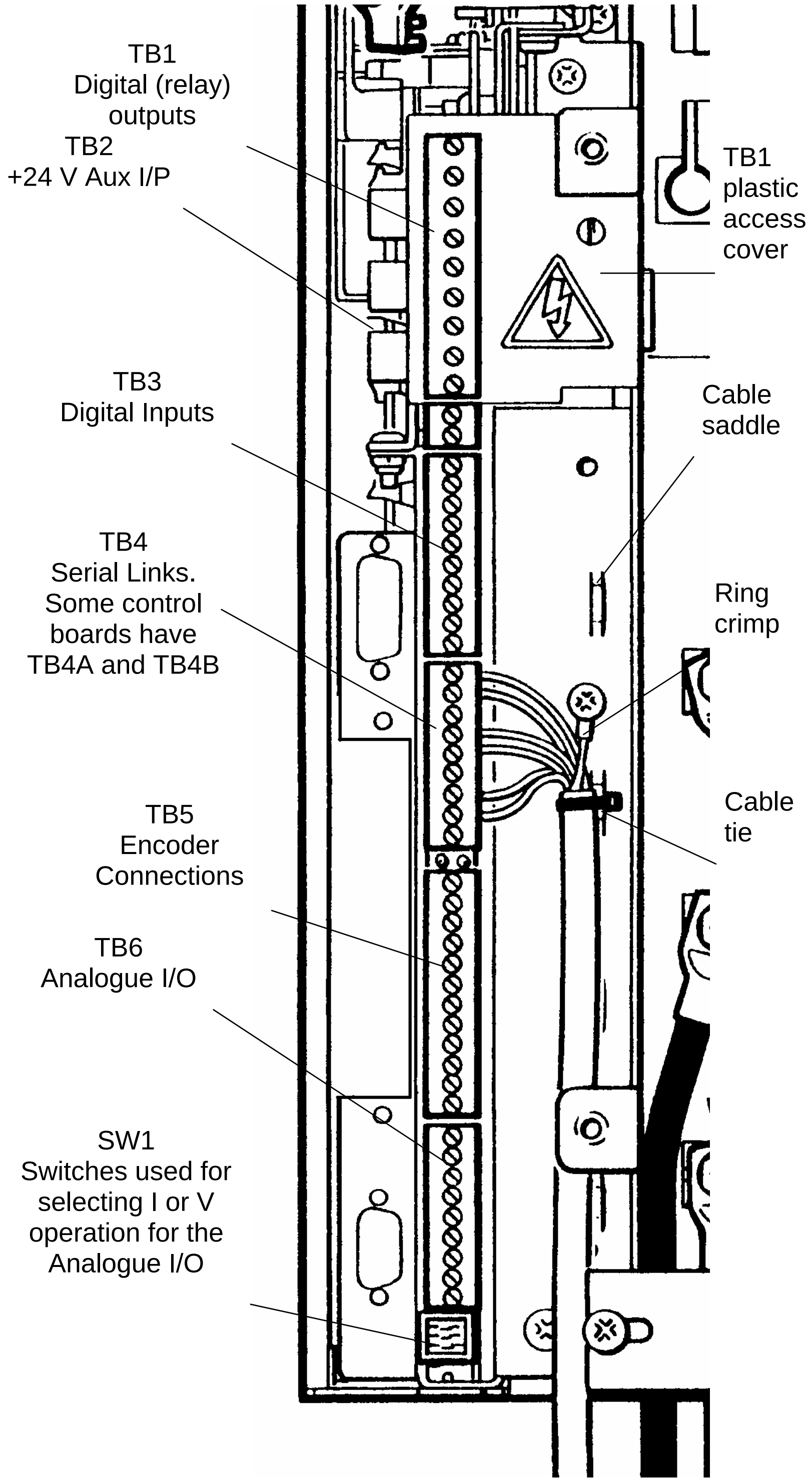


Figure 3-8 Control connections

3.12 Cable Connections - Frame Sizes 3 and 4

Frame sizes 3 and 4 have a similar connector layout. Figures 3-9 and 3-10 show details for frame size 4.

Notes:

1. For cable sizes refer to Tables 3-3 to 3-5, and to Figure 2 at the front of this manual.
2. External cables must be secured as close as possible to the MicroCubicle™; for frame size 4 this includes the fan supply cable.

3.12.1 AC Power and Motor Cables

(See Figure 3-9)

Mains Bridge	Machine Bridge
AC Power Cables	**Motor Cables**
1. If the cable from the line contactor LCN is screened or armoured, terminate the screen at a gland where the cable enters the MicroCubicle™.	1. Connect the motor cables, via the bottom fingerguard, to terminals R/U, S/V and T/W on the bridge.
2. Connect the cable from the line contactor LCN terminals R7, S7 and T7, via the bottom fingerguard, to terminals R/U, S/V and T/W on the bridge. Take great care to maintain correct phasing.	2. Terminate the motor cable screen or conduit at at the gland where the cable exits the cabinet.
3. Connect a cable from the bridge earth (ground) terminal marked ⏚, via the bottom fingerguard, to a convenient point on the metal component panel. The earth cable must be the same size as one phase of the power cable unless local safety regulations require a larger size.	3. Connect a cable from the bridge earth (ground) terminal marked ⏚ via the bottom fingerguard, to a convenient point on the metal component panel. The earth cable must be the same size as one phase of the motor cable unless local safety regulations require a larger size.
4. Tighten the connections to the torque value given in Table 3-2 (page 3-9) for the appropriate bridge size.	4. Tighten the connections to the torque value given in Table 3-2 (page 3-9) for the appropriate bridge size.
5. Restrain external cables as close as possible to the MicroCubicle™.	5. Restrain external cables as close as possible to the MicroCubicle™.

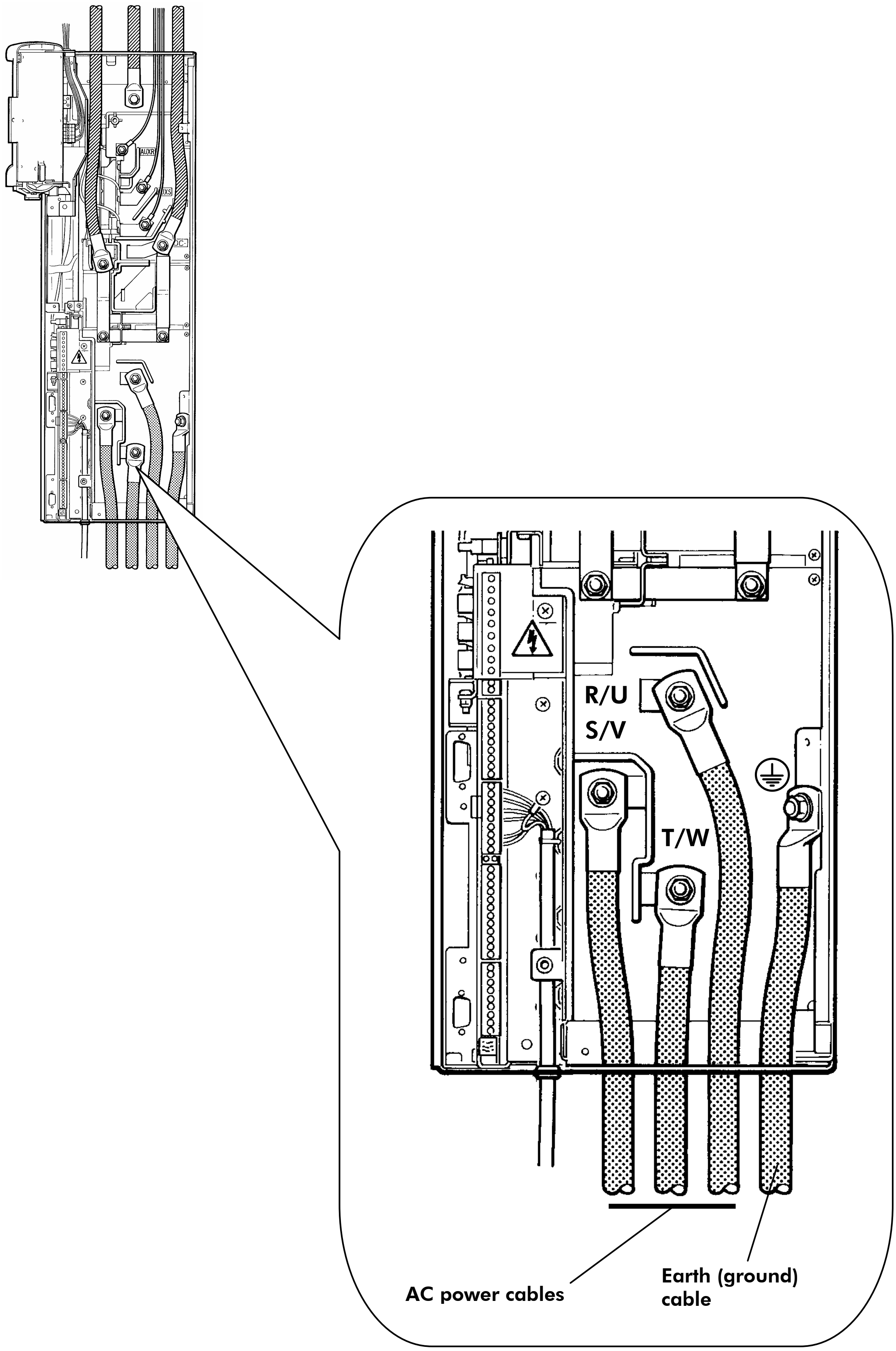


Figure 3-9 Power connections to frame sizes 3 and 4 (frame size 4 shown)

3.12.2 DC Link and Ancillary Cables

(See Figure 3-10)

<table>
<tr><th>Mains Bridge</th><th>Machine Bridge</th></tr>
<tr><td colspan="2">DC Link Cables

1. Connect the DC link cables between the DC+ terminal on the mains bridge and the DC+ terminal on the machine bridge, and between the DC– terminal on the mains bridge and the DC– terminal on the machine bridge. Run the cables out via the plastic fingerguard at the top of the chassis. Run the DC+ and DC– cables together.
2. Tighten the connections to the torque value shown in Table 3-2 (Page 3-9).</td></tr>
<tr><td>Auxiliary Supply Cables

1. On frame size 3 products only, loosen the captive screw "B" securing the keypad harbour to floating nut "C". Swing the harbour out to gain access to the auxiliary supply connectors.
2. Refer to Figure 3-10 and connect the fused auxiliary supply cables to terminals AUX R, AUX S and AUX T, via the top fingerguard to allow cable access. It is very important to maintain correct phasing such that mains network phase R is connected through to AUX R etc.
3. Connect the auxiliary supply earth (ground) terminal marked ⏚ to a convenient point on the metal component panel. The earth cable must be the same size as one phase of the power cable unless local safety regulations require a larger size.
4. Torque the connections to the values shown in Table 3-2 (Page 3-9).</td><td></td></tr>
<tr><td>Contactor LCN Wiring

1. Using suitable wire (see Section 3.7.4), connect the fan transformer 110 V to TB7 pin 1 on the pre-charge pcb and connect the contactor coil to TB7 pin 2. Route the wiring up via the bottom of the chassis, alongside the control wiring.
2. Use cable ties to secure wiring to the DB panel (size 4) and to the control wiring cable saddles (Figure 3-8).</td><td></td></tr>
</table>

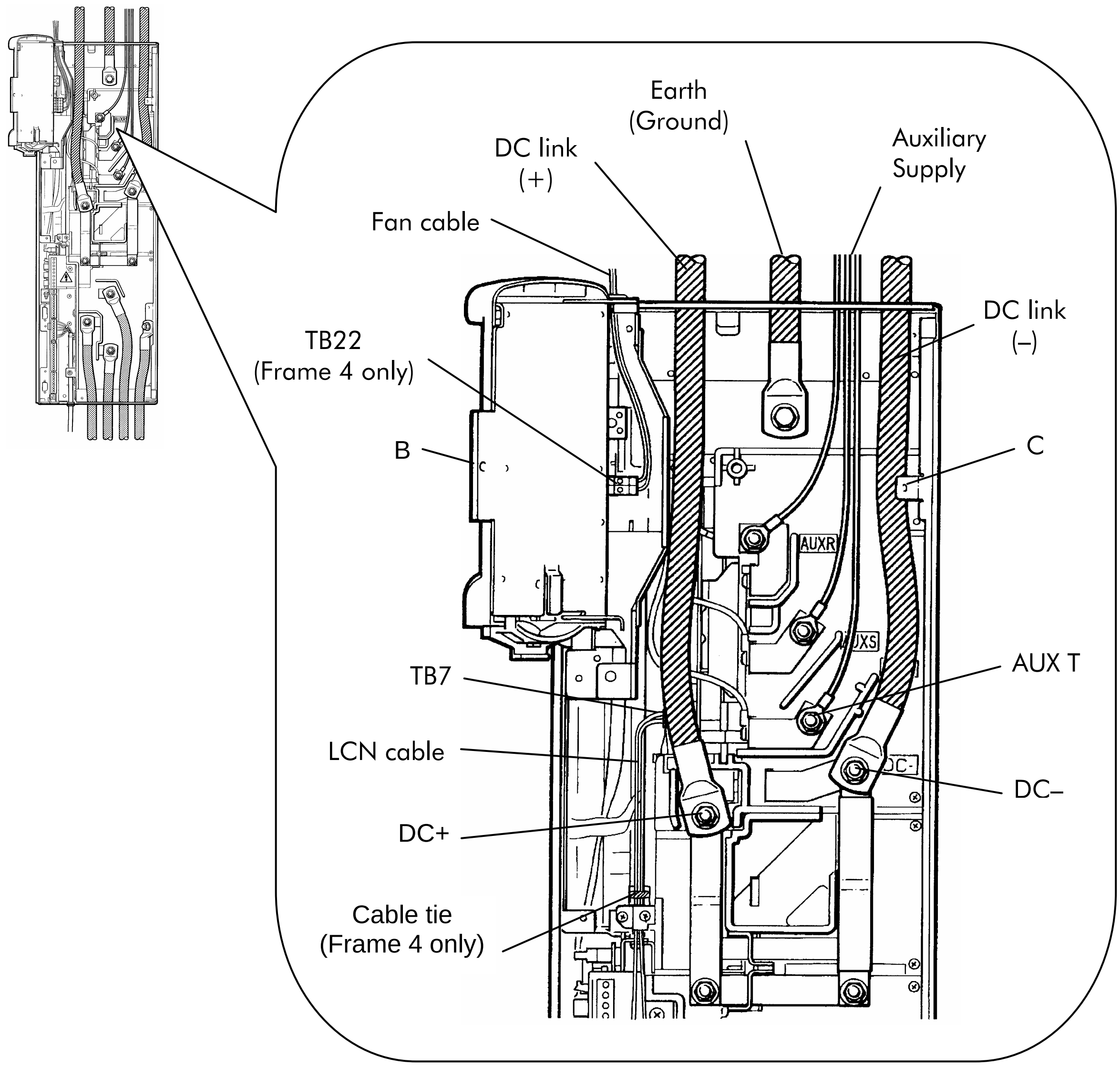


Figure 3-10 Ancillary wiring for frame sizes 3 and 4 (frame size 4 shown)

Mains and Machine Bridges
Fan Supply Cable (frame size 4 only) 1. Loosen the captive screw "B" securing the keypad harbour to floating nut "C". Swing the harbour out to gain access to fan connector TB22. 2. Connect the fused 230 V AC fan supply from the fan transformer, through the grommet at the top of the chassis, to TB22 terminals 2 and 4. **Note:** The fused 230 V AC from the fan transformer can supply the fans of two converters which have identical ratings. 3. Swing the keypad harbour into position and secure with the captive screw.

Referring to Figure 3-7, close the power door and secure with screws "A". Close the control door.

Restrain external cables as close as possible to the MicroCubicle™ chassis, this includes the fan supply cables for frame size 4 converters.

3.13 Cable Connections - Frame Size 6

Note: External cables must be secured as close as possible to the MicroCubicle™ chassis.

3.13.1 AC Power, Motor and DC Link Cables

(See Figure 3-11)

Note: Where parallel connections are made (see Figure 3-13) with smaller cable sizes, copper spacers have been provided to space the crimps off the busbars, as shown in Figure 3-14. Where sizes above 2 x 300 mm^2 are required (2 x 600 MCM), insulated busbars may be connected directly to the terminals.

<table>
<tr><th>Mains Bridge</th><th>Machine Bridge</th></tr>
<tr><td>AC Power Cables

1. Connect the AC power cables from terminals R7, S7 and T7 on line contactor LCN, via the bottom plastic fingerguard, to terminals R/U, S/V and T/W on the converter chassis, taking care to maintain correct phasing.

2. If the cable from line contactor LCN is screened or armoured, terminate the screen at a gland where the cable enters the cabinet.

3. Connect the chassis earth (ground) terminal marked ⏚ to a convenient point on the metal component panel. The earth cable must be the same size as one of the power cables unless local safety regulations require a larger size.

4. Tighten the connections to the torque value given in Table 3-2.

5. If the mains network cable is screened or armoured, terminate the screen at a gland where the cable enters the cabinet.</td><td>Motor Cables

1. Connect the motor cables via the bottom plastic fingerguard, to terminals R/U, S/V and T/W on the bridge.

2. Terminate the motor cable screen or conduit at at the gland where the cable exits the cabinet.

3. Connect the chassis earth (ground) terminal marked ⏚ to a convenient point on the metal component panel. The earth cable must be the same size as one of the motor cables unless local safety regulations require a larger size.

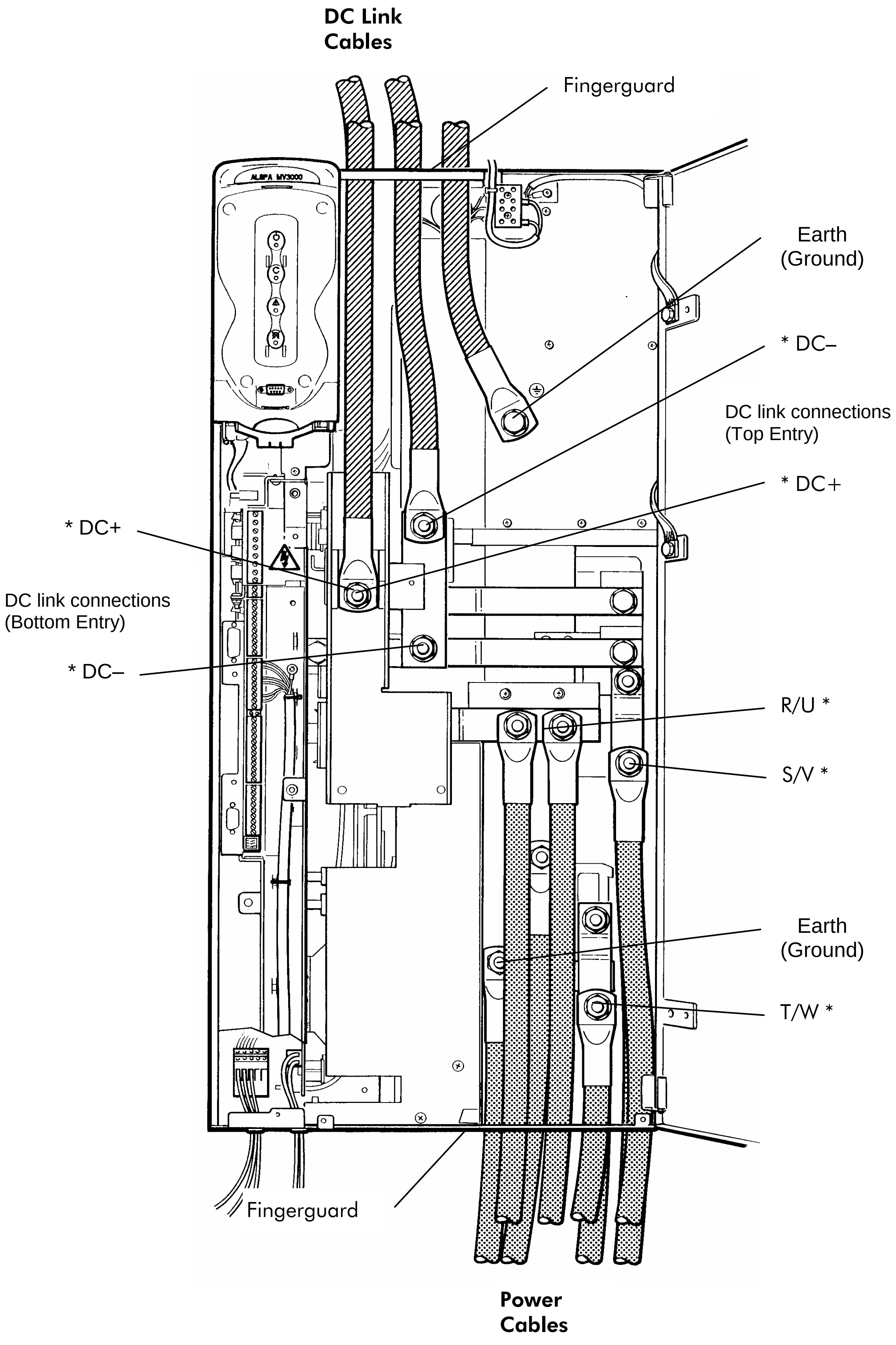
4. Tighten the connections to the torque value given in Table 3-2.</td></tr>
<tr><td colspan="2">DC Link Cables

The DC link cables can enter the converter chassis from either the top or the base, though top entry is preferred so as to give greater segregation from AC power cables.

1. Route the DC link cables from the SFE into the machine bridge via the top fingerguard.

2. Connect the DC link cables between the DC+ terminals on the mains and machine bridges, and between the DC– terminals on each bridge. Run the DC+ and DC– cables together.

3. Tighten the connections to the torque value shown in Table 3-2 (page 3-9).</td></tr>
</table>



* Where two cables are to be connected to one stud, see Figure 3-14

Figure 3-11 Power connections for frame size 6, showing parallel cabling

3.13.2 Ancillary Cables

(See Figure 3-12)

Note: Two grommets are packed separately and must be fitted in the positions shown.

Mains Bridge	Machine Bridge
Auxiliary Supply Cable Push the 3-phase auxiliary supply cable through the left-hand grommet at the base of the chassis and connect the cable to TB20 terminals AUX R, AUX S and AUX T. It is very important to maintain correct phasing, so that mains network phase R is connected through to AUX R etc. Refer to the interconnection diagram, Figure 2 on Page iii.	
Contactor LCN Wiring 1. Remove the M5 taptite screw (X) securing the plastic shroud to the fuse cover plate. 2. Withdraw the fuse cover plate by removing M5 taptite screws (Y) and (Z). 3. Using suitable wire (see Section 3.7.4), connect the fan transformer 110 V to TB7 pin 1 on the pre-charge pcb. Route the wiring up through the grommet on the converter base, beneath TB7. 4. Connect a similar wire from the contactor coil, up through the same grommet, to TB7 pin 2 on the pre-charge pcb. 5. Re-fit the fuse cover plate and plastic shroud using the three M5 taptite screws (X), (Y) and (Z).	
Fan Supply Cable Connect the fused 230 V AC fan supply from the fan transformer, via fingerguard at the top of the chassis, to fan connector TB22, terminals 2 and 4.	**Fan Supply Cable** Connect a fused 230 V AC fan supply via fingerguard at the top of the chassis, to fan connector TB22, terminals 2 and 4. Note that this supply can be taken from the SFE fan transformer 230 V output, which is fused for fans in two MicroCubicles™ of the same rating.

Referring to Figure 3-7, close the power door and secure with screws "A". Close the control door.

Restrain external cables as close as possible to the MicroCubicle™ chassis.

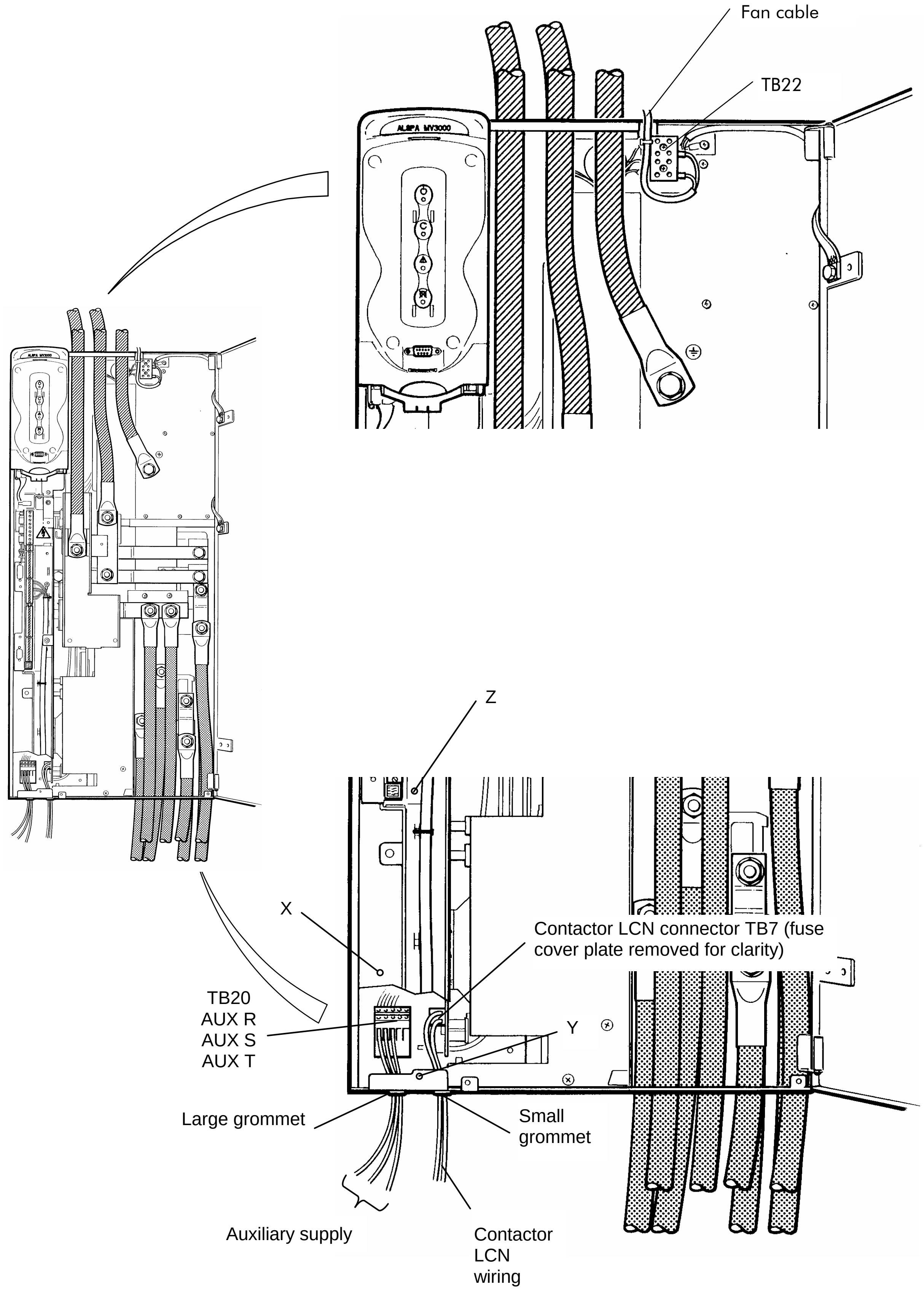


Figure 3-12 Ancillary wiring for frame size 6

3.14 Cable Connections - Frame Size 7

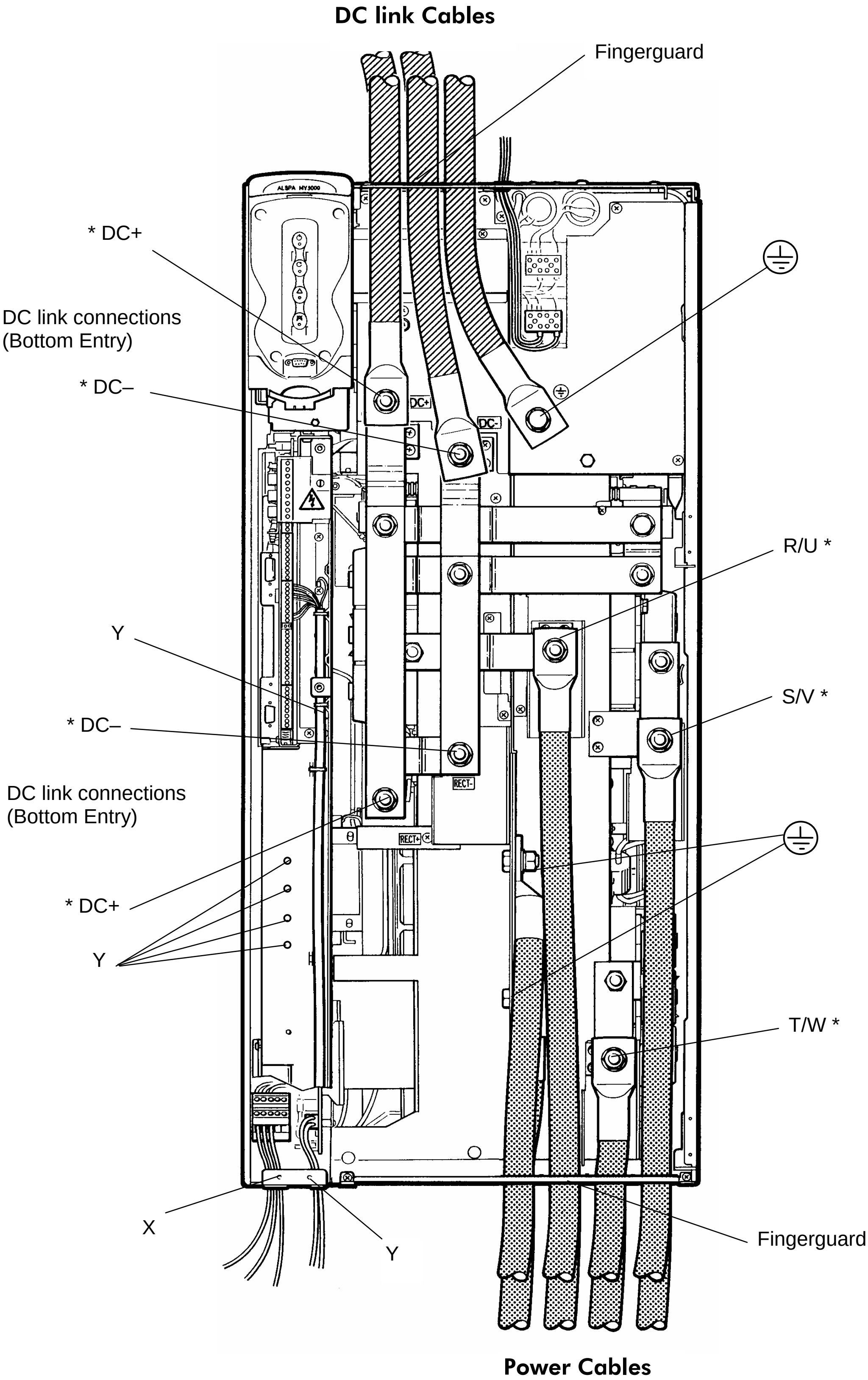
Note: External cables must be secured as close as possible to the Microcubicle™ chassis.

3.14.1 AC Power, Motor and DC Link Cables

(See Figure 3-13)

Note: Where parallel connections are made (see Figure 3-13) with smaller cable sizes, copper spacers have been provided to space the crimps off the busbars, as shown in Figure 3-14. Where sizes above 2 x 300 mm^2 are required (2 x 600 MCM), insulated busbars may be connected directly to the terminals.

Mains Bridge	Machine Bridge
AC Power Cables	**Motor Cables**
1. Connect the AC power cables from terminals R7, S7 and T7 on the line contactor LCN, through the bottom fingerguard, to terminals R/U, S/V and T/W on the converter chassis. Take care to maintain correct phasing.	1. Connect the motor cables, via the bottom fingerguard, to terminals R/U, S/V and T/W on the chassis.
2. If the cable from line contactor LCN is screened or armoured, terminate the screen at a gland where the cable enters the cabinet.	2. Terminate the motor cable screen or conduit at at the gland where the cable exits the cabinet.
3. Connect the chassis earth (ground) terminal marked ⏚ to a convenient point on the metal component panel. The earth cable must be the same size as one of the power cables unless local safety regulations require a larger size.	3. Connect the chassis earth (ground) terminal marked ⏚ to a convenient point on the metal component panel. The earth cable must be the same size as one of the motor cables unless local safety regulations require a larger size.
4. Tighten the connections to the torque value given in Table 3-2.	4. Tighten the connections to the torque value given in Table 3-2.
5. If the mains network cable is screened or armoured, terminate the screen at a gland where the cable enters the cabinet.	5. Terminate the motor cable screen or conduit at at the gland where the cable exits the cabinet.



* Where two cables are to be connected to one stud, see Figure 3-14

Figure 3-13 Power connections for frame size 7, showing parallel cabling

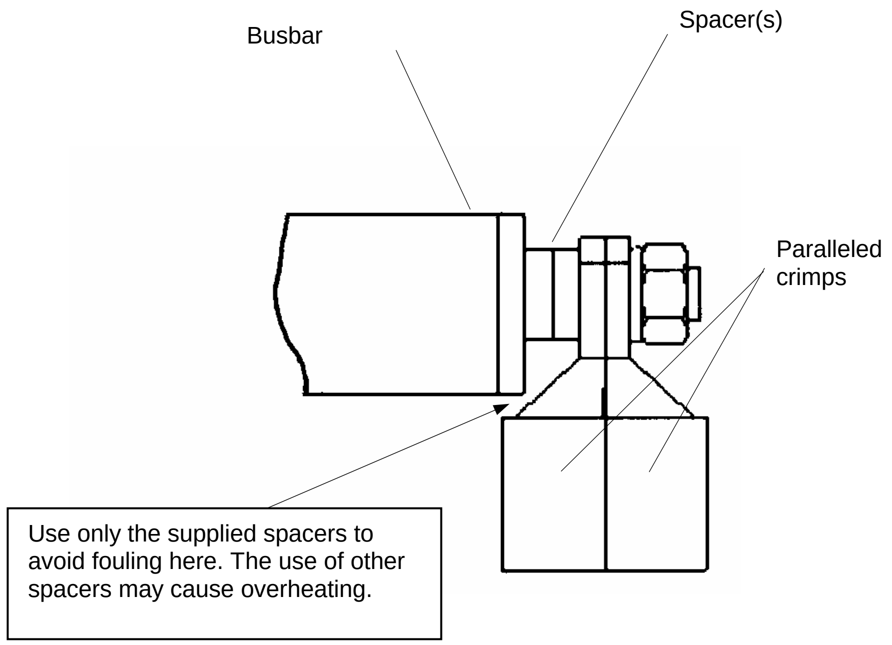


Figure 3-14 Use of spacers to avoid fouling busbar

<table>
<tr><th>Mains Bridge</th><th>Machine Bridge</th></tr>
<tr><td colspan="2">
DC Link Cables
(See Figure 3-13)

The DC link cables can enter the converter chassis from either the top or the base, though top entry is preferred so as to give greater segregation from AC power cables.

Note: DC link cables should exit/enter the mains and machine bridges by the same route, i.e. if the cables exit the mains bridge at the top, they should enter the machine bridge at the top.

1. Route the DC link cables from the mains bridge and into the machine bridge via the top fingerguard. Run the DC+ and DC– cables together.

2. Connect the DC link cables between the DC+ terminals on the mains and machine bridges, and between the DC– terminals on each bridge.

3. Tighten the connections to the torque value shown in Table 3-2 (page 3-9).
</td></tr>
</table>

3.14.2 Ancillary Cables

(See Figure 3-15)

Note: Two grommets are packed separately and must be fitted in the positions shown.

Mains Bridge	Machine Bridge
Auxiliary Supply Cable 1. Release the screw (A) securing the plastic shroud over connector TB20, rotate the shroud upwards and clip it behind dowel (B). 2. Push the 3-phase auxiliary supply cable through the left-hand grommet at the base of the chassis and connect the cable to TB20 terminals AUX R, AUX S and AUX T. It is very important to maintain correct phasing, so that mains network phase R is connected through to AUX R etc. Refer to the interconnection diagram, Figure 2, on Page iii. 3. Close and secure the plastic shroud.	
Contactor LCN Wiring 1. Refer to Figure 3-13. Remove the M5 taptite screw (X) securing the plastic shroud to the chassis. 2. Remove the six M5 taptite screws (Y) securing the fuse plate cover and withdraw the cover, complete with the plastic shroud. 3. Refer to Figure 3-15. Using suitable wire (see Section 3.7.4), connect the fan transformer to TB7 pin 1 on the pre-charge pcb. Route the wiring up through the grommet on the converter base, beneath TB7. 4. Connect a similar wire from the contactor coil, up through the same grommet, to TB7 pin 2 on the pre-charge pcb. 5. Refer to Figure 3-13. Re-fit the fuse cover plate and plastic shroud using the seven M5 taptite screws (X) and (Y).	

Fan Supply Cable	**Fan Supply Cable**
Connect the fused 230 V AC fan supply from the fan transformer, via fingerguard at the top of the chassis, to fan connector TB22, terminals 2 and 4.	Connect a fused 230 V AC fan supply via fingerguard at the top of the chassis, to fan connector TB22, terminals 2 and 4. Note that this supply can be taken from the AEM fan transformer 230 V output, which is fused for fans in two MicroCubicles™ of the same rating.

Referring to Figure 3-7, close the power door and secure with screws "A". Close the control door.

Restrain external cables as close as possible to the MicroCubicle™ chassis.

3.15 Ancillary Components

(See Figure 2 on Page iii)

WARNING
Fit suitable shrouds to items exposing high voltage to allow safe working within the enclosure.

Use cables as specified in Table 3-3 and 3-5 to interconnect the ancillary components of the SFE as shown in Figure 2 (at the front of this manual).

These components are:

1. AC Line reactor, parts /01 and /02 (See Note)
2. Line contactor (LCN)
3. PWM filter
4. PWM filter fuseholder assembly
5. Fan transformer
6. EMC capacitors (optional)
7. EMC filter(s) (optional)

Ensure that the specified fuses are fitted to the fan transformer and to the PWM filter fuseholder assembly.

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

Note: The fixing dimensions for the AC line reactors, given in Section 2, are intended for fixing the reactors to a cabinet floor or to a component panel. However, the reactors are designed to allow part /01 items to be stacked on top of part /02 items if desired. This is illustrated in Figure 3-16; the transformer frames are pre-drilled to facilitate stacking.

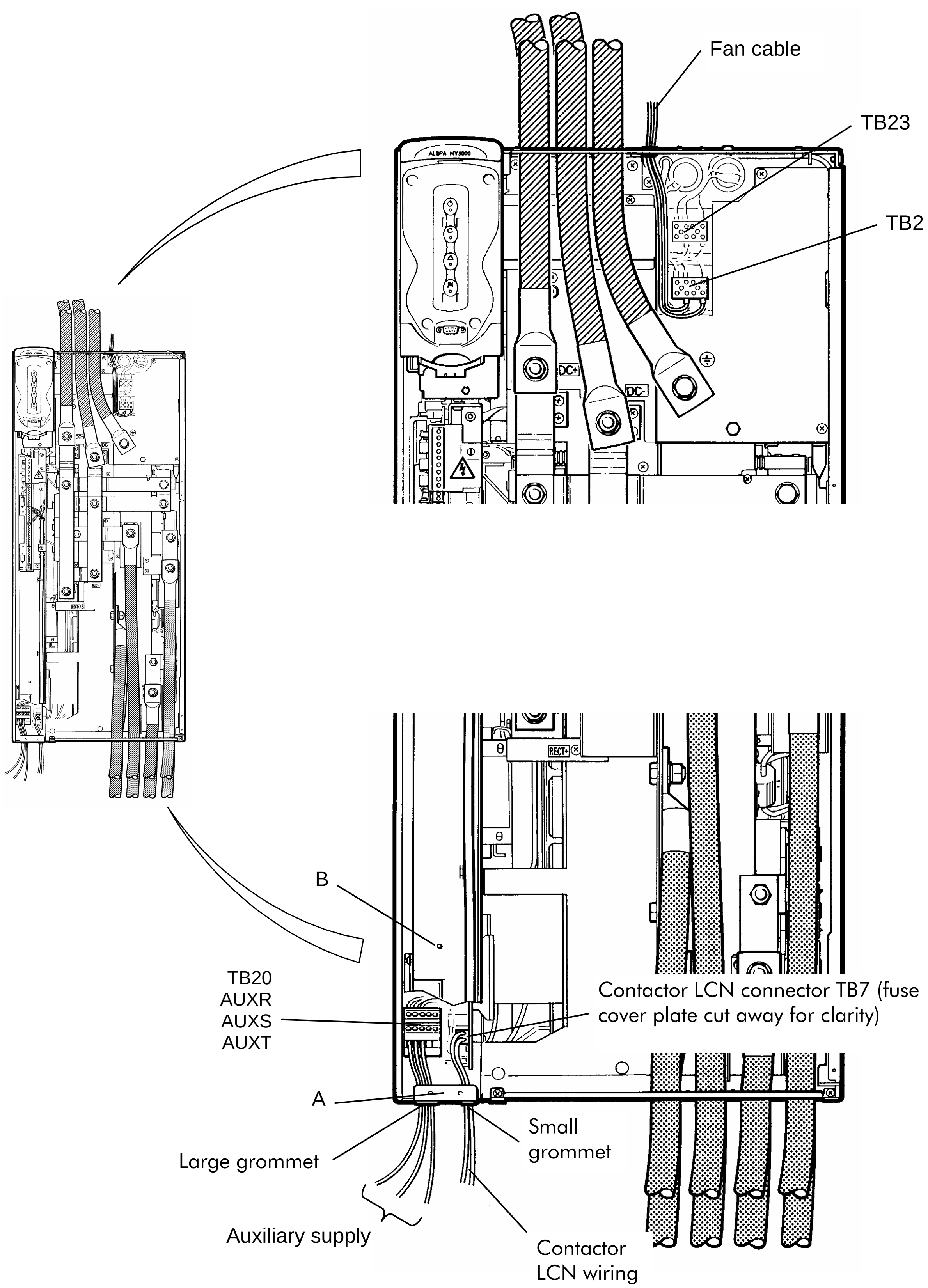


Figure 3-15 Ancillary wiring for frame size 7

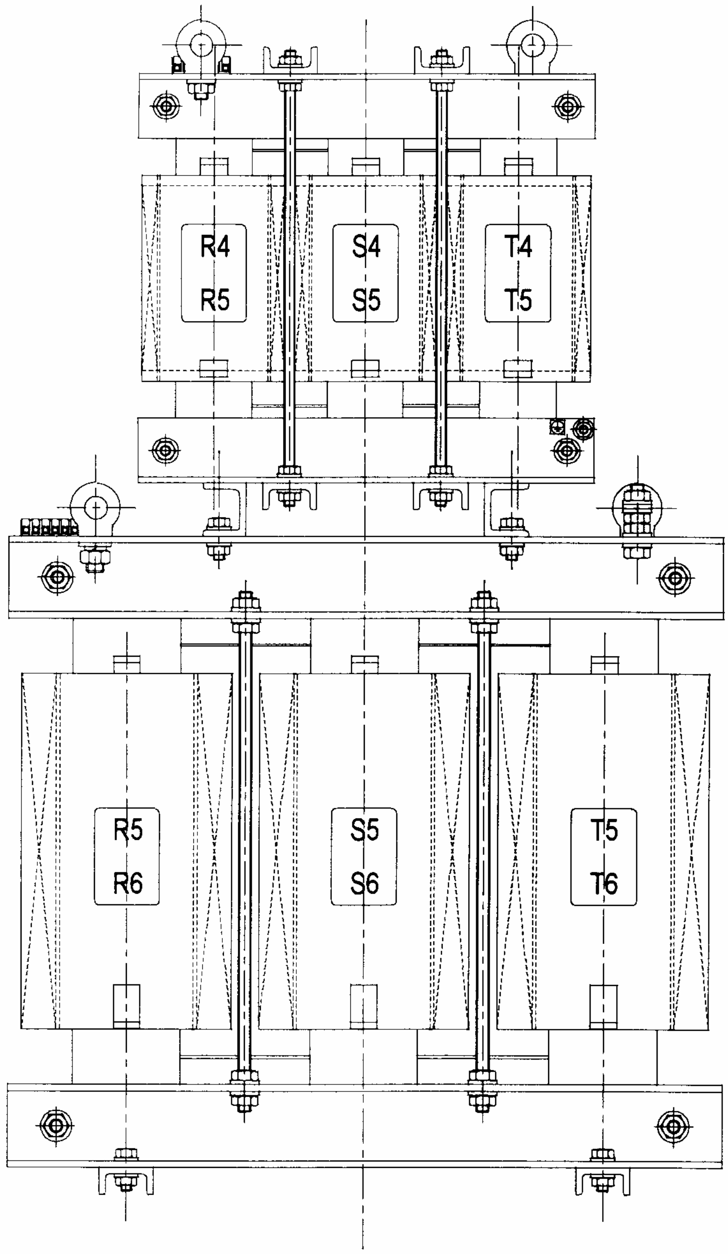


Figure 3-16 Illustration of stacked AC line reactors

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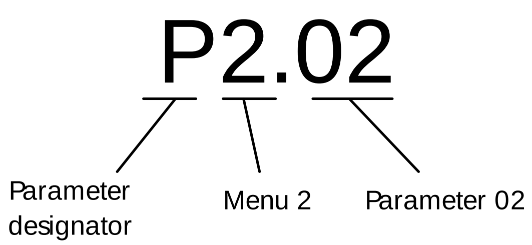
4. Using Menus and Parameters

4.1 Menu Structure Overview

4.1.1 Parameters

The ALSPA 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. Menus for the mains and machine bridges are similar, however the menu listing for mains bridges include four additional menus required for the active control of DC voltages. Complete menu listings are shown in Section 5A, Table 5A-1 for mains bridges and in Section 5B, Table 5B-1 for machine bridges. Menus and parameters are fully described in the optional Software Technical Manual T1679.

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.



4.2 Use of the Drive Data Manager™ (Keypad)

The Drive Data Manager™ provides keypad functionality to configure the converter, in addition to providing diagnostic functions and motor control for machine bridges.

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

4.2.1 Navigation Key

The 4-way Navigation key is used to navigate menus and parameters, and to edit parameter values. Navigation key functions are illustrated in Figure 4-1.

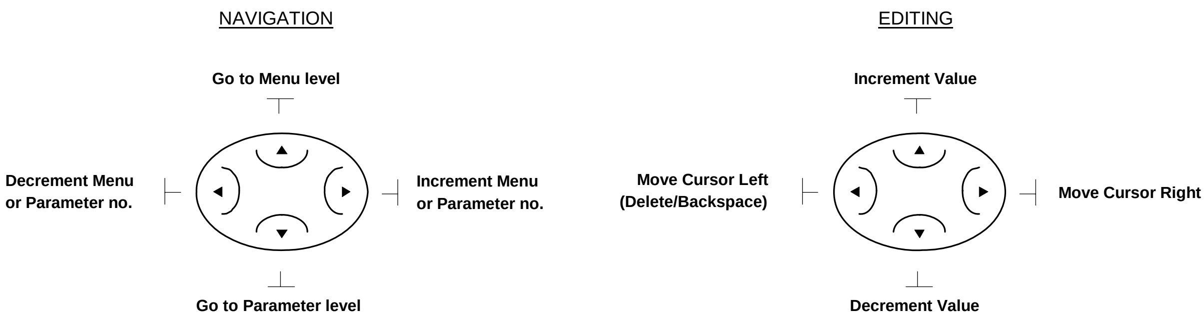


Figure 4-1 Drive Data Manager™ navigation key

4.2.2 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 4.2.6.

The example given in Figure 4-2 is the start-up screen, shown shaded, which displays the default value for P1.00.

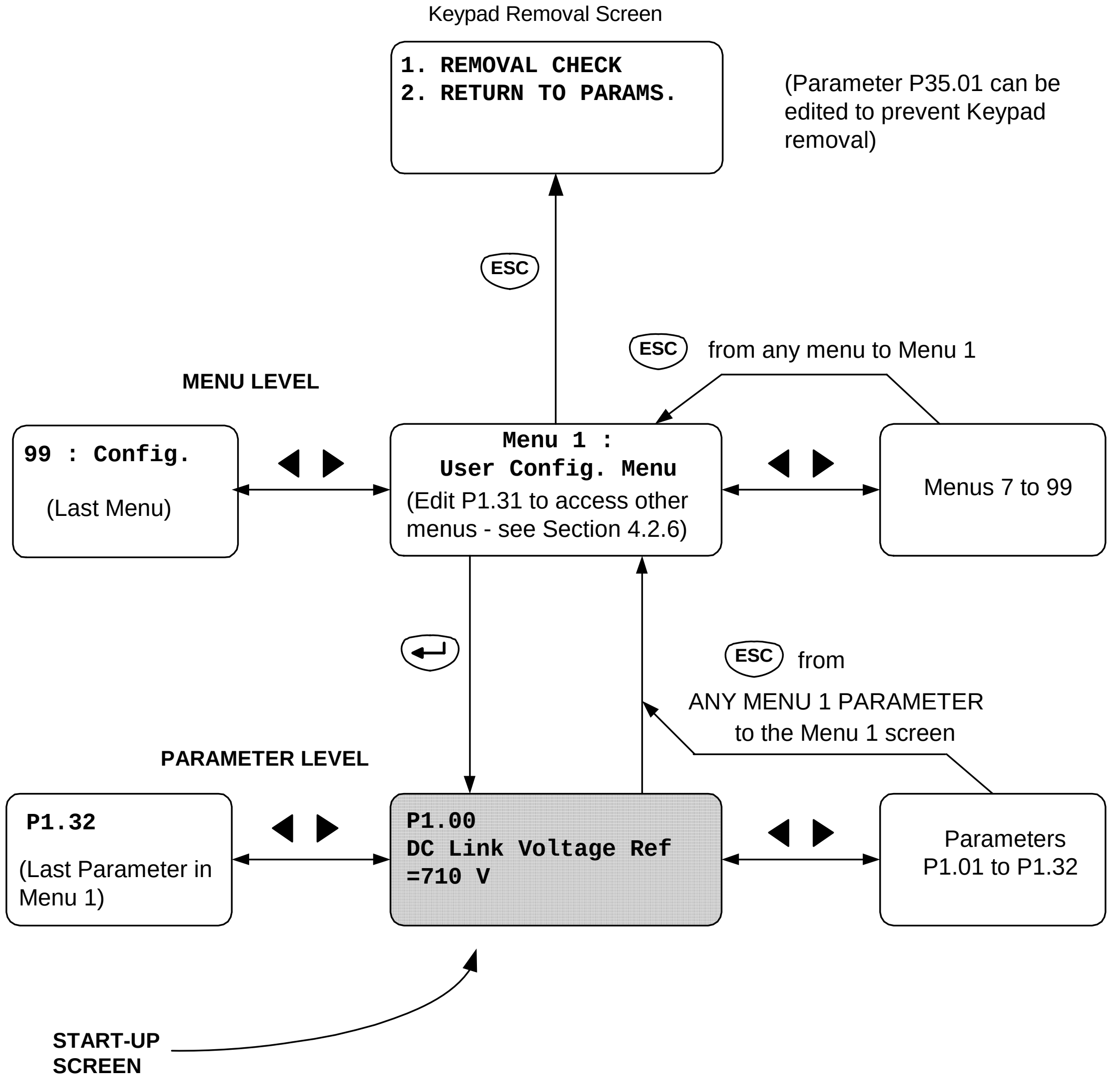


Figure 4-2 Navigating menus and parameters (example shows mains bridge)

4.2.3 Editing Parameters

Two types of parameter may be edited:

NUMERICAL parameters – to change the value

LIST parameters – to choose from a list

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.

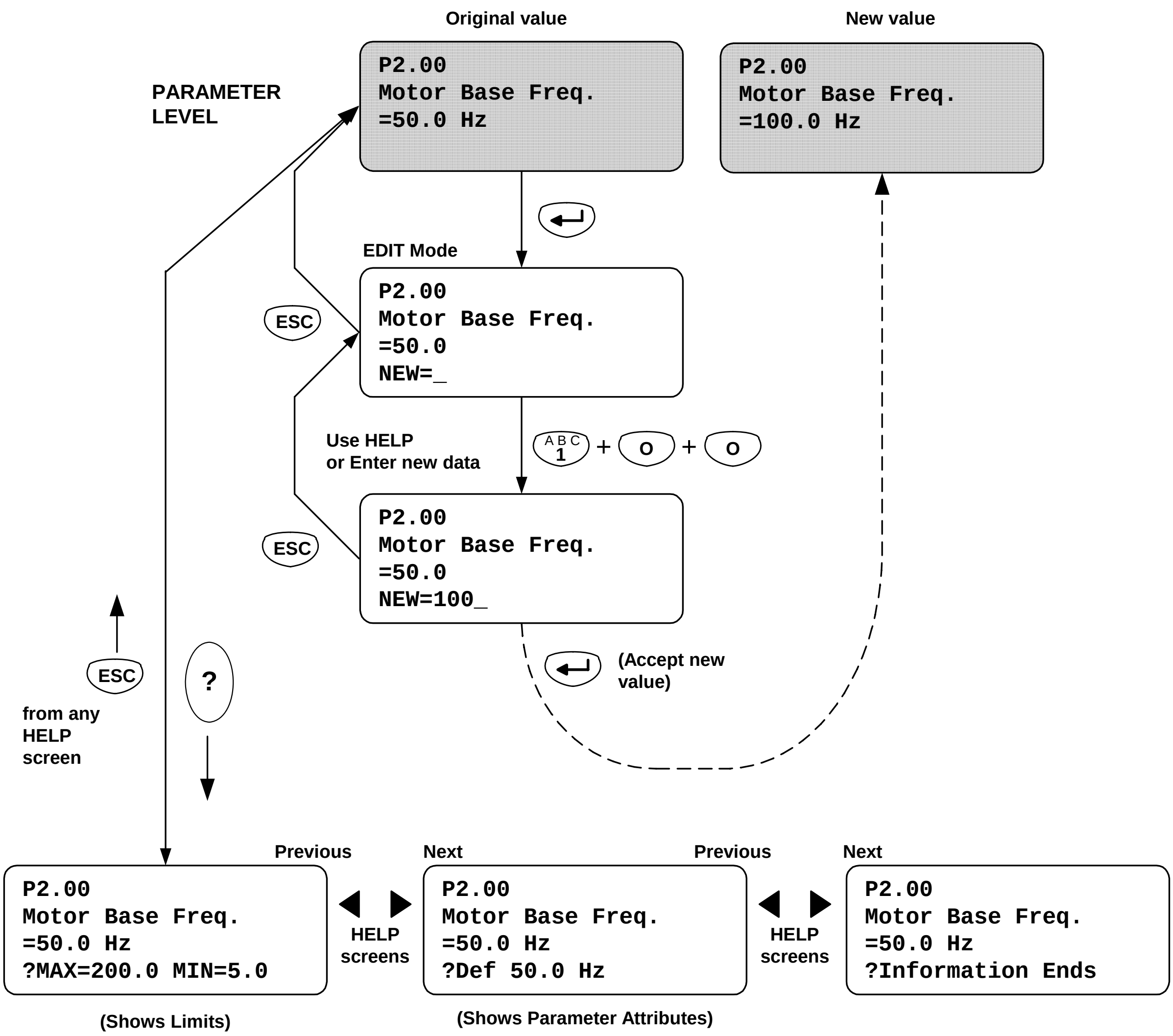


Figure 4-3 Editing a "numerical" parameter (example shows machine bridge)

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.

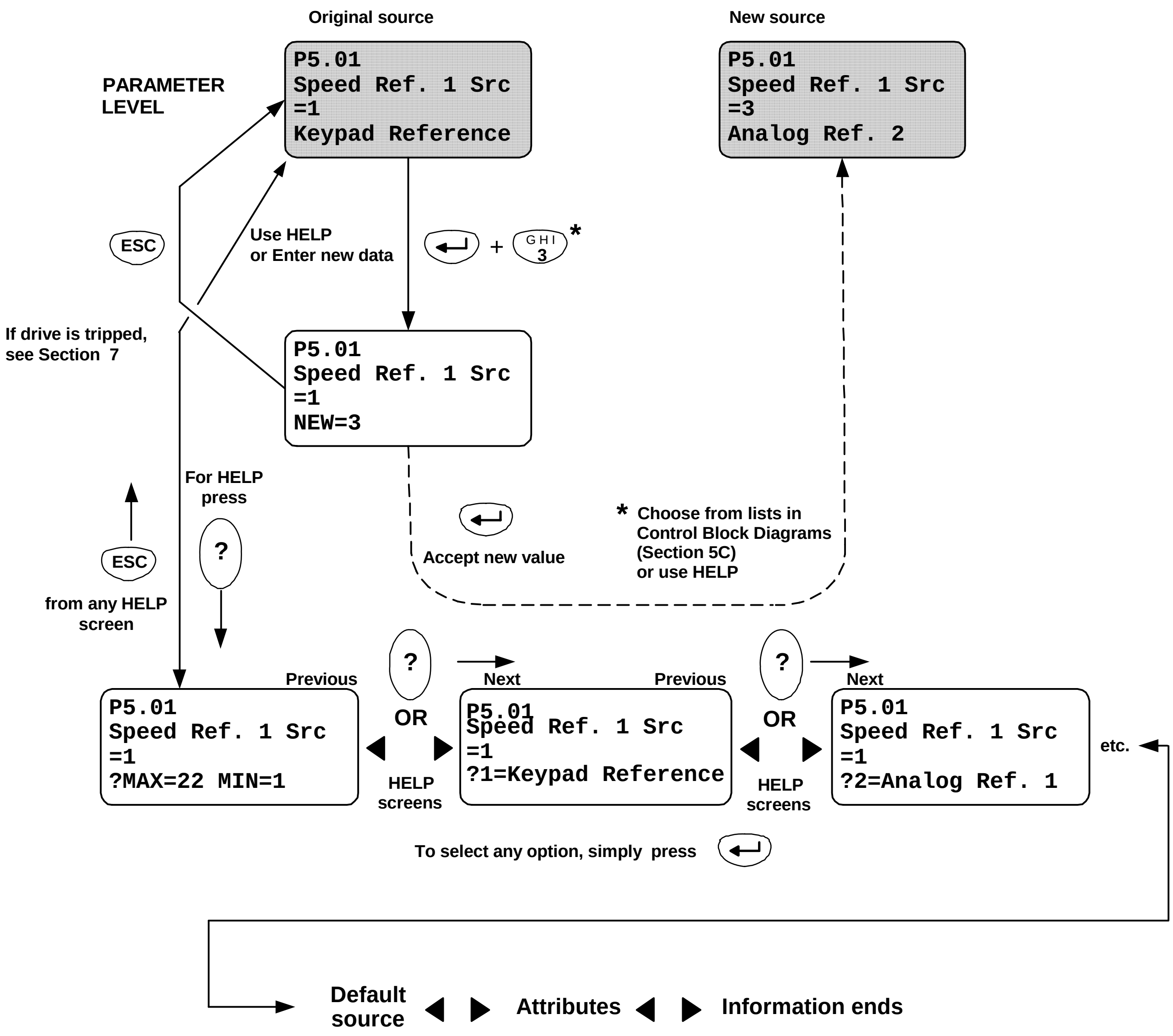


Figure 4-4 Editing a "list" parameter

4.2.4 Using the Keypad HELP (?) Key

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

4.2.5 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 :

4.2.6 Access to Other Menus (P1.31)

PQR 6	ABC 1	•	0	0	↵
P	**1**	**.**	**0**	**0**	< **ENTER**>

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 4.5.2.

4.2.7 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 converter checks if keypad removal is allowed as the keypad may have Start/Stop control, or the keypad Speed Reference may be active (except in SFE mode).

To remove the keypad, continue as shown in Table 4-1.

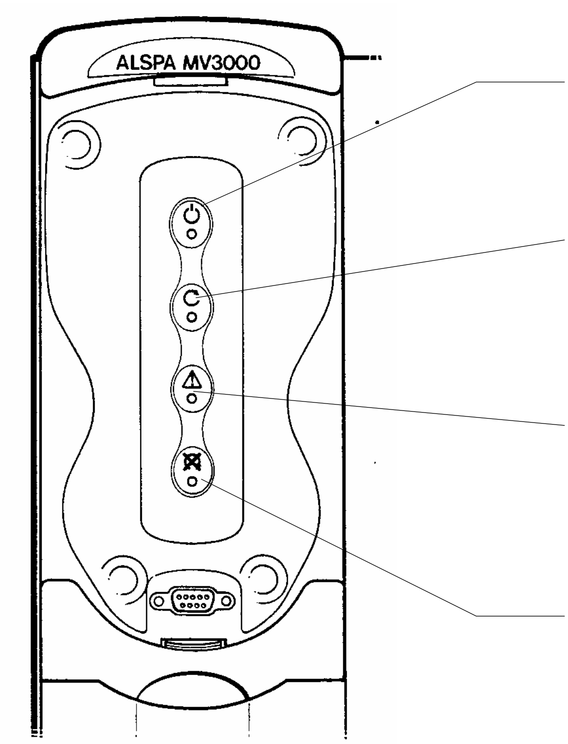
Note: CF = control flag, described in Section 4.4.

Table 4-1 How to remove the keypad

	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 <u>not</u> be either the <u>active</u> reference source or the <u>backup</u> reference source. The reference sources are held in P5.01 to P5.05 and are made active by CF4 to CF7 (P5.07 to P5.10) respectively.
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).

4.3 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 <u>not</u> fitted, four LEDs on the keypad harbour indicate the converter status as shown in Figure 4-5 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

Figure 4-5 Keypad harbour status indicators

Refer to Section 7 for a full description of fault indications

4.4 Application Programming

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

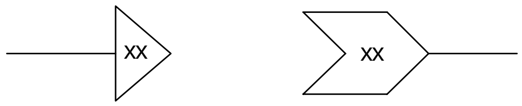
The ALSPA MV3000e software contains a large number of pre-defined special functions and a range of freely connectable logic, which, when combined, will allow the user to solve many application problems and generally enhance the final application solution.

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.

4.4.1 Control Flags and Status Flags

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



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

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

1. 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.

2. 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

1. 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.
2. 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)

3. Edit a value into the control flag parameter, this value will determine what the flag is connected to. Table 4-2 summarises the possible choices:

Table 4-2 Control flag and digital I/O connections

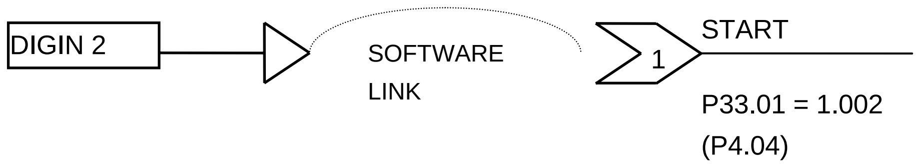
Value	Control Flag (CF) or Digital Output is connected to:
0.000 or 0	OFF
0.001 or 1	ON
1.001 to 1.006	DIGITAL INPUT 1 to 6
2.000 to 2.110	STATUS FLAGS 0 to 110
3.000 to 3.015, 3.100 to 3.115	RS485 CONTROL WORDS 0 and 1, BITS 0 to 15
4.000 to 4.015, 4.100 to 4.115	RS232 CONTROL WORDS 0 and 1, BITS 0 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

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.

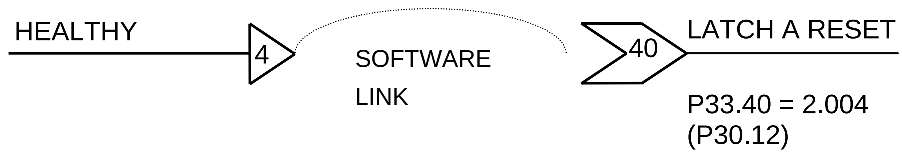
Example 1: How the Start Flag is connected

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

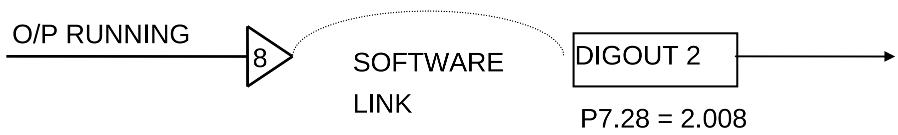
This example shows a simple connection which might be made to the logic blocks



4.4.2 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



4.4.3 Programming Analogue I/O

Sheet 6 of the control block diagrams shows the parameters associated with the analogue I/O.

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. Refer to Table 5A-2 (page 5A-4) and to Figure 1 on page ii.

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

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 ALSPA MV3000e software can then be output via an analogue output and either displayed on a meter or passed to another converter.

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)

4.5 Security Attributes and Passwords

4.5.1 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.

4.5.2 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

1. The Engineer's password is stored in P99.08 (a 4-digit code).
2. The Operator's password is stored in P99.07 (a 4-digit code).
3. 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.
4. Once unlocked, new passwords can be edited into P99.08 or P99.07.

4.6 Control Block Diagrams

Control Block Diagrams for the ALSPA MV3000e are provided in Section 5C.
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 4-6 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.

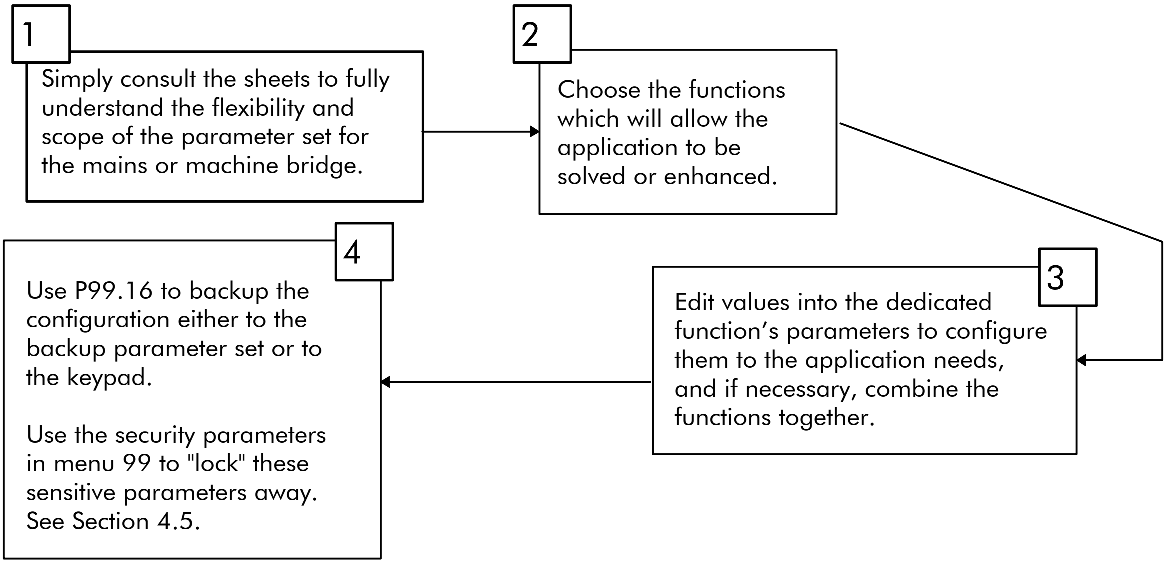
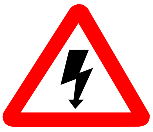


Figure 4-6 Use of control block diagrams

5A. Commissioning a Mains Bridge



WARNING

- **Wait at least 5 minutes after isolating supplies and check that 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.**
- **This equipment may be connected to more than one live circuit. Disconnect all supplies before working on the equipment.**
- **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 70 dB(A), dependent on the air flow path.**
  Measure the audible noise level in the installation.
  When the audible noise level exceeds 70 dB(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.

5A.1 Introduction

Section 5A shows how to commission a bi-directional converter as a mains bridge for a basic application. This section should be read in conjunction with Section 4 which explains how to use the menus, parameters, passwords and keypad which are required for commissioning. The flowchart in Figure 5A-1 shows how commissioning is carried out in simple steps.

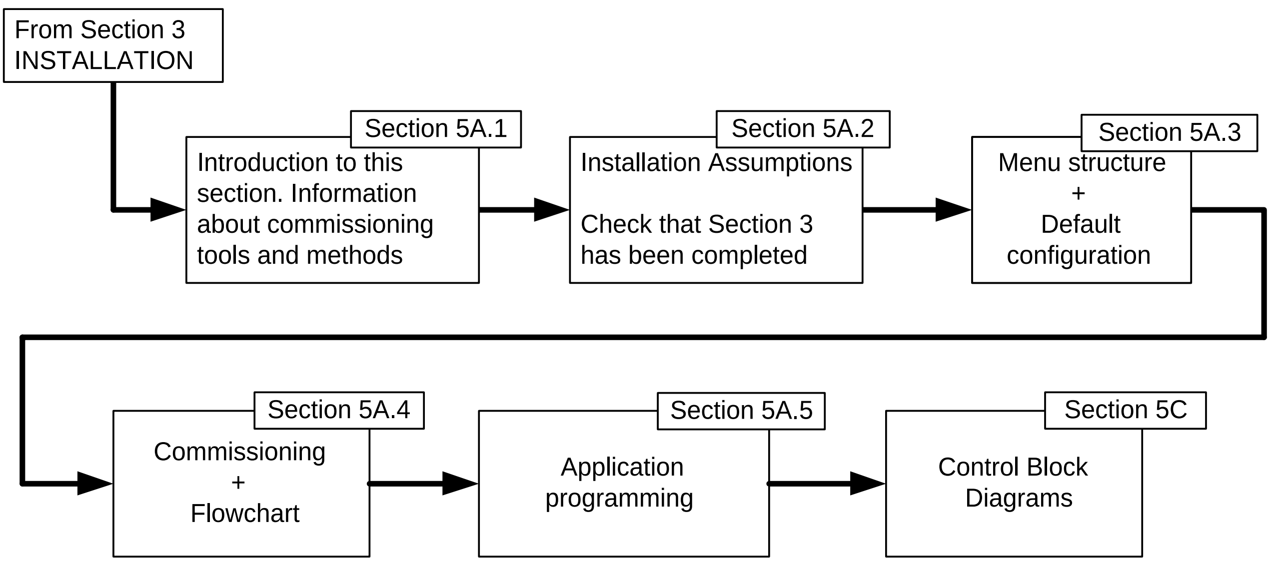


Figure 5A-1 Overview of commissioning procedure

When the converter leaves the factory it is programmed with sensible default values for all parameters, for use either as a mains bridge or as a machine bridge (in one of four motor control modes). When power is first applied the converter defaults to mains bridge configuration and, during commissioning, the user is given the opportunity to adjust the values of some of the parameters to enable it to function in specific applications. Because the mains bridge is normally connected to ancillary components (e.g. line reactors, contactor etc.) to form a Sinusoidal Front End (SFE), the relevant parameters are called SFE parameters.

Commissioning Tools

In this manual, commissioning is carried out 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 procedures given in Section 5A.4. Once basic commissioning is complete, further application-specific parameters may require setting. Section 5A.5 explains how to customise the drive.

PC based software tools are available to allow easy programming of the converter via a serial link. Refer to Section 9 (Options).

Commissioning Methods

To commission the converter, either of two methods can be used:

1. For a simple application, follow the "Simple Start" instructions in Section 5A.4.2 and press RUN from the digital I/O – the converter will safely generate a default DC voltage suitable for most simple applications. Refer to Sections 5A.3.2 and 5A.3.3 for details of the default settings.

2. For a complex application, follow the "Guided Commissioning" flowcharts in Section 5A.4.3 and adjust parameter values to obtain a precisely controlled voltage at the DC terminals.

When these simple procedures have been completed the user can commission for specific applications using the control diagrams provided in Section 5C.

5A.2 Installation Assumptions

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

5A.3 Menu Structure Overview

5A.3.1 Menu Listing

The menus that are visible if P1.31 = 2 (see Section 4.2.6) are shown in Table 5A-1. When SFE mode is enabled (P99.01 = 4), the remaining menus are not visible for a SFE.

Table 5A-1 Menus relevant to a converter operating as a SFE

Menu	Description	Menu	Description
1	User configured menu	41	Programmable status word settings
7	Plant I/O settings	42	Pointer source settings
10	Trips and warnings	45	Drive temperature monitoring
11	Advanced drive monitoring	50	Basic SFE setup
16	PID controller settings	51	SFE monitoring
17	Reference sequencer settings	52	Advanced SFE setup
18	Motorised potentiometer settings	53	SFE reference setup
19	Trim reference settings	59	CANopen Extended I/O settings
21	Fixed reference settings	60	CANopen scaling parameters
23	Dynamic brake control settings	61	CDC CAN port
26	History log settings	62	CDC CANopen
27	History log playback settings	63	CDC DeviceNet
28	Auto-reset settings	75	PROFIBUS
30	Logic block settings	78	MicroPEC
31	Status flag generator settings	80	Fieldbus - Configuration and status data
32	Serial links settings	83	Fieldbus - Fast produced VCOMs
33	Control flag 0 to 99 source settings	84	Fieldbus - Fast consumed VCOMs
34	Control flag 100 to 127 source settings	85	Fieldbus - Slow VCOMs and FIP refs.
35	Miscellaneous features settings	89	Fieldbus - Data spy module
39	User configurable menu (Menu 1) settings	98	Menu enable selection settings
40	Summing nodes settings	99	Configuration settings

5A.3.2 Menu 1

This is a special menu containing a selection of parameters copied from the complete parameter list of the converter. Menu 1 can be configured via Menu 39 to hold the most useful parameters in any application. Table 5A-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 5A-2 Menu 1 – user configured menu

Parameter No.	Source Parameter Configured by Menu 39	Function	Default	Range	Attribute (Refer to Section 4.5)
P1.00	P50.00	DC Link Voltage Reference	As drive size	550 V to 850 V or 700 V to 1100 V or 700 V to 1140 V	E / R
P1.01	P51.00	DC Link Voltage	0	0 V to 30 000 V	R
P1.02	P51.01	Mains Current	0.0	0.0 A to 9999.0 A	R
P1.03	P51.03	Mains Frequency	0	+40.00 Hz to +70.00 Hz –40.00 Hz to –70.00 Hz	R
P1.04	P51.04	Measured Mains Voltage	0	0 V to 1000 Vrms	R
P1.05	P51.06	Power from Mains	0	–999.0 kW to +999.0 kW	R
P1.06	P10.00	Warning No. 1	0	100 to 137	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 = Français 3 = Portuguese 4 = German	O
P1.10	P50.01	Line Choke Inductance	As drive size	30 to 12 000 µH per phase	E
P1.11	P50.02	DC-fed Drives Rating	100%	0 to 10 000 % SFE Rating	E
P1.12	P50.03	Active Current Positive Limit	110.00%	0.00 to 150.00 % SFE Nominal Current	E / R
P1.13	P50.04	Active Current Negative Limit	110.00%	0.00 to 150.00 % SFE Nominal Current	E / R
P1.14	P52.08	Mains Underfrequency Trip	45.00 Hz	40.00 to 70.00 Hz	E
P1.15	P52.09	Mains Underfrequency Warning	45.00 Hz	40.00 to 70.00 Hz	E
P1.16	P52.10	Mains Overfrequency Warning	63.00 Hz	40.00 to 70.00 Hz	E
P1.17	P52.11	Mains Overfrequency Trip	63.00 Hz	40.00 to 70.00 Hz	E
P1.18	P53.03	Load Power Feedforward Source	4	0 = None 1 = Current sensor ch1 2 = Current sensor ch2 3 = Fast analogue ch1 4 = Fast analogue ch2	S.E.N.L

(continued)

Parameter No.	Source Parameter Configured by Menu 39	Function	Default	Range	Attribute (Refer to Section 4.5)
P1.19	P51.10	Feedforward Current Demand	0	–9999.0 to +9999.0 A	R
P1.20	P51.13	Active Current	0	–150 % to +150 %	R
P1.21	P7.27	Digital Output 1 Signal	–2.005 (Healthy)	See Table 4-2 in Section 4.4	E.N
P1.22	P7.28	Digital Output 2 Signal	2.008 (SFE Running)	See Table 4-2 in Section 4.4	E.N
P1.23	P7.29	Digital Output 3 Signal	2.100 (At Volts)	See Table 4-2 in Section 4.4	E.N
P1.24	P33.00	Normal Stop	1.001	1.001 to 1.006 (Digin 1-6)	
P1.25	P33.01	Start	1.002	1.001 to 1.006 (Digin 1-6)	
P1.26	P34.16	Keypad / Remote	1.004	1.001 to 1.006 (Digin 1-6)	
P1.27	P99.05	Drive Nominal Current	As drive size	As drive size	R
P1.28	P99.11	Drive Voltage Grade. Note! Keypad goes off-line briefly when edited.	0	0 = Standard voltage grade 1 = Alternate voltage grade	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 DELTA's	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, subject to control mode selection in P99.01	E.N.L
P1.32	P99.06 Always a Menu Parameter	Security Code	0	0 to 9999	O

5A.3.3 Default Configuration

When the converter leaves the factory, all the parameters are pre-loaded with default values which allow it to safely generate a DC voltage when connected as an SFE.
Table 5A-3 will provide help in understanding the default settings for Start/Stop control. The table should be read in conjunction with the control block diagrams (see Section 5C) and the explanation of Control Flags (CF) and Status Flags (SF) in Section 4.4.

Table 5A-3 Start/Stop selection of active voltage control at default

	LOCAL CONTROL
WHEN	**DIGIN4** (Local/Remote)
IS	OPEN
IT SELECTS	Keypad Control
BECAUSE	CF116 is set OFF, as it is connected to DIGIN4 (P1.26 = P34.16)
WHICH MEANS	Keypad has Start/Stop Control
NOTE	All other Start/Stops are inactive
	REMOTE CONTROL
WHEN	**DIGIN4** (Local/Remote)
IS	CLOSED
IT SELECTS	Remote Control
BECAUSE	CF116 is set ON, as it is connected to **DIGIN4** (P34.16 = P1.26)
WHICH MEANS	Remote Start/Stop connections become active (**DIGIN1** and **DIGIN2** at default)
NOTE	Keypad Start/Stops are inactive

5A.3.4 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 SFE:

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).

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

The SFE will now be at default settings.

When commissioning is complete the user may duplicate (using menu 39) up to 31 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.

5A.4 Commissioning Procedure

Note: Various hazards exist whilst commissioning the converter. Before commencing work ensure you have read the various safety instructions in Section 3 and Section 5A.

CAUTION

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

5A.4.1 Introduction

Commissioning the SFE is simple. Just choose the required commissioning level from the two alternatives:

1. SIMPLE START — **Basic wiring and press RUN! (See Section 5A.4.2)**

2. GUIDED COMMISSIONING — **Follow the Flowcharts in Section 5A.4.3**

Then fully configure the SFE for:

THE APPLICATION

(Use the Control Block Diagrams in Section 5C)

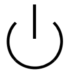
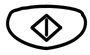
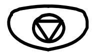
5A.4.2 Simple Start

Using this simple method the SFE will generate a controlled DC voltage at the DC terminals, with no parameter edits.

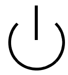
- **Install the SFE (Section 3)**
- **Connect the SFE as shown on the front cover diagram**
- **Switch on the main AC supply to the SFE. This will now function as a diode rectifier, generating a DC link voltage**
- **Check that the fans are running**

<u>To control the DC voltage</u> :

By using the keypad –

- **Open the switch on DIGIN 4 (= keypad control) and check that the green “Standby” LED is lit on the keypad.** 
- **Start the active control of DC voltage by pressing** 
- **Stop the active control of DC voltage by pressing** 

By using digital I/O connected as in Figure 1 at the front of this manual –

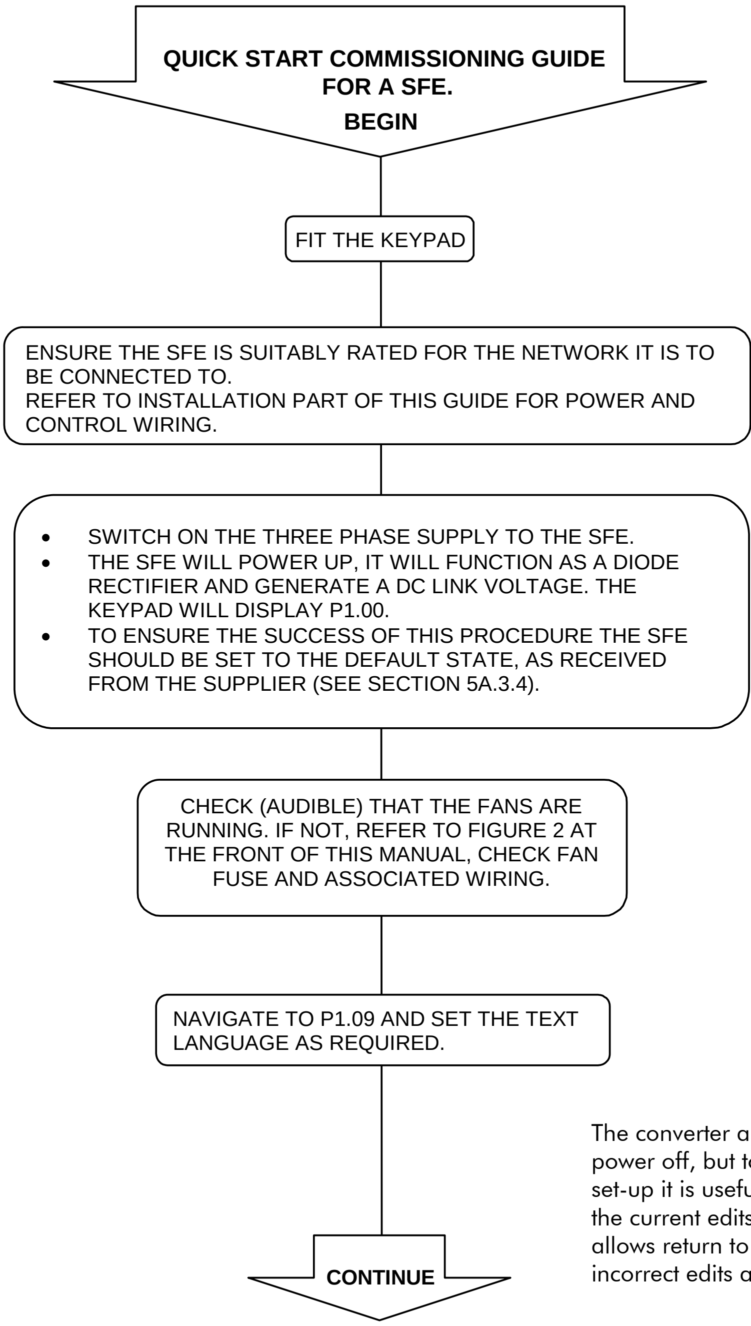
- **Close the switch on DIGIN 4 (= remote control) and check that the green “Standby” LED is lit on the keypad harbour.** 
- **Switch on the active control of DC voltage by closing DIGIN 2**
- **Switch off the active control of DC voltage by opening DIGIN 1**

5A.4.3 Guided Commissioning of a SFE

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

Note: This flowchart is for MicroCubicle™ systems only, it is not suitable for DELTA systems.

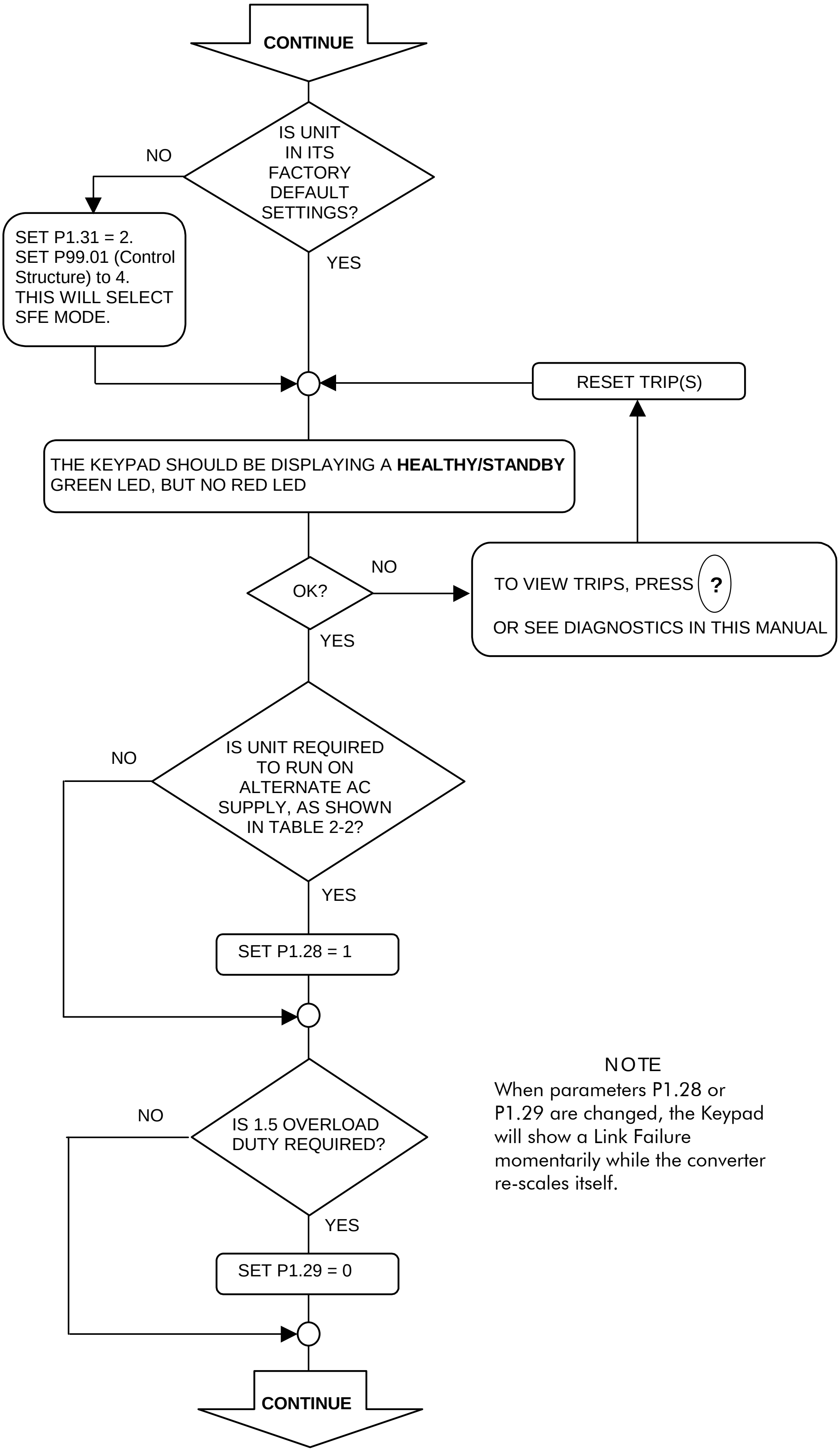
5A.4.3.1 SFE Quick Start



HINT

The converter 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.

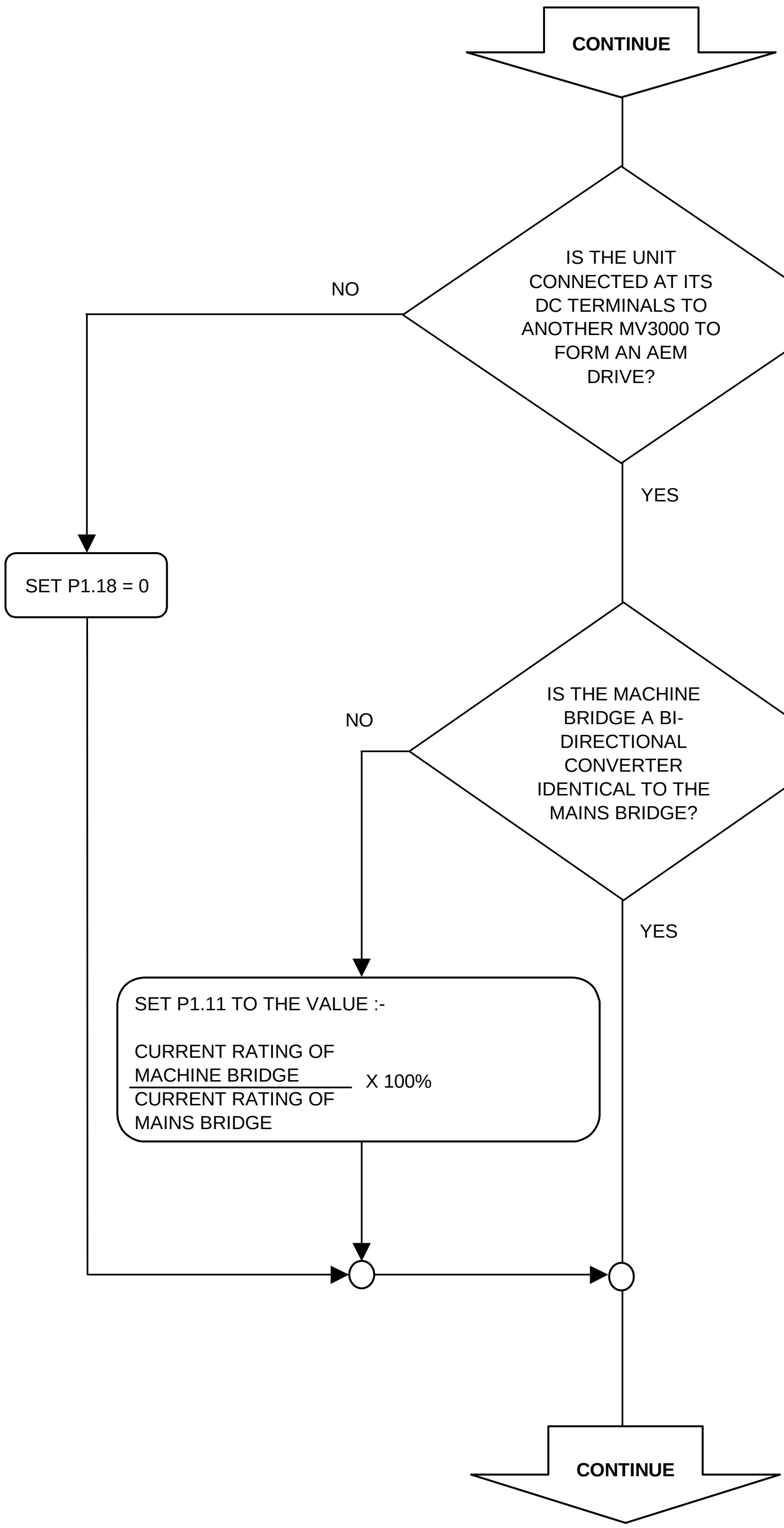
SFE Quick Start (continued)



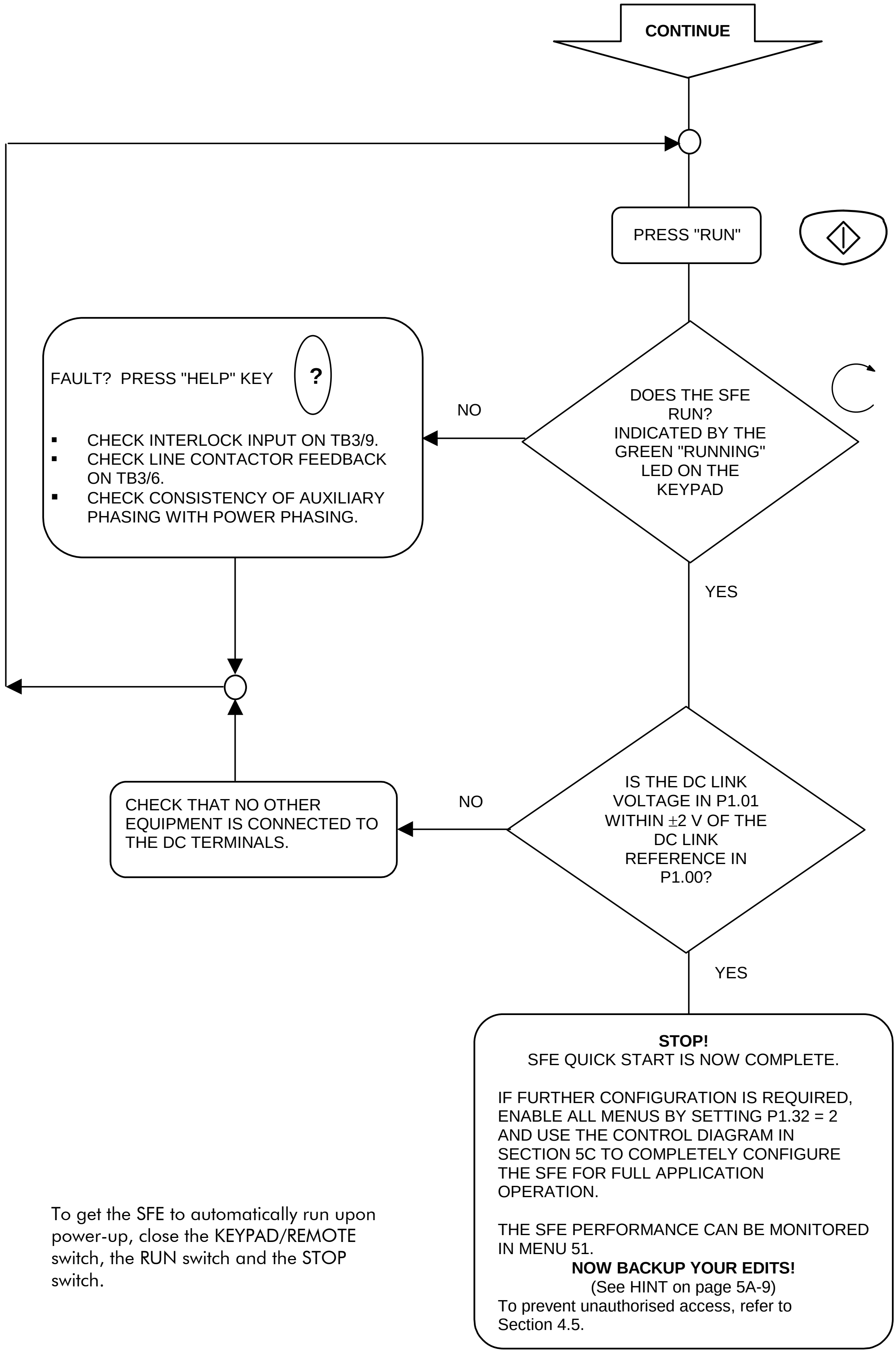
NOTE

When parameters P1.28 or P1.29 are changed, the Keypad will show a Link Failure momentarily while the converter re-scales itself.

SFE Quick Start (continued)



SFE Quick Start (continued)



To get the SFE to automatically run upon power-up, close the KEYPAD/REMOTE switch, the RUN switch and the STOP switch.

5A.5 Application Programming

Once the basic commissioning procedure has been completed, the user may find the need to customise the SFE parameters to accurately satisfy all the needs of the application. Practical advice, with hints and worked examples, is given in Section 4.4. Together with the Control Block Diagrams provided in Section 5C, this will enable the user to design systems for almost any application.

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5B. Commissioning a Machine Bridge

WARNING

- **Wait at least 5 minutes after isolating supplies and check that 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.**
- **This equipment may be connected to more than one live circuit. Disconnect all supplies before working on the equipment.**
- **Do not use mobile phones or walkie talkies within 2 meters (6feet) of the equipment.**
- **The combined audible noise emitted by fans in an installation can be greater than 70dB(A), dependent on the air flow path.**
  When the audible noise 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.

5B.1 Introduction

Section 5B shows how to commission a bi-directional converter as a machine bridge for a basic application. The commissioning procedure may easily be applied to any required system configuration where one or more machine bridges are used. This section should be read in conjunction with Section 4 which explains how to use the menus, parameters, passwords and keypad which are required for commissioning. The flowchart in Figure 5B-5-1 shows how commissioning is carried out in simple steps:

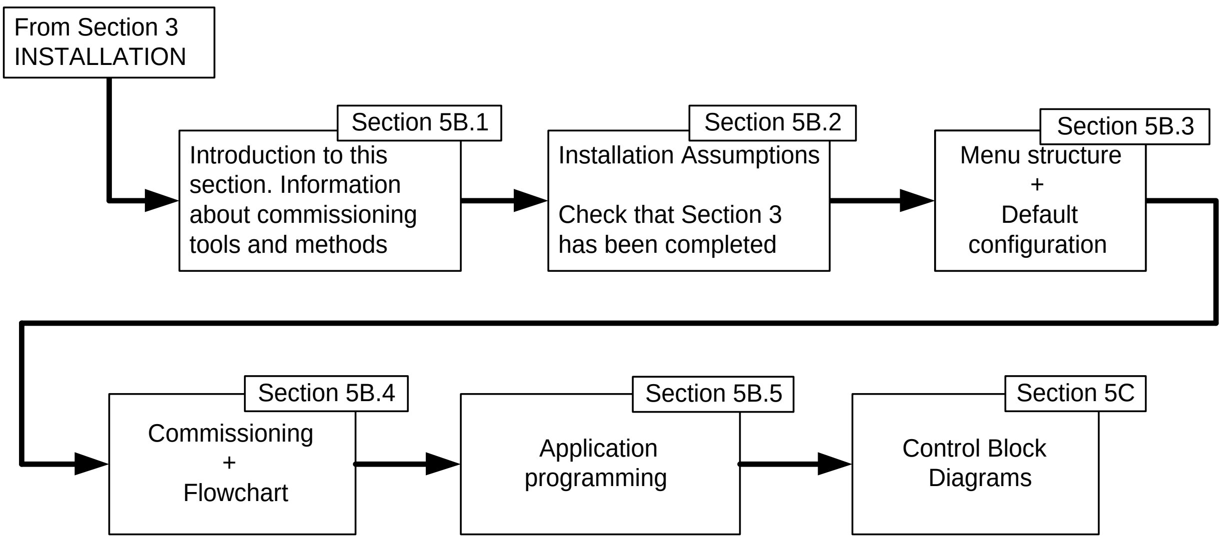


Figure 5B-5-1 Overview of commissioning procedure

When the converter leaves the factory it is programmed with sensible default values for all parameters, for use either as an SFE or as a machine bridge . When power is first applied the converter defaults to SFE configuration. During commissioning the machine bridge is configured into one of four motor control modes, each with its own set of default parameters – frequency control (VVVF), vector control with encoder, vector control without encoder or scalar mode. The user is then given the opportunity to adjust the values of some of these parameters to enable the converter to function as a machine bridge in specific applications. Note that Scalar mode is very specialised, it is not included in Guided Commissioning (flowcharts) but is included in the Control Block Diagrams in Section 5C.

Commissioning Tools

In this manual, commissioning is carried out 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 procedures given in Section 5B.4. Once basic commissioning is complete, further application-specific parameters may require setting. Section 5B.5 explains how to customise the machine bridge.

PC based software tools are available to allow easy programming of the machine bridge via a serial link. Refer to Section 9 (Options).

Commissioning Methods

To commission the drive, either of two methods can be used:

1. For a simple application, follow the "Simple Start" instructions in Section 5B.4.2 –the converter will safely turn a 400 V 50 Hz induction motor in frequency control mode. Refer to Sections 5B.3.2 and 5B.3.3 for details of the default settings.

2. For a complex application, follow the "Guided Commissioning" flowcharts in Section 5B.4.3 and adjust parameter values to drive an induction motor in any of four control modes, see above.

When these simple procedures have been completed the user can commission for specific applications using the control diagrams provided in Section 5C.

5B.2 Installation Assumptions

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

5B.3 Menu Structure Overview

5B.3.1 Menu Listing

Menus relevant to a machine bridge are shown in Table 5B-1. The remaining menus may be selected but are not effective for a machine bridge.

Table 5B-1 Menus relevant to a converter operating as a machine bridge

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

5B.3.2 Menu 1

This is a special menu containing a selection of parameters copied from the complete parameter list of the converter. Menu 1 can be configured via Menu 39 to hold the most useful parameters in any application. Table 5B-2 shows the default parameters and their factory default values copied into Menu 1, when one of the machine control modes has been selected. The table also shows the identity of the source parameters.

Table 5B-2 Menu 1 – user configured menu

Parameter No.	Source Parameter Configured by Menu 39	Function	Default	Range	Attribute (Refer to Section 4.5)
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
P1.06	P10.00	Warning No. 1	0	100 to 199	R
P1.07	P10.10	Trip No. 1	0	0 to 99	R
P1.08	P10.11	Trip No. 2	0	0 to 99	R
P1.09	P99.10	User Text Language	1	1 = English 2 = Français 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	Acceleration Rate Forward	10	0.1 %/s to 3000 %/s	E
P1.23	P6.02	Deceleration 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

(continued)

Parameter No.	Source Parameter Configured by Menu 39	Function	Default	Range	Attribute (Refer to Section 4.5)
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 from motor	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 DELTAs 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

5B.3.3 Default Configuration

When the converter leaves the factory, all the machine bridge parameters are pre-loaded with default values which allow it to drive a motor safely and in a sensible manner when it is set to one of the three DRIVE modes. Table 5B-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 (Section 5C) and the explanation of Control Flags (CF) and Status Flags (SF) in Section 4.4.

Table 5B-3 Start/Stop and reference selecting at default

	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

5B.3.4 Returning to Factory Default Settings

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.

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 converter:

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

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

The converter will now be at default settings.

Note: For a bi-directional converter, the default operation mode is SFE mode, which is not a machine control mode. In order to select a machine control mode, follow Sections 5B.4.2 or 5B.4.3.

When commissioning is complete the user may duplicate (using Menu 39) 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.

5B.4 Commissioning Procedure

Note: Various hazards exist whilst commissioning this equipment. Before commencing work ensure you have read the various safety instructions in Section 3.

5B.4.1 Introduction

Commissioning the converter is simple. Just choose the required commissioning level from the two alternatives:

1. SIMPLE START — **Basic wiring and procedures (See Section 5B.4.2)**

2. GUIDED COMMISSIONING — **Follow the Flowcharts in Section 5B.4.3**

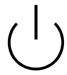
Then fully configure the converter for:

THE APPLICATION

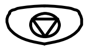
(Use the Control Block Diagrams in Section 5C)

5B.4.2 Simple Start

Using this simple method the machine bridge will turn a 400 V 50 Hz motor with the drive current matching the nameplate current, in Frequency Control (VVVF) mode.

- **Install the machine bridge (Section 3)**
- **Connect the machine bridge as shown in Figures 1 and 2 at the front of the manual. Connect the keypad**
- **Start the SFE, to supply power to the machine bridge**
- **Check that the fans on the machine bridge are running (audible check). If they are not running, refer to Figure 2 at the front of the manual, check the fan fuse and associated wiring**
- **If the bridge is a bi-directional converter the keypad will indicate a warning (amber LED). In this case:** 
    - **Enable all menus by setting P1.31 = 2**
    - **Select VVVF motor control by setting P99.01 = 1. The warning will reset and the keypad will indicate "Standby" (green LED)** 

<u>To control the motor</u> :

- **By using the keypad –**
    - **Select "Keypad Control" by opening the switch on DIGIN 4. If the converter trips, reset the trip as shown in Section 7.4.3**
    - **Start the motor by pressing** 
    - **Stop the motor by pressing** 
    - **Raise/Lower the speed using** 

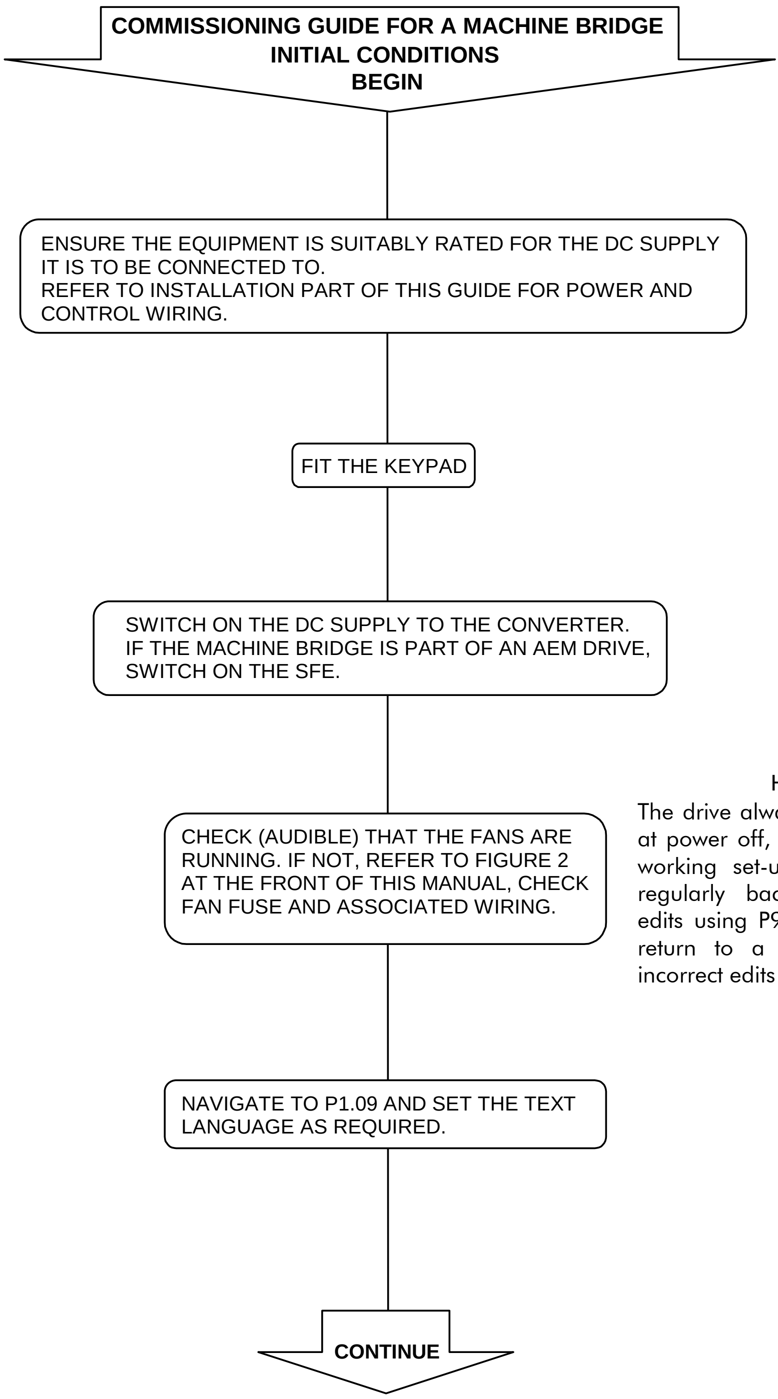
- **By using digital I/O connected as in Figure 1 at the front of this manual –**
    - **Select "Remote Control" by closing the switch on DIGIN 4**
    - **Start the motor by closing the switch on DIGIN 2**
    - **Stop the motor by opening the switch on DIGIN 1**
    - **Raise/Lower the motor speed using Analogue Inputs 1 or 2, depending on the position of DIGIN 5**

5B.4.3 Guided Commissioning of a Machine Bridge

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

Note: This procedure is applicable to a single machine bridge fed from a single mains bridge in an AEM drive. For more complex systems, additional commissioning steps may be required. In this case, your supplier should be consulted.

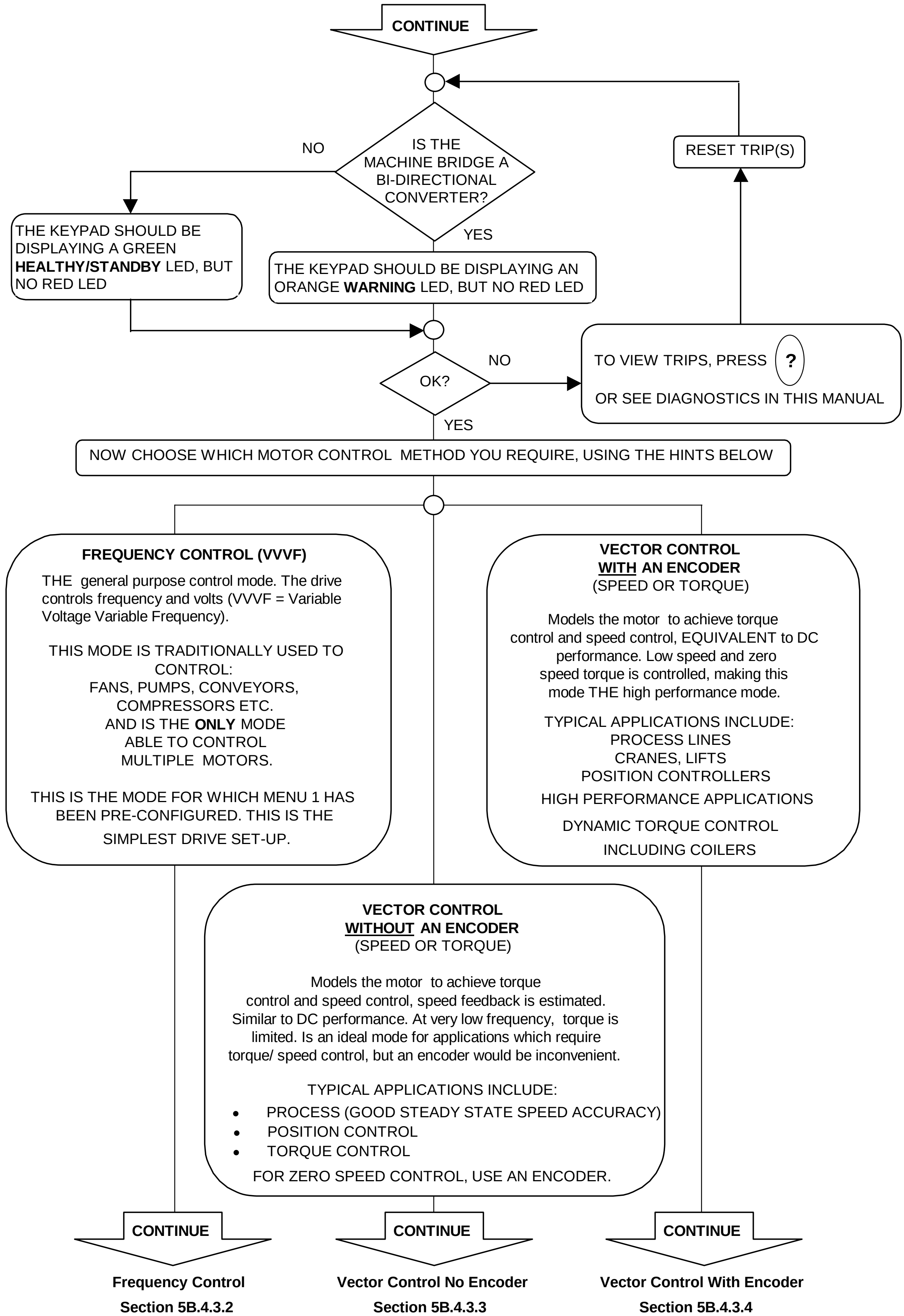
5B.4.3.1 Initial Conditions



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.

Initial Conditions (continued)



5B.4.3.2 Frequency Control (VVVF) Mode

CONTINUE
Frequency Control

ENABLE ALL MENUS BY SETTING P1.31 = 2.
SELECT VVVF CONTROL STRUCTURE BY SETTING P99.01 = 1

THE ORANGE **WARNING** LED SHOULD EXTINGUISH AND THE GREEN **STANDBY/HEALTHY** LED SHOULD BE LIT

OK?

NO → TO VIEW TRIPS, PRESS ? OR VIEW DIAGNOSTICS IN THIS MANUAL → RESET TRIPS

YES ↓

EDIT THE FOLLOWING PARAMETERS, TO CONFIGURE THE DRIVE

P1.10	MOTOR BASE VOLTAGE	Motor nameplate voltage (V)
P1.11	MOTOR BASE FREQUENCY	Motor nameplate frequency (Hz)
P1.12	MOTOR FULL LOAD CURRENT	Motor nameplate current (A)
P1.13	MOTOR NOMINAL SPEED	Motor nameplate speed (r/min)
P1.14	MOTOR POWER FACTOR	Motor nameplate cos Φ. If unknown, leave at default value
P1.15	MAXIMUM SPEED FORWARD	Default Value = 1500 r/min
P1.16	MAXIMUM SPEED REVERSE	Default Value = 1500 r/min
P1.17	MINIMUM SPEED FORWARD	Default Value = 0 r/min
P1.18	MIN SPEED REVERSE	Default Value = 0 r/min
P1.19	FLUXING CONTROL	Quadratic - useful for fans
P1.22	ACCELERATION RATE FORWARD	Default Value = 10.0%/s
P1.23	DECELERATION RATE FORWARD	Default Value = 10.0%/s
P23.05	MOTOR REGENERATIVE POWER LIMIT	Set Value = -0.1 kW (= unlimited)
P23.20	NON-MV3000 DB UNIT FITTED	Set Value = 1 (= regeneration capability)

- ON ALL DRIVES, 110% DUTY IS DEFAULT. 150% DUTY CAN BE SELECTED BY SETTING P1.29 = 0.
- STANDARD VOLTAGE GRADE IS DEFAULT. ALTERNATE VOLTAGE GRADE CAN BE SELECTED BY SETTING P99.11 = 1. SEE TABLE 2-1

NOTE
When parameter P99.11 or P1.29 is changed, the keypad will show a Link Failure momentarily while the converter re-scales itself.

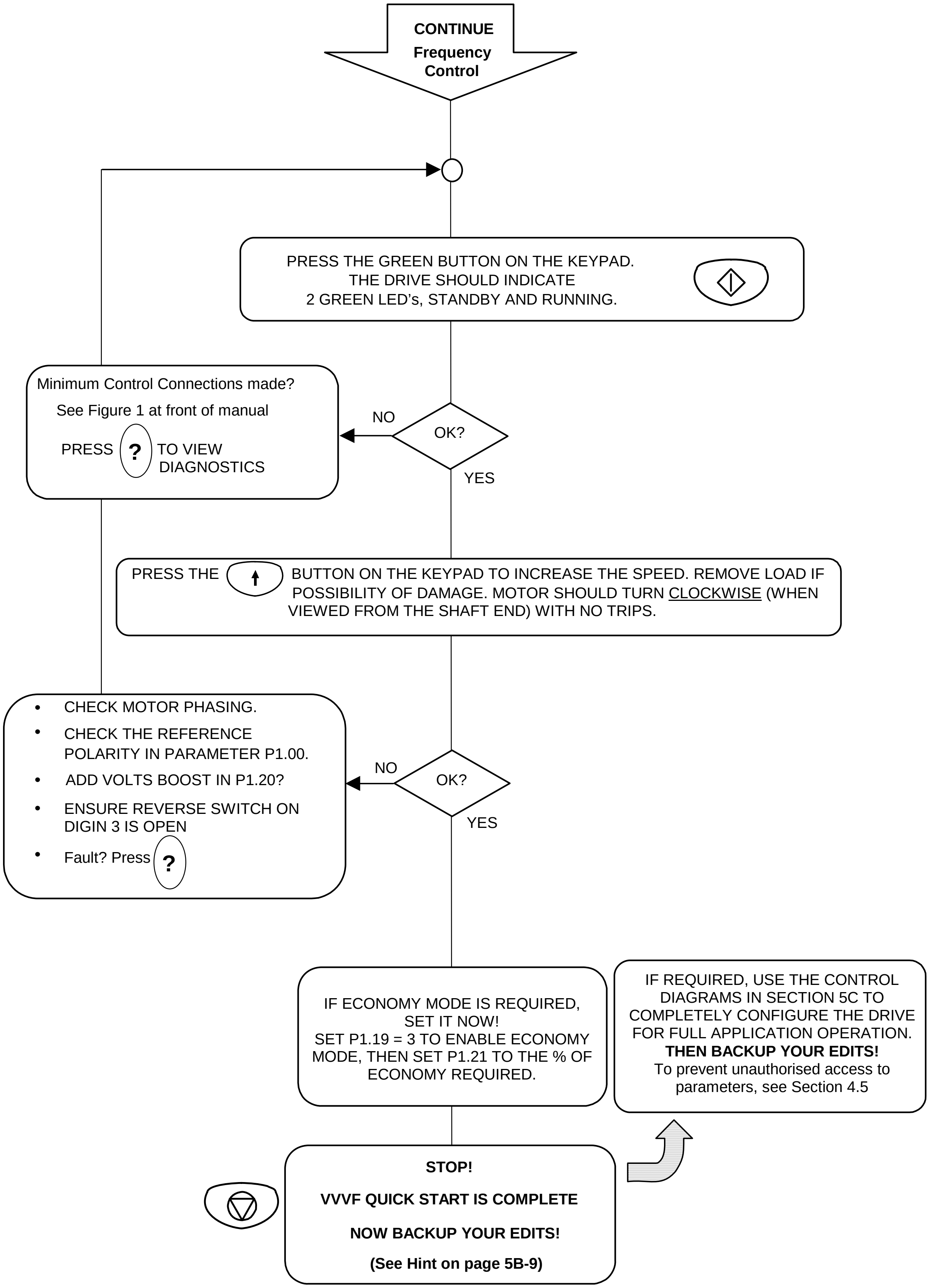
SET UP THE LOAD POWER FEEDFORWARD LINK

SET P7.23 ANALOGUE OUTPUT 2 MODE = 5 (0-20 mA fast load power feedforward)
SET P7.25 ANALOGUE OUTPUT 2 SCALE = Current rating (Amps) of MV3000 machine bridge
SET the AN O/P 2 slider on SW1 to its 20 mA position.

MOVE TO P1.00 AND ENSURE THAT ITS VALUE IS 0.00

CONTINUE
Frequency Control

Frequency Control (VVVF) Mode (continued)



5B.4.3.3 Vector Control, No Encoder

CONTINUE
Vector No Encoder

THE DEFAULT SET-UP IS FOR SPEED CONTROL,
TORQUE CONTROL WILL BE SELECTED AT THE END OF THIS PROCEDURE.

ENABLE ALL MENUS BY SETTING P1.31 = 2.
SELECT VECTOR CONTROL STRUCTURE BY SETTING P99.01 = 2

THE ORANGE **WARNING** LED SHOULD EXTINGUISH AND THE GREEN **STANDBY/HEALTHY** LED SHOULD BE LIT

OK?

NO → TO VIEW TRIPS, PRESS ? OR VIEW DIAGNOSTICS IN THIS MANUAL → RESET TRIPS

YES

EDIT THE FOLLOWING PARAMETERS, TO CONFIGURE THE DRIVE

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: 3 = ENCODERLESS
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 $\frac{\text{SFE DC Link reference}}{\sqrt{2}}$
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
P6.02	DECELERATION RATE FORWARD	Default value = 10.0%/s
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 5B-15).
If required, re-edit this parameter after calibration run.

CONTINUE
Vector No Encoder

Vector Control, No Encoder (continued)

CONTINUE
Vector No Encoder

- ON ALL DRIVES, 110% DUTY IS DEFAULT. 150% DUTY CAN BE SELECTED BY SETTING P1.29 = 0.
- STANDARD VOLTAGE GRADE IS DEFAULT. ALTERNATE VOLTAGE GRADE CAN BE SELECTED BY SETTING P99.11 = 1. SEE TABLE 2-1

NOTE

When parameter P99.11 or P1.29 is changed, the keypad will show a Link Failure momentarily while the converter re-scales itself.

SET UP THE LOAD POWER FEEDFORWARD LINK

SET P7.23 ANALOGUE OUTPUT 2 MODE = 5 (0-20 mA fast load power feedforward)
SET P7.25 ANALOGUE OUTPUT 2 SCALE = Current rating (Amps) of MV3000 machine bridge.
SET the AN O/P 2 slider on SW1 to its 20 mA position.

OPEN LOOP TESTING

The Drive is equipped with a simple way of invoking Frequency Control from the Vector menus.

THIS TEST IS OPTIONAL, BUT IS A SAFE AND PRACTICAL WAY TO CHECK MOTOR INSTALLATION AND TO DETERMINE A VALUE FOR THE MOTOR MAGNETISING CURRENT, REQUIRED FOR P12.00.

- 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 RUN BUTTON (Drive Running and Standby LED's on at this point).
- ENTER A VALUE INTO P13.12, E.G. 10Hz TO BEGIN WITH. THE MOTOR SHOULD ROTATE CLOCKWISE.
- TO MEASURE THE 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 HAS FINISHED LOOK AT THE VALUE IN P9.05, AND RECORD (typically 1/3 of motor full load current).
- TERMINATE THE OPEN LOOP TEST BY PRESSING THE STOP BUTTON AND BY SETTING P13.11 = O.
- EDIT P12.00 WITH THE RECORDED VALUE, IF NOT ALREADY KNOWN.

OK?

NO:

Minimum Control Connections made?
CHECK MOTOR PHASING
FAULT? - Press ? for Diagnostics

YES:

CONTINUE
Vector No Encoder

Vector Control, No Encoder (continued)

CONTINUE
Vector No Encoder

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 FOLLOWING PARAMETERS:

- P12.11 TO P12.16 IN STAR (Y) EQUIVALENT.

  Y = Δ ÷ 3

- P12.17 TO P12.21 IF SPEEDS ABOVE BASE SPEED ARE REQUIRED. THESE PARAMETERS ARE LISTED ON PAGE 5C-12.

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 RETURN 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?

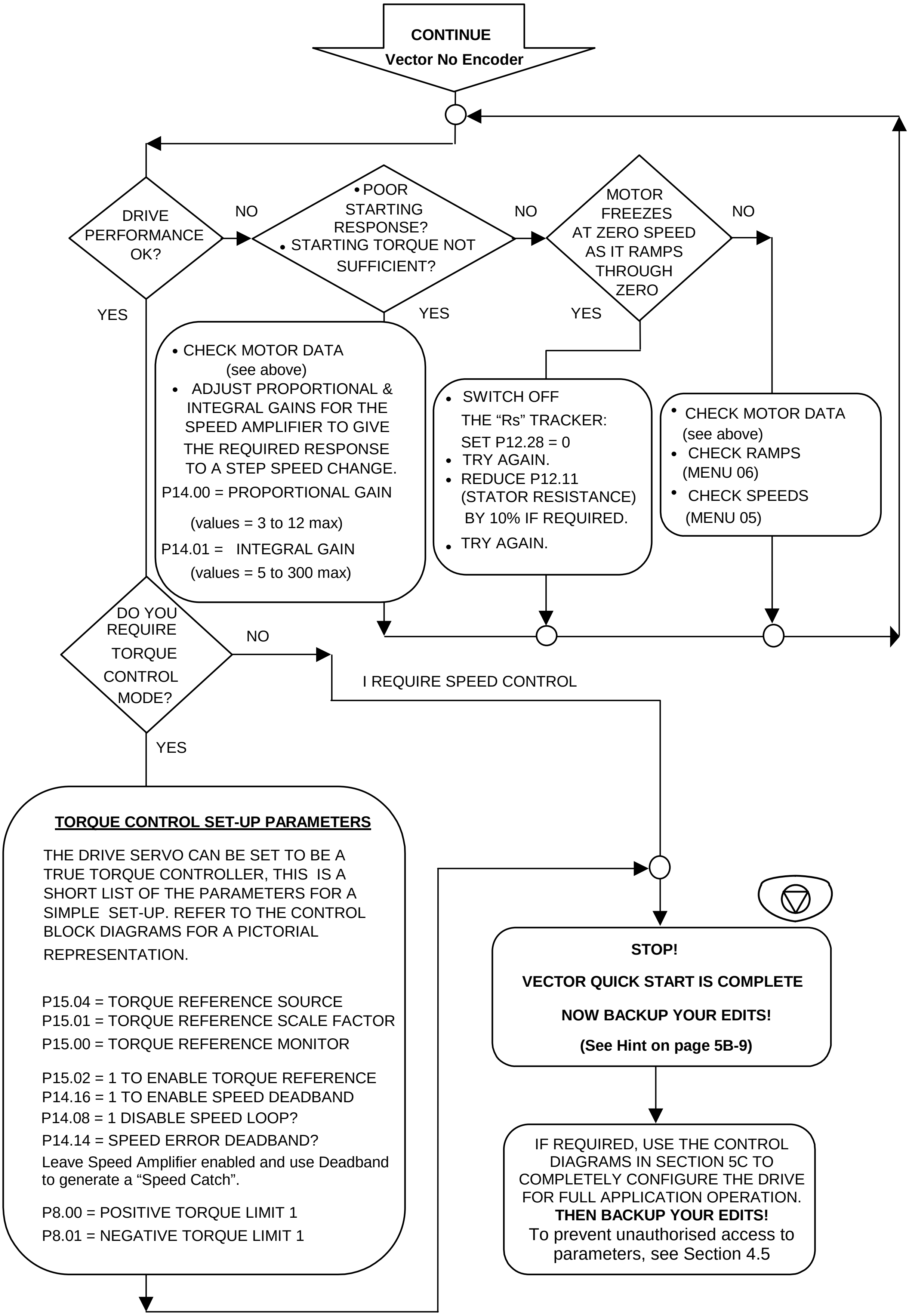
NO:

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

YES:

CONTINUE
Vector No Encoder

Vector Control, No Encoder (continued)



5B.4.3.4 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 AT THE FRONT OF THE MANUAL.

CABLING RECOMMENDATIONS CAN BE FOUND BY CONSULTING SECTION 3.9.

SWITCH THE DRIVE BACK ON

ENABLE ALL MENUS BY SETTING P1.32 = 2.
SELECT VECTOR CONTROL STRUCTURE BY SETTING P99.01 = 2

THE ORANGE **WARNING** LED SHOULD EXTINGUISH AND THE GREEN **STANDBY/HEALTHY** LED SHOULD BE LIT

OK?

NO → TO VIEW TRIPS, PRESS ? OR VIEW DIAGNOSTICS IN THIS MANUAL → RESET TRIPS

YES ↓

EDIT THE FOLLOWING PARAMETERS, TO CONFIGURE THE DRIVE

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

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

Vector Control with Encoder

Vector Control with Encoder (continued)

CONTINUE

Vector Control with Encoder

EDIT THE FOLLOWING DRIVE PARAMETERS

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 $\frac{\text{SFE DC Link reference}}{\sqrt{2}}$
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
P6.02	DECELERATION RATE FORWARD	Default value = 10.0 %/s
P23.05	MOTOR REGENERATIVE POWER LIMIT	Set value = -0.1 kW, unlimited
P29.00	FORWARD OVERSPEED LEVEL	Default value = 120 %
P29.01	REVERSE OVERSPEED LEVEL	Default value = 120 %

* Maximum speed cannot be set > base until a calibration run has been performed (page 5B-20). If required, re-edit this parameter after calibration run.

- ON ALL DRIVES, 110 % DUTY IS DEFAULT. 150 % DUTY CAN BE SELECTED BY SETTING P1.29 = 0.
- STANDARD VOLTAGE GRADE IS DEFAULT. ALTERNATE VOLTAGE GRADE CAN BE SELECTED BY SETTING P99.11 = 1. SEE TABLE 2-1

NOTE

When parameter P99.11 or P1.29 is changed, the keypad will show a Link Failure momentarily while the converter re-scales itself.

SET UP THE LOAD POWER FEEDFORWARD LINK

SET P7.23 ANALOGUE OUTPUT 2 MODE = 5 (0-20 mA fast load power feedforward)
SET P7.25 ANALOGUE OUTPUT 2 SCALE = Current rating (Amps) of MV3000 machine bridge.
SET the AN O/P 2 slider on SW1 to its 20 mA position.

CONTINUE

Vector Control with Encoder

Vector Control with Encoder (continued)

CONTINUE
Vector Control with Encoder

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^{o} FOR ONE SHAFT REVOLUTION.

OK?

NO:

- CHECK THE ENCODER CONNECTIONS.
- CHECK THE ENCODER LINE COUNT IN P13.04/P13.05
- ENSURE REVERSE SWITCH ON DIGIN 3 IS OPEN.

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.

OK?

NO:

Minimum Control Connections made?

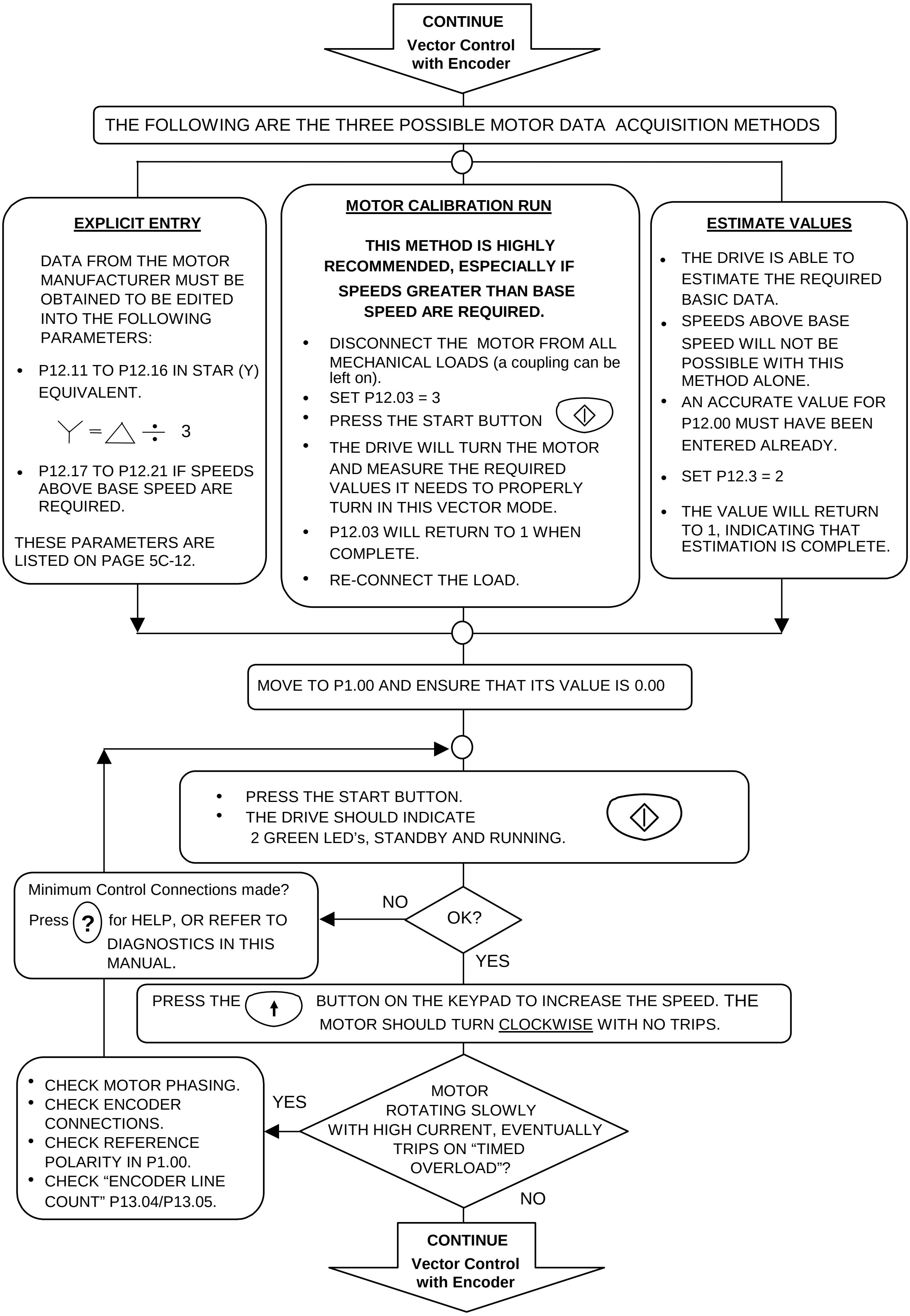
- CHECK MOTOR PHASING FAULT? Press ? for HELP, OR SEE DIAGNOSTICS IN THIS MANUAL.
- ENSURE REVERSE SWITCH ON DIGIN 3 IS OPEN.

YES

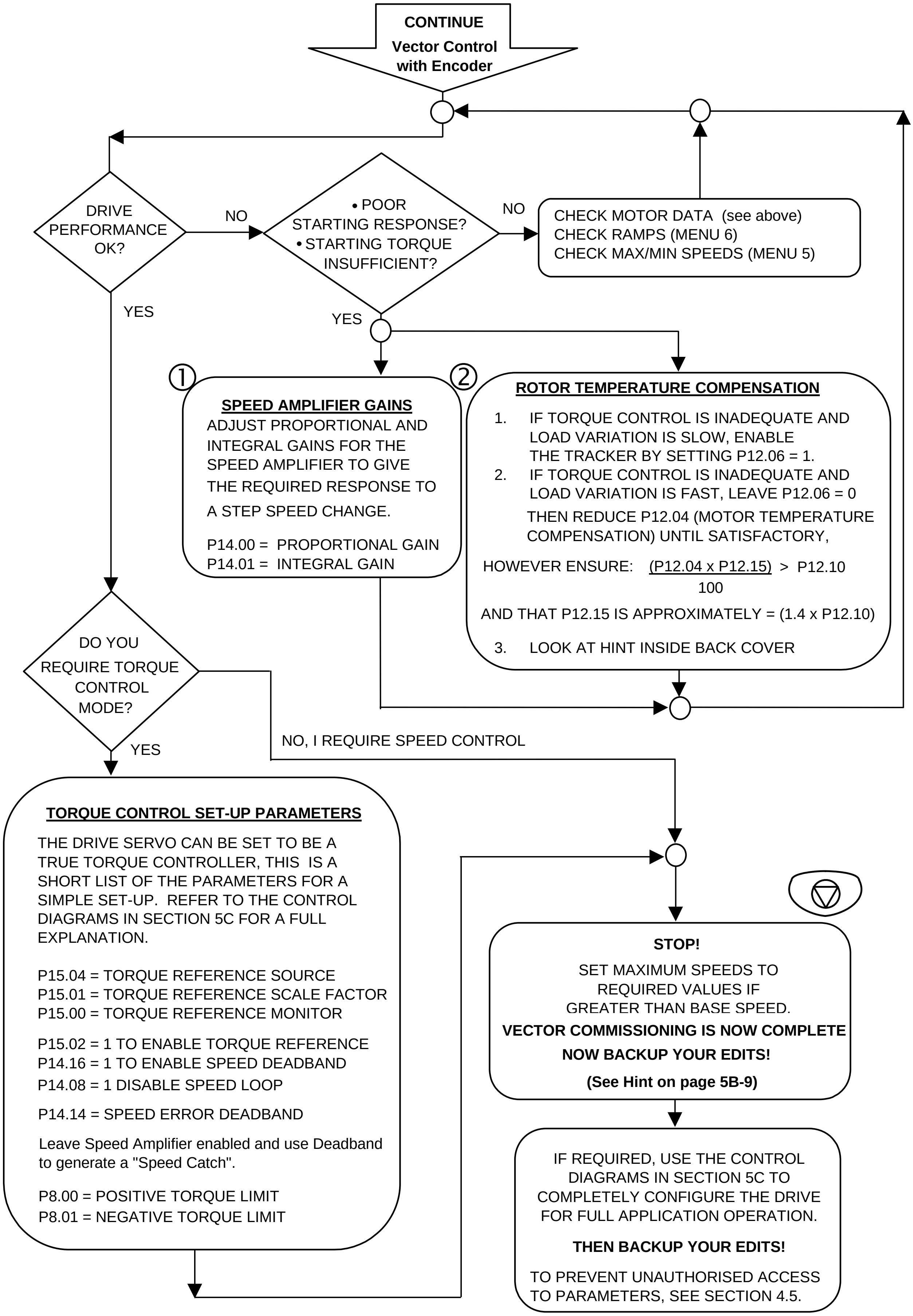
THE DRIVE REQUIRES AN ACCURATE MODEL OF THE MOTOR TO RUN THE VECTOR CONTROLLER PROPERLY. **IT IS STRONGLY RECOMMENDED THAT A FULL CALIBRATION RUN IS INITIATED** TO DO THIS.
THE NEXT CHART EXPLAINS THE CALIBRATION CHOICES.

CONTINUE
Vector Control with Encoder

Vector Control with Encoder (continued)



Vector Control with Encoder (continued)



5B.5 Application Programming

Once the basic commissioning procedure has been completed, the user may find the need to customise the drive parameters to accurately satisfy all the needs of the application. Practical advice, with hints and worked examples, is given in Section 4.4. Together with the Control Block Diagrams in Section 5C, this will enable the user to design systems for almost any application.

5C. Control Block Diagrams

The Control Block Diagrams for the SFE and the Machine Bridge are shown on the following pages. Section 4.6 shows how to use the diagrams to configure the bi-directional converters for specific applications.

The control diagrams are listed in Table 5C-1. The table shows which diagrams are concerned with each type of converter.

Table 5C-1 Control block diagrams

Sheet No.	Description	DB	SFE	Machine Bridge
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 Switches and Square Roots	✓	✓	✓
15	Comparators, Ramp Function and Brake Logic	✓	✓	✓
16	Motor Scalar Control			✓
17	SFE Control System Overview		✓	
18	SFE Vector Control, Part 1		✓	
19	SFE Vector Control, Part 2		✓	

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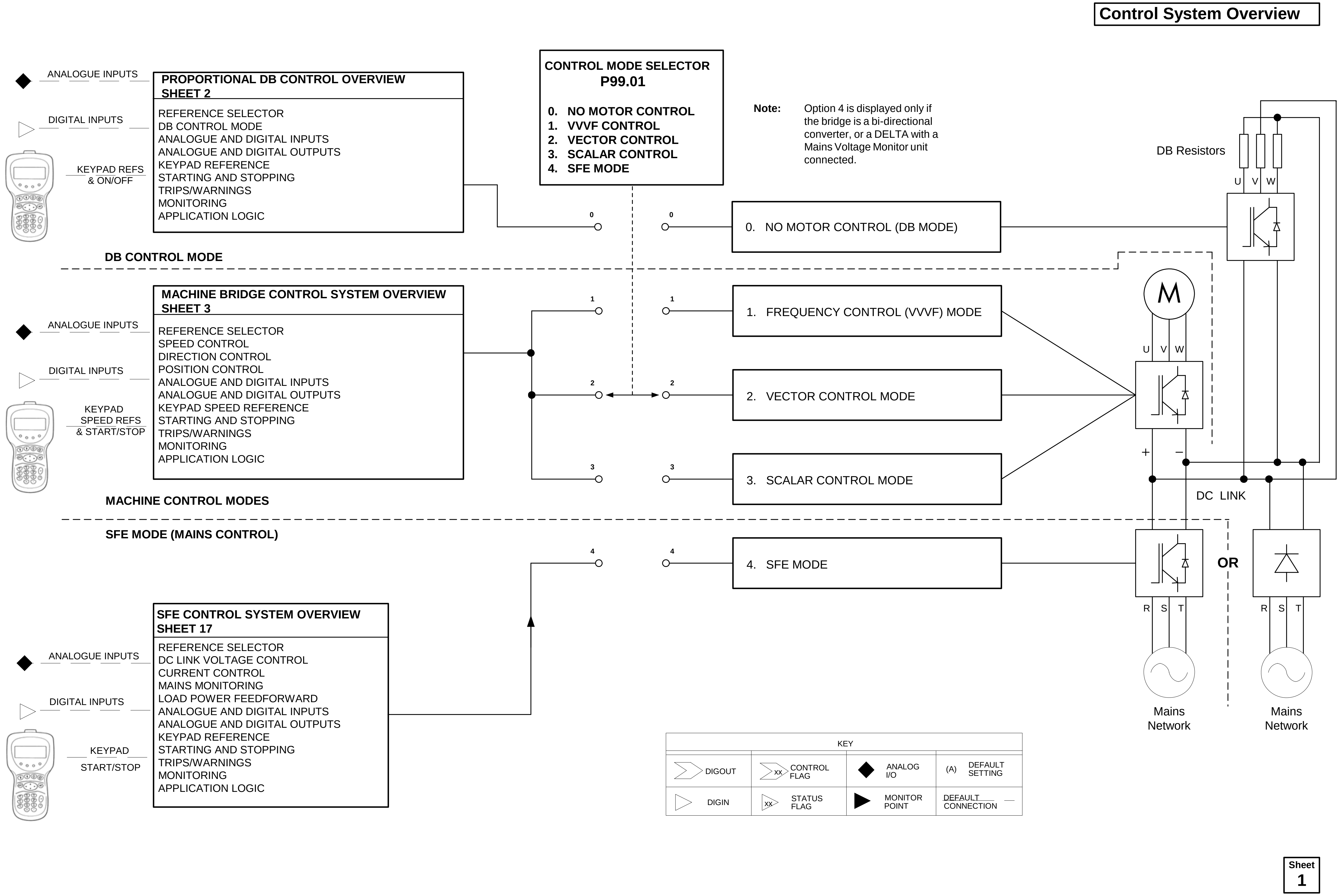
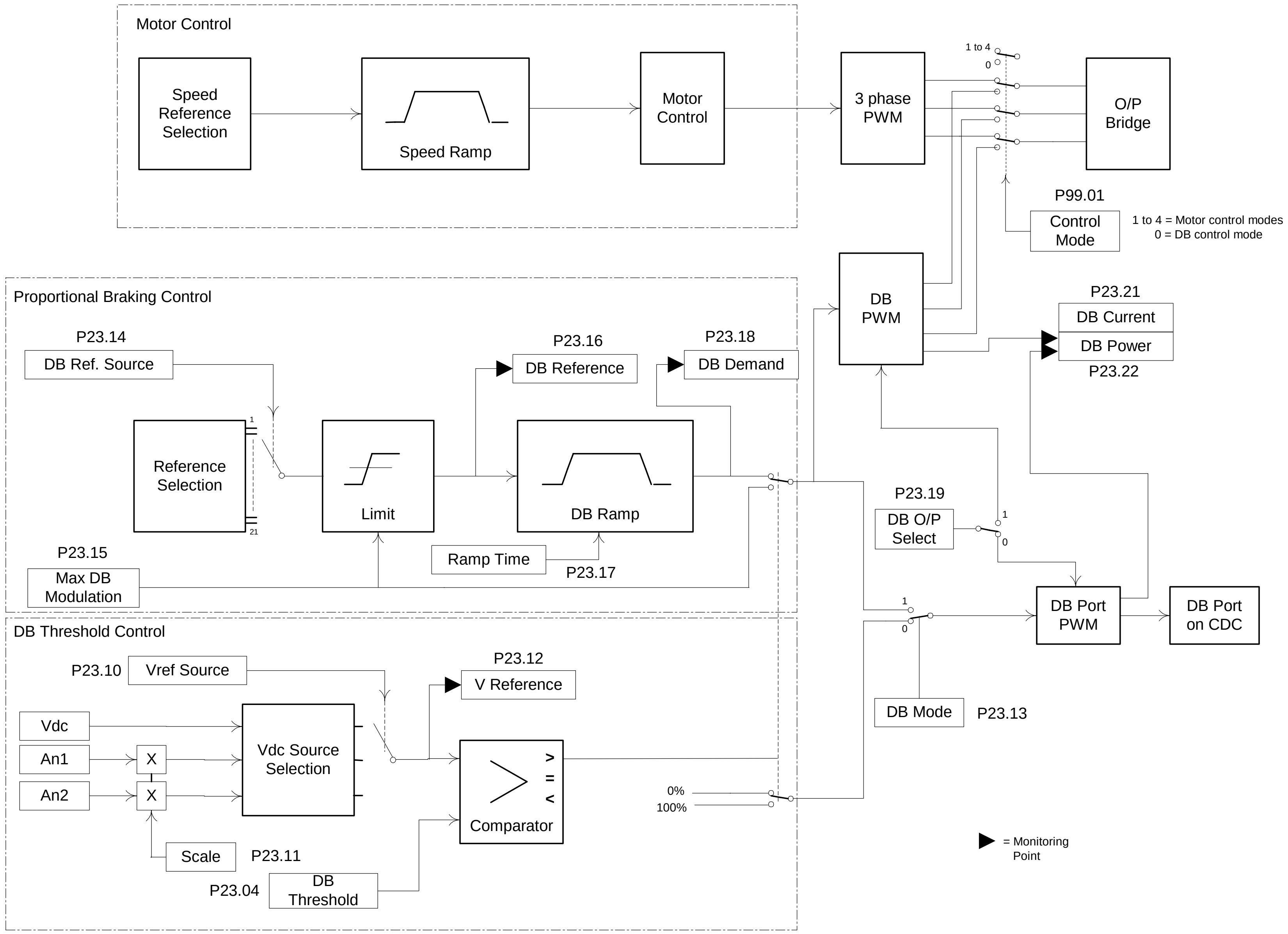
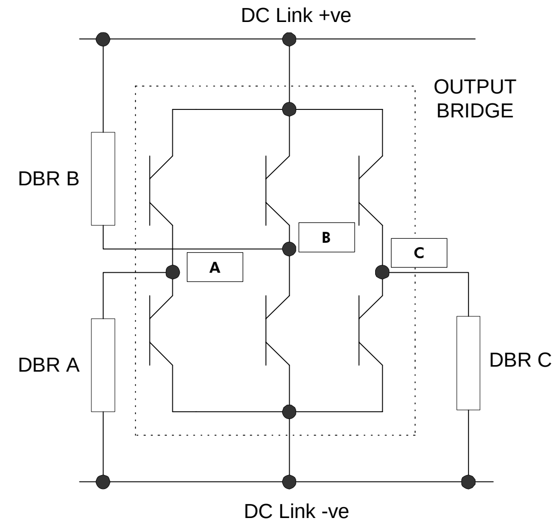

Control System Overview
ANALOGUE INPUTS
DIGITAL INPUTS
KEYPAD REFS & ON/OFF
PROPORTIONAL DB CONTROL OVERVIEW SHEET 2
REFERENCE SELECTOR
DB CONTROL MODE
ANALOGUE AND DIGITAL INPUTS
ANALOGUE AND DIGITAL OUTPUTS
KEYPAD REFERENCE
STARTING AND STOPPING
TRIPS/WARNINGS
MONITORING
APPLICATION LOGIC
CONTROL MODE 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
U V W
0
0
0. NO MOTOR CONTROL (DB MODE)
DB CONTROL MODE
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
ANALOGUE INPUTS
DIGITAL INPUTS
KEYPAD SPEED REFS & START/STOP
1
1
1. FREQUENCY CONTROL (VVVF) MODE
2
2
2. VECTOR CONTROL MODE
3
3
3. SCALAR CONTROL MODE
M
U V W
+ −
DC LINK
MACHINE CONTROL MODES
SFE MODE (MAINS CONTROL)
4
4
4. SFE MODE
OR
R S T
R S T
Mains Network
Mains Network
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
ANALOGUE INPUTS
DIGITAL INPUTS
KEYPAD START/STOP
KEY
DIGOUT
xx CONTROL FLAG
ANALOG I/O
(A) DEFAULT SETTING
DIGIN
xx STATUS FLAG
MONITOR POINT
DEFAULT CONNECTION
Sheet 1

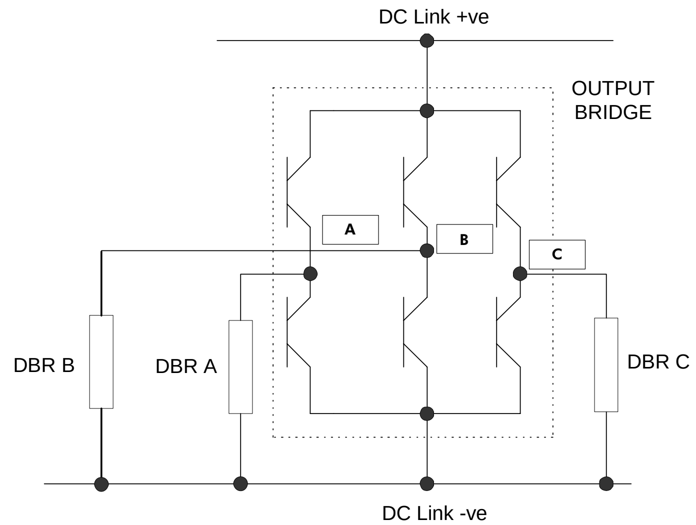
PROPORTIONAL DB CONTROL



MENU 23



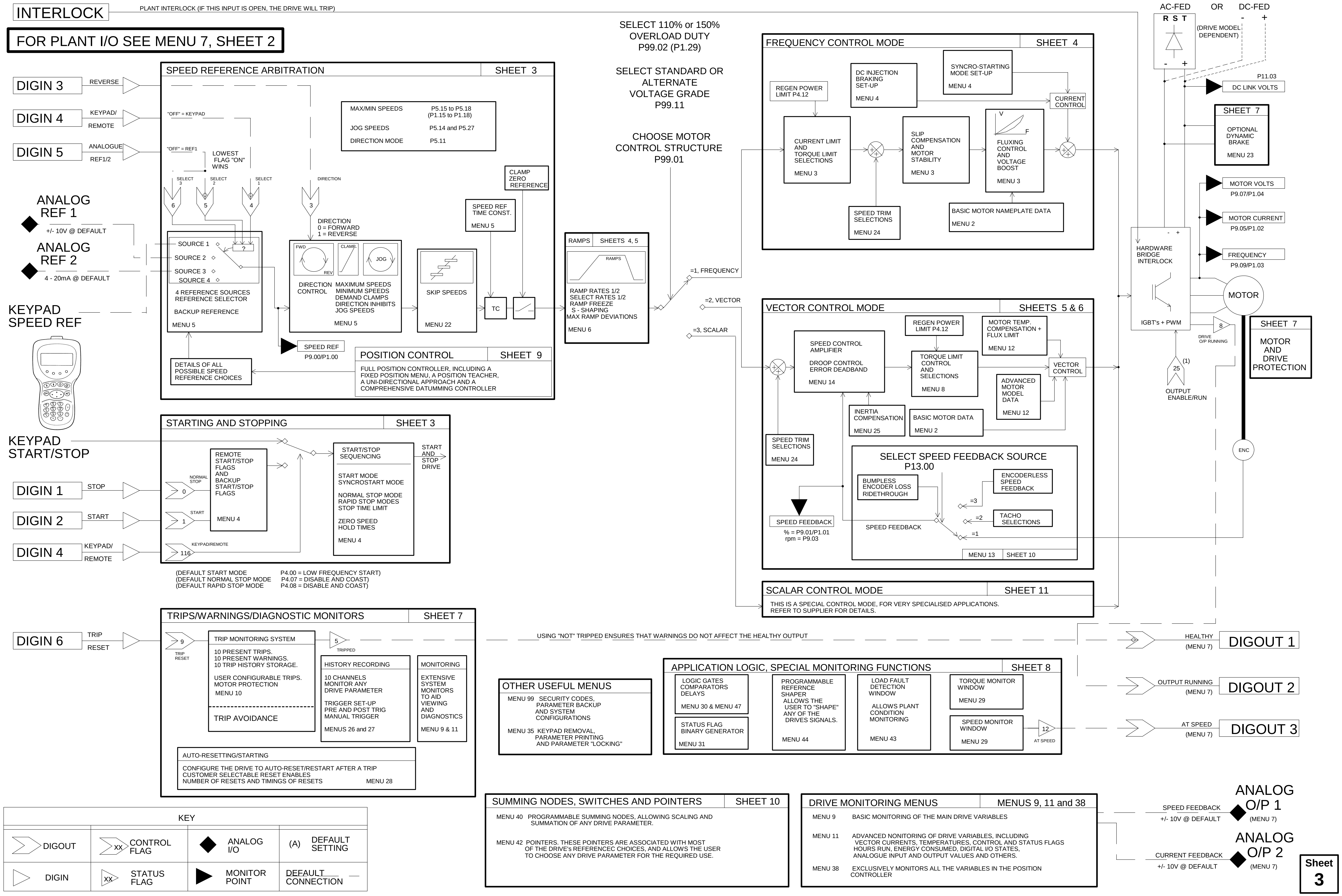
Output Bridge Connections For Proportional DB Control

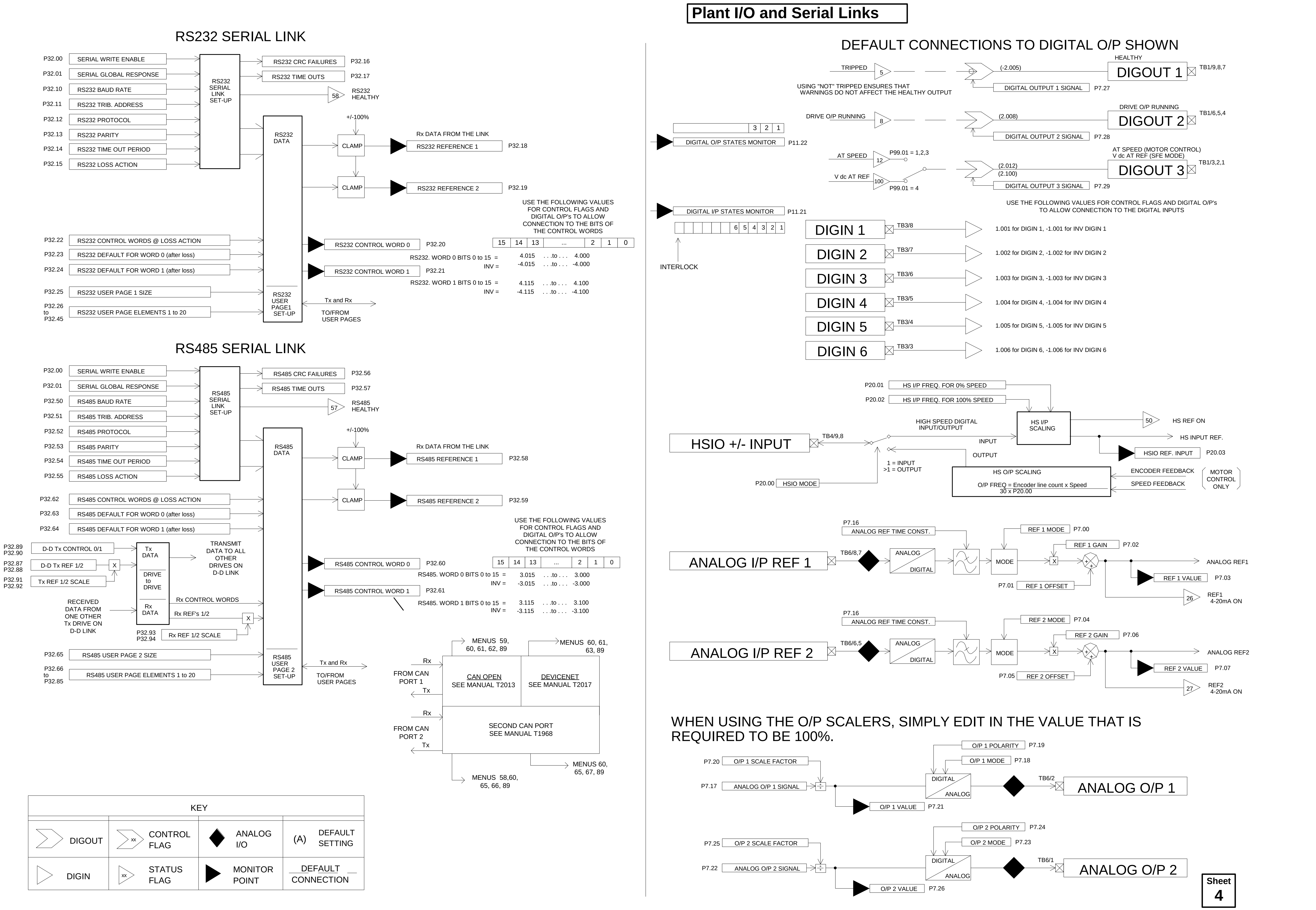


Output Bridge Connections For Threshold DB Control

Sheet 2

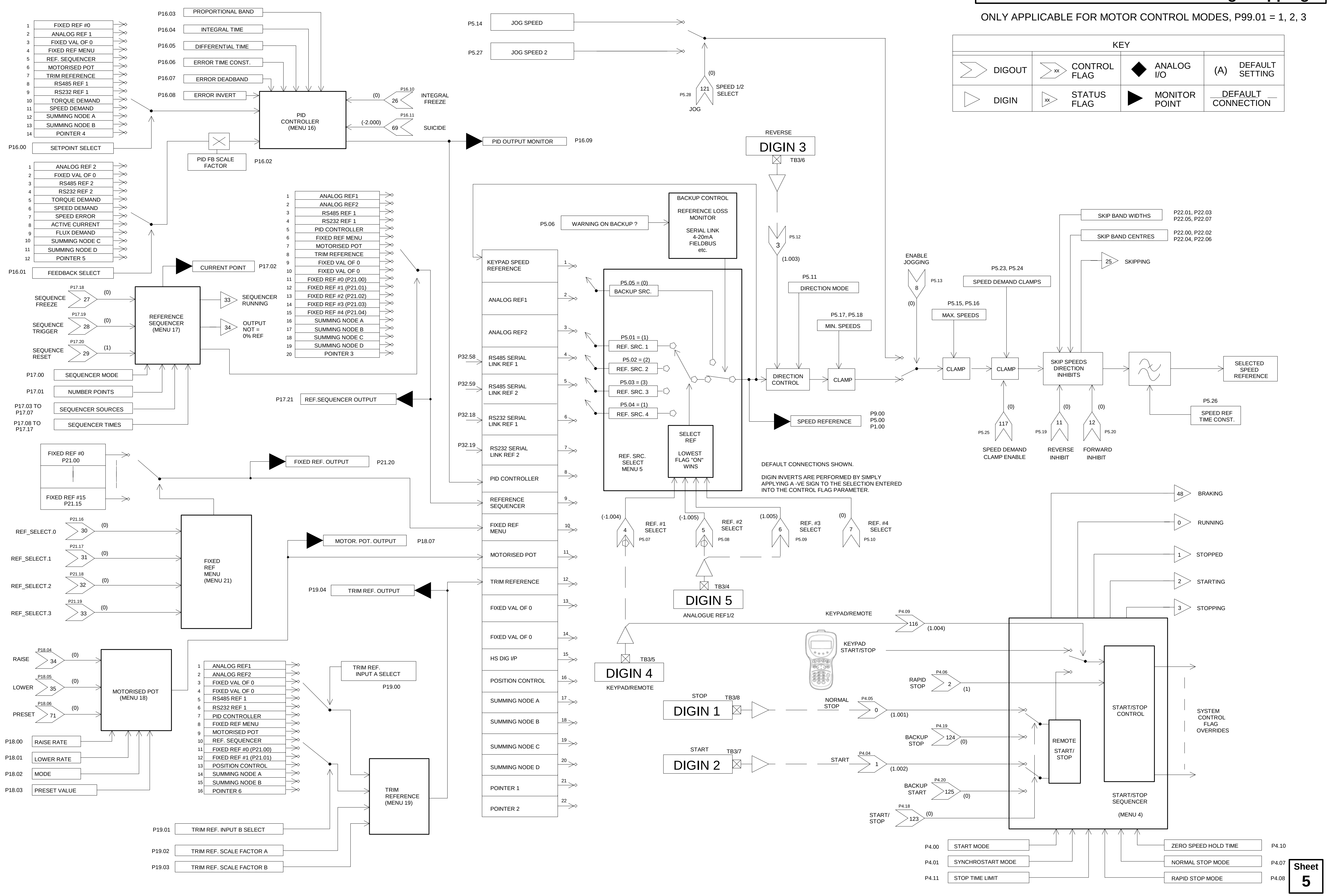
Machine Bridge Control System Overview

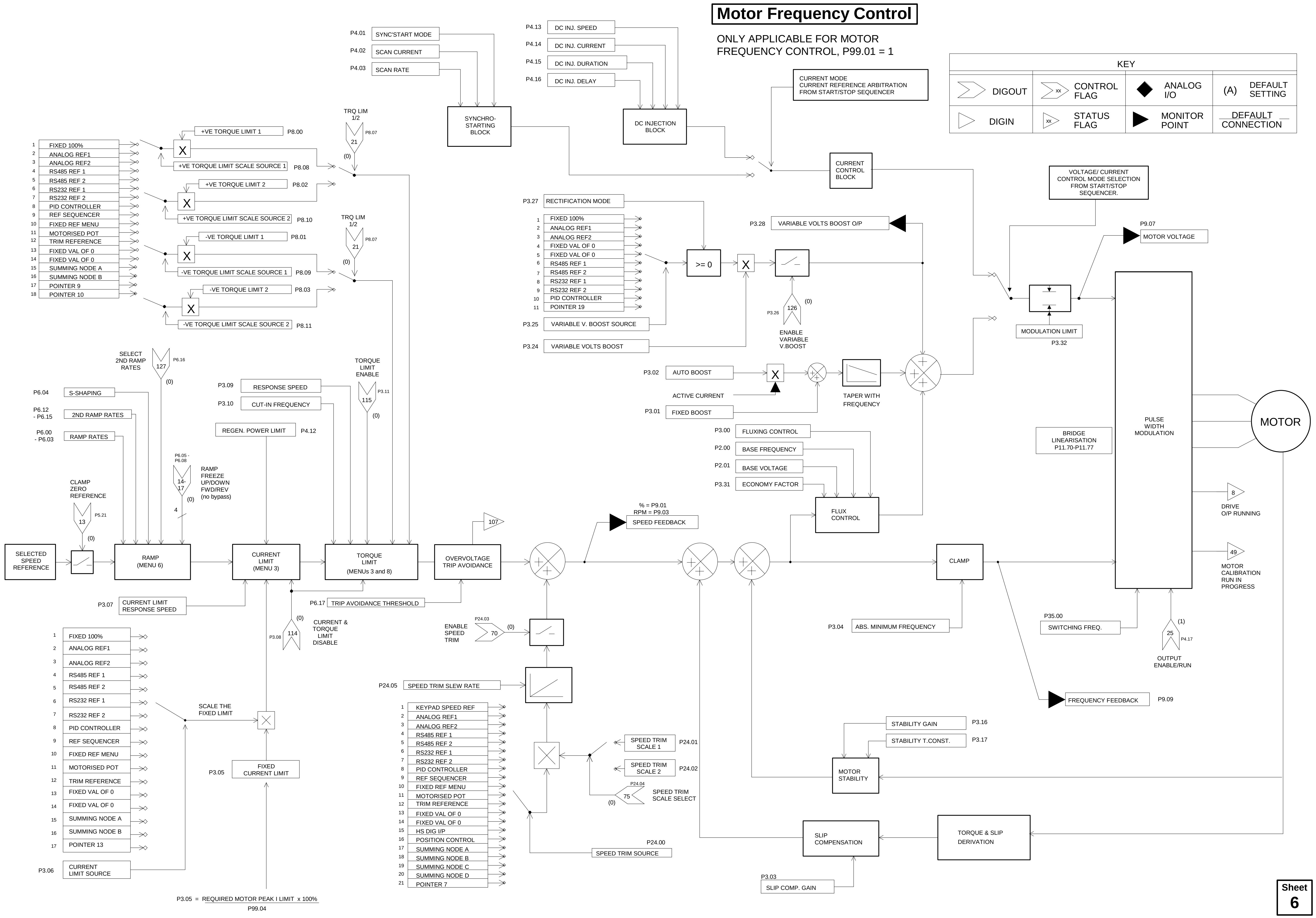



Plant I/O and Serial Links
RS232 SERIAL LINK
P32.00 SERIAL WRITE ENABLE
P32.01 SERIAL GLOBAL RESPONSE
P32.10 RS232 BAUD RATE
P32.11 RS232 TRIB. ADDRESS
P32.12 RS232 PROTOCOL
P32.13 RS232 PARITY
P32.14 RS232 TIME OUT PERIOD
P32.15 RS232 LOSS ACTION
RS232 SERIAL LINK SET-UP
RS232 CRC FAILURES P32.16
RS232 TIME OUTS P32.17
58 RS232 HEALTHY
+/-100%
RS232 DATA
CLAMP
Rx DATA FROM THE LINK
RS232 REFERENCE 1 P32.18
RS232 REFERENCE 2 P32.19
USE THE FOLLOWING VALUES FOR CONTROL FLAGS AND DIGITAL O/P's TO ALLOW CONNECTION TO THE BITS OF THE CONTROL WORDS
P32.22 RS232 CONTROL WORDS @ LOSS ACTION
P32.23 RS232 DEFAULT FOR WORD 0 (after loss)
P32.24 RS232 DEFAULT FOR WORD 1 (after loss)
RS232 CONTROL WORD 0 P32.20
RS232 CONTROL WORD 1 P32.21
15 14 13 ... 2 1 0
RS232. WORD 0 BITS 0 to 15 = 4.015 . . .to . . . 4.000
INV = -4.015 . . .to . . . -4.000
RS232. WORD 1 BITS 0 to 15 = 4.115 . . .to . . . 4.100
INV = -4.115 . . .to . . . -4.100
P32.25 RS232 USER PAGE 1 SIZE
P32.26 to P32.45 RS232 USER PAGE ELEMENTS 1 to 20
RS232 USER PAGE1 SET-UP
Tx and Rx
TO/FROM USER PAGES
RS485 SERIAL LINK
P32.00 SERIAL WRITE ENABLE
P32.01 SERIAL GLOBAL RESPONSE
P32.50 RS485 BAUD RATE
P32.51 RS485 TRIB. ADDRESS
P32.52 RS485 PROTOCOL
P32.53 RS485 PARITY
P32.54 RS485 TIME OUT PERIOD
P32.55 RS485 LOSS ACTION
RS485 SERIAL LINK SET-UP
RS485 CRC FAILURES P32.56
RS485 TIME OUTS P32.57
57 RS485 HEALTHY
+/-100%
RS485 DATA
CLAMP
Rx DATA FROM THE LINK
RS485 REFERENCE 1 P32.58
RS485 REFERENCE 2 P32.59
P32.62 RS485 CONTROL WORDS @ LOSS ACTION
P32.63 RS485 DEFAULT FOR WORD 0 (after loss)
P32.64 RS485 DEFAULT FOR WORD 1 (after loss)
USE THE FOLLOWING VALUES FOR CONTROL FLAGS AND DIGITAL O/P's TO ALLOW CONNECTION TO THE BITS OF THE CONTROL WORDS
P32.89 P32.90 D-D Tx CONTROL 0/1
P32.87 P32.88 D-D Tx REF 1/2
P32.91 P32.92 Tx REF 1/2 SCALE
Tx DATA
DRIVE to DRIVE
Rx DATA
TRANSMIT DATA TO ALL OTHER DRIVES ON D-D LINK
RECEIVED DATA FROM ONE OTHER Tx DRIVE ON D-D LINK
Rx CONTROL WORDS
Rx REF's 1/2
P32.93 P32.94 Rx REF 1/2 SCALE
RS485 CONTROL WORD 0 P32.60
RS485 CONTROL WORD 1 P32.61
15 14 13 ... 2 1 0
RS485. WORD 0 BITS 0 to 15 = 3.015 . . .to . . . 3.000
INV = -3.015 . . .to . . . -3.000
RS485. WORD 1 BITS 0 to 15 = 3.115 . . .to . . . 3.100
INV = -3.115 . . .to . . . -3.100
P32.65 RS485 USER PAGE 2 SIZE
P32.66 to P32.85 RS485 USER PAGE ELEMENTS 1 to 20
RS485 USER PAGE 2 SET-UP
Tx and Rx
TO/FROM USER PAGES
MENUS 59, 60, 61, 62, 89
MENUS 60, 61, 63, 89
FROM CAN PORT 1
Rx
Tx
CAN OPEN SEE MANUAL T2013
DEVICENET SEE MANUAL T2017
FROM CAN PORT 2
SECOND CAN PORT SEE MANUAL T1968
MENUS 60, 65, 67, 89
MENUS 58,60, 65, 66, 89
KEY
DIGOUT
CONTROL FLAG
ANALOG I/O
(A) DEFAULT SETTING
DIGIN
STATUS FLAG
MONITOR POINT
DEFAULT CONNECTION
DEFAULT CONNECTIONS TO DIGITAL O/P SHOWN
TRIPPED 5
HEALTHY
(-2.005)
DIGOUT 1 TB1/9,8,7
DIGITAL OUTPUT 1 SIGNAL P7.27
USING "NOT" TRIPPED ENSURES THAT WARNINGS DO NOT AFFECT THE HEALTHY OUTPUT
DRIVE O/P RUNNING 8
(2.008)
DRIVE O/P RUNNING
DIGOUT 2 TB1/6,5,4
DIGITAL OUTPUT 2 SIGNAL P7.28
3 2 1
DIGITAL O/P STATES MONITOR P11.22
AT SPEED 12
P99.01 = 1,2,3
V dc AT REF 100
P99.01 = 4
(2.012)
(2.100)
AT SPEED (MOTOR CONTROL)
V dc AT REF (SFE MODE)
DIGOUT 3 TB1/3,2,1
DIGITAL OUTPUT 3 SIGNAL P7.29
USE THE FOLLOWING VALUES FOR CONTROL FLAGS AND DIGITAL O/P's TO ALLOW CONNECTION TO THE DIGITAL INPUTS
DIGITAL I/P STATES MONITOR P11.21
6 5 4 3 2 1
INTERLOCK
DIGIN 1 TB3/8 1.001 for DIGIN 1, -1.001 for INV DIGIN 1
DIGIN 2 TB3/7 1.002 for DIGIN 2, -1.002 for INV DIGIN 2
DIGIN 3 TB3/6 1.003 for DIGIN 3, -1.003 for INV DIGIN 3
DIGIN 4 TB3/5 1.004 for DIGIN 4, -1.004 for INV DIGIN 4
DIGIN 5 TB3/4 1.005 for DIGIN 5, -1.005 for INV DIGIN 5
DIGIN 6 TB3/3 1.006 for DIGIN 6, -1.006 for INV DIGIN 6
P20.01 HS I/P FREQ. FOR 0% SPEED
P20.02 HS I/P FREQ. FOR 100% SPEED
HIGH SPEED DIGITAL INPUT/OUTPUT
HS I/P SCALING
50 HS REF ON
HS INPUT REF.
HSIO REF. INPUT P20.03
HSIO +/- INPUT TB4/9,8
INPUT
OUTPUT
1 = INPUT
>1 = OUTPUT
P20.00 HSIO MODE
HS O/P SCALING
O/P FREQ = Encoder line count x Speed / 30 x P20.00
ENCODER FEEDBACK
SPEED FEEDBACK
MOTOR CONTROL ONLY
P7.16 ANALOG REF TIME CONST.
REF 1 MODE P7.00
REF 1 GAIN P7.02
ANALOG I/P REF 1 TB6/8,7
ANALOG DIGITAL
MODE
ANALOG REF1
REF 1 VALUE P7.03
P7.01 REF 1 OFFSET
26 REF1 4-20mA ON
P7.16 ANALOG REF TIME CONST.
REF 2 MODE P7.04
REF 2 GAIN P7.06
ANALOG I/P REF 2 TB6/6,5
ANALOG REF2
REF 2 VALUE P7.07
P7.05 REF 2 OFFSET
27 REF2 4-20mA ON
WHEN USING THE O/P SCALERS, SIMPLY EDIT IN THE VALUE THAT IS REQUIRED TO BE 100%.
O/P 1 POLARITY P7.19
O/P 1 MODE P7.18
P7.20 O/P 1 SCALE FACTOR
P7.17 ANALOG O/P 1 SIGNAL
DIGITAL ANALOG
TB6/2 ANALOG O/P 1
O/P 1 VALUE P7.21
O/P 2 POLARITY P7.24
O/P 2 MODE P7.23
P7.25 O/P 2 SCALE FACTOR
P7.22 ANALOG O/P 2 SIGNAL
TB6/1 ANALOG O/P 2
O/P 2 VALUE P7.26
Sheet 4

Reference Arbitration and Starting/Stopping

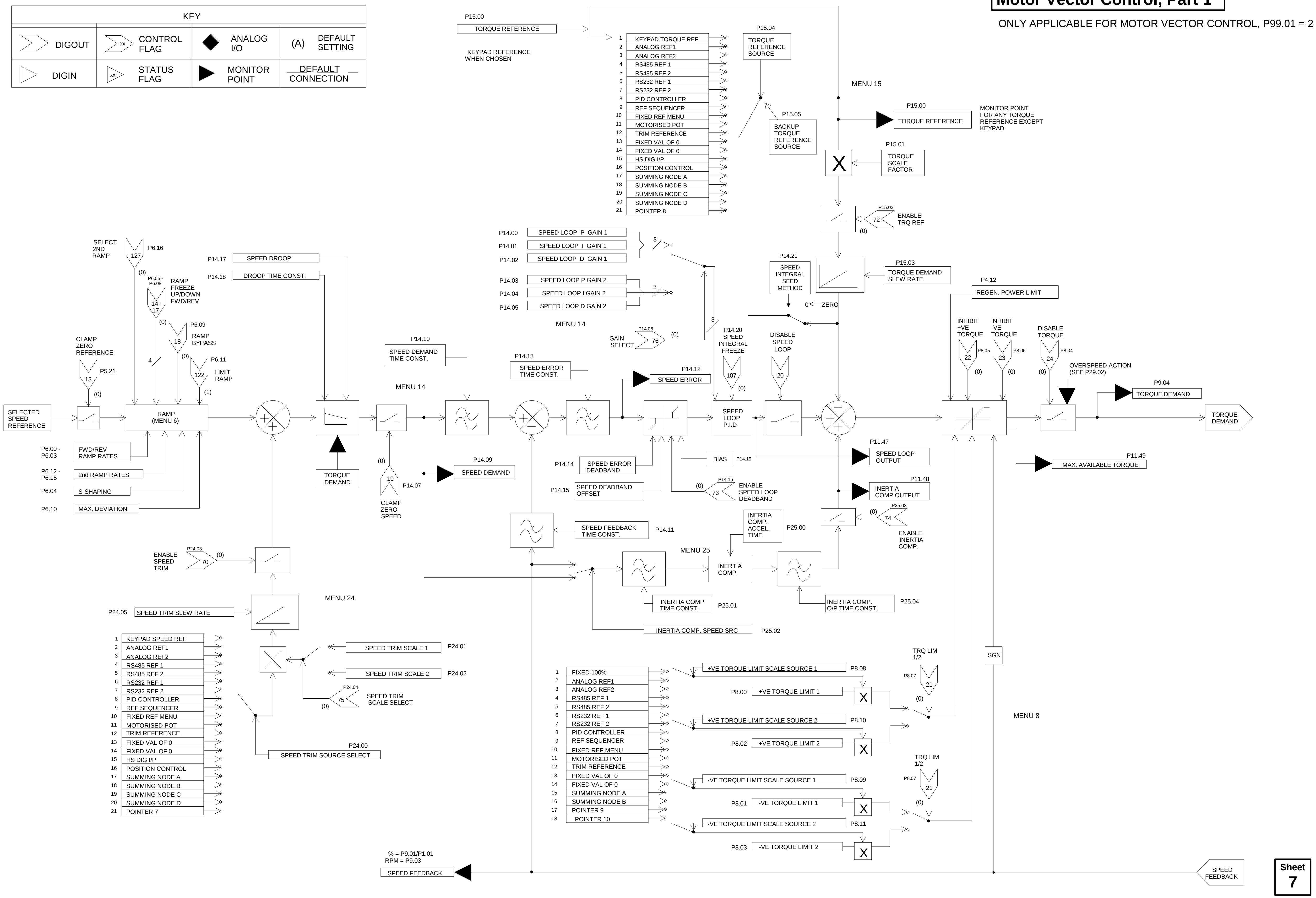
ONLY APPLICABLE FOR MOTOR CONTROL MODES, P99.01 = 1, 2, 3



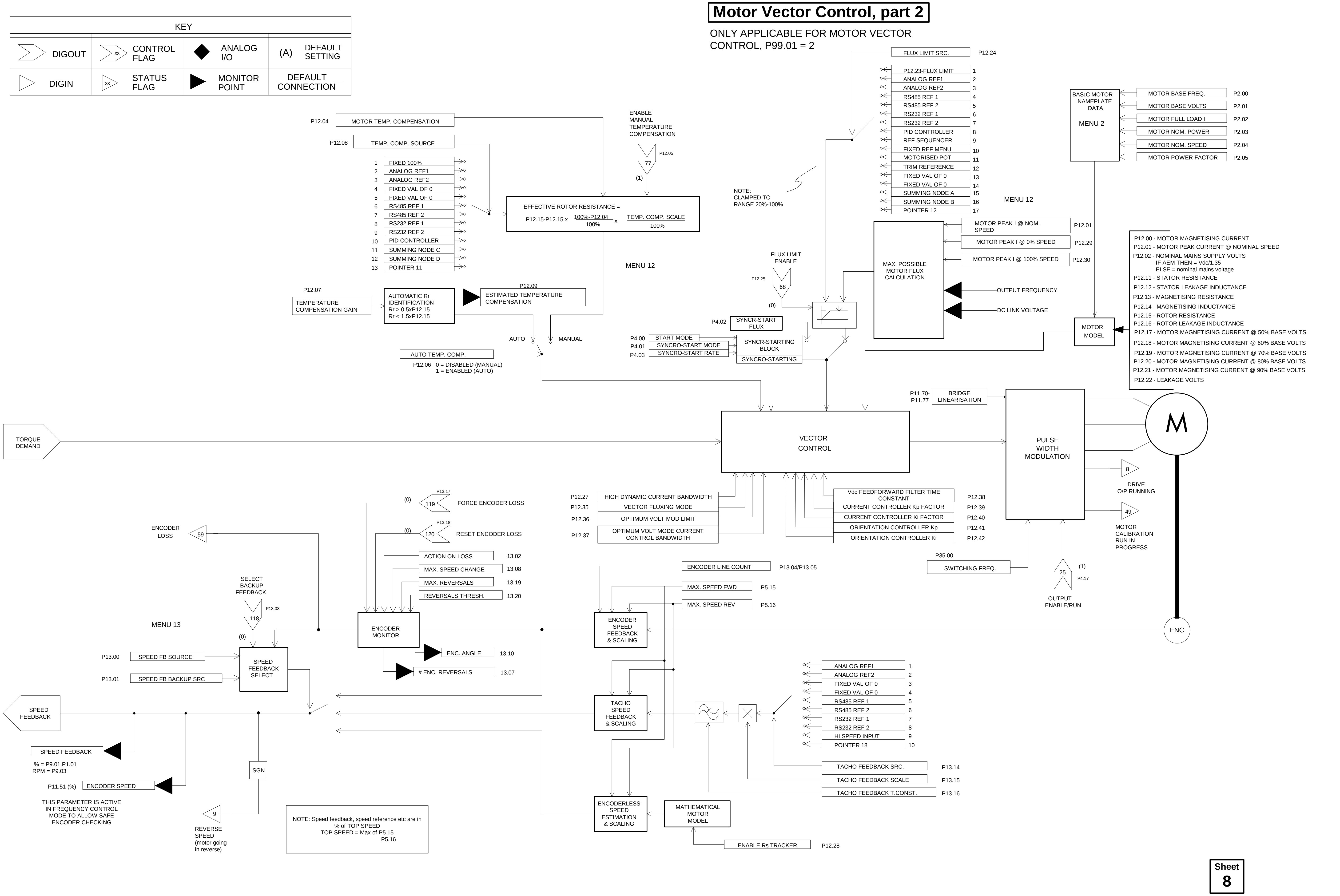

Motor Frequency Control
ONLY APPLICABLE FOR MOTOR FREQUENCY CONTROL, P99.01 = 1
KEY
DIGOUT
CONTROL FLAG
ANALOG I/O
(A) DEFAULT SETTING
DIGIN
STATUS FLAG
MONITOR POINT
DEFAULT CONNECTION
P4.01 SYNC'START MODE
P4.02 SCAN CURRENT
P4.03 SCAN RATE
SYNCHRO-STARTING BLOCK
P4.13 DC INJ. SPEED
P4.14 DC INJ. CURRENT
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
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 9
18 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 21 P8.07 (0)
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
P3.25 VARIABLE V. BOOST SOURCE
P3.24 VARIABLE VOLTS BOOST
>= 0
P3.28 VARIABLE VOLTS BOOST O/P
P3.26 126 (0) ENABLE VARIABLE V.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
SELECT 2ND RAMP RATES 127 P6.16 (0)
P6.04 S-SHAPING
P6.12 - P6.15 2ND RAMP RATES
P6.00 - P6.03 RAMP RATES
P6.05 - P6.08 14-17 (0) RAMP FREEZE UP/DOWN FWD/REV (no bypass)
CLAMP ZERO REFERENCE 13 P5.21 (0)
P3.09 RESPONSE SPEED
P3.10 CUT-IN FREQUENCY
REGEN. POWER LIMIT P4.12
TORQUE LIMIT ENABLE 115 P3.11 (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
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
SCALE THE FIXED LIMIT
P3.05 FIXED CURRENT LIMIT
P3.05 = REQUIRED MOTOR PEAK I LIMIT x 100% / P99.04
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
FREQUENCY FEEDBACK P9.09
STABILITY GAIN P3.16
STABILITY T.CONST. P3.17
MOTOR STABILITY
SLIP COMPENSATION
TORQUE & SLIP DERIVATION
P3.03 SLIP COMP. GAIN
Sheet 6

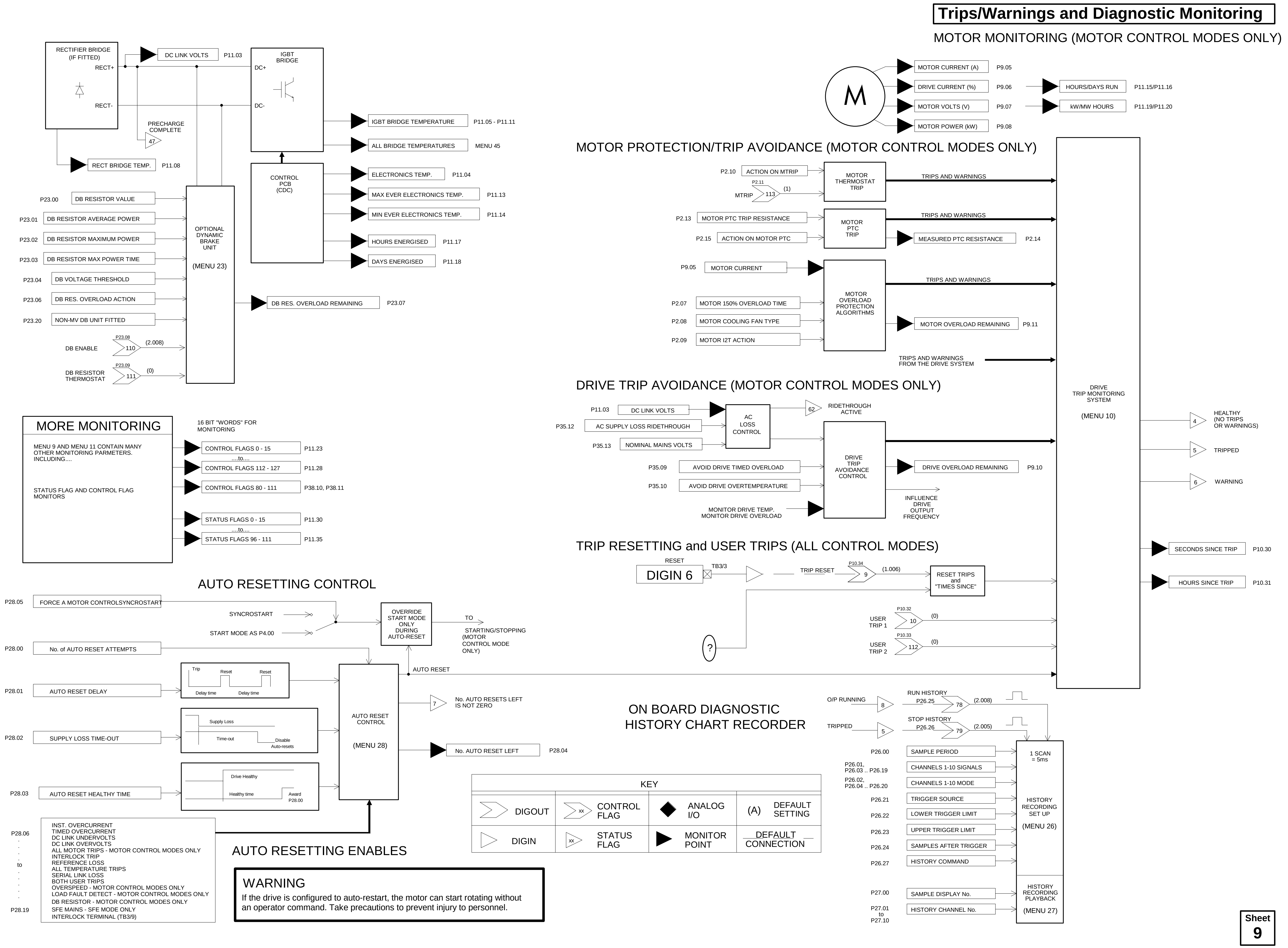
Motor Vector Control, Part 1

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



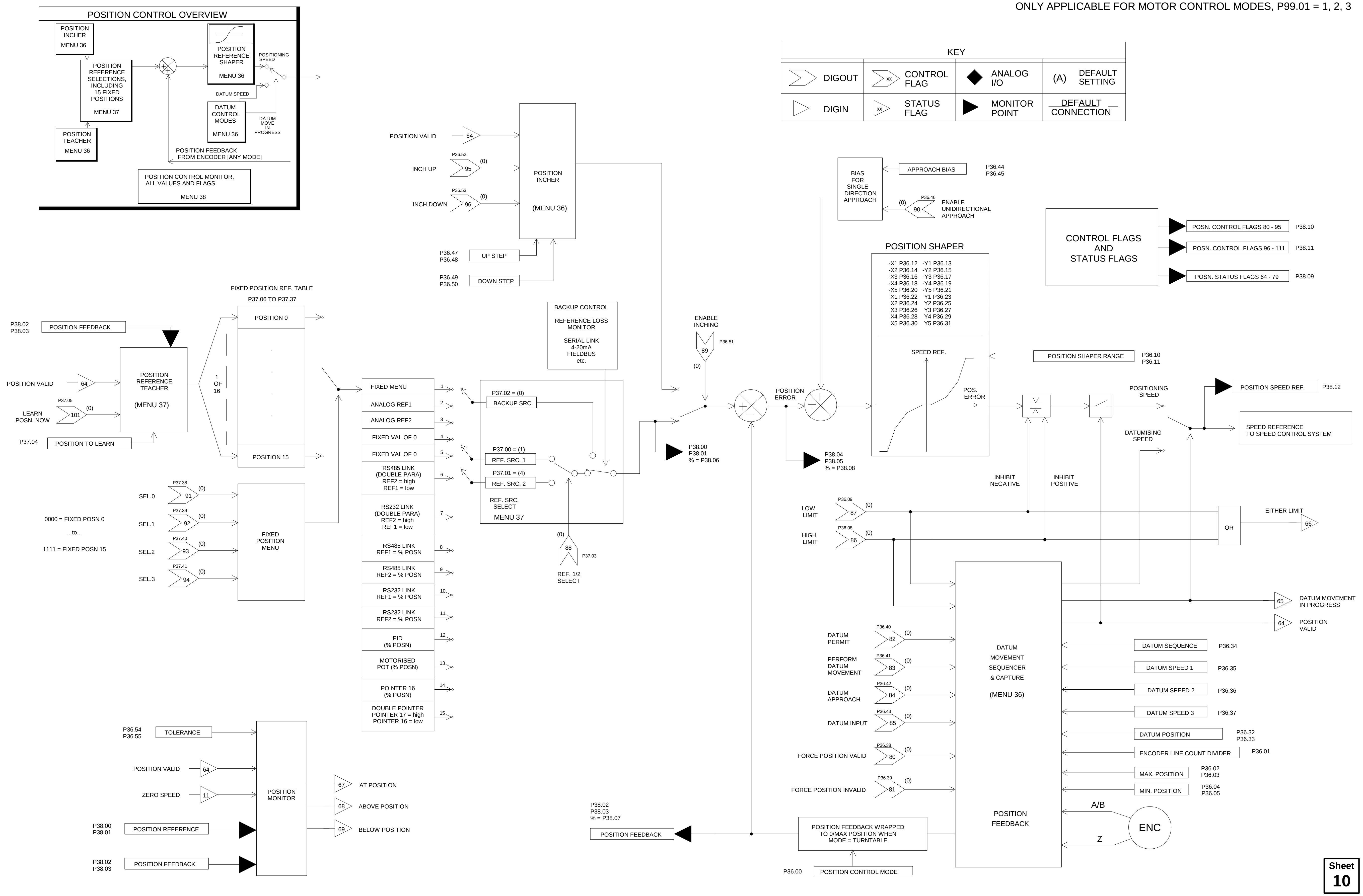
Sheet 7


Motor Vector Control, part 2
ONLY APPLICABLE FOR MOTOR VECTOR CONTROL, P99.01 = 2
KEY
DIGOUT
CONTROL FLAG
ANALOG I/O
(A) DEFAULT SETTING
DIGIN
STATUS FLAG
MONITOR POINT
DEFAULT CONNECTION
MOTOR TEMP. COMPENSATION
TEMP. COMP. SOURCE
EFFECTIVE ROTOR RESISTANCE =
TEMP. COMP. SCALE
ENABLE MANUAL TEMPERATURE COMPENSATION
AUTOMATIC Rr IDENTIFICATION
ESTIMATED TEMPERATURE COMPENSATION
TEMPERATURE COMPENSATION GAIN
AUTO TEMP. COMP.
P12.06 0 = DISABLED (MANUAL) 1 = ENABLED (AUTO)
MENU 12
NOTE: CLAMPED TO RANGE 20%-100%
FLUX LIMIT SRC.
FLUX LIMIT ENABLE
SYNCR-START FLUX
START MODE
SYNCRO-START MODE
SYNCRO-START RATE
SYNCR-STARTING BLOCK
MAX. POSSIBLE MOTOR FLUX CALCULATION
OUTPUT FREQUENCY
DC LINK VOLTAGE
BASIC MOTOR NAMEPLATE DATA
MENU 2
MOTOR BASE FREQ.
MOTOR BASE VOLTS
MOTOR FULL LOAD I
MOTOR NOM. POWER
MOTOR NOM. SPEED
MOTOR POWER FACTOR
MOTOR MODEL
P12.00 - MOTOR MAGNETISING CURRENT
P12.01 - MOTOR PEAK CURRENT @ NOMINAL SPEED
P12.02 - NOMINAL MAINS SUPPLY VOLTS
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
P12.22 - LEAKAGE VOLTS
TORQUE DEMAND
VECTOR CONTROL
PULSE WIDTH MODULATION
BRIDGE LINEARISATION
DRIVE O/P RUNNING
MOTOR CALIBRATION RUN IN PROGRESS
SWITCHING FREQ.
OUTPUT ENABLE/RUN
HIGH DYNAMIC CURRENT BANDWIDTH
VECTOR FLUXING MODE
OPTIMUM VOLT MOD LIMIT
OPTIMUM VOLT MODE CURRENT CONTROL BANDWIDTH
Vdc FEEDFORWARD FILTER TIME CONSTANT
CURRENT CONTROLLER Kp FACTOR
CURRENT CONTROLLER Ki FACTOR
ORIENTATION CONTROLLER Kp
ORIENTATION CONTROLLER Ki
ENCODER LOSS
FORCE ENCODER LOSS
RESET ENCODER LOSS
ACTION ON LOSS
MAX. SPEED CHANGE
MAX. REVERSALS
REVERSALS THRESH.
ENCODER MONITOR
ENC. ANGLE
ENC. REVERSALS
SELECT BACKUP FEEDBACK
MENU 13
SPEED FB SOURCE
SPEED FB BACKUP SRC
SPEED FEEDBACK SELECT
SPEED FEEDBACK
ENCODER SPEED
THIS PARAMETER IS ACTIVE IN FREQUENCY CONTROL MODE TO ALLOW SAFE ENCODER CHECKING
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
ENCODER LINE COUNT
MAX. SPEED FWD
MAX. SPEED REV
ENCODER SPEED FEEDBACK & SCALING
TACHO SPEED FEEDBACK & SCALING
ENCODERLESS SPEED ESTIMATION & SCALING
MATHEMATICAL MOTOR MODEL
ENABLE Rs TRACKER
TACHO FEEDBACK SRC.
TACHO FEEDBACK SCALE
TACHO FEEDBACK T.CONST.
ENC
Sheet 8


Trips/Warnings and Diagnostic Monitoring
MOTOR MONITORING (MOTOR CONTROL MODES ONLY)
M
MOTOR CURRENT (A) P9.05
DRIVE CURRENT (%) P9.06
MOTOR VOLTS (V) P9.07
MOTOR POWER (kW) P9.08
HOURS/DAYS RUN P11.15/P11.16
kW/MW HOURS P11.19/P11.20
RECTIFIER BRIDGE (IF FITTED)
RECT+
RECT-
DC LINK VOLTS P11.03
IGBT BRIDGE
DC+
DC-
PRECHARGE COMPLETE
47
RECT BRIDGE TEMP. P11.08
IGBT BRIDGE TEMPERATURE P11.05 - P11.11
ALL BRIDGE TEMPERATURES MENU 45
CONTROL PCB (CDC)
ELECTRONICS TEMP. P11.04
MAX EVER ELECTRONICS TEMP. P11.13
MIN EVER ELECTRONICS TEMP. P11.14
HOURS ENERGISED P11.17
DAYS ENERGISED P11.18
P23.00 DB RESISTOR VALUE
P23.01 DB RESISTOR AVERAGE POWER
P23.02 DB RESISTOR MAXIMUM POWER
P23.03 DB RESISTOR MAX POWER TIME
P23.04 DB VOLTAGE THRESHOLD
P23.06 DB RES. OVERLOAD ACTION
P23.20 NON-MV DB UNIT FITTED
DB ENABLE P23.08 110 (2.008)
DB RESISTOR THERMOSTAT P23.09 111 (0)
OPTIONAL DYNAMIC BRAKE UNIT (MENU 23)
DB RES. OVERLOAD REMAINING P23.07
MOTOR PROTECTION/TRIP AVOIDANCE (MOTOR CONTROL MODES ONLY)
P2.10 ACTION ON MTRIP
MTRIP P2.11 113 (1)
MOTOR THERMOSTAT TRIP
TRIPS AND WARNINGS
P2.13 MOTOR PTC TRIP RESISTANCE
P2.15 ACTION ON MOTOR PTC
MOTOR PTC TRIP
MEASURED PTC RESISTANCE P2.14
P9.05 MOTOR CURRENT
P2.07 MOTOR 150% OVERLOAD TIME
P2.08 MOTOR COOLING FAN TYPE
P2.09 MOTOR I2T ACTION
MOTOR OVERLOAD PROTECTION ALGORITHMS
MOTOR OVERLOAD REMAINING P9.11
TRIPS AND WARNINGS FROM THE DRIVE SYSTEM
DRIVE TRIP MONITORING SYSTEM (MENU 10)
DRIVE TRIP AVOIDANCE (MOTOR CONTROL MODES ONLY)
P11.03 DC LINK VOLTS
P35.12 AC SUPPLY LOSS RIDETHROUGH
P35.13 NOMINAL MAINS VOLTS
AC LOSS CONTROL
62 RIDETHROUGH ACTIVE
P35.09 AVOID DRIVE TIMED OVERLOAD
P35.10 AVOID DRIVE OVERTEMPERATURE
MONITOR DRIVE TEMP. MONITOR DRIVE OVERLOAD
DRIVE TRIP AVOIDANCE CONTROL
DRIVE OVERLOAD REMAINING P9.10
INFLUENCE DRIVE OUTPUT FREQUENCY
4 HEALTHY (NO TRIPS OR WARNINGS)
5 TRIPPED
6 WARNING
SECONDS SINCE TRIP P10.30
HOURS SINCE TRIP P10.31
MORE MONITORING
16 BIT "WORDS" FOR MONITORING
MENU 9 AND MENU 11 CONTAIN MANY OTHER MONITORING PARMETERS. INCLUDING....
STATUS FLAG AND CONTROL FLAG MONITORS
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
TRIP RESETTING and USER TRIPS (ALL CONTROL MODES)
RESET
DIGIN 6
TB3/3
TRIP RESET P10.34 9 (1.006)
RESET TRIPS and "TIMES SINCE"
USER TRIP 1 P10.32 10 (0)
USER TRIP 2 P10.33 112 (0)
?
AUTO RESETTING CONTROL
P28.05 FORCE A MOTOR CONTROLSYNCROSTART
SYNCROSTART
START MODE AS P4.00
OVERRIDE START MODE ONLY DURING AUTO-RESET
TO STARTING/STOPPING (MOTOR CONTROL MODE ONLY)
P28.00 No. of AUTO RESET ATTEMPTS
AUTO RESET
P28.01 AUTO RESET DELAY
Trip Reset Reset Delay time Delay time
P28.02 SUPPLY LOSS TIME-OUT
Supply Loss Time-out Disable Auto-resets
P28.03 AUTO RESET HEALTHY TIME
Drive Healthy Healthy time Award P28.00
AUTO RESET CONTROL (MENU 28)
7 No. AUTO RESETS LEFT IS NOT ZERO
No. AUTO RESET LEFT P28.04
P28.06 to P28.19
INST. OVERCURRENT
TIMED OVERCURRENT
DC LINK UNDERVOLTS
DC LINK OVERVOLTS
ALL MOTOR TRIPS - MOTOR CONTROL MODES ONLY
INTERLOCK TRIP
REFERENCE LOSS
ALL TEMPERATURE TRIPS
SERIAL LINK LOSS
BOTH USER TRIPS
OVERSPEED - MOTOR CONTROL MODES ONLY
LOAD FAULT DETECT - MOTOR CONTROL MODES ONLY
DB RESISTOR - MOTOR CONTROL MODES ONLY
SFE MAINS - SFE MODE ONLY
INTERLOCK TERMINAL (TB3/9)
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.
KEY
DIGOUT
CONTROL FLAG
ANALOG I/O
(A) DEFAULT SETTING
DIGIN
STATUS FLAG
MONITOR POINT
DEFAULT CONNECTION
ON BOARD DIAGNOSTIC HISTORY CHART RECORDER
O/P RUNNING 8 RUN HISTORY P26.25 78 (2.008)
TRIPPED 5 STOP HISTORY P26.26 79 (2.005)
P26.00 SAMPLE PERIOD
P26.01, P26.03 .. P26.19 CHANNELS 1-10 SIGNALS
P26.02, P26.04 .. P26.20 CHANNELS 1-10 MODE
P26.21 TRIGGER SOURCE
P26.22 LOWER TRIGGER LIMIT
P26.23 UPPER TRIGGER LIMIT
P26.24 SAMPLES AFTER TRIGGER
P26.27 HISTORY COMMAND
1 SCAN = 5ms
HISTORY RECORDING SET UP (MENU 26)
P27.00 SAMPLE DISPLAY No.
P27.01 to P27.10 HISTORY CHANNEL No.
HISTORY RECORDING PLAYBACK (MENU 27)
Sheet 9

Motor Position Controller

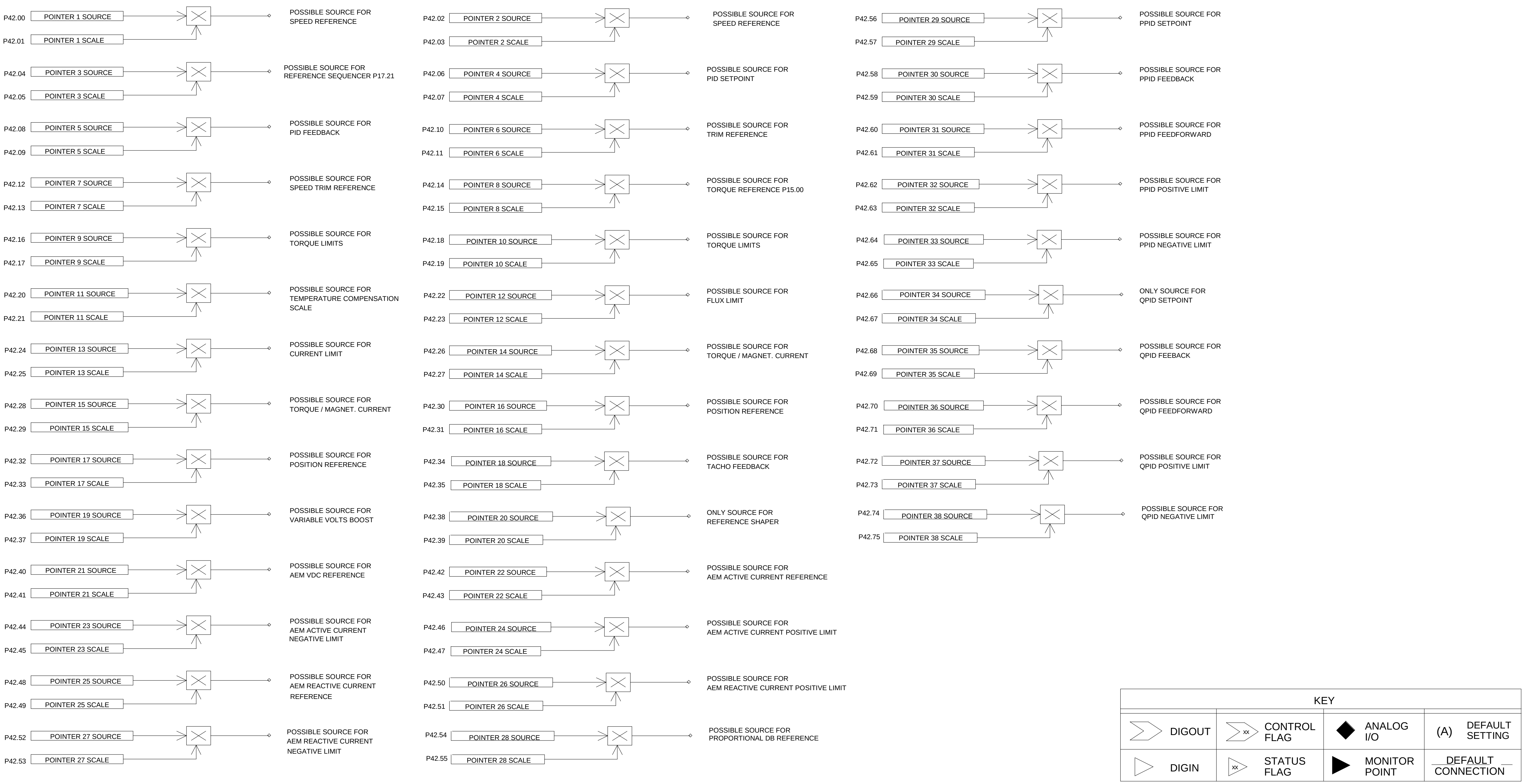
ONLY APPLICABLE FOR MOTOR CONTROL MODES, P99.01 = 1, 2, 3



Pointers

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

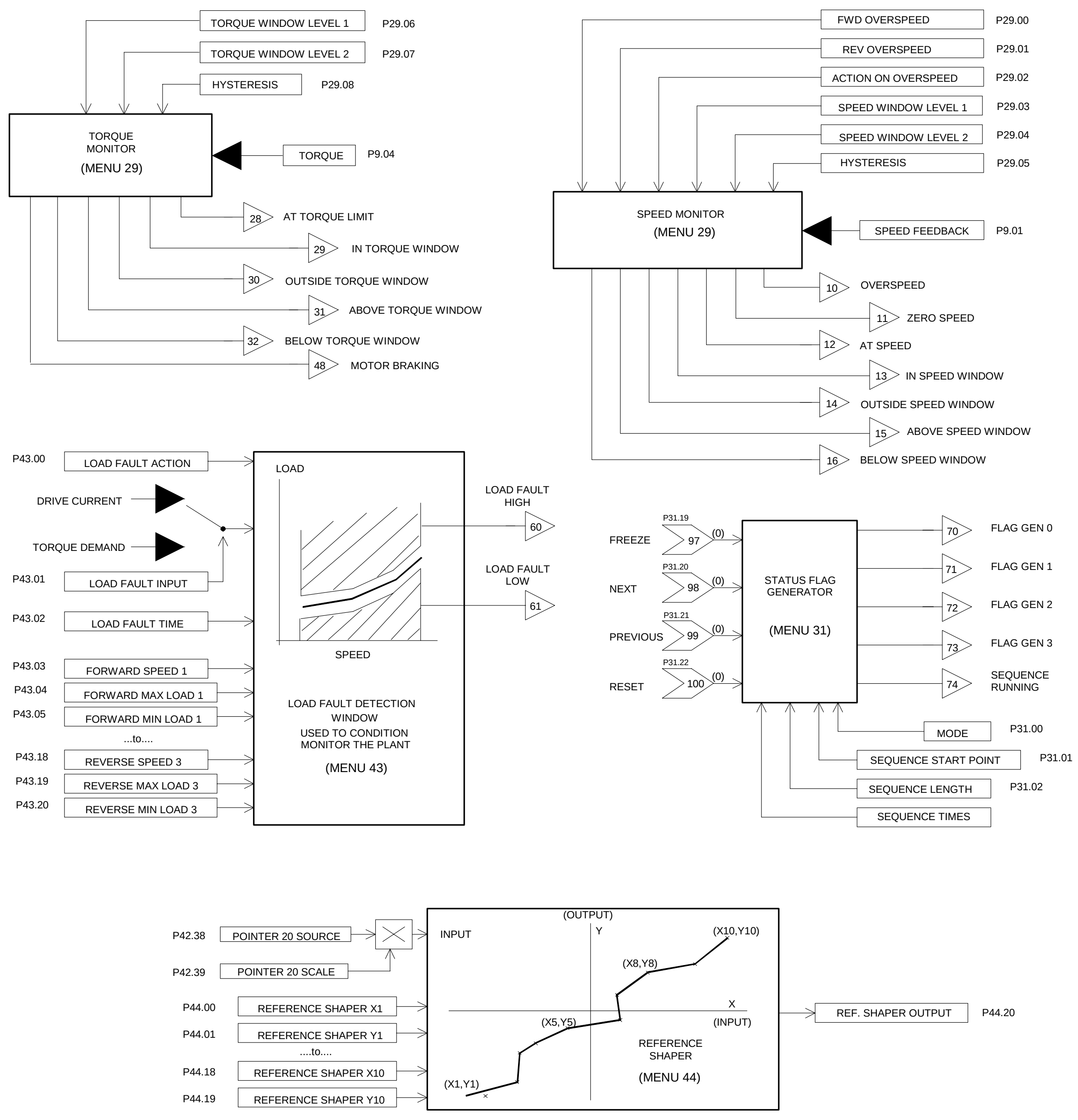
E.G. CHOOSE POINTER 1 FROM THE SPEED REFERENCE CHOICE SELECTION (SHEET 2)
THEN CONFIGURE POINTER 1 BELOW.
THE POINTER SOURCES CAN BE ANY DRIVE PARAMETER.

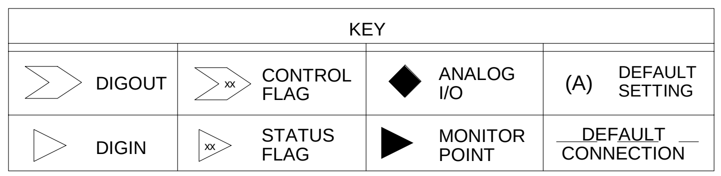


Sheet 11

Special Monitoring Functions

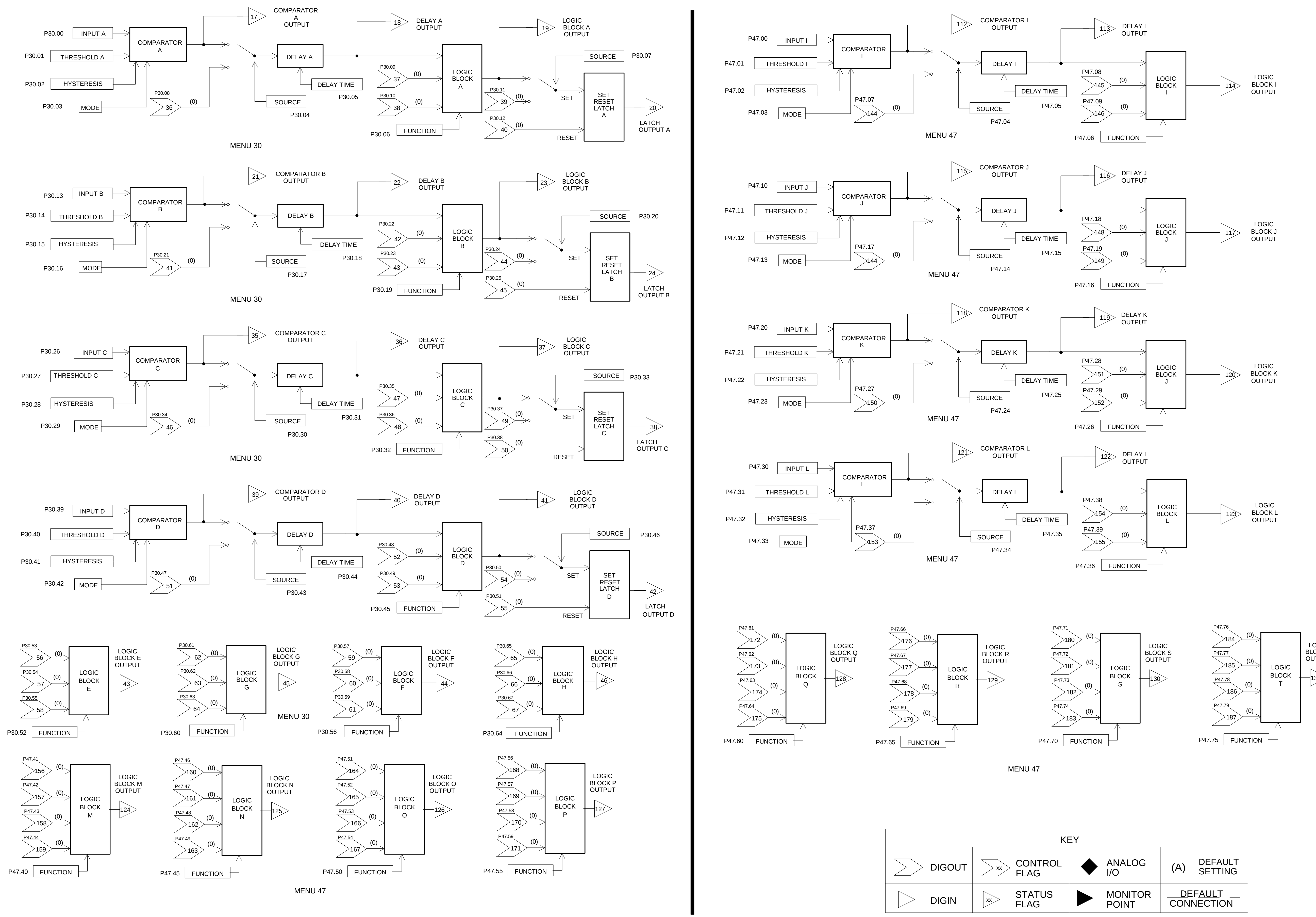
APPLICATION MONITORS AND SPECIAL FUNCTIONS, MOTOR CONTROL MODES ONLY





Sheet 12

Application Logic - General Purpose Logic Blocks



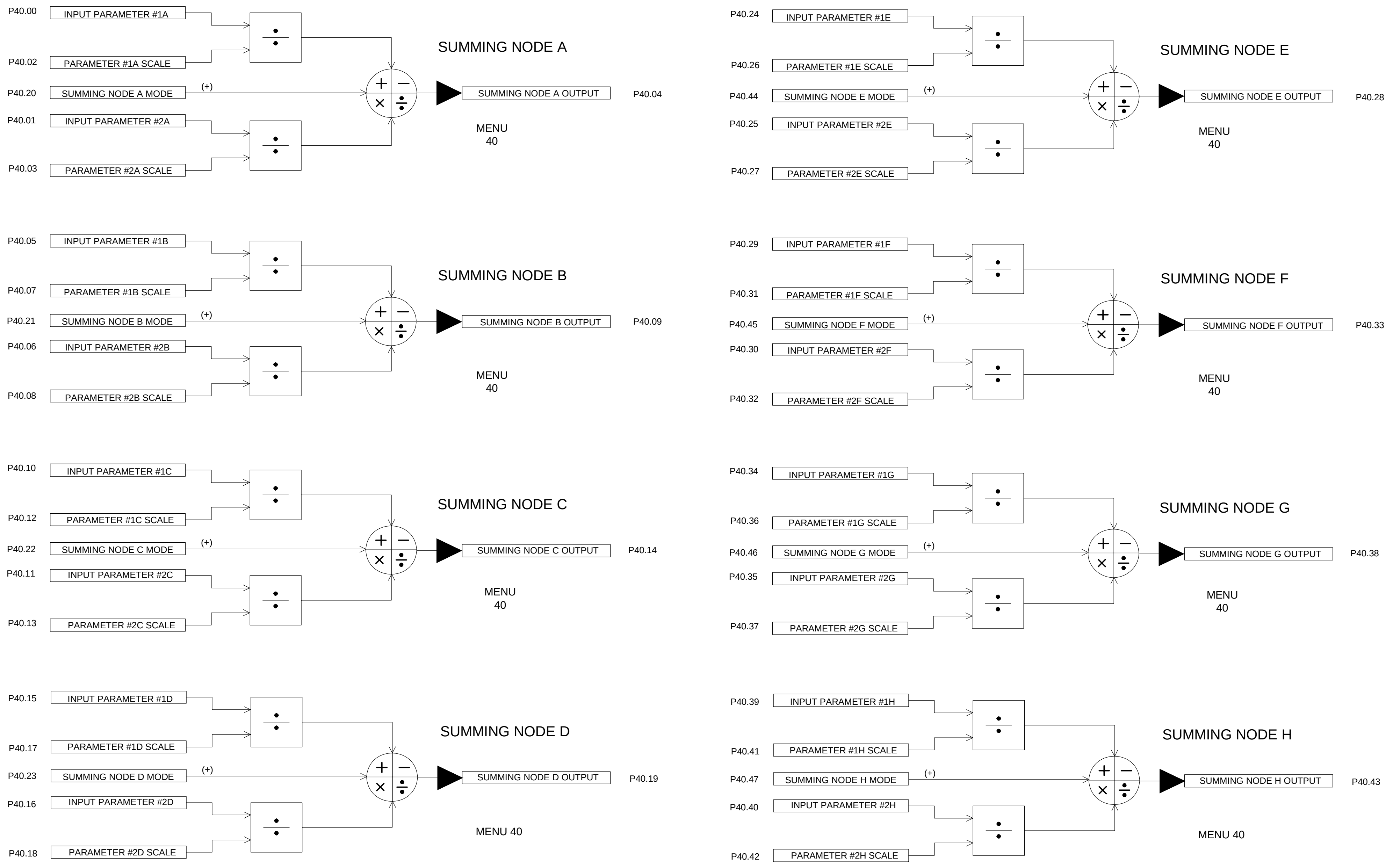
Sheet
13

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.

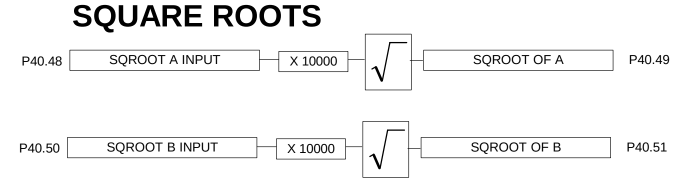
$$\text{SUMMING NODE OUTPUT} = \left(\left(\frac{\text{SUMMING NODE INPUT 1}}{\text{SUMMING NODE SCALE 1}} \right) ? \left(\frac{\text{SUMMING NODE INPUT 2}}{\text{SUMMING NODE SCALE 2}} \right) \right) \times 100.00\%$$

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

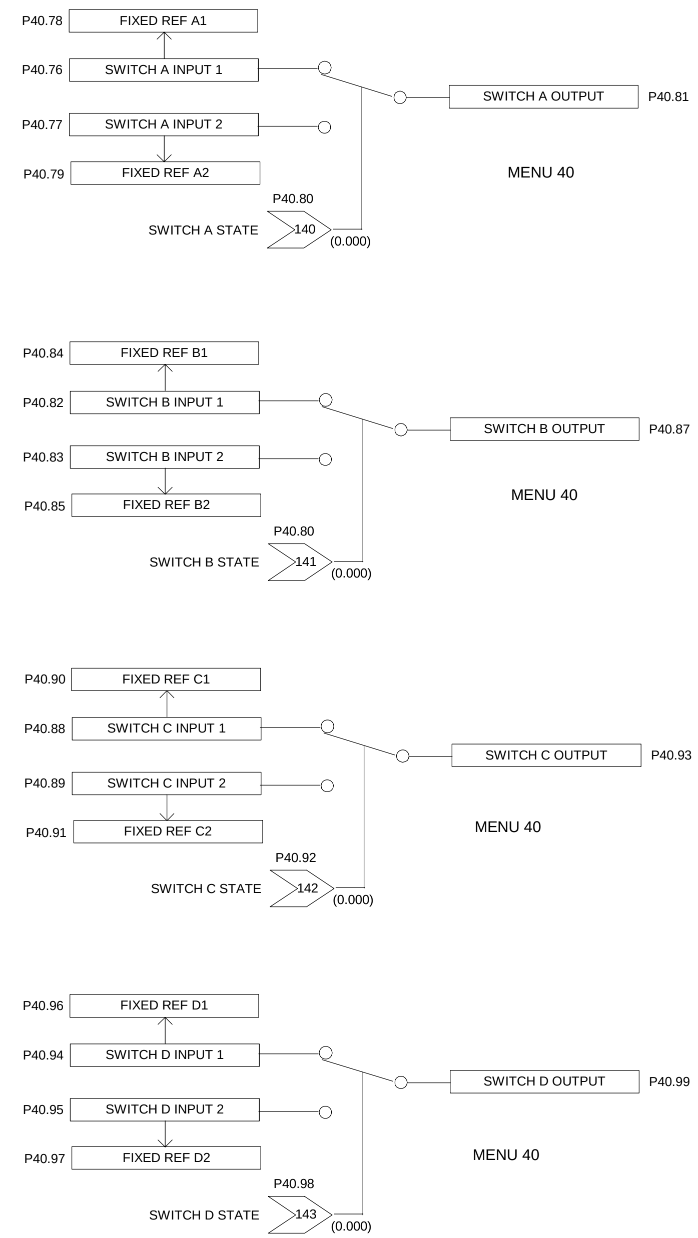


KEY			
DIGOUT	CONTROL FLAG	ANALOG I/O	(A) DEFAULT SETTING
DIGIN	STATUS FLAG	MONITOR POINT	DEFAULT CONNECTION

SQUARE ROOTS



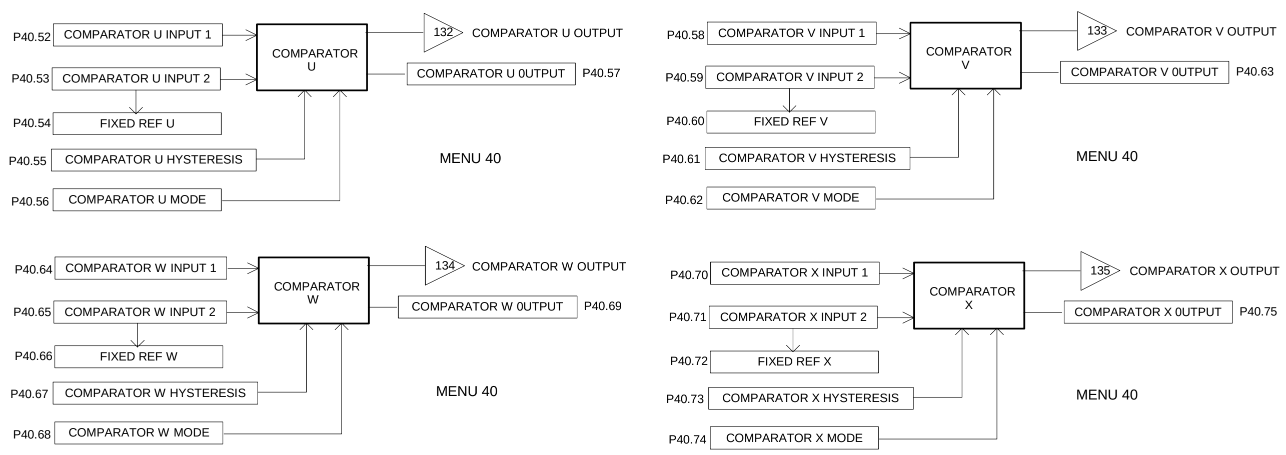
ANALOGUE SWITCHES



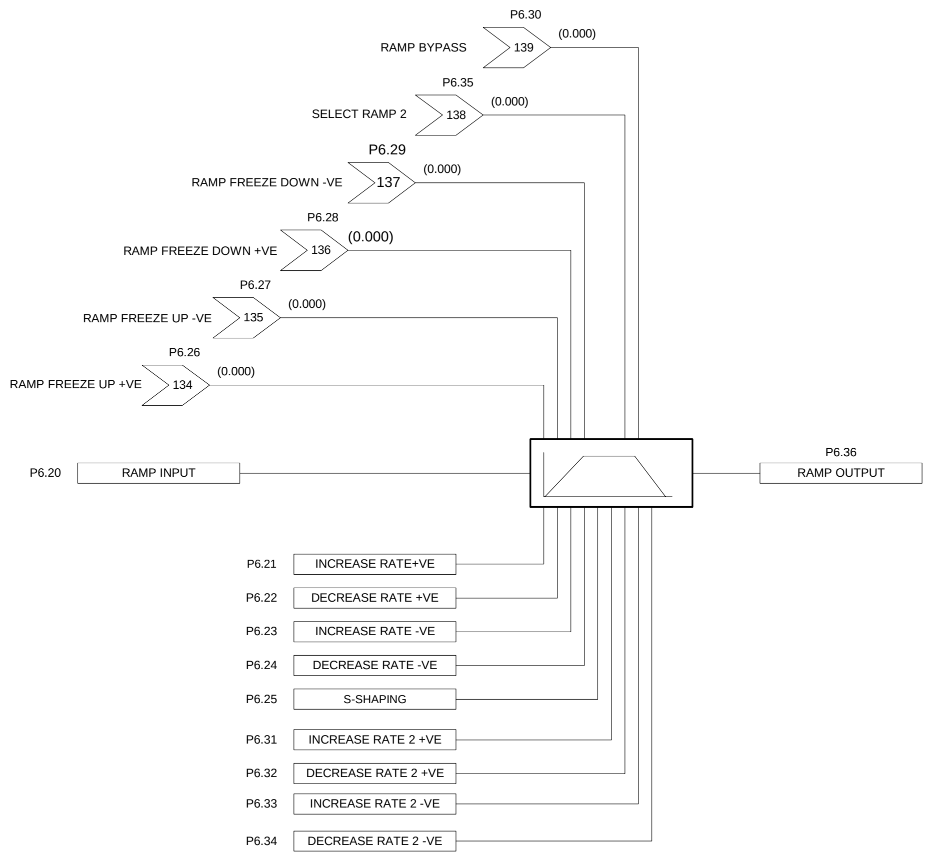
Sheet 14

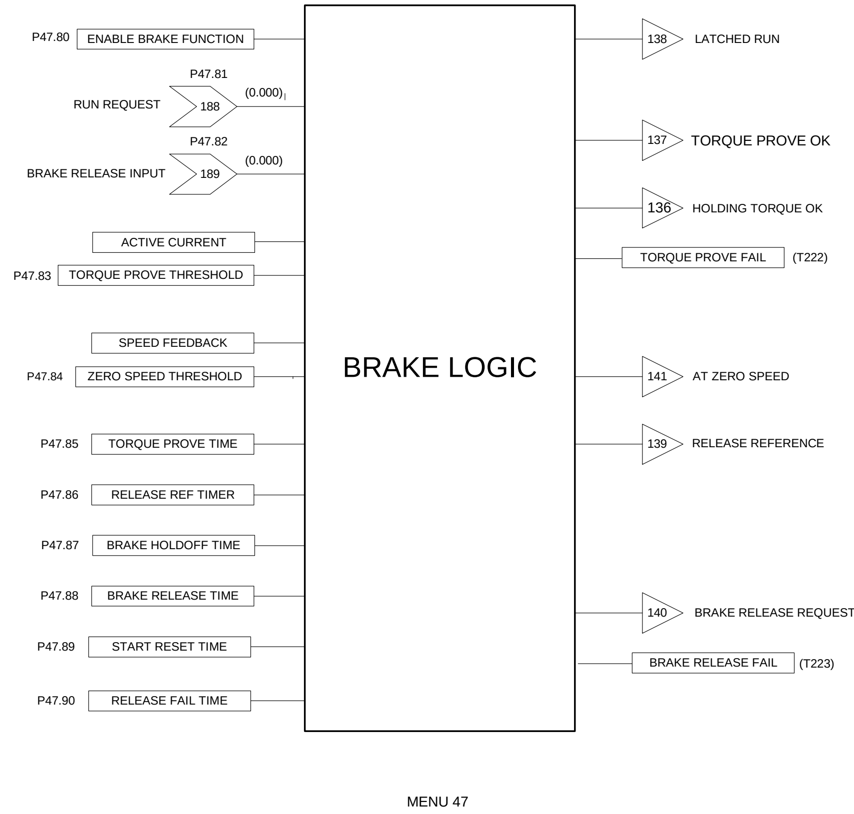
Comparators, Ramp Function & Brake Logic

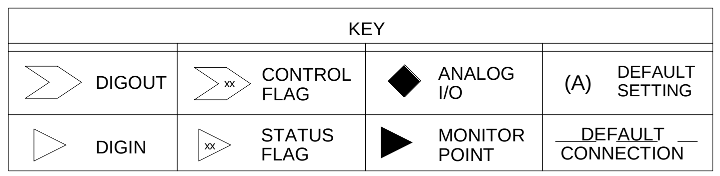
COMPARATORS



RAMP FUNCTION



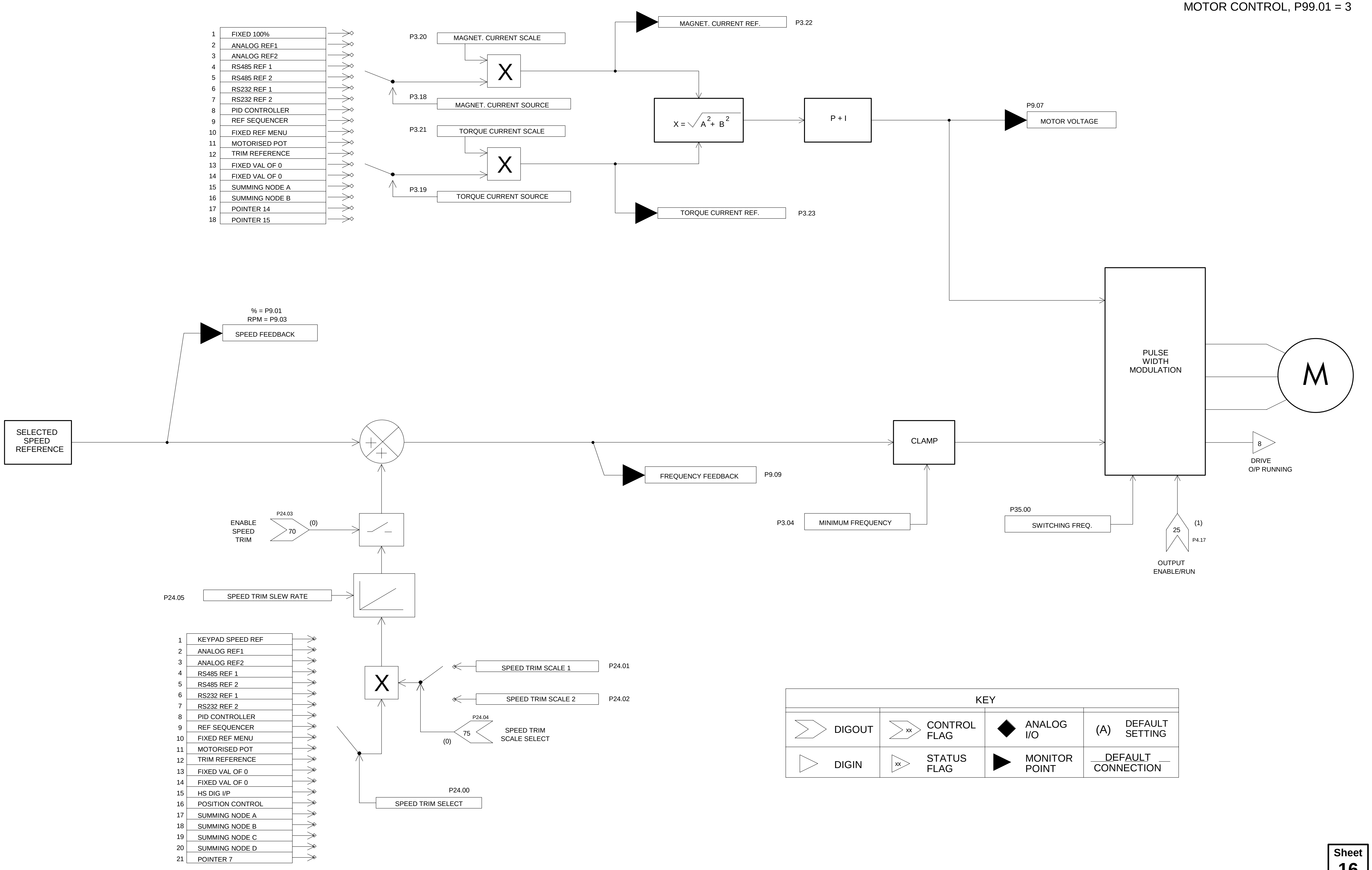




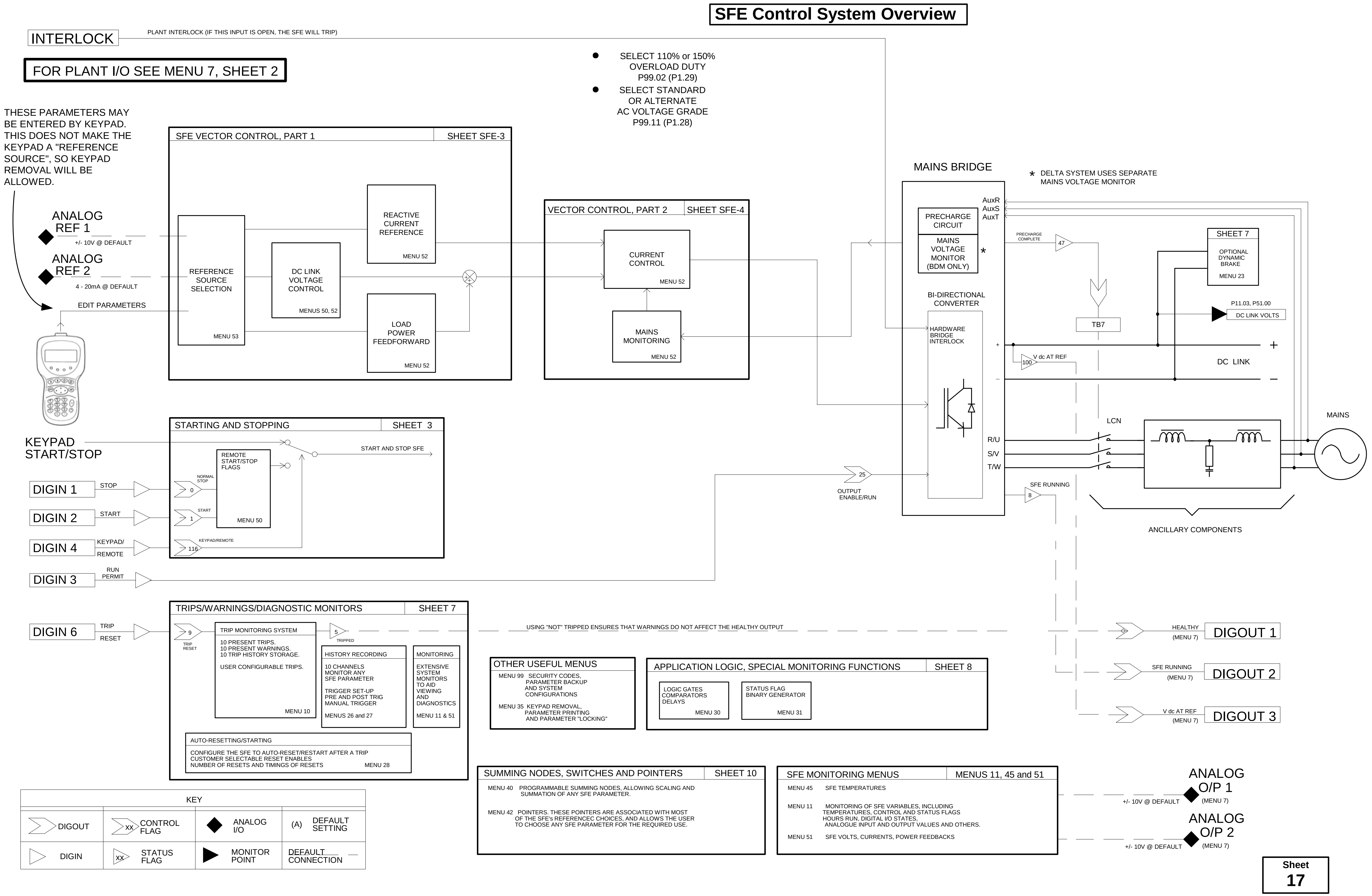
Sheet 15

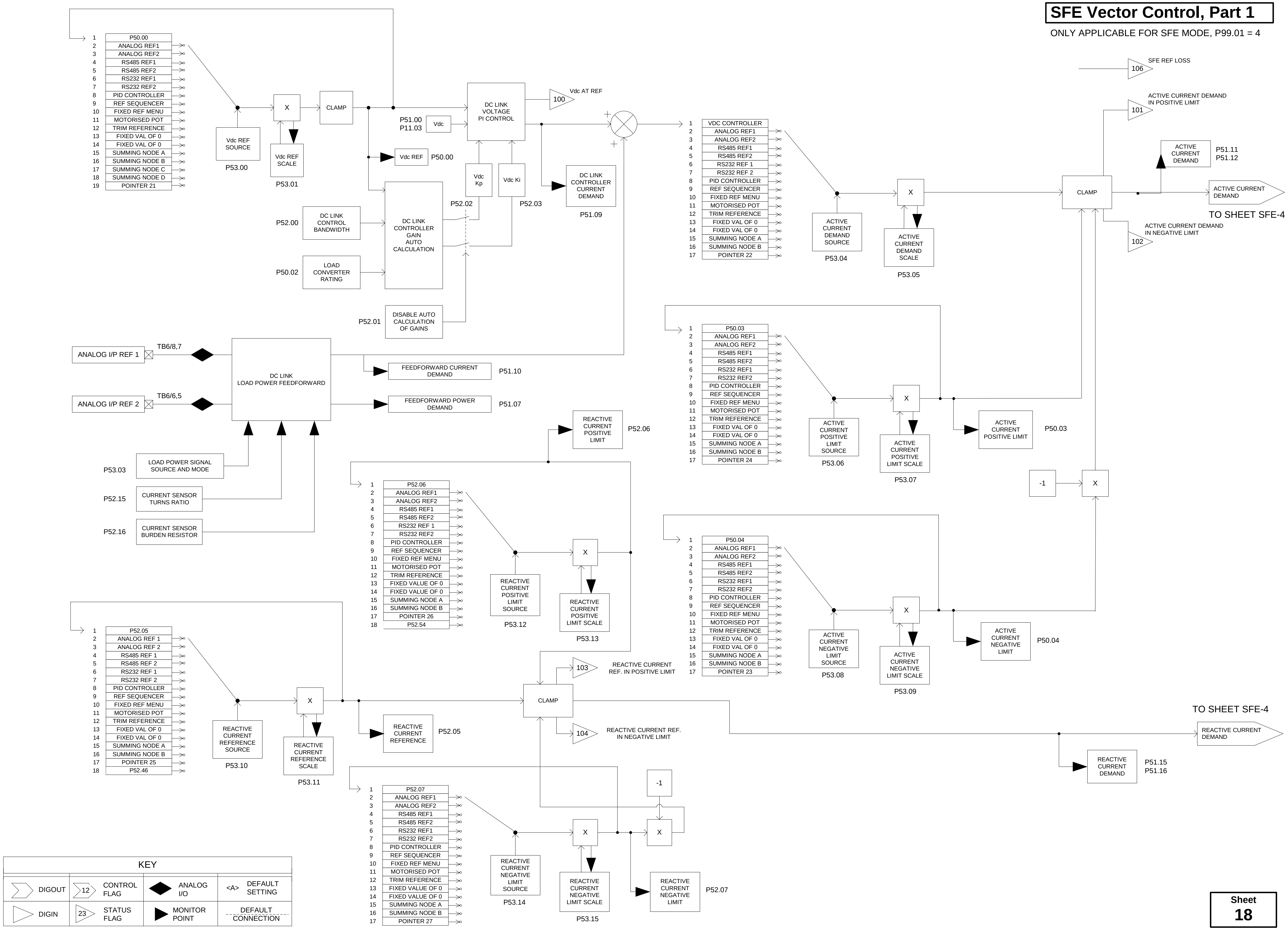
Scalar Control

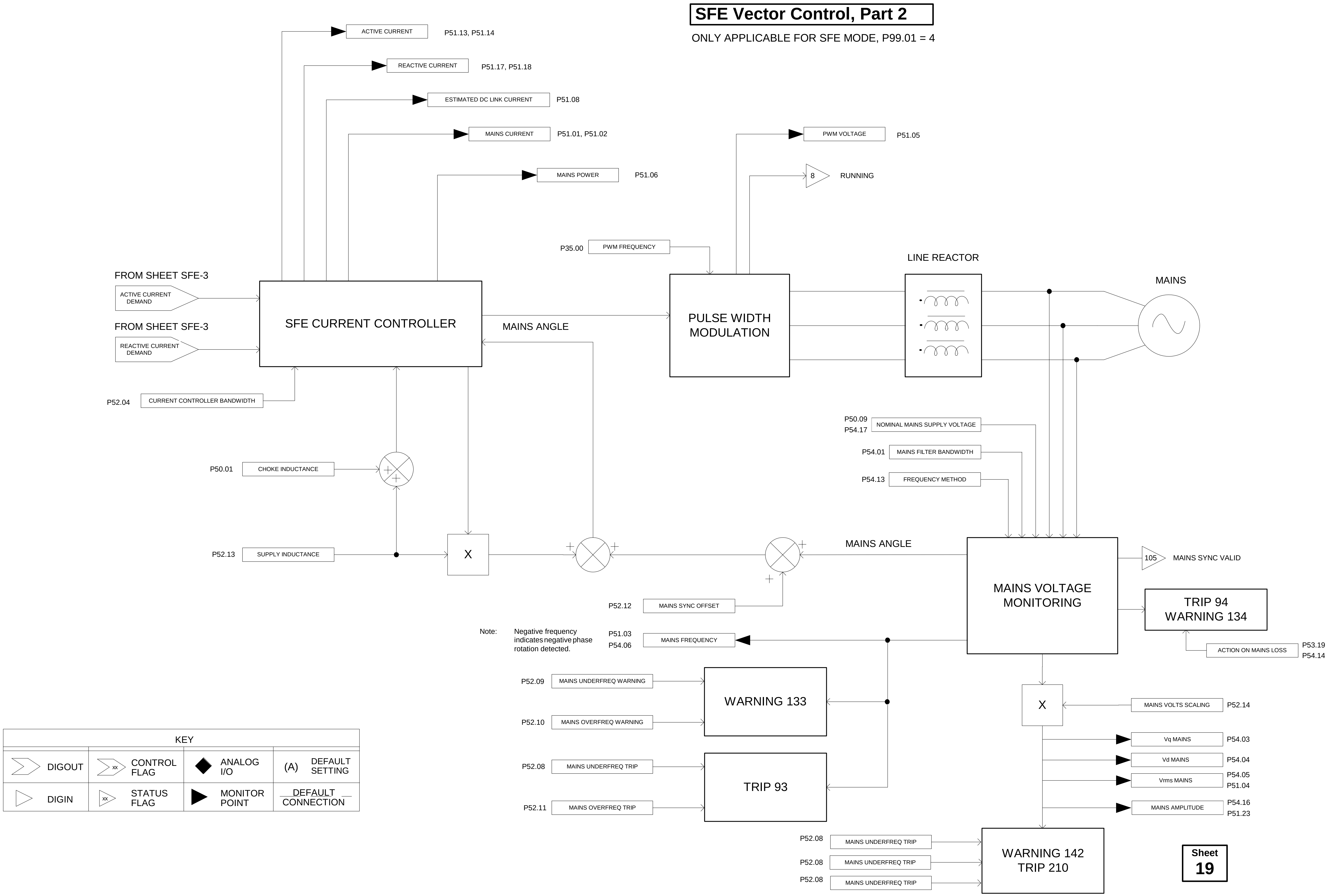
ONLY APPLICABLE FOR SCALAR MOTOR CONTROL, P99.01 = 3



Sheet 16


SFE Control System Overview
INTERLOCK
PLANT INTERLOCK (IF THIS INPUT IS OPEN, THE SFE WILL TRIP)
FOR PLANT I/O SEE MENU 7, SHEET 2
SELECT 110% or 150% OVERLOAD DUTY P99.02 (P1.29)
SELECT STANDARD OR ALTERNATE AC VOLTAGE GRADE P99.11 (P1.28)
THESE PARAMETERS MAY BE ENTERED BY KEYPAD. THIS DOES NOT MAKE THE KEYPAD A "REFERENCE SOURCE", SO KEYPAD REMOVAL WILL BE ALLOWED.
ANALOG REF 1
+/- 10V @ DEFAULT
ANALOG REF 2
4 - 20mA @ DEFAULT
EDIT PARAMETERS
SFE VECTOR CONTROL, PART 1
SHEET SFE-3
REFERENCE SOURCE SELECTION
MENU 53
DC LINK VOLTAGE CONTROL
MENUS 50, 52
REACTIVE CURRENT REFERENCE
MENU 52
LOAD POWER FEEDFORWARD
MENU 52
VECTOR CONTROL, PART 2
SHEET SFE-4
CURRENT CONTROL
MENU 52
MAINS MONITORING
MENU 52
MAINS BRIDGE
PRECHARGE CIRCUIT
MAINS VOLTAGE MONITOR (BDM ONLY)
*
* DELTA SYSTEM USES SEPARATE MAINS VOLTAGE MONITOR
AuxR
AuxS
AuxT
PRECHARGE COMPLETE
47
TB7
SHEET 7
OPTIONAL DYNAMIC BRAKE
MENU 23
P11.03, P51.00
DC LINK VOLTS
BI-DIRECTIONAL CONVERTER
HARDWARE BRIDGE INTERLOCK
V dc AT REF
100
DC LINK
+
–
R/U
S/V
T/W
LCN
MAINS
ANCILLARY COMPONENTS
SFE RUNNING
8
25
OUTPUT ENABLE/RUN
KEYPAD START/STOP
STARTING AND STOPPING
SHEET 3
REMOTE START/STOP FLAGS
MENU 50
START AND STOP SFE
NORMAL STOP
0
START
1
KEYPAD/REMOTE
116
DIGIN 1
STOP
DIGIN 2
START
DIGIN 4
KEYPAD/ REMOTE
DIGIN 3
RUN PERMIT
DIGIN 6
TRIP RESET
TRIPS/WARNINGS/DIAGNOSTIC MONITORS
SHEET 7
9
TRIP RESET
TRIP MONITORING SYSTEM
10 PRESENT TRIPS.
10 PRESENT WARNINGS.
10 TRIP HISTORY STORAGE.
USER CONFIGURABLE TRIPS.
MENU 10
5
TRIPPED
HISTORY RECORDING
10 CHANNELS MONITOR ANY SFE PARAMETER
TRIGGER SET-UP PRE AND POST TRIG MANUAL TRIGGER
MENUS 26 and 27
MONITORING
EXTENSIVE SYSTEM MONITORS TO AID VIEWING AND DIAGNOSTICS
MENU 11 & 51
AUTO-RESETTING/STARTING
CONFIGURE THE SFE TO AUTO-RESET/RESTART AFTER A TRIP
CUSTOMER SELECTABLE RESET ENABLES
NUMBER OF RESETS AND TIMINGS OF RESETS
MENU 28
USING "NOT" TRIPPED ENSURES THAT WARNINGS DO NOT AFFECT THE HEALTHY OUTPUT
HEALTHY (MENU 7)
DIGOUT 1
SFE RUNNING (MENU 7)
DIGOUT 2
V dc AT REF (MENU 7)
DIGOUT 3
OTHER USEFUL MENUS
MENU 99 SECURITY CODES, PARAMETER BACKUP AND SYSTEM CONFIGURATIONS
MENU 35 KEYPAD REMOVAL, PARAMETER PRINTING AND PARAMETER "LOCKING"
APPLICATION LOGIC, SPECIAL MONITORING FUNCTIONS
SHEET 8
LOGIC GATES COMPARATORS DELAYS
MENU 30
STATUS FLAG BINARY GENERATOR
MENU 31
SUMMING NODES, SWITCHES AND POINTERS
SHEET 10
MENU 40 PROGRAMMABLE SUMMING NODES, ALLOWING SCALING AND SUMMATION OF ANY SFE PARAMETER.
MENU 42 POINTERS. THESE POINTERS ARE ASSOCIATED WITH MOST OF THE SFE's REFERENCEC CHOICES, AND ALLOWS THE USER TO CHOOSE ANY SFE PARAMETER FOR THE REQUIRED USE.
SFE MONITORING MENUS
MENUS 11, 45 and 51
MENU 45 SFE TEMPERATURES
MENU 11 MONITORING OF SFE VARIABLES, INCLUDING TEMPERATURES, CONTROL AND STATUS FLAGS HOURS RUN, DIGITAL I/O STATES, ANALOGUE INPUT AND OUTPUT VALUES AND OTHERS.
MENU 51 SFE VOLTS, CURRENTS, POWER FEEDBACKS
ANALOG O/P 1
+/- 10V @ DEFAULT
(MENU 7)
ANALOG O/P 2
+/- 10V @ DEFAULT
(MENU 7)
KEY
DIGOUT
XX CONTROL FLAG
ANALOG I/O
(A) DEFAULT SETTING
DIGIN
XX STATUS FLAG
MONITOR POINT
DEFAULT CONNECTION
Sheet
17


SFE Vector Control, Part 1
ONLY APPLICABLE FOR SFE MODE, P99.01 = 4
P50.00
ANALOG REF1
ANALOG REF2
RS485 REF1
RS485 REF2
RS232 REF1
RS232 REF2
PID CONTROLLER
REF SEQUENCER
FIXED REF MENU
MOTORISED POT
TRIM REFERENCE
FIXED VAL OF 0
FIXED VAL OF 0
SUMMING NODE A
SUMMING NODE B
SUMMING NODE C
SUMMING NODE D
POINTER 21
Vdc REF SOURCE
P53.00
X
Vdc REF SCALE
P53.01
CLAMP
Vdc REF
P50.00
DC LINK VOLTAGE PI CONTROL
P51.00
P11.03
Vdc
Vdc AT REF
100
Vdc Kp
Vdc Ki
P52.02
P52.03
DC LINK CONTROLLER CURRENT DEMAND
P51.09
DC LINK CONTROL BANDWIDTH
P52.00
DC LINK CONTROLLER GAIN AUTO CALCULATION
LOAD CONVERTER RATING
P50.02
DISABLE AUTO CALCULATION OF GAINS
P52.01
VDC CONTROLLER
RS232 REF 1
RS232 REF 2
POINTER 22
ACTIVE CURRENT DEMAND SOURCE
P53.04
ACTIVE CURRENT DEMAND SCALE
P53.05
CLAMP
SFE REF LOSS
106
ACTIVE CURRENT DEMAND IN POSITIVE LIMIT
101
ACTIVE CURRENT DEMAND
P51.11
P51.12
ACTIVE CURRENT DEMAND
TO SHEET SFE-4
ACTIVE CURRENT DEMAND IN NEGATIVE LIMIT
102
ANALOG I/P REF 1
TB6/8,7
ANALOG I/P REF 2
TB6/6,5
DC LINK LOAD POWER FEEDFORWARD
FEEDFORWARD CURRENT DEMAND
P51.10
FEEDFORWARD POWER DEMAND
P51.07
LOAD POWER SIGNAL SOURCE AND MODE
P53.03
CURRENT SENSOR TURNS RATIO
P52.15
CURRENT SENSOR BURDEN RESISTOR
P52.16
P50.03
POINTER 24
ACTIVE CURRENT POSITIVE LIMIT SOURCE
P53.06
ACTIVE CURRENT POSITIVE LIMIT SCALE
P53.07
ACTIVE CURRENT POSITIVE LIMIT
P50.03
-1
REACTIVE CURRENT POSITIVE LIMIT
P52.06
P52.06
RS232 REF 1
RS232 REF2
FIXED VALUE OF 0
POINTER 26
P52.54
REACTIVE CURRENT POSITIVE LIMIT SOURCE
P53.12
REACTIVE CURRENT POSITIVE LIMIT SCALE
P53.13
P50.04
POINTER 23
ACTIVE CURRENT NEGATIVE LIMIT SOURCE
P53.08
ACTIVE CURRENT NEGATIVE LIMIT SCALE
P53.09
ACTIVE CURRENT NEGATIVE LIMIT
P50.04
P52.05
ANALOG REF 1
ANALOG REF 2
RS485 REF 1
RS485 REF 2
POINTER 25
P52.46
REACTIVE CURRENT REFERENCE SOURCE
P53.10
REACTIVE CURRENT REFERENCE SCALE
P53.11
REACTIVE CURRENT REFERENCE
P52.05
103
REACTIVE CURRENT REF. IN POSITIVE LIMIT
104
REACTIVE CURRENT REF. IN NEGATIVE LIMIT
TO SHEET SFE-4
REACTIVE CURRENT DEMAND
REACTIVE CURRENT DEMAND
P51.15
P51.16
P52.07
POINTER 27
REACTIVE CURRENT NEGATIVE LIMIT SOURCE
P53.14
REACTIVE CURRENT NEGATIVE LIMIT SCALE
P53.15
REACTIVE CURRENT NEGATIVE LIMIT
P52.07
KEY
DIGOUT
12
CONTROL FLAG
ANALOG I/O
<A>
DEFAULT SETTING
DIGIN
23
STATUS FLAG
MONITOR POINT
DEFAULT CONNECTION
Sheet
18


SFE Vector Control, Part 2
ONLY APPLICABLE FOR SFE MODE, P99.01 = 4
ACTIVE CURRENT
P51.13, P51.14
REACTIVE CURRENT
P51.17, P51.18
ESTIMATED DC LINK CURRENT
P51.08
MAINS CURRENT
P51.01, P51.02
MAINS POWER
P51.06
PWM VOLTAGE
P51.05
8
RUNNING
P35.00
PWM FREQUENCY
LINE REACTOR
MAINS
FROM SHEET SFE-3
ACTIVE CURRENT DEMAND
FROM SHEET SFE-3
REACTIVE CURRENT DEMAND
SFE CURRENT CONTROLLER
MAINS ANGLE
PULSE WIDTH MODULATION
P52.04
CURRENT CONTROLLER BANDWIDTH
P50.09
P54.17
NOMINAL MAINS SUPPLY VOLTAGE
P54.01
MAINS FILTER BANDWIDTH
P54.13
FREQUENCY METHOD
P50.01
CHOKE INDUCTANCE
P52.13
SUPPLY INDUCTANCE
X
MAINS ANGLE
MAINS VOLTAGE MONITORING
105
MAINS SYNC VALID
TRIP 94
WARNING 134
P52.12
MAINS SYNC OFFSET
Note:
Negative frequency indicates negative phase rotation detected.
P51.03
P54.06
MAINS FREQUENCY
ACTION ON MAINS LOSS
P53.19
P54.14
P52.09
MAINS UNDERFREQ WARNING
P52.10
MAINS OVERFREQ WARNING
WARNING 133
X
MAINS VOLTS SCALING
P52.14
Vq MAINS
P54.03
Vd MAINS
P54.04
Vrms MAINS
P54.05
P51.04
MAINS AMPLITUDE
P54.16
P51.23
P52.08
MAINS UNDERFREQ TRIP
P52.11
MAINS OVERFREQ TRIP
TRIP 93
P52.08
MAINS UNDERFREQ TRIP
P52.08
MAINS UNDERFREQ TRIP
P52.08
MAINS UNDERFREQ TRIP
WARNING 142
TRIP 210
KEY
DIGOUT
xx
CONTROL FLAG
ANALOG I/O
(A)
DEFAULT SETTING
DIGIN
xx
STATUS FLAG
MONITOR POINT
DEFAULT CONNECTION
Sheet
19

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6. Preventive Maintenance

WARNING

- **Wait at least 5 minutes after isolating supplies and check that voltage between DC+ and DC- has reduced to a safe level before working on this equipment.**
- **This equipment may be connected to more than one live circuit. Disconnect all supplies before working on the equipment.**

6.1 Tools and Equipment Required

- Torque wrench, of a size suitable for the converter power terminals. The torque range required is drive size dependent and is shown in Table 3-2, page 3-10.
- Terminal screwdriver, suitable for control connectors.
- Flat blade screwdriver, suitable for opening the power door (RH door).
- Star-head screwdriver, suitable for removing upper and lower fingerguards.
- CLIP ON Ammeter to measure 1- 20 Amp AC.

6.2 Maintenance Schedules

Access

1. Switch off the equipment and isolate it from the electrical supply.
2. Gain access to the equipment.

Monthly

1. Ensure all ventilation louvres are unobstructed. They are located at the top and bottom of the converter, and on the PWM filter.
2. Examine auxiliary and power terminals for signs of overheating (damaged insulation and discolouration).
3. Check security of mounting bolts.
4. Check the currents in each PWM filter connection from R5, S5 and T5 (see page iii). The lowest value measured should not be less than 80% of the largest value measured. If there is a greater discrepancy, change the filter. Note that the nominal value for any specific filter should be between 1 and 20 Amp.

Annual

1. Carry out the Monthly schedule as above.
2. Check all power and control terminations are secure, refer to Table 3-2 for torque settings of power terminations.
3. 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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7. Diagnostics

7.1 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 on the back cover of this manual.

7.1.1 Fault Indication

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

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 for the most recent warning.

7.2 Warnings

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 on the inside of the back cover.

7.3 Trips

If the TRIPPED indicator is flashing, a serious fault has occurred which has caused the converter 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.

7.4 Viewing Warnings and Trips

Parameters in the converter 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	**Available parameters in Menu 10**
P1.06 = FIRST WARNING	P10.00 - P10.09 = WARNINGS 1 to 10
P1.07 - P1.08 = FIRST 2 TRIPS	P10.10 - P10.19 = CURRENT TRIPS 1 to 10
	P10.20 - P10.29 = TRIP HISTORY 1 to 10

Viewing using navigation keys

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

Viewing using "help" key

1. When the converter is showing either a Trip or Warning, press (?) .
2. 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.

7.4.1 Action in the Event of a Warning

1. Press (?) and select "2" – Display Warnings.
2. Display P10.00 and note the first warning. This is the problem which is causing the warning indication.
3. 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.
4. Refer to the back cover and check the meaning of each warning. Take corrective action as necessary.

7.4.2 Action in the event of a Trip

1. Press (?) and select "2" – Display Trips.
2. 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).
3. In turn, Display P10.11 to P10.19 and record any additional trips which may be present.
4. Refer to the table inside the back cover and check the meaning of each fault. Take corrective action as necessary.
5. See Section 7.4.3 for resetting trips.

7.4.3 Resetting Trips

From the Digital Inputs

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

Press (?) and select option 3 (Attempt Trip Reset).

7.4.4 Trip Fault Codes

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

7.5 Using the HELP Key

If the converter trips, get information on the trip by pressing (?) .

A screen appears, giving four choices as shown below:

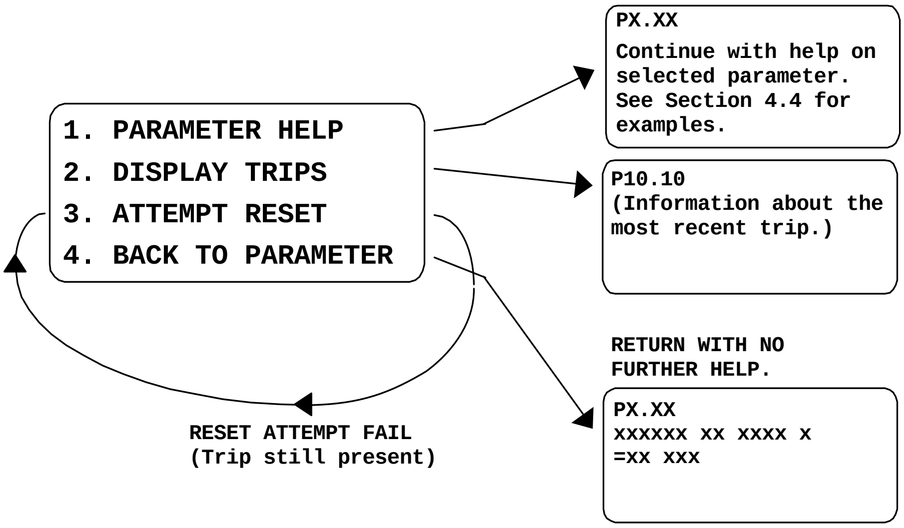

Figure 7-1 Help screen for trips

PRESS

1 If the keypad was connected when the converter tripped, this shows the last screen displayed before the trip.

2 Displays parameter P10.10 – gives information about the trip.

3 Attempts to reset the trip. If the attempt fails, this screen re-appears.

4 If the converter tripped while displaying a parameter, the screen will re-display the parameter.

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

The HELP system works as described for trips, except that P10.00 displays the most recent

Warning, as in Figure 7-2 below:

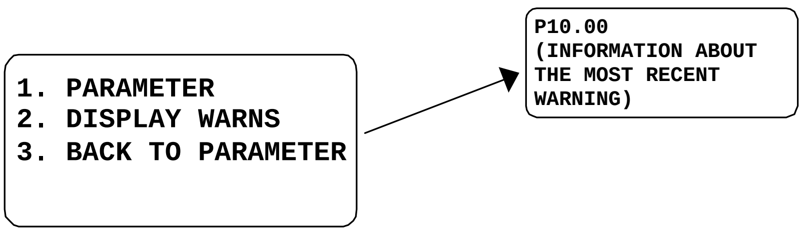

Figure 7-2 Help screen for warnings

7.6 Diagnostic Hints

1. There is a list of helpful hints recorded on the inside of the back cover of this manual.
2. Use Sections 7.4 and 7.5 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.
3. Examine the trip or warning history as shown in Section 7.4.

7.6.1 Changing Pcb's

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

7.6.2 Failure of Converter Firmware

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

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

To assist **Converteam** personnel in diagnosing the cause of the software malfuncion, the memory contents of the converter can be uploaded to a PC as shown in Section 7.6.3 and sent to **Converteam** at the address shown at the end of this manual.

7.6.3 Uploading the Converter Memory Contents to a PC

7.6.3.1 Using Windows™ 3.1 or 3.11 Terminal Emulation

1. Start Windows™ Terminal.
2. From ***Settings***, choose ***Communications***.
3. 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).
4. Choose an available Comm port.
5. Check that in ***Settings***, Emulation is at default (= VT-100 [ANSI]).
6. From ***Transfers***, choose ***Receive text file***.
7. Name the file.
8. 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.
9. Press capital ***G*** to start the memory contents upload. The upload takes about 10 minutes.
10. When the upload is complete press ***Stop*** to terminate. This saves the file.
11. Press the "***.***" key to re-start the MV3000e firmware.
12. See Section 7.6.2 for mailing instructions.

The Terminal connection can be saved as "MV3000e" for next time.

7.6.3.2 Using Windows™ 95 or NT4

1. Start Windows™ Hyper Terminal.
2. Follow the ***"wizard"*** as presented.

3. Name the new connection "MV3000e" and choose an icon.

4. Choose an available Comm port.

5. Set communications parameters to ***9600*** baud, ***no parity***, ***1 stop***, ***Xon/Xoff*** flow control.

6. Select ***File - Properties***. From the dialogue box choose the ***Settings*** tab. Set the emulation to VT100.

7. 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.

8. From ***Transfer***, choose ***Capture text***.

9. Name the file.

10. Press capital ***G*** to start the memory contents upload. The upload takes about 10 minutes.

11. When the upload is complete press ***Stop*** to terminate. This saves the file.

12. Press the "***.***" key to re-start the MV3000e firmware.

13. See Section 7.6.2 for mailing instructions.

The Terminal connection can be saved as "MV3000e" for next time.

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8. Spare Parts

The pre-charge fuses may be obtained from any source, including **Converteam**. All other spares, as listed in Table 8-2, must be obtained only from **Converteam**.

8.1 Pre-charge Fuses

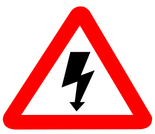
Data for pre-charge fuses is shown in Table 8-1. The data is given here in addition to the part numbers shown in Section 8.2 to allow local purchase of fuses, which may be helpful during commissioning. Replacing these fuses with any other rating or type will invalidate safety approvals.

Table 8-1 Pre-charge fuse data

Frame size	Fuse rating A	Fuse type (Qty. 3)
3	4	Littelfuse KLKD 4
4	4	Littelfuse KLKD 4
6	6	Littelfuse KLKD 6
7	6	Littelfuse KLKD 6

8.1.1 Replacing Pre-charge Fuses

1. Switch off the converter and isolate all supplies.



WARNING

- **Wait at least 5 minutes after isolating supplies and check that voltage between DC+ and DC- has reduced to a safe level before working on this equipment.**
- **This equipment may be connected to more than one live circuit. Disconnect all supplies before working on the equipment.**

2. Gain access to the converter interior as described in Section 3.10.

Procedure for frame sizes 3 and 4
(See Figure 8-1, size 3 shown)

1. 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.

2. Fit replacement fuses of the correct type and rating, (see Table 8-1), close and secure the keypad harbour, then close the converter doors.

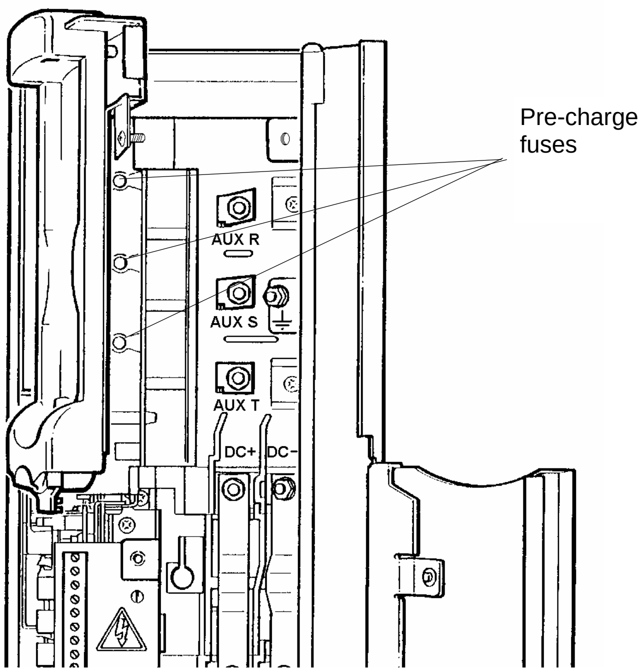


Figure 8-1 Frame size 3 and 4 pre-charge fuse access

Procedure for frame sizes 6 and 7
(See Figure 8-2, size 7 shown)

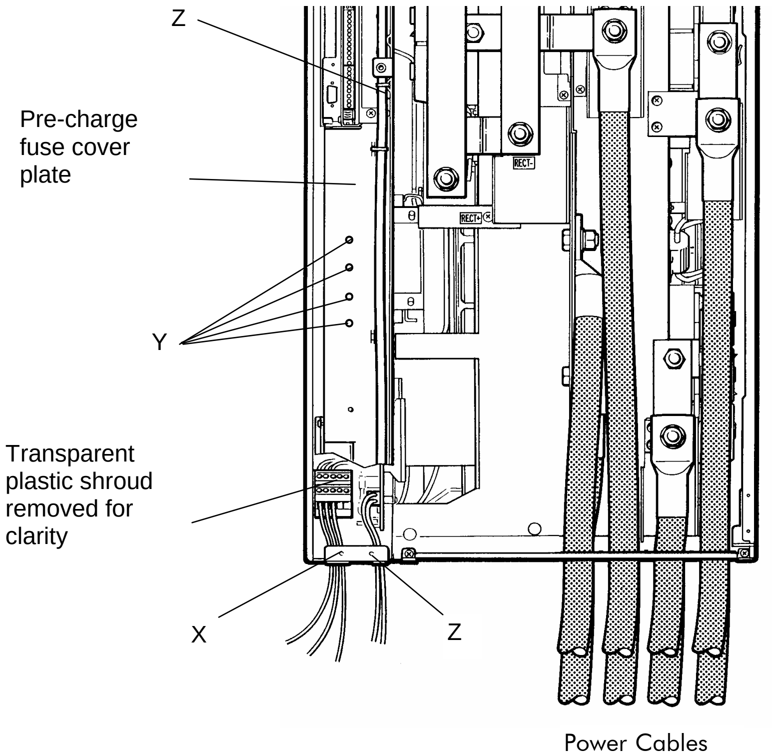


Figure 8-2 Frame size 6 and 7 pre-charge fuse access

The pre-charge fuses are mounted on a printed circuit board (pcb) behind the pre-charge fuse cover plate, see Figure 8-2. The transparent plastic shroud protecting the fan terminal block is attached to the chassis at (X) and to the cover plate.

Replace the pre-charge fuses as follows:

1. On frame size 6 converters, 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.

2. Locate the three pre-charge fuses mounted on the printed circuit board (pcb), exposed when the cover plate is removed. The pcb is similar to that shown for frame size 3 in Figure 8-1.

3. Remove the three fuses, taking care that they do not fall inside the converter.

4. Fit replacement fuses of the correct type and rating (see Table 8-1).

5. 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 four M5 screws (Y) to fit the pre-charge fuse cover plate to the pcb mounting metalwork, then use two M5 screws (Z) to secure the plate to the converter chassis. Secure the shroud to the chassis with the retained screw (X).

6. Close the converter doors.

8.2 Spare Parts Listing

The parts listed in Table 8-2 are available as spares from your local authorised **Converteam** 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.

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 converter. Even if the Combination Number of pcbs is identical, the identity parameters programmed into EEPROM will be different.

Swapping pcbs between converters would move the programmed converter identity between converters which may have other components with different build standards. This can affect scaling factors etc.and prevent correct operation.

<u>If pcbs are swapped between converters of different ratings, serious damage is likely to occur.</u>

Table 8-2 Spares listing for ALSPA MV3000 bi-directional converters

MicroCubicle™	Frame	Control Module	Fan	Frame Size 3 & 4 Mains Voltage Monitor And Precharge Unit	Frame Size 6 & 7 Transistor - Transistor Module	Frame Size 6 & 7 Transistor/ Precharge Module	SMPS (Switch Mode Power Supply)	Precharge Fuses (Qty. 3)
400 V/480 V								
MV3071J5A1	3	S41Y7784/40	S41Y7786/10	S41Y8152/10			S20X4320/20	S82030/370
MV3140J5A1	4	S41Y7784/40	S98101/153	S41Y8007/70			S20X4320/20	S82030/370
MV3364J5A1	6	S41Y7784/40	SMV98101/151		S41Y7770/50	S41Y8162/10	S20X4321/30	S82030/372
MV3566J5A1	7	S41Y7784/40	SMV98101/151		S41Y8081/90	S41Y8169/10	S20X4321/30	S82030/372
600/690 V								
MV3099J6A1	4	S41Y7784/40	S98101/153	S41Y8007/80			S20X4321/10	S82030/370
MV3242J6A1	6	S41Y7784/40	SMV98101/151		S41Y8036/10	S41Y8162/20	S20X4321/10	S82030/372
MV3382J6A1	7	S41Y7784/40	SMV98101/151		S41Y8081/100	S41Y8169/20	S20X4321/10	S82030/372

9. Options

9.1 Optional Hardware

The following options are available for the complete ALSPA MV3000e range of MicroCubicle™ bi-directional converters.
Additional options are being added to the converter range as part of the ongoing development process. Please contact your authorised **Converteam** dealer for the latest list of options.

Item	Part No.	Description
ALSPA MV3000e Drive Data Manager™	MVS3000-4001	A multi-function unit with keypad functionality that can be used to edit and monitor converter 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 converter, held in the hand or permanently mounted on any suitable surface. The keypad incorporates special keys to start and stop active control of a DC voltage (SFE), or to start and stop a motor, and to control its speed (machine bridge).
ALSPA MV3000e Drive Data Manager™ Lead and Door Mounting Kit	MVS3001-4001	A keypad-to-converter interconnection cable, mounting gasket and drilling template to allow the keypad to be mounted on a flat surface, e.g. the cabinet door.
ALSPA Drive Coach	MVS3004-4001	A software program that enables uploading of parameters to a PC and downloading of parameters to a converter, with full monitoring facilities and on-line help. The software is supplied on CD-ROM and runs under Microsoft Windows™ 3.1, 95, 98 or NT.
PC Programming Lead	GDS1009-4001	Connects a PC serial port to the converter RS232 port.
Dynamic Brakes MV3071J5A1 MV3140J5A1 MV3099J6A1 MV3364J5A1 MV3242J6A1 MV3566J5A1 MV3382J6A1	 MV3DB045S5 MV3DB092S5 MV3DB061S6 MV3DB247S5 MV3DB185S6 MV3DB391S5 MV3DB246S6	A range of dynamic brake switch modules, fitted within the machine bridge 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) MV3071J5A1; MV3071J6A1 MV3140J5A1; MV3099J6A1 MV3364J5A1; MV3242J6A1 MV3566J5A1; MV3382J6A1	 MVS3003-4003 MVS3003-4004 MVS3003-4006 MVS3003-4007	A cover to prevent foreign bodies and water from accidentally dropping into the converter from above.
ALSPA MV3000e Ethernet Interface – Single Channel. ALSPA MV3000e Ethernet Interface – Dual Channel.	MVS3012-4001 MVS3012-4002	A self-contained module that fits within the converter to provide connectivity to 10 MHz or 100 MHz Ethernet communications networks. Full fixing kit supplied.
ALSPA MV3000e Profibus Field Bus Coupler. Baud rates : 187.5 kbits/s 500 kbits/s 1.5 Mbits/s 12 Mbits/s	MVS3007-4002	A self-contained module that fits within the converter to provide communications over a PROFIBUS-DP network. Full fixing kit supplied.

(continued)

Item	Part No.	Description
EMC Filter MV3071J5A1 MV3140J5A1 MV3099J6A1 MV3364J5A1 MV3242J6A1 MV3566J5A1 MV3382J6A1	 MV3FLT180A5A1 MV3FLT180A5A1 MV3FLT150A6X1 MV3FLT400A5X1 MV3FLT250A6X1 MV3FLT600A5X1 MV3FLT400A6X1	A range of EMC Filters that together with EMC Ferrites (see below) will assist the inverter installation to meet EMC requirements. These generally apply when operating in non-industrial environments or when the inverter is installed in the proximity of sensitive equipment. Assuming that provision has already been made for fitting the PWM filter and associated Input Line Reactors then one EMC Filter plus one motor cable Ferrite Ring will be required to meet EMC emission requirements.
EMC Ferrite MV3071J5A1 MV3140J5A1 MV3099J6A1 MV3364J5A1 MV3242J6A1 MV3566J5A1 MV3382J6A1	 MV3FLT140B6A1 MV3FLT140B6A1 MV3FLT140B6A1 MV3FLT566B6A1 MV3FLT566B6A1 MV3FLT566B6A1 MV3FLT566B6A1	A range of EMC Ferrites that together with EMC Filters (see above) will assist the inverter installation to meet EMC requirements. These generally apply when operating in non-industrial environments or when the inverter is installed in the proximity of sensitive equipment. Assuming that provision has already been made for fitting the PWM filter and associated Input Line Reactors then one EMC Filter plus one motor cable Ferrite Ring will be required to meet EMC emission requirements.
ALSPA MV3000e MicroPEC Applications Processor	MVS3009-4001	A self-contained add-on module that fits onto the control board (CDC or DELTA) to add Function Block Programmability to the ALSPA MV3000e drive.
ALSPA MV3000e CAN Port 2 Fieldbus Module	MVS3011-4001	A self contained add-on module that fits onto the control board (CDC or DELTA) to give a second DeviceNet or CANopen Fieldbus connection. This allows a drive whose in-built CAN port is already used for CANopen to have a DeviceNet connection and vice versa. Alternatively the module can be used to provide either a second DeviceNet or CANopen connection.

9.2 Optional Manuals

Details of manuals which may be obtained from **Converteam** as options are given in Section 1.9.

10. 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 DC link electrolytic capacitors in the drive 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 capacitors used in the PWM filters contain a non-toxic mineral oil that has a flash point of 140 ˚C (284 ˚F). Do not incinerate these capacitors. This mineral oil is also an environmental pollutant and due care should be taken when disposing of the capacitors.

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

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DIAGNOSTIC HINTS FOR THE SINUSOIDAL FRONT END

Note: These hints are aimed mainly at the DEFAULT SFE, to help with problems which may be experienced while working wih this manual. Reference is made to the default input/output diagram (Figure 1), located on Page ii inside the front cover, and to the interconnection diagram (Figure 2) on Page iii.

Problem	Possible solution
Healthy LED is not lit.	Is the plant "INTERLOCK" connected? Refer to the default input/output diagram.
SFE failure after frequent switching on and off.	The SFE has correctly carried out self-protection procedures after frequent switching on and off in a short period of time. Replace pre-charge fuses, see Section 8.
The SFE will not run from the Keypad.	The SFE must be in "Keypad control" (i.e. Local control). Check that DIGIN 4 is open. Use a DVM or view P11.21. DIGIN 4 is connected to CF116 which selects local/remote.
The SFE will not run from the terminals.	The SFE must be in "Remote control". Check that DIGIN 4 is closed, use a DVM or view P11.21. DIGIN 4 is connected to CF116 which selects Keypad/Remote.
The SFE will not run from either Keypad or terminals, and displays Warning 136 (CF25/ LCN feedback loss).	LCN feedback signal LCN AUX missing. • Check line contactor feedback wiring to TB3/6. • Check that LCN has closed. If the LCN has <u>not</u> closed: • Check LCN coil supply voltage. • Check wiring to TB7. • Check that DC link volts (P51.00) is greater than pre-charge threshold (P52.17).
Trip code 96 (Aux phase loss) is displayed and cannot be reset.	SFE is not detecting the correct phase displacement on its auxiliary terminals. • Check wiring to AUX R, AUX S, AUX T terminals. • Check pre-charge fuses, see Section 8.
All LED's flashing	This indicates a major software or hardware fault with the controller. Normal software operation cannot continue. Refer to Section 7.6.2.
The analogue input references are not functioning as expected.	The default setting for ANIN1 is 0 - 10 V (0 - 100%) and the default for ANIN2 is 4 - 20 mA (20% - 100%). The DIP switches (SW1) on the drive I/O board configure the inputs for current or voltage. • Check the DIP switches against those shown on the default input/output diagram. • Ensure the link TB6/3 to TB6/7 is connected when using the drive's 10.5 V supply (TB6/9). • Check the analogue input settings in P7.00 to P7.07 against default settings. • Check the values entering the analogue inputs in P7.03, P7.07 respectively.
The analogue outputs are not functioning as expected.	The default settings for ANOP1 and ANOP2 are 0 - 10 V, 0 - 100%. The DIP switches (SW1) on the I/O board should both be set for volts. • Check the DIP switch settings against those shown on the default input/output diagram. • Check the analogue output settings in P7.17 to P7.26 against default settings. • Check the values coming from the analogue outputs in P7.21, P7.26 respectively.
SFE trips on overcurrent or overvolts when run is attempted.	• Check that the Auxiliary terminals (AUX R, AUX S, AUX T) are consistent with the power terminals R/U, S/V and T/W, i.e. AUX R is wired to R/U etc. • Check the wiring of ancillary components against the interconnection diagram.
Trip code 93 (Mains Sync Fault) is displayed when run is attempted.	• Check wiring of ancillary components against the interconnection diagram. • Is there excessive impedance in the mains supply to the SFE? (i.e. is the mains supply fault level too small?). See performance data in Section 2.9.3.

DIAGNOSTIC HINTS FOR THE MACHINE BRIDGE

Note: These hints are aimed mainly at the DEFAULT machine bridge, to help with problems which may be experienced while working wih this manual. Reference is made to the default input/output diagram (Figure 1), located on Page ii inside the front cover, and to the interconnection diagram (Figure 2) on Page iii.

Problem	Possible solution
Healthy LED is not lit.	Is the plant "INTERLOCK" connected? Refer to the default input/output diagram.
Drive failure after frequent switching on and off.	The drive has correctly carried out self-protection procedures after frequent switching on and off in a short period of time. Replace pre-charge fuses, see Section 8.
The drive will not run from the Keypad.	The drive must be in "Keypad control" (i.e. Local control). Check that DIGIN 4 is open. Use a DVM or view P11.21. DIGIN 4 is connected to CF116 which selects local/remote.
The drive will not run from the terminals.	The drive must be in "Remote control". Check that DIGIN 4 is closed, use a DVM or view P11.21. DIGIN 4 is connected to CF116 which selects local/remote. Also check that the "SFE Running" output is not inhibiting the "STOP" input on DIGIN 1.
All LED's flashing	This indicates a major software or hardware fault with the controller. Normal software operation cannot continue. Refer to Section 7.6.2.
The speed reference is not working.	The default drive has 3 speed references programmed: a) Local (Keypad) reference value entered in P1.00 b) Remote ANIN1, programmed to be 0 - 10 V, view value in P11.36 c) Remote ANIN2, programmed to be 4 - 20 mA, view value in P11.37 • Monitor P9.00 whilst operating the required reference. • To achieve Keypad reference, ensure DIGIN 4 is open. • To achieve any Remote reference, ensure DIGIN 4 is closed. • To select between Remote references ANIN1 and ANIN2, toggle DIGIN 5.
The analogue input references are not functioning as expected.	The default setting for ANIN1 is 0 - 10 V (0 - 100%) and the default for ANIN2 is 4 - 20 mA (20% - 100%). The DIP switches (SW1) on the drive I/O board configure the inputs for current or voltage. • Check the DIP switches against those shown on the default input/output diagram. • Ensure the link TB6/3 to TB6/7 is connected when using the drive's 10.5 V supply (TB6/9). • Check the analogue input settings in P7.00 to P7.07 against default settings. • Check the values entering the analogue inputs in P7.03, P7.07 respectively.
The analogue outputs are not functioning as expected.	The default DIP switch (SW1) setting for ANOP1 is 0 - 10 V, 0 - 100%. The setting for ANOP2 is 0 – 20 mA, 0 – 100%. • Check the DIP switch settings against those shown on the default input/output diagram. • Check the analogue output settings in P7.17 to P7.26 against default settings. • Check the values coming from the analogue outputs in P7.21, P7.26 respectively.
Deceleration ramps not being followed, seems to take longer than set.	The drive is programmed at the factory to prevent itself tripping on overvoltage trips. When an AC motor is decelerated, the motor generates voltage back to the drive DC link, the amount of voltage depends on the speed of the deceleration and the load inertia. If the time taken to stop the load is too long: • Check the deceleration rates set in P1.23 or P6.02, P6.03 (repeated). • Check the value set in P4.12 (P23.05) and ensure that it is sufficient (note that –0.1 kW limit means "unlimited").
Motor turns slowly and draws excess current when in Vector control with an encoder.	This is known as "Wrongly Phased". Check the motor phasing and check the encoder connections. Refer to the Commissioning flowchart, which suggests tests that can be made to verify the encoder integrity.
Drive will not complete a CALIBRATION run.	Although the CAL run should be done off load, for small motors with low inertia it may help to keep the coupling on the motor shaft. Also check the accuracy of the basic motor data entered, especially Mag current, it needs to be in the right order of magnitude.
Not enough torque available after a calibration run. VECTOR CONTROL WITH ENCODER.	• Check P12.10, this is the measured COLD value of Rr determined by the CAL run. Check P12.15, this is the calculated HOT value of Rr. The value of P12.15 ≅ 1.4 x P12.10. If this is not true simply edit P12.15 = 1.4 x P12.10. • Check P12.02, the value of mains voltage, then check the value of P11.49, this is maximum torque the drive has calculated to be available at the motor. • Check P8.00 to P8.03. Values greater than P11.49 will be unattainable. • Try enabling Auto Temperature Compensation. Set P12.06 = 1. Increase P12.07 to increase the rate of auto-compensation, to achieve required motor torque.
Warnings 134 and 136 displayed, trips on code 94 when "RUN" pressed.	Follow the machine bridge Guided Commissioning procedure in Section 5B.4 to choose the correct control mode.

WARNING & TRIP CODES

TRIP CODE	DESCRIPTION
1	Interlock
2	Reference Loss
3	DC Overvolts
4	DC Undervolts
5	Timed Overload
6	Over Temperature
7	Instantaneous Overcurrent
8	U-Phase - Overcurrent
9	U-Phase - HW Overtemp
10, 11	As 8, 9 for V-Phase
12, 13	As 8, 9 for W-Phase
14	Encoder PS Fail
15	Auxiliary ±15 V Fail
16	Auxiliary 24 V Fail
17	Unidentified PIB
18	History Restore Fail
19	New Drive
20	Parameter Edits Lost
21 M	Motor Thermostat
22 M	Motor I^2T
23	RS232 Loss
24	RS485 Loss
25	Internal Reference Fail
26	Under Temperature
27	Keypad Loss/Removed
28 M	Current Imbalance
29	Precharge Failure
30	Drive ID Violation
57 M	Overspeed
58	Current Control Fault
59 M	Motor Calibration Failure
60 M	Unsuitable Motor
61 M	Encoder Loss
62	User Trip 1
63	FIP Loss
64 M	Load Fault - High
65 M	Load Fault - Low
66	Motor PTC
67	DB Resistor
68	Reserved
70 M	Datumize Error
71 M	Speed Feedback Loss
72 M	Over Frequency
73	User Trip 2
93 SFE	Mains Freq Trip
94 SFE	Mains Sync Loss
95 SFE	Mains Monitor Loss
96 SFE	Aux Phase Loss
97	Unknown Trip
98 SFE	Choke PTC
99	Unknown Trip
100-149	Reserved
150	PWM Error
151	DB Overcurrent Trip
152	DB Hardware Overtemp Trip
200	CAN,1,Loss, - see P61.43

69 31-56 74-92 153-199	(Relate to DELTA systems. Refer to Software Manual T1679EN)

WARNING CODE	DESCRIPTION
100	Excess Current
101 M	Motor Thermostat
102 M	Motor I^2t
103	Motor PTC
104	DB Resistor
105	Reference Loss
107	High Temperature
108	Low Temperature
110	Backup Ref Loss
112	RS232 Loss
113	RS485 Loss
114 M	Overspeed
115 M	Encoder Loss
116	FIP Loss
120 - 125	Internal Software Fault
128 M	Load Fault - High
129 M	Load Fault – Low
130	CAN 1 Loss - see P61.43
131	CAN PDO/sec too high
132	Bad CAN ID - see P61.45
133 SFE Warning	Mains Frequency
134 SFE	Mains Sync Loss
135	CAN 1 PDO/IO clash
136 SFE	CF25 /LCN F/B Loss
137 SFE	Choke PTC

VIEWING WARNINGS AND TRIPS
MENU 10

Parameter	View
10.00 - 10.09	Warning Nos. 1 - 10
10.10 - 10.19	Trip Nos. 1 - 10
10.20 - 10.29	Trip History Nos. 1 - 10
10.30	Secs Since Trip
10.31	Hours Since Trip
10.32	CF10 - User Trip 1
10.33	CF112 - User Trip 2
10.34	CF9 - Trip Reset

HISTORY

THE DRIVE IS EQUIPPED WITH A 10-CHANNEL HISTORY RECORDER.

MENU 26 – ALLOWS SET-UP OF THE LOG

MENU 27 – ALLOWS PLAYBACK OF THE LOG

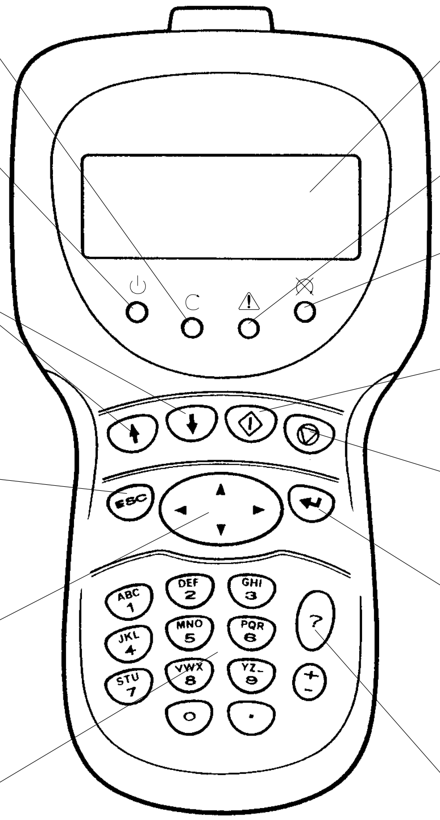
WARNING/TRIP code annotations :

M = only if motor control (P99.01 = 1, 2 or 3)

SFE = only if SFE control (P99.01 = 4)

DRIVE DATA MANAGER™

KEYPAD FUNCTIONS



RUNNING led (Green)

HEALTHY (STANDBY) led (Green)

RAISE and **LOWER** keys, used to Raise and Lower motor speed when Keypad Reference is selected.

ESC key, used whilst Editing and Navigating.

NAVIGATION key, used to Navigate around the SFE/Drive Menus and Parameters. Also used for Editing.

Alpha/Numeric keys, used whilst Editing or Short Cutting parameters.

DISPLAY 4-line, 20-digit

WARNING led (Yellow)

TRIPPED led (Red)

* **RUN** key. Press to start the motor or control of DC link volts in Keypad Control.

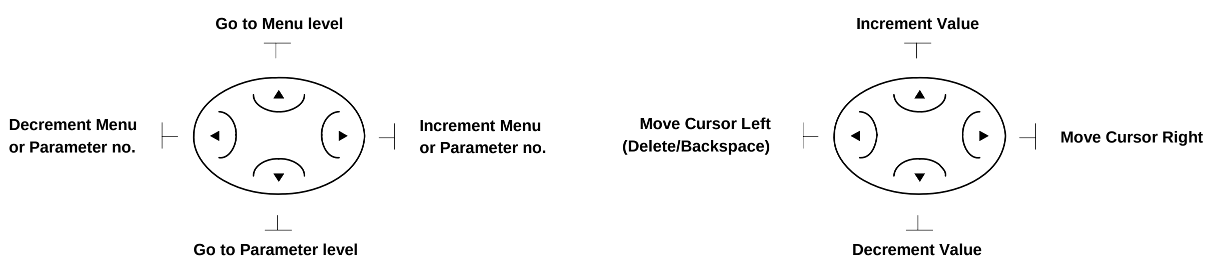
* **STOP** key. Press to stop the motor or control of DC link volts in Keypad Control.

ENTER key. Press to Enter a menu or Enter (Load) an edit.

HELP key. Press to get Diagnostic Help in case of a Trip or Warning, or to get Help about any drive or SFE parameter. See examples of Help key use in Section 4.2 and Diagnostic Help in Section 7.

* Keypad Control is selected via Digital Input 4, which in turn operates Control Flag 116 – see Control Block Diagrams.

NAVIGATION KEY



See over for Diagnostics and Help

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