T1679EN Software Manual Rev 08

MV3000e Drive Range

Basic Drive Modules - Air Cooled & Liquid Cooled

DOCUMENT HISTORY

Revision Number	Date Of Revision	Details
Issue 0002	08/01	Internal issue only.
Issue 0003	08/06	Revisions and corrections with new data included and parameters and menus for Version 6.00 Firmware added.
Issue 0004	10/03	Revisions and corrections with new data included and parameters and menus for Version 7.00, 8.00, 9.00 and 10.00 Firmware added. Sections 10, 11, 12, and 13 added.
Issue 0005	03/06	Revisions and corrections with new data included and parameters and menus for Versions 11.01, 11.60, 11.73, 11.86, 11.94 and 12.00 Firmware added; these additions include Menus 47, 54, 55 and 58. Sections 11 and 12 – 'Commissioning' removed.
Issue 0006	Nov 2012	Company name change, etc.
Rev 0007	December 2013	Company name change, etc. Additions to: Section 6.11.1, Parameter: P11.03 – DC Link Voltage. Section 6.52, Parameter: P54.07 – DC Link Voltage The following added: P6.04, P6.37, P6.38, P6.40
Rev 0008	March 2021	Company name change, etc.

ACKNOWLEDGEMENTS

MODBUS™ is a trademark of Groupe Schneider.

SAFETY INSTRUCTIONS

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

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

Local safety laws and regulations must always be observed.

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

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

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

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

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

In The European Union:

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

WARNINGS, CAUTIONS & NOTES

WARNING
• **"An instruction that draws attention to the risk of injury or death" (BS 4884-1: 1992).**

CAUTION
• **"An instruction that draws attention to the risk of damage to the product, process or surroundings" (BS 4884-1: 1992).**

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

DISPOSAL

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

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

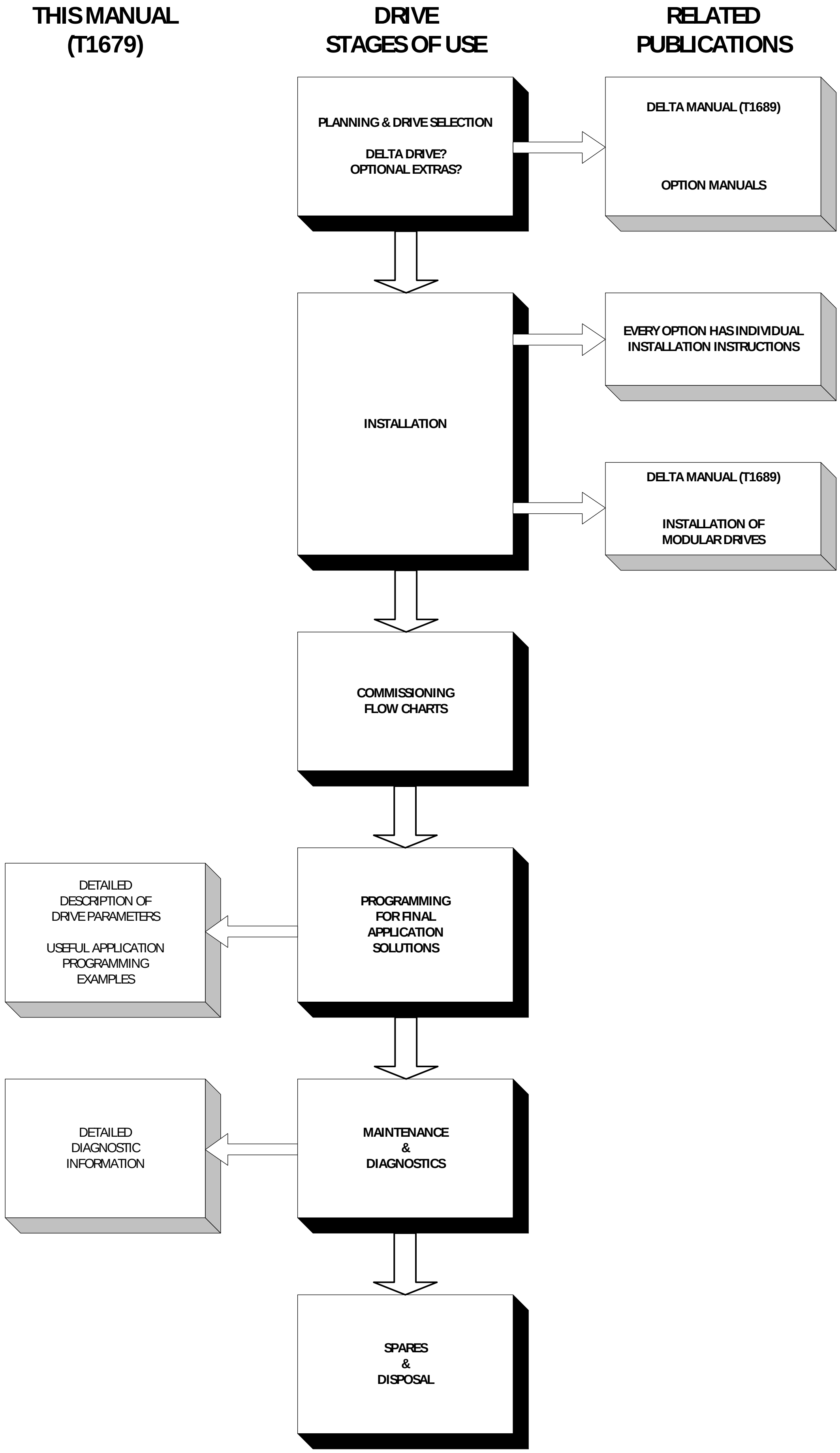
In common with all products of this type, the high voltage electrolytic capacitors contain an electrolyte, which must be disposed of as hazardous waste. The electrolytes are solutions of organic and/or boric acid. The major solvents in the capacitors are butyrolactone and ethylene glycol. The electrolyte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

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

SCOPE

This publication should be read in conjunction with the appropriate Standard Product and/or Technical Manuals. This publication 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.

DOCUMENT STRUCTURE



OVERVIEW

CONTENTS

1. INTRODUCTION

1.1 ABOUT THIS MANUAL

This Software Technical Manual provides a competent user trained in the MV3000e drive system with a detailed description of the drive parameters available with Version 12.00 Firmware. These parameters enable a drive to be fully configured for any specific application. The manual includes a full description of several serial communication protocols that may be used to allow remote control of the drive.

This manual covers the complete range of MV3000e drives, including Basic Drive Modules (MicroCubicles™), air-cooled and liquid-cooled DELTA drives. The range of drives includes all modes of operation as outlined in Section 1.1.1.

This T1679 manual should be regarded as part of the MV3000e drive unit. It should be retained for the life of the drive and passed on to any subsequent owner or user.

1.1.1 Finding Data in the Manual

Section 7 of the manual includes a set of Control Block Diagrams for all modes of operation and these provide a starting point when defining parameters for a particular application. The diagrams graphically represent a drive's parameters. It is suggested that they are referred to before any work is done to specify parameters. The modes of operation detailed at the Control Block Diagrams are:

- Variable Voltage Variable Frequency (VVVF
- Vector with Encoder;
- Vector without Encoder;
- Scalar;
- Active Energy Management (AEM)/Sinusoidal Front End (SFE).

Section 3 introduces menus and parameters and explains their structure and relationships.

Section 5 includes tables of all the parameters, grouped in order of menu, and includes parameter:

- function;
- default value;
- range of values;
- attributes (indicating security level/type);
- useful comments.

Section 6 includes a comprehensive description of all the parameters. These are presented in ascending order of Menu number. Refer to the sectional contents list and the subject and parameter indexes for assistance in finding a particular parameter or any of its associated data.

Section 4 describes the Default drives, as configured by **GE Power Conversion**, including input/output connections and control functions. The purpose of Menu 1, which shows parameter default values, control functions and attributes, is also explained.

Section 2 describes the Drive Data Manager™ (Keypad) that enables communication with a drive. Guidance is included to show how it can be used to navigate menus and enter, list and edit parameters.

Section 8 explains methods of serial link communication with a drive, including that via RS232C and RS485 ports, and includes a description of several communication protocols. A description of all the drive parameters required for configuration of a serial link is included.

Section 9 includes diagnostic details for a drive including what to do if the drive displays a WARNING or a TRIP. Fault indicators, warnings and trips are all discussed with helpful hints and recommended procedures for remedial action.

Installation and commissioning instructions are provided in the Getting Started Manuals T1676 and T2002 and the DELTA manual T1689 (see Section 1.6 for more details).

Three indexes are included at the back of the manual; a general subject index, an index of menu and parameter titles and a numerical index of all the parameter numbers.

1.2 ABOUT THE MV3000E DRIVE UNIT

The MV3000e range of variable speed AC drives provides powerful features at an economical price. At the standard level, MV3000e is a simple to use inverter for general-purpose applications for ratings from 22 kW to 5.8 MW.

At a higher level, open up the parameter menus; add Fieldbus communications, hardware expansion and programming enhancement facilities, and the power of MV3000e comes alive. Add to this universal control strategies such as frequency control, closed loop flux vector control and encoderless flux vector control, and MV3000e easily manages a vast spectrum of industrial applications. A typical MV3000e drive unit is shown in Figure 1-1 with the optional Drive Data Manager™ fitted.

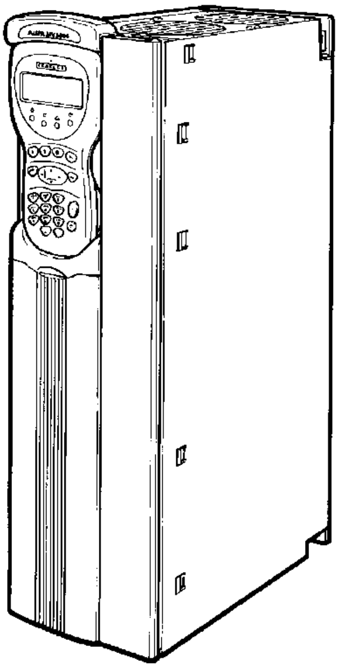


Figure 1-1. – General View of a Typical MV3000e Drive Unit

In Sinusoidal Front End (SFE) applications an MV3000e Bi-directional Converters are configured to connect between mains and a DC Link – the DC Link will typically be connected to one or more Machine Bridges. The SFE is able to control current flow into and out of the mains in order to maintain a constant DC Link voltage, and as such, allows 4-quadrant operation of the Machine Bridge.

1.3 ABOUT THE MV3000E PRODUCT IN SINUSOIDAL FRONT END (SFE) MODE

There are two types of MV3000e products that support operation in SFE mode:

- a range of MicroCubicles™ identified by the letter 'J' in their product code;
- the DELTA product.

NOTE: In both cases, additional auxiliary circuitry is required to achieve SFE functionality.

1.3.1 The Range of MicroCubicles™ identified by Letter 'J' in their Product Code

This range is fitted with internal hardware that allows them to monitor and synchronise to the mains to which they are connected. When connected to further external auxiliary hardware, they can operate in SFE mode. The 'J' code product does not include a power rectifier circuit. The 'J' product is intended for use either as an SFE or a Machine Bridge. A typical application would include two identical 'J' products connected at their DC terminals, one used as an SFE, and the other as a Machine Bridge.

NOTE: Standard MV3000e MicroCubicles™ cannot be used in SFE mode, but can be used as a Machine Bridge.

1.3.2 The MV DELTA product used as a Sinusoidal Front End (SFE)

A dedicated mains monitoring unit can be plugged into a standard MVDELTA controller to provide the control function, whilst 1-6 standard MVDELTA transistor modules can be used to form a power circuit, along with other auxiliary components.

1.4 CONTROL INTERFACE

The MV3000e drive may be controlled by means of an optional Drive Data Manager™ (which provides Keypad functionality), by local controls or via a serial link.

1.5 CUSTOMER SUPPORT AND TRAINING

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

Contact **GE Power Conversion** at the appropriate customer support telephone number shown at the end of this manual.

1.6 ASSOCIATED PUBLICATIONS

GE Power Conversion Publications associated with this Software Manual are now listed.

T1676 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.

T2002 MV3000e Getting Started Manual for Active Energy Management Drives

This 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.

T1689 MV DELTA, Supplementary Technical Manual to T1641, for MV3000e

This manual includes specifications and instructions to allow a competent user trained in drives to safely install the components of MV3000e DELTA systems to construct DELTA drive units.

DELTA drives are a unique system of modular based drive units, 150 kW to 2.2 MW in air-cooled versions, 600 kW to 5.8 MW in liquid cooled versions.

T1692 Drive Coach MVS3004-4001 User's Guide

This manual describes the **GE Power Conversion** Drive Coach software for use with Windows 3.1, 95/98 and for Windows NT 4.0, Windows 2000 and XP. The manual includes a CD-ROM that contains all the software for the product and information for installation, configuration and maintenance of the software.

T2013 MV3000e CANopen Fieldbus Facility Technical Manual for MV3000e Drives

This manual describes the use of CANopen* with MV3000e Drives. There are two methods of use namely to provide additional I/O for the drive – both analogue and digital – and to provide communication between drives in a production cell or functional group.

NOTE: **CANopen is a networking system based on the CAN serial bus.**

T1684 MV3000e Dynamic Braking Units MV3DB Series Technical Manual

This manual provides a competent user, trained in electrical installation practice, with sufficient information to safely install, commission, maintain and dispose of an MV3000e Dynamic Braking Unit.

T1686 Direct FIP MVS3002-4001 and MVS3002-4002

This manual provides a competent user, trained in electrical installation practice, with sufficient information to safely install, commission, maintain and dispose of Direct FIP printed circuit boards.

T1694 PROFIBUS Field Bus Couplers MVS3007-4001 & MVS3007-4002

This manual provides a competent user, trained in electrical installation practice, with sufficient information to safely install, commission, maintain and dispose of PROFIBUS Field Bus Couplers.

T2017 MV3000e DeviceNet Fieldbus Facility

This manual explains how to configure the drive in software to communicate with other devices on a DeviceNet bus.

T2034 MV3000e Ethernet Interface Technical Manual

This manual provides a competent user, trained in electrical installation practice, with sufficient information to safely install, commission, maintain and dispose of MV3000e Ethernet Interface printed circuit boards.

T1968 MV3000 2nd CANPort 'CANopen & DeviceNet' Fieldbus Facility Technical Manual

This manual describes the use of CANopen and DeviceNet protocols with an optional 2nd CANPort module that can be fitted to MV3000e Drives.

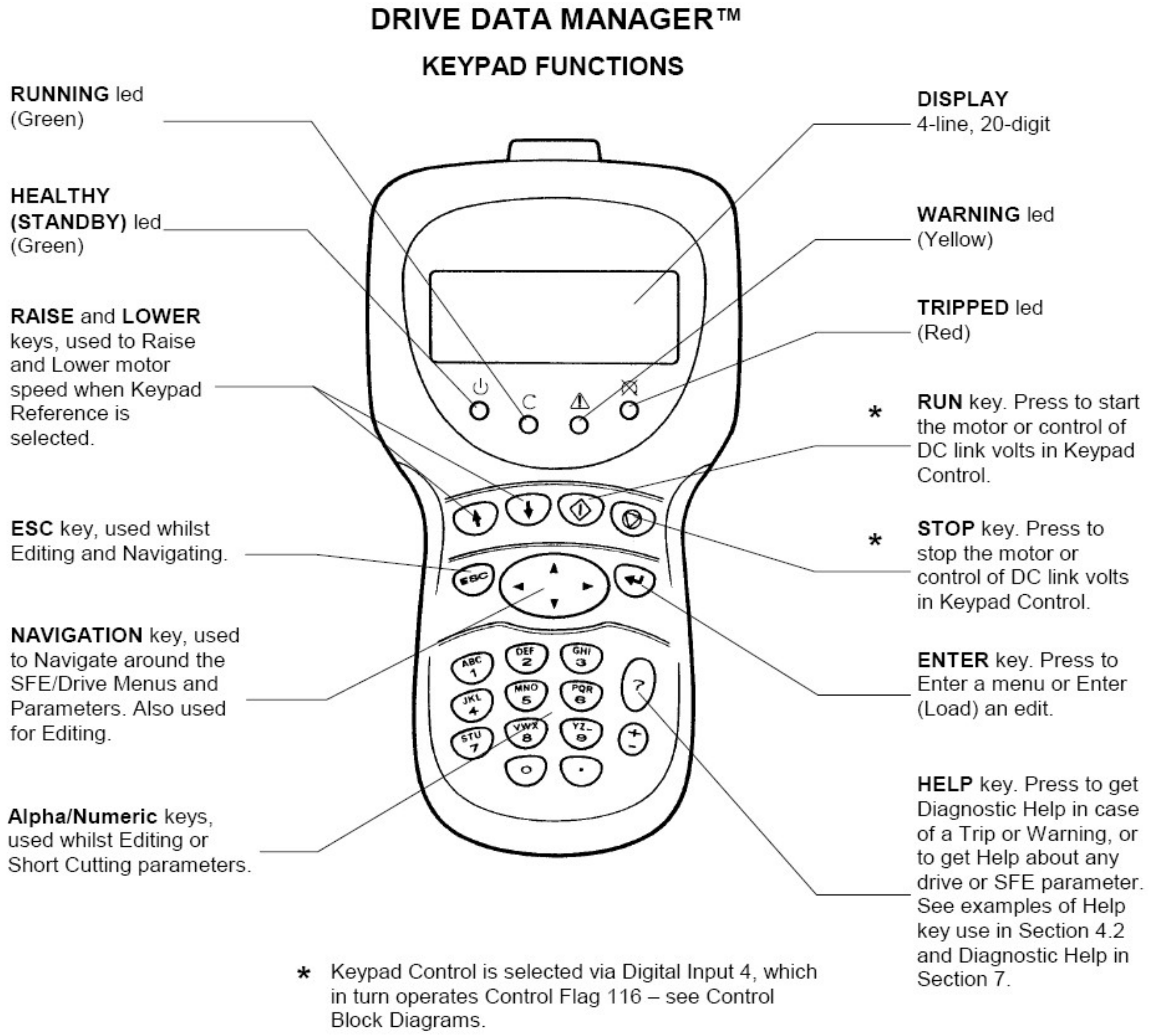
2. USE OF THE DRIVE DATA MANAGER™

2.1 INTRODUCTION

The Drive Data Manager™ is a multi-purpose unit that provides Keypad functions and a 4-line, 20-digit display to allow drive configuration. The Drive Data Manager™ includes four LEDs that show the status of the drive, and it also incorporates four special keys that give stop/start and speed control of a motor. A fifth special key can summon help about parameters, warnings and trips.

This section shows how to use the Drive Data Manager™ to navigate menus and parameters.

2.2 DRIVE DATA MANAGER™ FUNCTIONS



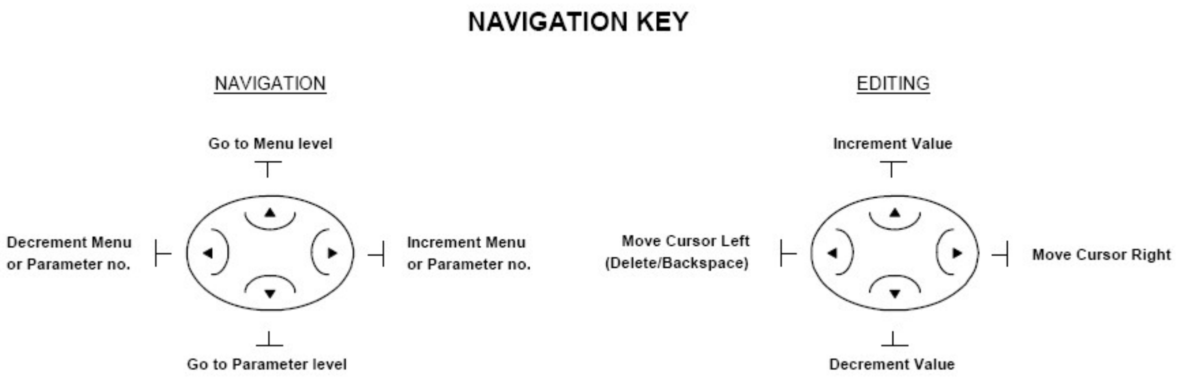


Figure 2-1. – Drive Data Manager™ Indicators & Controls

2.2.1 Navigation Key

The 4-way Navigation key is used to navigate menus and parameters, and to edit parameter values. Operation of the Navigation key is shown in Figure 2-1.

2.2.2 Navigating Menus and Parameters

Figure 2-2 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 3.2.2.

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

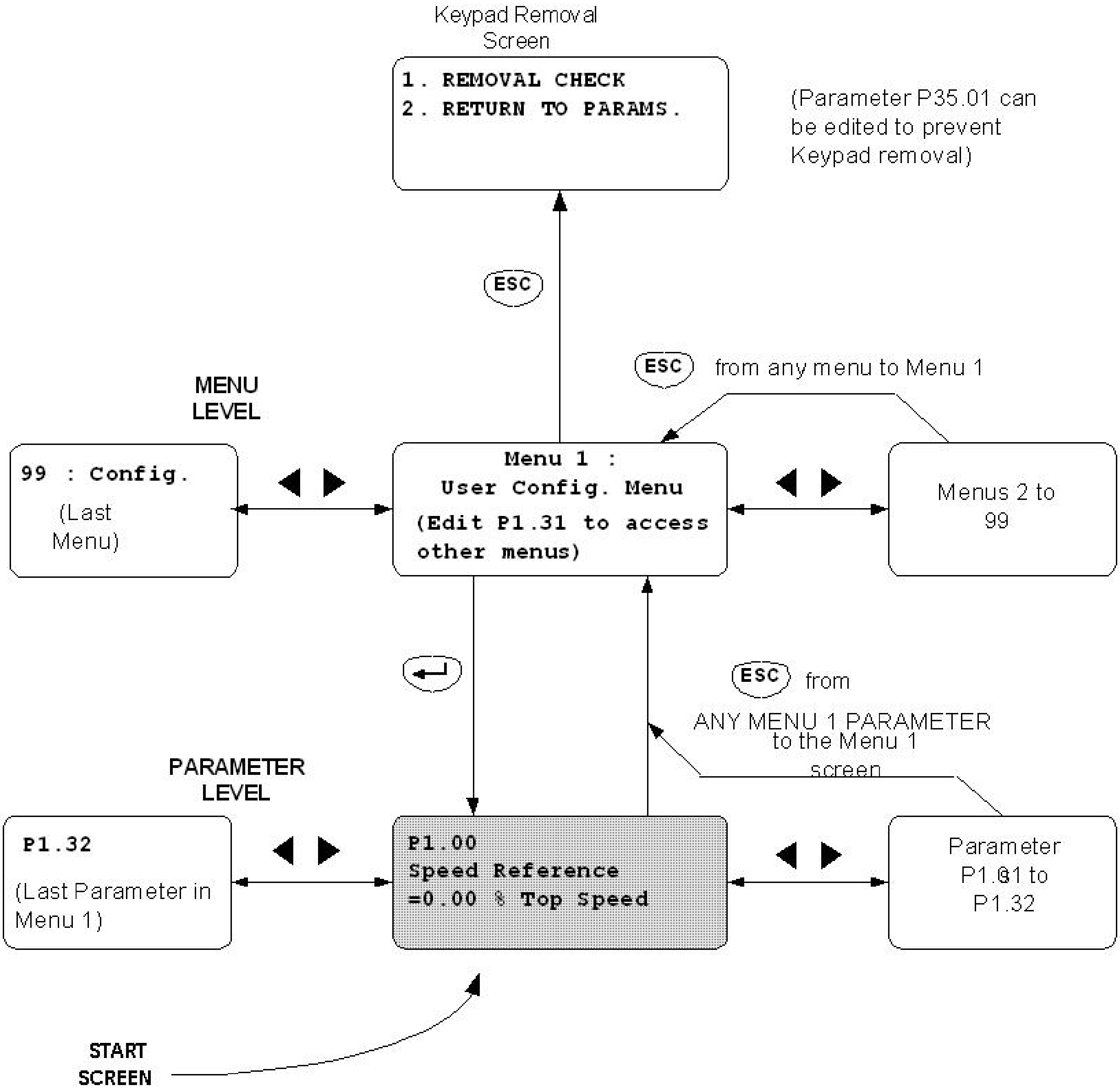


Figure 2-2. – Navigating Menus & Parameters

2.2.3 Editing Parameters

Two types of parameter may be edited:

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

The factory default settings can be regained if desired - see 3.2.4.

NUMERICAL Parameter

As an example of editing "numerical" parameters, Figure 2-3 shows how to edit the value of the Motor Base Frequency parameter P2.00.

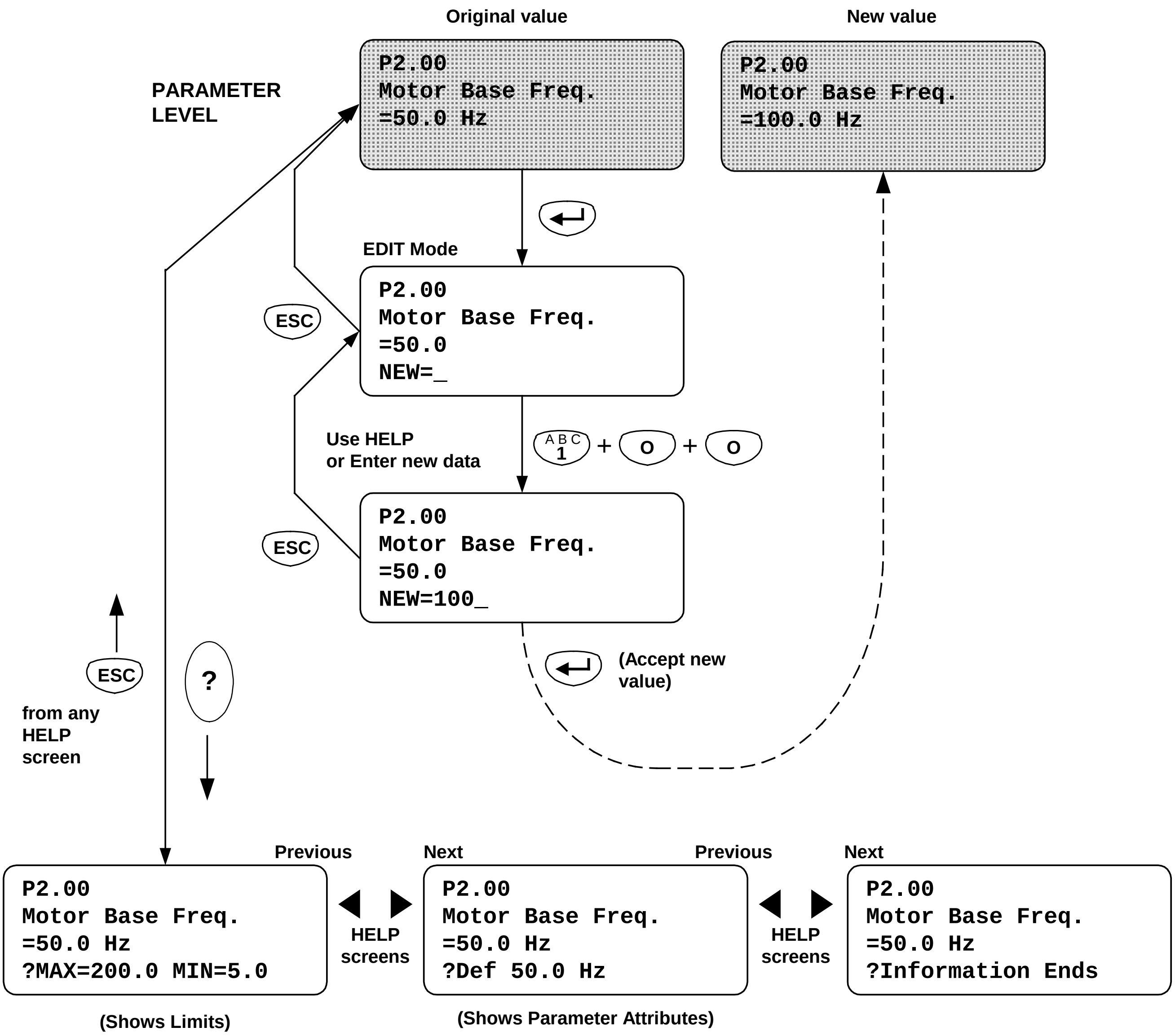


Figure 2-3. –Editing a 'Numerical' Parameter

LIST Parameter

This type of parameter contains a list of sources, items etc. Figure 2-4 shows how to select from a "list" parameter, using the Speed Reference 1 Source parameter P5.01 as an example.

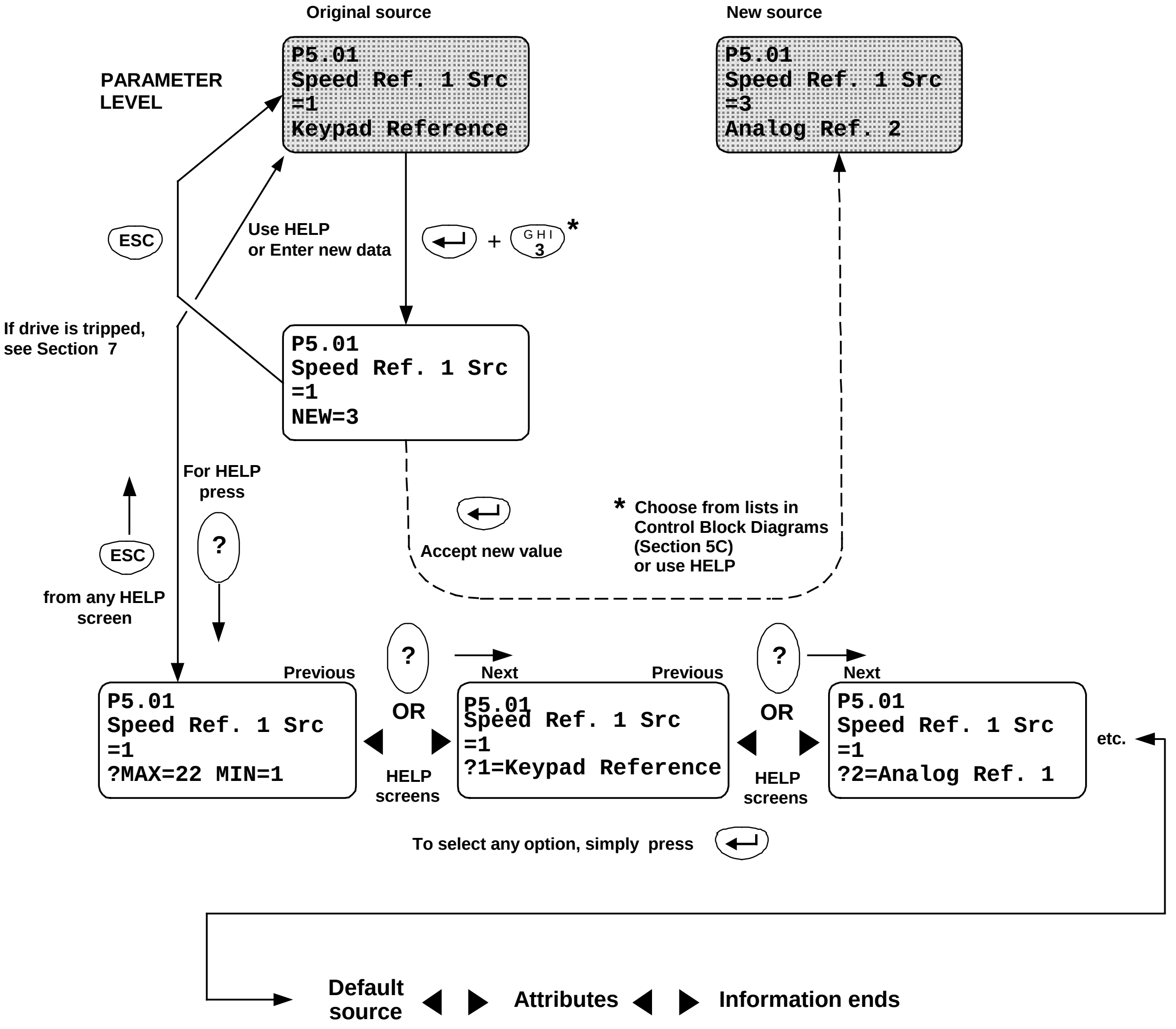


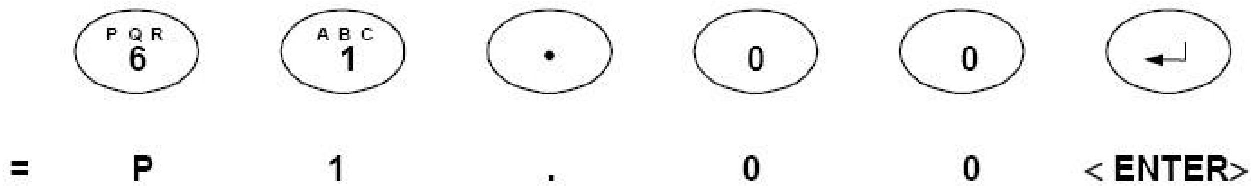
Figure 2-4. – Editing a 'List' Parameter

2.2.4 Using The Keypad HELP (?) Key

The ? key can provide diagnostic help or parameter help, this help function is context sensitive. Section 9 describes the use of the ? key during diagnostics, and Figure 2-3 and Figure 2-4 (Numerical and List parameters) show examples of how to get Parameter help.

2.2.5 SHORTCUT Method of Entering a Parameter Number

If the parameter number is known, it can be entered directly using a shortcut method. Press the relevant alphanumeric keys to enter the desired Parameter Number, including the letter P and the decimal point. For example enter P5.01 to select the Speed Ref. 1 Source parameter previously referred to.



2.2.6 Removal of the Drive Data Manager™ (Keypad)

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

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

To remove the Keypad, continue as shown in Table 2-1.

	Do What?	How?
1	Ensure the keypad is neither in control of the Start/Stop nor the keypad Speed Reference is active	AT DEFAULT: Simply close DIGIN4, this will select Remote. ELSE: **Gain the necessary authorisation before continuing.** a) Make P34.16 = 1, to set CF116 ON, this removes the Start/Stop control from the keypad. b) If a machine bridge, the keypad must <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).

Table 2-1. – How to Remove the Drive Data Manager™ (keypad)

2.3 RECALLING A PARAMETER SET FROM A DRIVE DATA MANAGER™

The MV3000e MicroCubicle™ and the MV3000e DELTA AC Drives incorporate a feature to enable the transfer of parameters from one drive to another via the Drive Data Manager™ (where the Parameter Set can be saved). This feature is invoked via Parameter P99.16 – Backup Parameter – see Section **6.57.11**.

Recalling a Parameter Set from one drive to another is a very powerful and useful feature. However, care must be taken to ensure that an incorrect Parameter Set in the target drive does not result from copying the Parameter Set from an inappropriately configured drive, particularly from a drive of different rating from the source drive. It is therefore recommended that reference be made to the additional guidance in ‘Notes for Recalling a Parameter Set from the Drive Data Manager™ (Keypad)’ in Section **6.57.11**.

3. PARAMETER OVERVIEW

3.1 INTRODUCTION

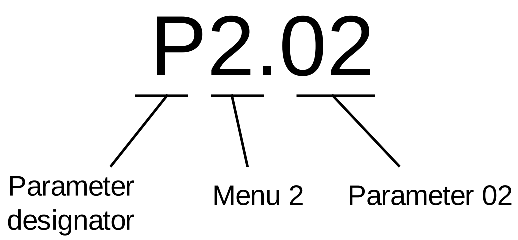
The MV3000e is controlled by means of parameters that are conveniently grouped into menus to form a Menu Structure.

3.2 MENUS AND PARAMETERS

3.2.1 Parameters

The MV3000e software uses system constants, scaling factors and other data (collectively referred to as PARAMETERS) arranged into MENUS for ease of use. Menus group parameters by like function e.g. Menu 6 is Ramp Settings. The complete menu listing is shown in Table 3-1.

Every parameter has a unique 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.



3.2.2 Access to Other Menus (P1.31)

As shipped, only Menu 1 is accessible. Access to other menus is controlled by the value entered into parameter P1.31 that 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 (user chooses the menus to be open)
2	All menus open

Access to P1.31 is controlled by passwords.

3.2.3 Security Passwords

To prevent inadvertent or unauthorised access to parameters, **GE Power Conversion** provides two levels of security. They are known as Operator and Engineer levels, and each is accessed by a password (4-digit code) that can be entered to allow an authorised operator or engineer to change parameter values. These codes are numbers set in parameters P99.07 (operator security code) and P99.08 (engineer security code).

When editing is completed entering a value, other than the operator or engineer codes, in P99.06, locks the parameters.

At default, the operator and engineer passwords are both open.

The parameters concerned with the editing and use of security passwords are described in Section **6.57.7**.

3.2.4 Returning to Factory Default Settings

Record the settings in "Edit Review Mode" i.e. set P35.03 = 1.

If incorrect data is entered during commissioning, the factory default settings can be regained using the following procedure:

a) Set parameter P1.31 = 2.

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

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

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

e) Navigate to P99.06 (see 6.62.7) and enter the password for engineer access.

f) Set P99.17 = 1 and press ↵

The drive will now be at default settings.

3.2.5 Complete Menu Listing

A complete list of menus is shown in Table 3-1.

These menus are described in associated product documentation:

- Menus 59, 60, 61 and 62 are described in the CANopen product manual;
- Menus 58, 65, 66 and 67 are described in the 2nd CAN Port Manual;
- Menu 63 is described in the DeviceNet manual; Menus 74 and 75 are described in the PROFIBUS Manual;
- Menu 78 is described in the MicroPEC™ Instruction Sheet; Menus 80, 83, 84, 85 and 89 are described in documentation supplied with FIP Fieldbus cards.
- Menus 50, 51, 52, 53 and 56 are specific to the SFE and are listed in Sections 4, 5 and 6.
- In SFE Mode, only the shaded menus are visible.

Menu	Description	Menu	Description
1	User configured menu	41	Programmable status word settings
2	Basic motor settings	42	Pointer source settings
3	Frequency control settings	43	Load fault detection window settings
4	Start and stop control	44	Reference shaper settings
5	Speed reference settings	45	Temperature
6	Ramp settings	46	Ridethrough Menu
7	Plant I/O settings	47	Second Logic Menu
8	Torque limit settings	50	Basic SFE Setup
9	Basic drive monitoring	51	SFE Monitoring
10	Trips and warnings	52	Advanced SFE Setup
11	Advanced drive monitoring	53	SFE Reference Setup
12	Motor advanced settings (vector only)	54	Mains Monitor Menu
13	Speed feedback settings (vector only)	55	Machine Bridge Control Menu
14	Speed loop settings (vector only)	56	AC Voltage Control Menu
15	Torque reference settings (vector only)	58*	CANopen Extended I/O settings Can Port 2
16	PID controller settings	59*	CANopen Extended I/O settings CAN Port 1
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	65*	CAN Port 2
22	Skip speed settings	66*	CAN 2 CANopen
23	Dynamic brake control settings	67*	CAN 2 DeviceNet
24	Speed trim settings	70-72	Application Code Developer
25	Inertia compensation settings	74	PROFIBUS Fieldbus Coupler
26	History log settings	75*	PROFIBUS Fieldbus Coupler
27	History log playback settings	78*	MicroPEC™
28	Auto-reset settings	76	Reserved
29	Speed and torque monitor settings	77	Reserved
30	Logic block settings	80*	Fieldbus - Configuration and status data
31	Status Flag generator settings	83*	Fieldbus - Fast produced VCOMs
32	Serial links settings	84*	Fieldbus - Fast consumed VCOMs
33	Control Flag 0 to 99 source settings	85*	Fieldbus - Slow VCOMs and FIP refs.
34	Control Flag 100 to 127 source settings	86	Ethernet interface Menu
35	Miscellaneous features	89*	Fieldbus - Data spy module
36	Position controller settings (encoder only)	90	Manufacturer's Menu
37	Position reference settings (encoder only)	91	Fast Analog Output
38	Position controller monitor (encoder only)	98	Menu enable selection settings
39	Menu 1 Setup Menu	99	Configuration settings
40	Summing nodes settings		

Table 3-1. – Menu Listing

4. THE DEFAULT DRIVE

4.1 INTRODUCTION

The drive may be operated as a simple frequency control drive using the default configuration of Menu 1. In this configuration all other menus that give access to the advanced features, including vector control are "invisible". To gain access to the other menus P1.31 in Menu 1 must be set to 2.

A drive may also be used in Sinusoidal Front End (SFE) applications for which the default configuration of Menu 1 is included.

4.1.1 Default I/O Connections and Set-up for the Drive

Control and Reference of the drive can be either from the Drive Data Manager™ (Keypad), or via the I/O terminal blocks TB1 to TB6 at default (TB4 or TB4A and TB4B).

Refer to the Wiring Diagram in the appropriate MV3000e Getting Started or MVDELTA Manual (see Section 1.6). The default drive configuration defined in Menu 1 requires the following I/O connections to be made:

- Digital Input Functions.
- Analogue Input Functions.
- Digital Output Functions.
- Analogue Output Functions and Modes.

Each of these connection requirements is now described for all operating modes.

NOTE: The "default" values listed for "J" drives (AEM Machine Bridge or SFE Mains Bridge) are AFTER the mode of operation has been selected. The operation mode is selected by P99.01 (see Section 6.57.2).

Digital Input Functions

The Digital Input Function connections to be made for the different operating modes are described in Table 4-1.

Termination and Function	Standard AC Fed Drives	AEM Machine Bridge	SFE Mains Bridge
DIGIN 1	Remote STOP (+24 V to allow RUN)		
DIGIN 2	Remote RUN		
DIGIN 3	Direction (+24 V = Reverse)		RUN PERMIT
DIGIN 4	Control and Reference source (0 V for Keypad, 24 V for Remote)		
DIGIN 5	Analogue Reference Select (0 V = Ref1; +24 V = Ref2)		-
DIGIN 6	Trip Reset (+24 V = Reset)		
INTERLOCK	Hardware drive inhibit (non programmable function). (Must be connected to +24 V to run the drive)		

Table 4-1. – Digital Input Functions

NOTES to Table 4-1:

1 The drive's default direction control mode is set by the polarity of the applied reference. The direction can also be reversed if DIGIN 3 is set to +24 V.

2 Trips may also be reset using the Keypad.

Analogue Input Modes

The Analogue Input Mode connections to be made for the different operating modes are described in Table 4-2.

Termination and Function	Standard AC Fed Drives	AEM Machine Bridge	SFE Mains Bridge
REF 1	±0 - 10V	±0 - 10V	±0 - 10V
REF 2	±4 - 20mA	±4 - 20mA	Fast Load Power Feedforward Input

Table 4-2. – Analogue Input Modes

Digital Output Functions

The Digital Output Function connections to be made for the different operating modes are described in Table 4-3.

Termination and Function	Standard AC Fed Drives	AEM Machine Bridge	SFE Mains Bridge
Digital Output 1	HEALTHY/STANDBY (Not Tripped)	HEALTHY	HEALTHY
Digital Output 2	OUTPUT RUNNING (Drive enabled)	RUNNING	SFE RUNNING
Digital Output 3	AT SPEED	AT SPEED	AT VOLTS

Table 4-3. – Digital Output Functions

Analogue Output Functions and Modes

The Analogue Output Function and Mode connections to be made for the different operating modes are described in Table 4-4.

Termination and Function	Standard AC Fed Drives	AEM Machine Bridge	SFE Mains Bridge
Analogue Output 1	0 - 10 V represents 0 - 100 % Speed	0 - 10 V represents 0 – 100 % Speed	-
Analogue Output 2	0 - 10 V represents 0 - 150% Full Load Current	0 - 10 V represents 0 - 150% Full Load Current *	-

Table 4-4. – Analogue Output Functions & Modes

NOTE: * During commissioning this value will be changed from its default to provide the Load Power Feedforward signal shown at the relevant wiring diagram in the T2002 Getting Started Manual (for AEM Drives).

4.2 PARAMETER SECURITY ATTRIBUTES

All parameters have attributes that 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 attributes are shown in Table 4-5 and now described.

Attribute	Security Level/Type
C	Confirm Edit – 'Enter to confirm', 'Esc to abort'
E	Engineer accessible - only accessible if the engineering password (P99.08) has been entered in P99.06
L	List parameter, value selected from a pre-defined list
N	(eNter) has to be pressed to update
O	Operator Accessible - only accessible if the operator password (P99.07) has been entered in P99.06
R	Read only (monitoring parameters)
S	Stop to edit. The parameter cannot be edited unless the drive is stopped.
X	e**X**cluded from CRC.

4.3 MENU 1 - DEFAULT PARAMETERS FOR A DRIVE

4.3.1 Menu 1 - Default Parameters for a Standard AC-fed or Machine Bridge Drive

Menu 1 provides an operator with the drive controls required for day-to-day operation of the drive. The default settings for this menu provide the controls for a simple frequency control drive with local Stop/Start logic as shown in Table 4-5.

An operator can choose alternative parameters for Menu 1; this facility is configured by the settings in Menu 39 (see Section **6.39**).

Table 4-5 lists the default contents of Menu 1. It also shows where these parameters are duplicated in the advanced menus.

Table 4-5. – Menu 1 – User Configured Menu

Parameter No.	Source Parameter Configured by Menu 39	Function	Default	Range	Attribute
P1.00	P9.00	Speed Reference	0.00	-100.00 % Top Speed to +100.00 % Top Speed	O
P1.01	P9.01	Speed Feedback	0.00	-300.00 % Top Speed to 300.00 % Top Speed	R
P1.02	P9.05	Motor Current	0.0	0.0 A to 9999.0 A (for MicroCubicle™ Drives) 0 to 9999 A (for DELTAs)	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 to +999.9 kW (for MicroCubicle™ Drives) –9999 to +9999 kW (for DELTAs)	R
P1.06	P10.00	Warning No. 1	0	0, 100 to 149	R
P1.07	P10.10	Trip No. 1	0	0 to 99, 150 to 202	R
P1.08	P10.11	Trip No. 2	0	0 to 99, 150 to 202	R
P1.09	P99.10	User Text Language	1	1 = English 2 = French 3 = Portuguese 4 = German	O

Table 4-5. – Menu 1 – User Configured Menu

Parameter No.	Source Parameter Configured by Menu 39	Function	Default	Range	Attribute
P1.10	P2.01	Motor Base Voltage	Size Dependent	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	Size Dep.	100 rpm to 9999 rpm	S, E, N
P1.14	P2.05	Motor Full Load Power	Drive rating dependent	0.1 to 0.99	S, E
P1.15	P5.15	Maximum Speed Fwd	1500	10 rpm to 6000 rpm	S, E
P1.16	P5.16	Maximum Speed Rev	1500	0 rpm to 6000 rpm	S, E
P1.17	P5.17	Minimum Speed Fwd	0	0 rpm to P5.15	S, E
P1.18	P5.18	Minimum Speed Rev	0	0 rpm to P5.15	S, E
P1.19	P3.00	Fluxing Control	1	1 = Linear V to F 2 = Square Law V to F (Fan curve) 3 = Economy flux mode	S, E, N, L
P1.20	P3.01	Fixed Volts Boost	0	0 V to 50 V	E
P1.21	P3.31	Economy Factor (Economy Flux Mode)	0	0 % to 50 % Nominal Flux	E
P1.22	P6.00	Accel. Rate Fwd.	10	0.1 %/s to 3000 %/s	E
P1.23	P6.02	Decel. Rate Fwd.	10	0.1 %/s to 3000 %/s	E
P1.24	P4.00	Start Mode	1	1 = Normal start 2 = Synchrostart	S, E, L
P1.25	P4.07	Normal Stop Mode	1	1 = Disable and Coast 2 = Ramp to Stop 3 = Torque limit 1 Stop 4 = Torque limit 2 Stop 5 = DC Injection	S, E, N, L
P1.26	P3.05	Fixed Current Limit	150 % when P1.29 = 0 110 % when P1.29 = 1	10 % to 150 % when P1.29 = 0 10 % to 110 % when P1.29 = 1	E
P1.27	P99.05	Drive Nominal Current	As drive size	As drive size	R
P1.28	P4.12	Motor Regenerative kW Limit	0.5	-0.1 kW to 6000.0 kW -0.1 means NO LIMIT, energy to be absorbed by DB unit	E
P1.29	P99.02	Overload Duty	1	0 = 150% Overload 1 = 110% overload	S, E, N, L
P1.30	P99.00	Number of DELTAs	0 1 - 6	0 = Not a DELTA system, possibly a MicroCubicle™ Number of DELTAs in system	R
P1.31	None Always a Menu Parameter	Advanced Menus (Controls which menus are open)	0	0 = None (Menu 1 only) 1 = As Menu 98 choices 2 = All Menus Open	E, N, L
P1.32	None Always a Menu Parameter	Security Code (P99.06)	As P99.06		O

4.3.2 Menu 1 - Default Parameters for a Basic Sinusoidal Front End (SFE) Application

Menu 1 provides an operator with the controls required for day-to-day operation for a Basic Sinusoidal Front End (SFE) Application. The default settings for this application of Menu 1 are different to those for the drive Menu 1. The controls for SFE are listed in Table 4-6.

An operator can choose alternative parameters for Menu 1; this facility is configured by the settings in Menu 39 (see Section **6.39**).

Table 4-6 lists the default contents of Menu 1. It also shows where these parameters are duplicated in the advanced menus.

Table 4-6. –Menu 1 – Default Parameters for Basic Sinusoidal Front End (SFE) Applications

Parameter No.	Source Parameter Configured by Menu 39	Function	Default	Range	Attribute
P1.00	P50.00	Vdc reference	Drive Size	550 V to 850 V or 700 V to 1100 V or 700 V to 1140 V	E
P1.01	P51.00	Vdc feedback	0	0 V to 30000 V	R
P1.02	P51.01	Current Feedback	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	Mains Voltage	0	0 V to 1000 V rms	R
P1.05	P51.06	Mains Power	0	-999.0 to 999.9 kW	R
P1.06	P10.00	Warning No. 1	0	0, 100 to 149	R
P1.07	P10.10	Trip No. 1	0	0 to 99, 150 to 202	R
P1.08	P10.11	Trip No. 2	0	0 to 99, 150 to 202	R
P1.09	P99.10	User Language	1	1 = English 2 = French 3 = Portuguese 4 = German	O
P1.10	P50.01	Choke Inductance	Drive Size	30 μH to 10 000 μH	E
P1.11	P50.02	% Rating of DC Fed Drives	100 %	0 % to 10 000 % (SFE Rating)	E
P1.12	P50.03	Active Current Positive Limit	110 %	0.00 % to 150 % (SFE Nom Current)	E
P1.13	P50.04	Active Current Negative Limit	110 %	0.00 % to 150 % (SFE Nom Current)	E
P1.14	P52.08	Mains Low Freq Trip Threshold	45.00 Hz	40.00 Hz to 70.00 Hz	E
P1.15	P52.09	Mains Low Freq Warning Threshold	45.00 Hz	40.00 Hz to 70.00 Hz	E
P1.16	P52.10	Mains High Freq Warning Threshold	63.00 Hz	40.00 Hz to 70.00 Hz	E
P1.17	P52.11	Mains High Freq Trip Threshold	63.00 Hz	40.00 Hz to 70.00 Hz	E
P1.18	P53.03	Load Power Feedforward Source	4	0 = None 1 = Current Sensor Ch 1 2 = Current Sensor Ch 2 3 = Fast Analogue Ch 1 4 = Fast Analogue Ch 2	E, N, L
P1.19	P51.10	Feedforward Current Demand	0	-9999.0 A to 9999.0 A	R
P1.20	P51.13	Active Current	0	-150 % to +150 %	R
P1.21	P7.27	Digital Output 1 Source	-2.005	See Control Flag Menus 33/34	E, N
P1.22	P7.28	Digital Output 2 Source	2.008	See Control Flag Menus 33/34	E, N

Table 4-6. –Menu 1 – Default Parameters for Basic Sinusoidal Front End (SFE) Applications

Parameter No.	Source Parameter Configured by Menu 39	Function	Default	Range	Attribute
P1.23	P7.29	Digital Output 3 Source	2.012	See Control Flag Menus 33/34	E, N
P1.24	P33.00	Stop Control	See Control Flag List	0.000 = Cleared (Off) 1.000 = Set (On)	E, N
P1.25	P33.01	Start Control	See Control Flag List	0.000 = Cleared (Off) 1.000 = Set (On)	E, N
P1.26	P34.16	Keypad/Remote	See Control Flag List	0.000 to 5.215	E, N
P1.27	P99.05	Drive Nominal Current	As drive size	As drive size	R
P1.28	P99.11	Drive Voltage Grade	0	0 = Standard Voltage Grade 1 = Alternative Voltage Grade	S, E, N. L
P1.29	P99.02	Overload Duty	1	0 = 150 % Overload 1 = 110 % Overload	S, E, N. L
P1.30	P99.00	Number of DELTAs	0 1 - 6	0 = Not a DELTA system, possibly a MicroCubicle™ Number of DELTAs in system	R
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	P99.06	Security Code (P99.06)	As P99.06		O

5. PARAMETER LISTING

5.1 INTRODUCTION

This section contains a listing of all drive parameters, grouped in menus for ease of reference. Each parameter is cross-referred to the descriptions in Sections 6, 8 and 9, and the lists include default values, range of values, attributes and a mode number for all parameters. Control Block Diagrams in Section 7 show how these parameters affect drive control.

5.2 ATTRIBUTES

All parameters have attributes that 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 types of attribute are described below.

Attribute	Security Level/Type
C	Confirm Edit – 'Enter to confirm', 'Esc to abort'.
E	Engineer accessible - only accessible if the engineering password . (P99.08) has been entered in P99.06.
L	List parameter, value selected from a pre-defined list.
N	(eNter) has to be pressed to update.
O	Operator Accessible - only accessible if the operator password (P99.07) has been entered in P99.06.
R	Read only (monitoring parameters).
S	Stop to edit. The parameter cannot be edited unless the drive is stopped.

5.3 MODE NUMBER

The tables in this section of the manual also include (Mode No.) for each parameter. This number indicates the relationship between a parameter and the mode of operation for a drive as determined by the values for the Control Structure at P99.01. However, the mode numbers used in the parameter tables are further extended from those at P99.01, to include additional indicators for Vector Control (see P13.00). A summary of the Mode Numbers used is:

0 = No motor

1 = VVVF (Variable Voltage Variable Frequency)

2 = Vector

- 2a = Vector with Encoder
- 2b = Vector with Tacho
- 2c = Encoderless Vector

3 = Scalar

4 = SFE (Sinusoidal Front End).

When Mode Number 2 is used in the tables it indicates that the specific parameter may be used with all modes of Vector Control. When a parameter is applied to a particular form of Vector Control it is represented by use of 2a, 2b or 2c.

When a range of numbers is included it indicates that the parameter may be used with all modes of operation e.g. 1-2 indicates use with VVVF and all the Vector modes (2a, 2b and 2c).

5.4 PARAMETER TABLES

5.4.1 Menu 2 – Basic Motor Settings

NOTE: Parameters in this table are described in Section 6.2 and Control Flags in Section 5.4.75 where marked CF List *

Par No.	Function	Default	Range	Attrib	Mode No.	Comments
P2.00	Motor Base Frequency	50 Hz	5.00 Hz to 200.00 Hz	S,E	1-3	
P2.01	Motor Base Voltage	Size Dep.	25 V to 1000 V (rms)	S,E,N	1-3	
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	1-3	
P2.03	Motor Nominal Power	Size of Drive	Drive size dependent	S,E,N	1-3	
P2.04	Motor Nominal Speed	Size Dep.	Drive size dependent	S,E,N	1-3	
P2.05	Motor Full Load Power Factor	Drive rating dependent	0.1 to 0.99	S,E	1	
P2.06	Number of Motor Poles	0	0 to 28 (even numbers) (0 = Drive computes number of poles)	S,E	1-3	
P2.07	Motor 150% Overload Time	60 s	10 s to 3600 s	E	1-3	
P2.08	Motor Cooling Fan Type	1	1 = Shaft driven 2 = Separately excited fan	E,N,L	1-3	
P2.09	Motor I^2T Action	2	0 = No Action. 1 = Warning at 75% limit. 2 = Warning at 75% Trip at 100 % limit. 3 = Current limit at 75% I^2T limit	E,N,L	1-3	Option 3 is only effective in Mode 1, i.e. VVVF
P2.10	Action on MTRIP (Motor thermostat trip	0	0 = No Action 1 = Warning 2 = Trip	E,N,L	1-3	
P2.11	CF113: MTRIP	0.000 CLEARED	See Control Flag Menus 33/34	E,N	1-3	CF List *
P2.12	Motor Continuous Duty	100	75% to 125%	E	1-3	
P2.13	Motor PTC Trip Resistance	3.00 kΩ	Max. = 10.00 kΩ Min. = 0.10 kΩ	E	1-3	
P2.14	Measured PTC Resistance		Max. = 10.00 kΩ Min. = 0.10 kΩ	R	1-3	
P2.15	Motor PTC Action	0	0 = No action 1 = Warning 2 = Trip 3 = Warning and current limit	E,L	1-3	

5.4.2 Menu 3 – Frequency Control Settings

NOTE: Parameters in this table are described in Section 6.3 and Control Flags in Section 5.4.75 where marked CF List *

Par No.	Function	Default	Range	Attrib	Mode No.	Comments
P3.00	Fluxing Control	1	1 = Linear V to F 2 = Square Law V to F (Fan curve) 3 = Economy flux mode	S,E,N,L	1	
P3.01	Fixed Volts Boost	0.0	0.0 V to 50.0 V	E	1	Vrms @ 0 Hz
P3.02	Auto Volts Boost (load dependent volts boost)	0.0	0.0% Nominal to 200.0% Nominal	E	1	
P3.03	Slip Compensation Gain	0.0	–200.0% Nominal to +200.0% Nominal	E	1	Hz @ FLC and unity PF
P3.04	Absolute Minimum Frequency	0.0	0.0 Hz to 50.0 Hz	E	1,3	
P3.05	Fixed Current Limit	110	10% to 110% (Drive Nominal 10% to 150% Current)	E	1	If P99.02 = 1 (default) If P99.02 = 0
P3.06	Current Limit Source	1	1 = Fixed 100 % 2 = Analogue REF1 3 = Analogue REF2 4 = RS485 REF 1 5 = RS485 REF2 6 = RS232 REF1 7 = RS232 REF2 8 = PID Controller 9 = Ref. Sequencer 10 = Fixed Ref. Menu 11 = Motorised Pot. 12 = Trim Reference 13 = Fixed 0% (Not used) 14 = Fixed 0% (Not used) 15 = Summing Node A 16 = Summing Node B 17 = Pointer 13	E,N,L	1	
P3.07	Current Limit Response Speed	20.0	0.0%/s to 500.0%/s	E	1	150% FLC @ ILIM = 100 %
P3.08	CF114: Current Limit Defeat	0.000 CLEARED	See Control Flag Menus 33/34	E,N	1	CF List *
P3.09	Torque Limit Response Speed	2.0	0.0%/s to 500.0%/s	E	1	
P3.10	Torque Limit Cut-in Frequency	1.00	0.20 Hz to 50.00 Hz	E	1	
P3.11	CF115: Torque Limit Enable	0.000 CLEARED	See Control Flag Menus 33/34	E,N	1	CF List *
P3.12	Motor Parameterisation Method	1	1 = Explicit entry 2 = Estimate from Nameplate 3 = Perform Calibration Run	S,E,N,L	1,2	
P3.13	VVVF Stator Resistance	Drive Size	0.1 mΩ to 3000 mΩ	E,N	1	
P3.14	VVVF Stator Inductance	Drive Size	0.1 mH to 30.0 mH	E	1	
P3.15	VVVF Magnetising Resistance	Drive Size	1 Ω to 20,000 Ω	E	1	
P3.16	Stability Gain	1.000	0.000Hz/(%/scan) to 4.000Hz/(%/scan)	E	1	
P3.17	Stability Time Constant	40	0 scans to 2000 scans	E	1	1 scan = 5 ms

NOTE: Parameters in this table are described in Section 6.3 and Control Flags in Section 5.4.75 where marked CF List *

Par No.	Function	Default	Range	Attrib	Mode No.	Comments
P3.18	Magnetising Current Reference Source	1	1 = Fixed 100 % 2 = Analogue REF1 3 = Analogue REF2 4 = RS485 REF 1 5 = RS485 REF2 6 = RS232 REF1 7 = RS232 REF2 8 = PID Controller 9 = Ref. Sequencer 10 = Fixed Ref. Menu 11 = Motorised Pot. 12 = Trim Reference 13 = Fixed 0% (Not used) 14 = Fixed 0% (Not used) 15 = Summing Node A 16 = Summing Node B 17 = Pointer 14 18 = Pointer 15	E,N,L	3	Scalar Control only
P3.19	Torque Current Reference Source	1	1 to 18 (see P3.18)	E,N,L	3	Scalar Control only
P3.20	Magnetising Current Reference Scale	100.00	0.00% to 150.00%	E	3	Scalar Control only
P3.21	Torque Current Reference Scale	100.00	0.00% to 150.00%	E	3	Scalar Control only
P3.22	Scalar Magnetising Current Reference	0.00	-327.67% to 327.67%	R	3	
P3.23	Scalar Torque Current Reference	0.00	-327.67% to 327.67%	R	3	
P3.24	Variable Volts Boost	0.0	0.0V to 100.0V	E	1	
P3.25	Variable Volts Boost Source	1	1 = Fixed 100 % 2 = Analogue REF 1 3 = Analogue REF 2 4 = Fixed 0% (Not used) 5 = Fixed 0% (Not used) 6 = RS485 REF 1 7 = RS485 REF2 8 = RS232 REF1 9 = RS232 REF2 10 = PID Controller 11 = Pointer 19	E,N,L	1	
P3.26	CF126 : Enable Variable Volts Boost	0.000 CLEARED	See Control Flag Menus 33/34	E,N	1	CF List *
P3.27	Rectification Mode	0	0 = Clamp 1 = Rectify 2 = Allow Negative	E,N,L	1	
P3.28	Variable Boost Output	0.0	–3276.7V to +3276.7V	R	1	
P3.29	Feedback Compensation	0	0 = Disabled 1 = Enabled	E,N,L	1	
P3.30	Frequency Multiplier	0	0 = Disabled 1 = Enabled	S,E,N,L	1	
P3.31	Economy Flux Factor	0	0% to 50%	E	1	Only for VVVF Mode
P3.32	VVVF Modulation Limit	Depends on Switching Frequency	82.00% to 107.00%	E	1	See parameter description

5.4.3 Menu 4 – Start & Stop Control

NOTE: Parameters in this table are described in Section 6.4 and Control Flags in Section 5.4.75 where marked CF List *

Par No.	Function	Default	Range	Attrib	Mode No.	Comments
P4.00	Start Mode	1	1 = Immediate low Frequency start 2 = Synchrostart	S,E,L	1-3	Not applicable when speed feedback is available.
P4.01	Synchrostart Mode	1	1 = Reference direction only 2 = Both Directions	S,E,L	1,2c,3	
P4.02	Synchrostart Current/Flux	10	0% to 100 % (% of drive rated current)	E	1,2c,3	
P4.03	Synchrostart Scan Rate	50	0%/s to 250%/s	E	1,2c,3	
P4.04	CF1: Start	1.002 Dig I/P 2	See Control Flag Menus 33/34	E,N	0-3	CF List *
P4.05	CF0: Normal Stop	1.001 Dig I/P 1	See Control Flag Menus 33/34	E,N	0-3	CF List *
P4.06	CF2: Rapid Stop	0.001 SET	See Control Flag Menus 33/34	E,N	0-3	CF List *
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	1-3	
P4.08	Rapid Stop Mode	1	1 to 5 (see P4.07)	S,E,N,L	1-3	
P4.09	CF116: Keypad/Remote	1.004 Dig. I/P 4	See Control Flag Menus 33/34	E,N	0-3	CF List *
P4.10	Zero Speed Hold Time	0.0	0.0 s to 500.0 s	S,E	1-3	
P4.11	Stop Time Limit	0	0 s to 3600 s 0 = No Stop Limit	S,E	1-3	
P4.12	Regen. Power Limit	Drive Size dependent	-0.1 kW to 6000.0 kW -0.1 means NO LIMIT, energy to be absorbed by DB unit	E	1-3	
P4.13	DC Injection Speed	10.0	0.0% to 100.0% speed at which DC injection begins.	E	1	
P4.14	DC Injection Current	100	0% to 150%	E	1	
P4.15	DC Injection Duration	5	1s to 120 s	E	1	
P4.16	DC Injection Delay	0.5	0.0 s to 20.0 s	E	1	
P4.17	CF25: Output Enable	0.001 SET	See Control Flag Menus 33/34	E,N	0-3	CF List *
P4.18	CF123: Backup Run/Stop Select	0.000 CLEARED	See Control Flag Menus 33/34	E,N	0-3	CF List *
P4.19	CF124: Backup Stop	0.000 CLEARED	See Control Flag Menus 33/34	E,N	0-3	CF List *
P4.20	CF125: Backup Start	0.000 CLEARED	See Control Flag Menus 33/34	E,N	0-3	CF List *
P4.21	Synchrostart Minimum Speed	0.00%	0.00 to 100.00%	S,E	1,2c,3	
P4.22	VVVF – Sync PF Demand	0.10	-1.00 to 1.00	E	1	
P4.23	VVVF – Sync PF Kp	5	0 to 1000	E	1	
P4.24	VVVF – Sync PF Ki	50	0 to 1000	E	1	
P4.25	Synchrostart Maximum Speed	0	0 = 100% 1 = P9.00 Value	E,L,N,S	1-3	
P4.26	Tr Period	Monitor	ms	R	1-3	
P4.27	Re-enable Delay	3.0Tr	0.5 to 10Tr	E,N	1-3	
P4.28	Restart Time	4.0Tr	1.0 to 10.0Tr	E,N	1-3	

5.4.4 Menu 5 – Speed Reference Settings

NOTE: Parameters in this table are described in Section 6.5 and Control Flags in Section 5.4.75 where marked CF List *

Par No.	Function	Default	Range	Attrib	Mode No.	Comments
P5.00	Speed Reference	0.00	–100.00 % Top Speed to +100.00 % Top Speed	O	1-3	0.01% of Top Speed (0.1% from Push Buttons)
P5.01	Speed Reference 1 Source	1	1 = Keypad Speed Ref 2 = Analogue REF1 3 = Analogue REF2 4 = RS485 REF 1 5 = RS485 REF2 6 = RS232 REF1 7 = RS232 REF2 8 = PID Controller 9 = Ref. Sequencer 10 = Fixed Ref. Menu 11 = Motorised Pot. 12 = Trim Reference 13 = Fixed 0% (Not used) 14 = Fixed 0% (Not used) 15 = High Speed Digital I/P 16 = Position Control 17 = Summing Node A 18 = Summing Node B 19 = Summing Node C 20 = Summing Node D 21 = Pointer 1 22 = Pointer 2	E,N,L	1-3	
P5.02	Speed Reference 2 Source	2	1 to 22 (see P5.01)	E,N,L	1-3	
P5.03	Speed Reference 3 Source	3	1 to 22 (see P5.01)	E,N,L	1-3	
P5.04	Speed Reference 4 Source	1	1 to 22 (see P5.01)	E,N,L	1-3	
P5.05	Backup Speed Reference	0	0 = No Backup 1 to 22 (see P5.01)	E,N,L	1-3	
P5.06	Warning on Backup	0	0 = Yes 1 = No	E,L	1-3	
P5.07	CF4: Reference1 Selector	–1.004 INV Digital Input 4	See Control Flag Menus 33/34	E,N	1-3	CF List *
P5.08	CF5: Reference 2 Selector	–1.005 INV Digital Input 5	See Control Flag Menus 33/34	E,N	1-3	CF List *
P5.09	CF6: Reference 3 Selector	1.005 Dig I/P 5	See Control Flag Menus 33/34	E,N	1-3	CF List *
P5.10	CF7: Reference 4 Selector	0.000 CLEARED	See Control Flag Menus 33/34	E,N	1-3	CF List *

NOTE: Parameters in this table are described in Section 6.5 and Control Flags in Section 5.4.75 where marked CF List *

Par No.	Function	Default	Range	Attrib	Mode No.	Comments
P5.11	Direction Control	1	1 = Polarity of Speed Ref. is XORed with the state of Control Flag 3 (flag 3 = 1 will invert the reference). 2 = Positive references input only. The sign of the reference is ONLY defined by the state of Flag 3.	E,L	1-3	
P5.12	CF3: Direction (1 = Rev)	1.003 Dig I/P 3	See Control Flag Menus 33/34	E,N	1-3	CF List *
P5.13	CF8: Jog Enable	0.000 CLEARED	See Control Flag Menus 33/34	E,N	1-3	CF List *
P5.14	Jog Speed 1	0.0	–100.0% Top Speed to +100.0% Top Speed	O	1-3	0.1% of Top Speed
P5.15	Maximum Speed Fwd	1500	10 r/min to 6000 r/min	S,E	1-3	
P5.16	Maximum Speed Rev	1500	0 r/min to 6000 r/min	S,E	1-3	
P5.17	Minimum Speed Fwd	0	0 r/min to P5.15	S,E	1-3	
P5.18	Minimum Speed Rev	0	0 r/min to P5.15	S,E	1-3	
P5.19	CF11: Reverse Inhibit	0.000 CLEARED	See Control Flag Menus 33/34	E,N	1-3	CF List *
P5.20	CF12: Forward Inhibit	0.000 CLEARED	See Control Flag Menus 33/34	E,N	1-3	CF List *
P5.21	CF13: Clamp Zero Ref	0.000 CLEARED	See Control Flag Menus 33/34	E,N	1-3	CF List *
P5.22	Process Top Speed	1000	–9999 Units to +9999 Units	E	1-3	User defined units
P5.23	Speed Clamp Limit 1	100.00	–100.00 % Top Speed to +100.00 % Top Speed	E	1-3	
P5.24	Speed Clamp Limit 2	–100.00	–100.00 % Top Speed to +100.00 % Top Speed	E	1-3	
P5.25	CF117: Enable Speed Demand Clamp	0.000 CLEARED	See Control Flag Menus 33/34	E,N	1-3	CF List *
P5.26	Speed Reference Time Constant	0.00	0.00 s to 5.00 s	E	1-3	
P5.27	Jog Speed 2	0.0	–100.00 % Top Speed to +100.00 % Top Speed	O	1-3	
P5.28	CF121: Jog Speed 1/ 2 Select	0.000 CLEARED	See Control Flag Menus 33/34	E,N	1-3	CF List *

5.4.5 Menu 6 – Ramp settings

NOTE: Parameters in this table are described in Section 6.6 and Control Flags in Section 5.4.75 where marked CF List *

Par No.	Function	Default	Range	Attrib	Mode No.	Comments
P6.00	Acceleration Rate Fwd	10.0	0.1%/s to 3000.0%/s	E	1,2	% Top Speed per second.
P6.01	Acceleration Rate Rev	0.0	0.0%/s to 3000.0%/s (0 = As Forward)	E	1,2	% Top Speed per second.
P6.02	Deceleration Rate Fwd	10.0	0.1%/s to 3000.0%/s	E	1,2	% Top Speed per second.

NOTE: Parameters in this table are described in Section 6.6 and Control Flags in Section 5.4.75 where marked CF List *

Par No.	Function	Default	Range	Attrib	Mode No.	Comments
P6.03	Deceleration Rate Rev	0.0	0.0%/s to 3000.0%/s (0 = As Forward)	E	1,2	% Top Speed per second.
P6.04	Speed to reach Full Accel/Decel Rate	0.0	0.0% Top Speed to 50.0% Top Speed	E	1,2	% Top Speed per second.
P6.05	CF14: Ramp Freeze Up Forward	0.000 CLEARED	See Control Flag Menus 33/34	E, N	1,2	CF List *
P6.06	CF15: Ramp Freeze Up Reverse	0.000 CLEARED	See Control Flag Menus 33/34	E, N	1,2	CF List *
P6.07	CF16: Ramp Freeze Down Forward	0.000 CLEARED	See Control Flag Menus 33/34	E, N	1,2	CF List *
P6.08	CF17: Ramp Freeze Down Reverse	0.000 CLEARED	See Control Flag Menus 33/34	E, N	1,2	CF List *
P6.09	CF18: Ramp Bypass	0.000 CLEARED	See Control Flag Menus 33/34	E, N	2	CF List *
P6.10	Maximum Ramp Deviation	5.00%	0.00 % Top Speed to 100.00 % Top Speed	E	2	
P6.11	CF122: Limit Ramp Deviation	0.000 CLEARED	Enables P6.10 See Control Flag Menus 33/34	E, N	2	CF List *
P6.12	Acceleration Rate Fwd 2	10.0	0.1%/s to 3000.0%/s	E	1,2	
P6.13	Deceleration Rate Fwd 2	10.0	0.1%/s to 3000.0%/s	E	1,2	
P6.14	Acceleration Rate Rev 2	0.0	0.0%/s to 3000.0%/s	E	1,2	
P6.15	Deceleration Rate Rev 2	0.0	0.0%/s to 3000.0%/s	E	1,2	
P6.16	CF127: Select Ramp 2	0.000 CLEARED	See Control Flag Menus 33/34	E, N	1,2	CF List *
P6.17	Trip Avoidance Threshold	Drive Size dependent	685 to 1500 V	E	1,2	
P6.18 to P6.19	Not Used					
P6.20	Ramp Input	1.00	1.00 to 99.99	E,N	0-4	
P6.21	Increase Rate +ve	10.0	0.1%/s to 3000.0%/s	E	0-4	
P6.22	Increase rate –ve	0.0	0.0%/s to 3000.0%/s 0.0 = As Increase Rate +ve	E	0-4	
P6.23	Decrease Rate +ve	10.0	0.1%/s to 3000.0%/s	E	0-4	
P6.24	Decrease Rate –ve	0.0	0.0%/s to 3000.0%/s 0.0 = As Decrease Rate +ve	E	0-4	
P6.25	S-Shape Range	0.0	0.0% to 50.0%	E	0-4	
P6.26	CF134: Ramp Freeze Up +ve	0.000 CLEARED	See Control Flag Menus 33/34	E,N	0-4	
P6.27	CF135: Ramp Freeze Up –ve	0.000 CLEARED	See Control Flag Menus 33/34	E,N	0-4	
P6.28	CF136: Ramp Freeze Down +ve	0.000 CLEARED	See Control Flag Menus 33/34	E,N	0-4	
P6.29	CF137: Ramp Freeze Down –ve	0.000 CLEARED	See Control Flag Menus 33/34	E,N	0-4	
P6.30	CF138: Ramp Bypass	0.000 CLEARED	See Control Flag Menus 33/34	E,N	0-4	
P6.31	Increase Rate +ve 2	10.0	0.1%/s to 3000.0%/s	E	0-4	
P6.32	Decrease Rate +ve 2	10.0	0.1%/s to 3000.0%/s	E	0-4	
P6.33	Increase Rate –ve 2	10.0	0.1%/s to 3000.0%/s	E	0-4	
P6.34	Decrease Rate -ve 2	10.0	0.1%/s to 3000.0%/s	E	0-4	
P6.35	CF139: Select Ramp 2	0.000 CLEARED	See Control Flag Menus 33/34	E,N	0-4	
P6.36	Ramp Output	Monitor	As Ramp Input	R	0-4	

5.4.6 Menu 7 – Plant I/O Settings

NOTE: Parameters in this table are described in Section 6.7 and Control Flags in Section 5.4.75 where marked CF List *

Par No.	Function	Default	Range	Attrib	Mode No.	Comments
P7.00	Analogue Reference 1 Input Mode	1	1 = 0% to ±100 % (V mode) 2 = ±(0% to 100 %) (V mode) 3 = –100 % to +100 % (V mode) 4 = ±(0% to 100 %) (V mode) 5 = 0% to ±100 % (I mode) 6 = ±(0% to 100 %) (I mode) 7 = –100 % to +100 % (I mode) 8 = ±(0% to 100 %) (I mode)	E,N,L	0-4	
P7.01	Analogue Reference 1 Offset Adjust	0.0	–100.0% to +100.0%	E	0-4	0.1% of Full Scale
P7.02	Analogue Reference 1 Gain Adjust	1.00	–2.00pu to +2.00pu	E	0-4	
P7.03	Analogue Reference 1 Value	0.00	–100.00 % to +100.00 %		0-4	0.1% of Full Scale
P7.04	Analogue Reference 2 Input Mode	6	1 to 8 (see P7.00)	E,N,L	0-4	
P7.05	Analogue Reference 2 Offset Adjust	0.0	–100.0% to +100.0%	E	0-4	0.1% of Full Scale
P7.06	Analogue Reference 2 Gain Adjust	1.00	–2.00pu to +2.00pu	E	0-4	
P7.07	Analogue Reference 2 Value	0.00	–100.00 % to +100.00 %		0-4	0.1% of Full Scale
P7.08 to P7.15	Reserved					
P7.16	Analogue Reference Filter Time Constant	50	0 ms to 5000 ms	E	0-4	
P7.17	Analogue O/P1 Signal	9.01	1.00 to 99.99	E,N	0-4	Any Drive Parameter
P7.18	Analogue O/P1 Mode	1	1 = 0 - 10V or 0 - 20mA 2 = 2 - 10V or 4 - 20mA 3 = 10 - 0V or 20 - 0mA 4 = 10V - 2V or 20 - 4mA 5 = 0 – 20mA Fast Power	E,N,L	0-4	
P7.19	Analogue O/P1 Polarity	1	0 = Monopolar 1 = Bipolar	E,N,L	0-4	
P7.20	Analogue O/P1 Scale	100.0	0 to ±Max of selected signal	E	0-4	
P7.21	Analogue O/P1 Value	0.0	–3276.7% to +3276.7%		0-4	0.1% of Full Scale
P7.22	Analogue O/P2 Signal	9.06	1.00 to 99.99	E,N	0-4	Any Drive Parameter
P7.23	Analogue O/P2 Mode	1	1 to 5 (see P7.18)	E,N,L	0-4	
P7.24	Analogue O/P2 Polarity	0	0 to 1 (see P7.19)	E,N,L	0-4	
P7.25	Analogue O/P2 Scale	1500	0 to ±Max of selected signal	E	0-4	
P7.26	Analogue O/P2 Value	0.0	–3276.7% to +3276.7%		0-4	0.1% of Full Scale
P7.27	Digital O/P 1 Signal	-2.005	See Control Flag Menus 33/34	E,N	0-4	CF list *
P7.28	Digital O/P 2 Signal	2.008	See Control Flag Menus 33/34	E,N	0-4	CF list *
P7.29	Digital O/P 3 Signal	2.012	See Control Flag Menus 33/34	E,N	0-4	CF List *

5.4.7 Menu 8 – Torque Limit Settings

NOTE: Parameters in this table are described in Section 6.8 and Control Flags in Section 5.4.75 where marked CF List *

Par No.	Function	Default	Range	Attrib	Mode No.	Comments
P8.00	Torque Limit (Also positive torque limit 1)	100.0	0.0% to 300.0%	E	1,2	0.1% of nominal torque. Note: This is also positive torque limit 1.
P8.01	Negative Torque Limit 1	-0.1	-0.1% = As P8.00 0.0% to 300.0%	E	1,2	0.1% of nominal torque.
P8.02	Positive Torque Limit 2	-0.1	-0.1% = As P8.00 0.0% to 300.0%	E	1,2	0.1% of nominal torque.
P8.03	Negative Torque Limit 2	-0.1	-0.1% = As P8.00 0.0% to 300.0%	E	1,2	0.1% of nominal torque.
P8.04	CF24 Disable Torque	0.000 OFF	See Control Flag Menus 33/34	E,N	1,2	CF List *
P8.05	CF22: Inhibit Positive Torque	0.000 OFF	See Control Flag Menus 33/34	E,N	1,2	CF List *
P8.06	CF23: Inhibit Negative Torque	0.000 OFF	See Control Flag Menus 33/34	E,N	1,2	CF List *
P8.07	CF21: Torque Limit Selection	0.000 OFF	See Control Flag Menus 33/34	E,N	1,2	CF List *
P8.08	Positive Torque Limit Scale Source 1	1 ON	1 = Fixed 100 % 2 = Analogue REF1 3 = Analogue REF2 4 = RS485 REF 1 5 = RS485 REF2 6 = RS232 REF1 7 = RS232 REF2 8 = PID Controller 9 = Ref. Sequencer 10 = Fixed Ref. Menu 11 = Motorised Pot. 12 = Trim Reference 13 = Fixed 0% (Not used) 14 = Fixed 0% (Not used) 15 = Summing Node A 16 = Summing Node B 17 = Pointer 9 18 = Pointer 10	E,N,L	1,2	
P8.09	Negative Torque Limit Scale Source 1	1	1 to 18 (see P8.08)	E,N,L	1,2	
P8.10	Positive Torque Limit Scale Source 2	1	1 to 18 (see P8.08)	E,N,L	1,2	
P8.11	Negative Torque Limit Scale Source 2	1	1 to 18 (see P8.08)	E,N,L	1,2	

5.4.8 Menu 9 – Basic Drive Monitoring

NOTE: Parameters in this table are described in Section 6.9 and Control Flags in Section 5.4.75 where marked CF List *

Par No.	Function	Default	Range	Attrib	Mode No.	Comments
P9.00	Speed Reference	0.00	–100.00 % Top Speed to +100.00 % Top Speed	O	1-3	

NOTE: Parameters in this table are described in Section 6.9 and Control Flags in Section 5.4.75 where marked CF List *

Par No.	Function	Default	Range	Attrib	Mode No.	Comments
P9.01	Speed Feedback	0.00	–300.00 % Top Speed to +300.00 % Top Speed	R	1-3	
P9.02	Process Speed	0	0 to ±3 x P5.22	R	1-3	Scaling determined by settings in P5.22
P9.03	Speed Feedback	0	0 to ±30,000 r/min	R	1-3	
P9.04	Torque Demand	0.0	–300.0% to +300.0%	R	1-3	0.1% of nominal torque
P9.05	Motor Current	0.0	0.0 A to 9999.0 A (for MicroCubicle™ Drives) 0 to 9999 A (for DELTAs)	R	1-3	
P9.06	Drive Current	0.0	0.0% to 300.0%	R	1-3	0.1% of Drive FLC
P9.07	Motor Volts	0	0 to 1000 Vrms	R	1-3	
P9.08	Motor Power	0.0	–999.0 to +999.9 kW (for MicroCubicle™ Drives) –9999 to +9999 kW (for DELTAs)	R	1-3	
P9.09	Frequency Feedback	0	–200 to +200 Hz	R	1-3	
P9.10	Drive Overload Remaining	100%	100 to 0 %	R	1-3	% of total overload capacity remaining.
P9.11	Motor Overload Remaining	100%	100 to 0 %		1-3	% of total overload capacity remaining.

5.4.9 Menu 10 – Trips & Warnings

NOTE: Parameters in this table are described in Section 6.10, Warning and Trip Codes in Section 9 and Control Flags in Section 5.4.75 where marked CF List *

Par No.	Function	Default	Range	Attrib	Mode No.	Comments
P10.00 to P10.09	Warning No. 1 to Warning No. 10	0	100 to 199	R	0-4	
P10.10 to P10.19	Trip No. 1 to Trip No. 10	0	0 to 99, 200 to 299	R	0-4	
P10.20 to P10.29	Trip History 1 to Trip History 10	0	0 to 999	R	0-4	
P10.30	Seconds Since Trip	0	0 to 3599 s	R	0-4	
P10.31	Hours Since Trip	0	0 to 672 h	R	0-4	
P10.32	CF10: User Trip1	0.000 CLEARED	See Control Flag Menus 33/34	E,N	0-4	CF List *
P10.33	CF112: User Trip 2	0.000 CLEARED	See Control Flag Menus 33/34	E,N	0-4	CF List *
P10.34	CF9: Trip Reset	1.006 Dig I/P 6	See Control Flag Menus 33/34	E,N	0-4	CF List *
P10.35	Action on "New Drive PCB" or "Unknown Drive Size" Trip	0	0 = No Action 1 = Use Drive ID information stored in Control PCB (SMPS was replaced) 2 = Use Drive ID information stored in SMPS (Control PCB was replaced)	C,N,E, L,S	0-4	

NOTE: Parameters in this table are described in Section 6.10, Warning and Trip Codes in Section 9 and Control Flags in Section 5.4.75 where marked CF List *

Par No.	Function	Default	Range	Attrib	Mode No.	Comments
P10.36	DELTA Identification Source	0	0 = DELTA Bridge 1 = Local Copy	S,L,N,E,C	0-4	Applies to DELTAs only
P10.37 to P20.39	Not Used					
P10.40	CF198: User Alert 1	0.000 OFF	See Control Flag Menus 33/34	E,N	0-4	
P10.41	User Action 1	0	0 = No Action 1 = Warning 2 = Trip	E,N,L	0-4	Trip/Warning Code = 230
P10.42	CF199: User Alert 2	0.000 OFF	See Control Flag Menus 33/34	E,N	0-4	
P10.43	User Action 2	0	0 = No Action 1 = Warning 2 = Trip	E,N,L	0-4	Trip/Warning Code = 231
P10.44	CF200: User Alert 3	0.000 OFF	See Control Flag Menus 33/34	E,N	0-4	
P10.45	User Action 3	0	0 = No Action 1 = Warning 2 = Trip	E,N,L	0-4	Trip/Warning Code = 232
P10.46	CF201: User Alert 4	0.000 OFF	See Control Flag Menus 33/34	E,N	0-4	
P10.47	User Action 4	0	0 = No Action 1 = Warning 2 = Trip	E,N,L	0-4	Trip/Warning Code = 233
P10.48	CF202: User Alert 5	0.000 OFF	See Control Flag Menus 33/34	E,N	0-4	
P10.49	User Action 5	0	0 = No Action 1 = Warning 2 = Trip	E,N,L	0-4	Trip/Warning Code = 234
P10.50	CF203: User Alert 6	0.000 OFF	See Control Flag Menus 33/34	E,N	0-4	
P10.51	User Action 6	0	0 = No Action 1 = Warning 2 = Trip	E,N,L	0-4	Trip/Warning Code = 235
P10.52	CF204: User Alert 7	0.000 OFF	See Control Flag Menus 33/34	E,N	0-4	
P10.53	User Action 7	0	0 = No Action 1 = Warning 2 = Trip	E,N,L	0-4	Trip/Warning Code = 236
P10.54	CF205: User Alert 8	0.000 OFF	See Control Flag Menus 33/34	E,N	0-4	
P10.55	User Action 8	0	0 = No Action 1 = Warning 2 = Trip	E,N,L	0-4	Trip/Warning Code = 237
P10.56	CF206: User Alert 9	0.000 OFF	See Control Flag Menus 33/34	E,N	0-4	
P10.57	User Action 9	0	0 = No Action 1 = Warning 2 = Trip	E,N,L	0-4	Trip/Warning Code = 238
P10.58	CF207: User Alert 10	0.000 OFF	See Control Flag Menus 33/34	E,N	0-4	
P10.59	User Action 10	0	0 = No Action 1 = Warning 2 = Trip	E,N,L	0-4	Trip/Warning Code = 239

5.4.10 Menu 11 – Advanced Drive Monitoring

NOTE: Parameters in this table are described in Section 6.11.

Par No.	Function	Default	Range	Attrib	Mode No.	Comments
P11.00	Active Current	0.0	–150.0 to +150.0%	R	1-3	% of drive FLC
P11.01	Magnetising Current	0.0	–150.0 to +150.0%	R	1-3	% of drive FLC
P11.02	PID Controller Output	0.00	–100.00 % to +100.00 %	R	0-4	0.01% of full scale
P11.03	DC Link Voltage	0	0 to 30,000 V	R	0-4	
P11.04	CDC Electronics Temperature	0	–40°C to +150°C	R	0-4	
P11.05	Output Bridge 1 Temperature	0	–40°C to +150°C	R	0-4	
P11.06	Output Bridge 2 Temperature	0	–40°C to +150°C	R	0-4	
P11.07	Output Bridge 3 Temperature	0	–40°C to +150°C	R	0-4	
P11.08	Input Bridge Temperature	0	–40°C to +150°C	R	0-4	
P11.09	Output Bridge 4 Temperature	0	–40°C to +150°C	R	0-4	
P11.10	Output Bridge 5 Temperature	0	–40°C to +150°C	R	0-4	
P11.11	Output Bridge 6 Temperature	0	–40°C to +150°C	R	0-4	
P11.12	DB Temperature	0	–40°C to +150°C	R	0-4	
P11.13	Maximum CDC Electronics Temperature	0	–40°C to +150°C	R	0-4	
P11.14	Minimum CDC Electronics Temperature	0	–40°C to +150°C	R	0-4	
P11.15	Hours Run	0	0 to 23 Hours	R	0-4	Does not respond to a factory default.
P11.16	Days Run	0	0 to 30,000 Days	R	0-4	Does not respond to a factory default.
P11.17	Hours Energised	0	0 to 23 Hours	R	0-4	
P11.18	Days Energised	0	0 to 30,000 Days	R	0-4	
P11.19	kW–Hours	0	0 kWh to 999.9 kWh	R	0-4	
P11.20	MW–Hours	0	0MWh to 9999MWh	R	0-4	
P11.21	Digital Input States	0000 h	0000 h to FFFF h (Also shown in Binary)	R	0-4	Hexadecimal and binary
P11.22	Digital Output States	0000 h	0000 h to FFFF h (Also shown in Binary)	R	0-4	Hexadecimal and binary
P11.23	Control Flags 0-15	0000 h	0000 h to FFFF h (Also shown in Binary)	R	0-4	Hexadecimal and binary
P11.24	Control Flags 16-31	0000 h	0000 h to FFFF h (Also shown in Binary)	R	0-4	Hexadecimal and binary
P11.25	Control Flags 32-47	0000 h	0000 h to FFFF h (Also shown in Binary)	R	0-4	Hexadecimal and binary
P11.26	Control Flags 48-63	0000 h	0000 h to FFFF h (Also shown in Binary)	R	0-4	Hexadecimal and binary
P11.27	Control Flags 64-79	0000 h	0000 h to FFFF h (Also shown in Binary)	R	0-4	Hexadecimal and binary
P11.28	Control Flags 112-127	0000 h	0000 h to FFFF h (Also shown in Binary)	R	0-4	Hexadecimal and binary
P11.29	Control Flags 96-111	0000 h	0000 h to FFFF h (Also shown in Binary)	R	0-4	Hexadecimal and binary
P11.30	Status Flags 0-15	0000 h	0000 h to FFFF h (Also shown in Binary)	R	0-4	Hexadecimal and binary

NOTE: Parameters in this table are described in Section 6.11.

Par No.	Function	Default	Range	Attrib	Mode No.	Comments
P11.31	Status Flags 16-31	0000 h	0000 h to FFFF h (Also shown in Binary)	R	0-4	Hexadecimal and binary
P11.32	Status Flags 32-47	0000 h	0000 h to FFFF h (Also shown in Binary)	R	0-4	Hexadecimal and binary
P11.33	Status Flags 48-63	0000 h	0000 h to FFFF h (Also shown in Binary)	R	0-4	Hexadecimal and binary
P11.34	Status Flags 64-79	0000 h	0000 h to FFFF h (Also shown in Binary)	R	0-4	Hexadecimal and binary
P11.35	Status Flags 96-111	0000 h	0000 h to FFFF h (Also shown in Binary)	R	0-4	Hexadecimal and binary
P11.36	Analogue Reference 1 Value	0.00	–100.00 % to +100.00 %	R	0-4	
P11.37	Analogue Reference 2 Value	0.00	–100.00 % to +100.00 %	R	0-4	
P11.38	Reserved					
P11.39	Reserved					
P11.40	Analogue O/P1 Value	0.0	–100.0% to +100.0%	R	0-4	
P11.41	Analogue O/P2 Value	0.0	–100.0% to +100.0%	R	0-4	
P11.42	Status Flags 64-79	0000 h	0000 h to FFFF h (Also shown in Binary)	R	0-4	Hexadecimal and binary
P11.43	Control Flags 128-143	0000 h	0000 h to FFFF h (Also shown in Binary)	R	0-4	Hexadecimal and binary
P11.44	Reserved					
P11.45	Speed Demand	0.00	–100.00 % to +100.00 %	R	1-3	% of Top Speed
P11.46	Speed Error	0.00	–300.00 % to +300.00 %	R	1-3	% of Top Speed
P11.47	Speed Loop Output	0.00	–300.00 % to +300.00 %	R	1-3	% of Top Speed
P11.48	Inertia Compensation Output	0.00	–300.00 % to +300.00 %	R	1-3	
P11.49	Maximum Torque Available	0.00	0.00 % to 300.00 %	R	1-3	Calculated on line by the drive.
P11.50	Torque Reference	0.00	–100.00 % to +100.00 %	O	2-3	% of nominal torque (not available in VVVF mode)
P11.51	Encoder Speed	0.00	–300.00 % to +300.00 %	R	1	
P11.52	Modulation Depth	0.00%	0.00 to 107%	R	0-4	
P11.53	Control Flags 144-159	0000 h	0000 h to FFFF h (Also shown in Binary)	R	0-4	Hexadecimal and binary
P11.54	Control Flags 160-175	0000 h	0000 h to FFFF h (Also shown in Binary)	R	0-4	Hexadecimal and binary
P11.55	Control Flags 176-191	0000 h	0000 h to FFFF h (Also shown in Binary)	R	0-4	Hexadecimal and binary
P11.56	Control Flags 192-207	0000 h	0000 h to FFFF h (Also shown in Binary)	R	0-4	Hexadecimal and binary
P11.57	Status Flags 112-127	0000 h	0000 h to FFFF h (Also shown in Binary)	R	0-4	Hexadecimal and binary
P11.58	Status Flags 128-143	0000 h	0000 h to FFFF h (Also shown in Binary)	R	0-4	Hexadecimal and binary
P11.59	CPU Usage	0.00	0 % to 100 %	R	0-4	
P11.60	Serial Number of Drive (Low Part)	1		R	0-4	Read from MicroCubicle™ Drive SMPS or DELTA DIB
P11.61	Serial Number of Drive (High Part	0		R	0-4	Read from MicroCubicle™ Drive SMPS or DELTA DIB

NOTE: Parameters in this table are described in Section 6.11.

Par No.	Function	Default	Range	Attrib	Mode No.	Comments
P11.62	Serial Number of Power Interface Board (Lo Part)	1		R	0-4	Read from PIB
P11.63	Serial Number of Power Interface Board (Hi Part)	0		R	0-4	Read from PIB
P11.64	Serial Number of SMPS (Low Part)	1		R	0-4	Read from SMPS
P11.65	Serial Number of SMPS (High Part)	0		R	0-4	Read from SMPS
P11.66	Serial Number of DELTA Interface Board (Lo Part)	1		R	0-4	Read from DELTA DIB
P11.67	Serial Number of DELTA Interface Board (Hi Part)	0		R	0-4	Read from DELTA DIB
P11.70	Bridge Linearisation Time at 1.25kHz*	5.080µs	0.000µs to 20.000µs	E	1-4	
P11.71	Bridge Linearisation Constant at 1.25kHz *	1.1% Drive FLC	0.0 to 50.0% Drive FLC	E	1-4	
P11.72	Bridge Linearisation Time at 2.5kHz *	4.240µs	0.000µs to 20.000µs	E	1-4	
P11.73	Bridge Linearisation Constant at 2.5kHz *	1.1% Drive FLC	As P11.71	E	1-4	
P11.74	Bridge Linearisation Time at 5.0 kHz *	3.880µs	As P11.72	E	1-4	
P11.75	Bridge Linearisation Constant at 5.0 kHz *	1.2% Drive FLC	As P11.71	E	1-4	
P11.76	Bridge Linearisation Time at 7.5 kHz *	3.760µs	As P11.72	E	1-4	
P11.77	Bridge Linearisation Constant at 7.5 kHz *	1.4% Drive FLC	As P11.71	E	1-4	

5.4.11 Menu 12 – Motor Advanced Settings (Vector Only)

NOTE: Parameters in this table are described in Section 6.12 and Control Flags in Section 5.4.75 where marked CF List *.

Par No.	Function	Default	Range	Attrib	Mode No.	Comments
P12.00	No-load I at 100%V (Magnetising Current	Size of Drive	0.0 A to 9999 A	S,E,N	1-3	From No-Load VVVF Open Loop Test
P12.01	Motor Peak Overload	150	100 % to 300 %	S,E,N	2	Vdc/1.35 for AEM
P12.02	Nominal Mains Supply Volts	400	300 V to 800 V	S,E	1,2	
P12.03	Motor Parameterisation Method	1	1 = Explicit entry 2 = Estimate from Nameplate 3 = Perform Calibration Run	S,E,N,L	1,2	
P12.04	Motor Temperature Compensation	100	20% to 300 %	E	2	% of nominal slip
P12.05	CF77: Enable Manual Temperature Compensation	0.001 SET	See Control Flag Menus 33/34	E,N	2	CF List *
P12.06	CF106: Enable Auto Temperature Compensation	0.000 CLEARED	See Control Flag Menus 33/34	E,L	2a	See Section 6.12.5
P12.07	Temp Compensation Gain	2.00	0.0%/s/% to 3.0%/s/%	E	2a	% Nom Rr/s/s

NOTE: Parameters in this table are described in Section 6.12 and Control Flags in Section 5.4.75 where marked CF List *.

Par No.	Function	Default	Range	Attrib	Mode No.	Comments
P12.08	Temperature Compensation Scale Source	1	1 = Fixed 100 % 2 = Analogue REF1 3 = Analogue REF2 4 = Fixed 0% (Not used) 5 = Fixed 0% (Not used) 6 = RS485 REF 1 7 = RS485 REF2 8 = RS232 REF1 9 = RS232 REF2 10 = PID Controller 11 = Summing Node C 12 = Summing Node D 13 = Pointer 11	E,N,L	2	
P12.09	Temperature Compensation Estimate	0	50% to 150%	R	2a	
P12.10	Measured Rotor Resistance (cold value	0	0 mΩ to 9999 mΩ	S,E,N	2a	0.1 mΩ
P12.11	Stator Resistance	Size of Drive	1 mΩ to 9999 mΩ	S,E,N	2	
P12.12	Stator Inductance	Size of Drive	0.1 mH to 30 mH	S,E	2	
P12.13	Magnetising Resistance	Size of Drive	1 Ω to 9999 Ω	S,E	2	
P12.14	Magnetising Inductance	Size of Drive	0.5 mH to 999.9 mH	S,E,N	2	
P12.15	Rotor Resistance	Size of Drive	100 mΩ to 9999 mΩ	S,E,N	2	
P12.16	Rotor Inductance (Leakage inductance)	Size of Drive	0.1 mH to 30 mH	S,E	2	
P12.17	No-load I at 50% V	0.0	0.0 A to Drive FLC	S,E,N	2	
P12.18	No-load I at 60% V	0.0	0.0 A to Drive FLC	S,E,N	2	
P12.19	No-load I at 70% V	0.0	0.0 A to Drive FLC	S,E,N	2	
P12.20	No-load I at 80% V	0.0	0.0 A to Drive FLC	S,E,N	2	
P12.21	No-load I at 90% V	0.0	0.0 A to Drive FLC	S,E,N	2	
P12.22	Leakage Volts	0.0	0.0 V to 300.0 V 0.0 = Calculated using motor equivalent circuit parameters (P12.11, P12.16)	E	2	
P12.23	Fixed Flux Limit	100	20% to 100 %	E	2	% of maximum flux
P12.24	Flux Limit Source	1	1 = P12.23-Fixed Flux Limit 2 = Analogue REF1 3 = Analogue REF2 4 = RS485 REF 1 5 = RS485 REF2 6 = RS232 REF1 7 = RS232 REF2 8 = PID Controller 9 = Ref. Sequencer 10 = Fixed Ref. Menu 11 = Motorised Pot. 12 = Trim Reference 13 = Fixed 0% (Not used) 14 = Fixed 0% (Not used) 15 = Summing Node A 16 = Summing Node B 17 = Pointer 12	E,N,L.	2	

NOTE: Parameters in this table are described in Section 6.12 and Control Flags in Section 5.4.75 where marked CF List *.

Par No.	Function	Default	Range	Attrib	Mode No.	Comments
P12.25	CF68: Flux Limit Enable	0.000 CLEARED	See Control Flag Menus 33/34	E,N	2	CF List *
P12.26	Flux Demand	0.00	0.00 to 100.00 %	R	2	% of no load Flux
P12.27	High Dynamic Mode Current Control Bandwidth	750	10rad/sec to 2000rad/sec	E	2	Applies to high dynamic mode only
P12.28	Rs Tracker	1	0 = Disabled 1 = Enabled	E,L.	2c	
P12.29	Motor Overload at 0% Speed	99	99% to 300 %	S,E,N	2	
P12.30	Motor Overload at Top Speed	99	99% to 300 %	S,E,N	2	
P12.31	Flux Controller Output	0.00%	-15.00% to +15.00%	R	2c	
P12.32	Leakage Test Current	100	50 to 100%	S,E	2	
P12.33	dFlux/dt Mask Time	1.00	0.00 to 10.00Tr	E	4	See Menu 55 in Section 6 for description
P12.35	Vector Fluxing Mode	1	0 = High Dynamic Mode 1 = Optimum Voltage Mode	L,N,E	2	Vector Control only
P12.36	Optimum Voltage Mode Modulation Limit	Depends on Switching Frequency	95.00% to 107.00% Dependent on Switching Frequency	E	2	
P12.37	Optimum Voltage Mode Current Control Bandwidth	600	10rad/s to 2000rad/s	E	2	Applies to optimum voltage mode only
P12.38	Vdc Feedforward Filter Time Constant	3.0	0.0ms to 3000.0ms	E	2	
P12.39	Current Control Kp Factor	100	0% to 500%	E	2	
P12.40	Current Control Ki Factor	100	0% to 500%	E	2c	Applies to encoderless control only
P12.41	Orientation Controller Kp	1750	-30 000 to +30 000	E	2c	
P12.42	Orientation Controller Ki	4500	-30 000 to +30 000	E	2c	Value is recalculated by the drive by the change of P2.00, P2.04 or P2.06
P12.43	Xcouple TC factor	100	0 to 1000%	E	2c	
P12.44	Xcouple Gain Factor	100	0 to 200%	E	2c	
P12.45	Rs Gain Factor	100	10 to 200%	E	2	
P12.46 to P12.49	Reserved					
P12.50	Enable Power Limit	0	0 = Disable 1 = Enable	E,L,N	0-4	
P12.51	Power Limit	0	0 to 65535kW	E	0-4	
P12.52	P-Limit Taper Band	25	-1 to 100V	E	0-4	
P12.53	Taper Limit	0	0 to 100	E	0-4	
P12.54	Minimum Power Limit	0.1	0.1 to 200.0kW	E	0-4	

5.4.12 Menu 13 – Speed Feedback Settings (Vector Only)

NOTE: Parameters in this table are described in Section 6.13 and Control Flags in Section 5.4.75 where marked CF List *.

Par No.	Function	Default	Range	Attrib	Mode No.	Comments
P13.00	Speed Feedback Source	1	1 = Encoder 2 = Tacho 3 = Encoderless	E,N,L	2	
P13.01	Backup Speed Feedback Source	1	1 to 3 (see P13.00)	E,N,L	2	
P13.02	Encoder Loss Action	1	0 = No Action (revert to backup and set SF59) 1 = Warning (As 0 but issue warning) 2 = Trip	E,L	2	
P13.03	CF118: Select Backup Feedback	0.000 CLEARED	See Control Flag Menus 33/34	E,N	2	CF List *
P13.04	Encoder Line Count	2500	32 Lines to 9999 Lines	S,E	2a	
P13.05	Encoder 10000 Lines	0	0 x10k Lines to 6 x10k Lines	S,E	2a	
P13.06	Encoder Power Supply Volts	5.0	4.5 V to 6.5 V	E	2a	
P13.07	Number of Encoder Reversals	0	0 to 32767 /10ms (see P13.19, P13.20)	R	2a	
P13.08	Maximum Speed Change	300	10 r/min/5 ms to 1000 r/min/5 ms	E	2a	
P13.09	Reserved					
P13.10	Motor Angle Feedback	0	0 to 360 degrees	R	2	
P13.11	Open Loop Test	0	0 = Disabled 1 = Enabled	S,E,L	2	
P13.12	Open Loop Frequency	0.0	–150.0 Hz to +150.0 Hz	E	2	
P13.13	Open Loop Ramp Rate	0.1	0.1 Hz/s to 10.0 Hz/s	E	2	
P13.14	Tacho Feedback Source	1	1 = Analogue REF1 2 = Analogue REF2 3 = Fixed 0% (Not used) 4 = Fixed 0% (Not used) 5 = RS485 REF 1 6 = RS485 REF2 7 = RS232 REF1 8 = RS232 REF2 9 = High Speed digital I/P 10 = POINTER 18	S,E,N,L	2b	
P13.15	Tacho Feedback Scale	90.0	33.3% to 90.0%	E	2b	
P13.16	Tacho Feedback Time Constant	0	0 Scans to 100 Scans	E	2b	1 scan = 5 ms
P13.17	CF119: Force Encoder Loss	0.000 CLEARED	See Control Flag Menus 33/34	E,N	2	CF List *
P13.18	CF120: Reset Encoder Loss	0.000 CLEARED	See Control Flag Menus 33/34	E,N	2	CF List *
P13.19	Maximum Encoder Reversals	10	0/10 ms to 1000/10 ms (see P13.07)	E	2a	
P13.20	Reversals Threshold	2.0	0.1% Top Speed to 100% Top Speed (see P13.07)	E	2a	

5.4.13 Menu 14 – Speed Loop Settings (Vector Only)

NOTE: Parameters in this table are described in Section 6.14 and Control Flags in Section 5.4.75 where marked CF List *.

Par No.	Function	Default	Range	Attrib	Mode No.	Comments
P14.00	Speed Loop Proportional Gain 1	5.00	0.01pu to 125.00pu	E	2	% Torque per % speed error
P14.01	Speed Loop Integral Gain 1	100.00	0.00pu/s to 3000.00pu/s	E	2	% Torque per second % speed error
P14.02	Speed Loop Derivative Gain 1	0.000	0.000pu.s to 10.000pu.s	E	2	% Torque per % speed error
P14.03	Speed Loop Proportional Gain 2	5.00	0.01pu to 125.00pu	E	2	% Torque per % speed error
P14.04	Speed Loop Integral Gain 2	100.00	0.00pu/s to 3000.00pu/s	E	2	% Torque per second % speed error
P14.05	Speed Loop Derivative Gain 2	0.000	0.000pu.s to 10.000pu.s	E	2	% Torque per % speed error
P14.06	CF76: Speed Loop Gain Select	0.000 CLEARED	See Control Flag Menus 33/34	E,N	2	CF List *
P14.07	CF19: Clamp Zero Speed	0.000 CLEARED	See Control Flag Menus 33/34	E,N	2	CF List *
P14.08	CF20: Disable Speed Loop	0.000 CLEARED	See Control Flag Menus 33/34	E,N	2	CF List *
P14.09	Speed Demand	0.00	–100.00 % to +100.00 %	R	2	% Top Speed. Demanded speed after ramp, trim and droop terms are imposed.
P14.10	Speed Demand Time Constant	0	0 scans to 500 scans	E	2	1 scan = 5 ms
P14.11	Speed Feedback Time Constant	0	0 scans to 500 scans	E	2	1 scan = 5 ms
P14.12	Speed Error	0.00	–300.00 % to +300.00 %	R	2	% of Top Speed.
P14.13	Speed Error Time Constant	0	0 scans to 500 scans	E	2	1 scan = 5 ms
P14.14	Speed Loop Error Deadband	0.00	0.00 % to 100.00 %	E	2	0.01% of Top Speed.
P14.15	Speed Loop Deadband Offset	0.00	0.00 % to P14.14	E	2	% of Top Speed.
P14.16	CF73: Enable Speed Loop Deadband	0.000 CLEARED	See Control Flag Menus 33/34	E,N	2	CF List *
P14.17	Speed Droop	0.0	–100.0% Top Speed to +100.0% Top Speed	E	2	% Top Speed for 100 % nominal torque.
P14.18	Speed Droop Time Constant	5	0 scans to 9999 scans	E	2	1 scan = 5 ms
P14.19	Deadband Bias	0.50%	0.00 % to 100.00 %	E	2	0.01% of Top Speed
P14.20	CF107: Speed Loop Integral Freeze	0.000 CLEARED	See Control Flag Menus 33/34	E,N	2	When set, freezes the speed loop integral term
P14.21	Speed Loop Integral Seed Method	0	O = From torque injection source 1= Seed to 0	L,N,E	2	Applicable when changing from torque to speed control.

5.4.14 Menu 15 – Torque Reference Settings (Vector Only)

NOTE: Parameters in this table are described in Section 6.15 and Control Flags in Section 5.4.75 where marked CF List *.

Par No.	Function	Default	Range	Attrib	Mode No.	Comments
P15.00	Torque Reference	0.00	–100.00 % to +100.00 %	R	2	% Nominal Torque
P15.01	Torque Reference Scale Factor	100.0%	0.0% to 300.0%		2	
P15.02	CF72: Enable Torque Reference	0.000 CLEARED	See Control Flag Menus 33/34	E,N	2	CF List *
P15.03	Torque Demand Slew Rate	0	0%/s to 5000 %/s % nominal Torque/sec	E	2	
P15.04	Torque Reference Source	1	1 = Keypad Torque Ref. 2 = Analogue REF1 3 = Analogue REF2 4 = RS485 REF 1 5 = RS485 REF2 6 = RS232 REF1 7 = RS232 REF2 8 = PID Controller 9 = Ref. Sequencer 10 = Fixed Ref. Menu 11 = Motorised Pot. 12 = Trim Reference 13 = Fixed 0% (Not used) 14 = Fixed 0% (Not used) 15 = High Speed Digital input 16 = Position Control 17 = Summing Node A 18 = Summing Node B 19 = Summing Node C 20 = Summing Node D 21 = Pointer 8	E,N,L	2	
P15.05	Backup Torque Reference	0	0 = No Backup 1 to 21 Same as P15.04	E,N,L	2	

5.4.15 Menu 16 – PID Controller Settings

NOTE: Parameters in this table are described in Section 6.16 and Control Flags in Section 5.4.75 where marked CF List *.

Par No.	Function	Default	Range	Attrib	Mode No.	Comments
P16.00	PID Setpoint Selection	1	1 = Fixed Ref. 0 2 = Analogue REF1 3 = Fixed 0% (Not used) 4 = Fixed Ref. Menu 5 = Ref. Sequencer 6 = Motorised Pot. 7 = Trim Reference 8 = RS485 REF 1 9 = RS232 REF1 10 = Torque Demand 11 = Speed Demand12 = Summing Node A 13 = Summing Node B 14 = POINTER 4	E,L	**0-4**	
P16.01	PID Feedback Selection	1	1 = Analogue REF2 2 = Fixed 0% (Not used) 3 = RS485 REF 2 4 = RS232 REF2 5 = Torque Demand 6 = Speed Demand 7 = Speed Error 8 = Active Current 9 = Flux Demand 10 = Summing Node C 11 = Summing Node D 12 = POINTER 5	S,E,L	**0-4**	
P16.02	PID FB Scale Factor	100.0	0.0% to 300.0%	E	**0-4**	
P16.03	PID Proportional Band	500.0	0.1% to 500.0%	E	**0-4**	
P16.04	PID Integral Time	0.0	0.0 s to 3000.0 s	E	**0-4**	
P16.05	PID Differential Time	0.0	0.0 s to 3000.0 s	E	**0-4**	
P16.06	PID Error Time Constant	0.00	0.00 s to 5.00 s	E	**0-4**	
P16.07	PID Error Deadband	0.0	0.0% to 50.0%	E	**0-4**	
P16.08	PID Error Invert	0	0 = Do not invert error 1 = Invert error	S,E,L	**0-4**	
P16.09	PID Output Monitor	0.00	–100.00 % to +100.00 %	R	**0-4**	
P16.10	CF26: PID Integral Gain Freeze	0.000 CLEARED	See Control Flag Menus 33/34	E,N	**0-4**	**CF List ***
P16.11	CF69: Suicide PID Controller	-2.000 INV SF0 Running	See Control Flag Menus 33/34	E,N	**0-4**	**CF List ***

5.4.16 Menu 17 – Reference Sequencer Settings

NOTE: Parameters in this table are described in Section 6.17 and Control Flags in Section 5.4.75 where marked CF List *.

Par No.	Function	Default	Range	Attrib	Mode No.	Comments
P17.00	Reference Sequencer Mode	0	0 = Stopped 1 = Manual Trigger 2 = Auto Cycle 3 = Auto Single Sequence	E,N,L	0-4	
P17.01	Number of Reference Sequence Points	1	1 to 5	E,N	0-4	
P17.02	Present Sequence Point	0	1 to 5	R	0-4	
P17.03	Sequencer Reference Point 1	11	1 = Analogue REF1 2 = Analogue REF2 3 = RS485 REF 1 4 = RS232 REF1 5 = PID Controller 6 = Fixed Ref. Menu 7 = Motorised Pot. 8 = Trim Reference 9 = Fixed 0% (Not used) 10 = Fixed 0% (Not used) 11 = Fixed Ref #0 (P21.00) 12 = Fixed Ref #1 (P21.01) 13 = Fixed Ref #2 (P21.02) 14 = Fixed Ref #3 (P21.03) 15 = Fixed Ref #4 (P21.04) 16 = Summing Node A 17 = Summing Node B 18 = Summing Node C 19 = Summing Node D 20 = Pointer 3	E,N,L	0-4	
P17.04	Sequencer Reference Point 2	12	1 to 20 (see P17.03)	E,N,L	0-4	
P17.05	Sequencer Reference Point 3	13	1 to 20 (see P17.03)	E,N,L	0-4	
P17.06	Sequencer Reference Point 4	14	1 to 20 (see P17.03)	E,N,L	0-4	
P17.07	Sequencer Reference Point 5	15	1 to 20 (see P17.03)	E,N,L	0-4	
P17.08	Reference Sequencer Time 1 (seconds	0.0	0.0 s to 59.9 s	E,N	0-4	
P17.09	Reference Sequencer Time 1 (minutes)	0.0	0 min to 9999 min	E,N	0-4	
P17.10	Reference Sequencer Time 2 (seconds)	0.0	0.0 s to 59.9 s	E,N	0-4	
P17.11	Reference Sequencer Time 2 (minutes)	0	0 min to 9999 min	E,N	0-4	
P17.12	Reference Sequencer Time 3 (seconds)	0.0	0.0 s to 59.9 s	E,N	0-4	
P17.13	Reference Sequencer Time 3 (minutes)	0	0 min to 9999 min	E,N	0-4	
P17.14	Reference Sequencer Time 4 (seconds)	0.0	0.0 s to 59.9 s	E,N	0-4	

NOTE: Parameters in this table are described in Section 6.17 and Control Flags in Section 5.4.75 where marked CF List *.

Par No.	Function	Default	Range	Attrib	Mode No.	Comments
P17.15	Reference Sequencer Time 4 (minutes)	0	0 min to 9999 min	E,N	0-4	
P17.16	Reference Sequencer Time 5 (seconds)	0.0	0.0s to 59.9s	E, N	0-4	
P17.17	Reference Sequencer Time 5 (minutes)	0	0min to 9999min	E, N	0-4	
P17.18	CF27: Reference Sequencer Freeze	0.000 CLEARED	See Control Flag Menus 33/34	E, N	0-4	CF List *
P17.19	CF28: Reference Sequencer Trigger	0.000 CLEARED	See Control Flag Menus 33/34	E, N	0-4	CF List *
P17.20	CF29: Reference Sequencer Reset	0.001 SET	See Control Flag Menus 33/34	E, N	0-4	CF List *
P17.21	Reference Sequencer Output	0.00	–100.00% to +100.00% motor top speed	R	0-4	

5.4.17 Menu 18 – Motorised Potentiometer Settings

NOTE: Parameters in this table are described in Section 6.18 and Control Flags in Section 5.4.75 where marked CF List *.

Par No.	Function	Default	Range	Attrib	Mode No.	Comments
P18.00	Motorised Potentiometer Raise Rate	10	0.1%/s to 3000 %/s	E	0-4	
P18.01	Motorised Potentiometer Lower Rate	10	0.1%/s to 3000 %/s	E	0-4	
P18.02	Motorised Potentiometer Mode	1	1 = Forward only 2 = Reverse only 3 = Forward and Reverse 4 to 6 As 1 to 3 but output reset to zero when stopped	E,N,L	0-4	
P18.03	Motorised Potentiometer Preset	0.0	0.0% to 100.0%	E	0-4	0.1% TOP SPEED
P18.04	CF34: Motorised Potentiometer Raise	0.000 CLEARED	See Control Flag Menus 33/34	E,N	0-4	CF List *
P18.05	CF35: Motorised Potentiometer Lower	0.000 CLEARED	See Control Flag Menus 33/34	E,N	0-4	CF List *
P18.06	CF71: Motorised Potentiometer Preset	0.000 CLEARED	See Control Flag Menus 33/34	E,N	0-4	CF List *
P18.07	Motorised Potentiometer Output	0.00	–100.00 % to +100.00 %	R	0-4	

5.4.18 Menu 19 – Trim Reference Settings

NOTE: Parameters in this table are described in Section 6.19.

Par No.	Function	Default	Range	Attrib	Mode No.	Comments
P19.00	Trim Reference Input A	1	1 = Analogue REF1 2 = Analogue REF2 3 = Fixed 0% (Not used) 4 = Fixed 0% (Not used) 5 = RS485 REF 1 6 = RS232 REF1 7 = PID Controller 8 = Fixed Ref. Menu 9 = Motorised Pot. 10 = Ref. Sequencer 11 = Fixed Ref #0 (P21.00) 12 = Fixed Ref #1 (P21.01) 13 = Position Control 14 = Summing Node A 15 = Summing Node B 16 = Pointer 6	S,E,N,L	0-4	
P19.01	Trim Reference Input B	1	1 to 16 (see P19.00)	S,E,N,L	0-4	
P19.02	Trim Reference Scale A	100.0	–150.0% to +150.0%	E	0-4	
P19.03	Trim Reference Scale B	0.0	–150.0% to +150.0%	E	0-4	
P19.04	Trim Reference Output	0.00	–100.00 % to +100.00 %	R	0-4	

5.4.19 Menu 20 – High Speed Digital I/O Settings

NOTE: Parameters in this table are described in Section 6.20.

Par No.	Function	Default	Range	Attrib	Mode No.	Comments
P20.00	HSIO Mode	1	-2 = Fast Trip Out -1 = 1 kHz Pulse 0 = Output at Drive Frequency 1 = Input 2 to 4096 = Output	E,N	0-4	
P20.01	HSIO Input Frequency for 0 Speed	0.0	0.0 kHz to 650.0 kHz	E	0-4	
P20.02	HSIO Input Frequency for 100 % Speed	100.0	0.0 kHz to 650.0 kHz	E	0-4	
P20.03	HSIO Input Reference Value	0.00	–100.00 % Top Speed to +100.00 % Top Speed	R	0-4	

5.4.20 Menu 21 – Fixed Reference Settings

NOTE: Parameters in this table are described in Section 6.21 and Control Flags in Section 5.4.75 where marked CF List *.

Par No.	Function	Default	Range	Attrib	Mode No.	Comments
P21.00 to P21.15	Fixed Reference #0 to Fixed Reference #15	0.00	–100.00 % to +100.00 %	E	0-4	0.1% of Top Speed
P21.16	CF30: Fixed Reference Select 0	0.000 CLEARED	See Control Flag Menus 33/34	E,N	0-4	CF List *
P21.17	CF31: Fixed Reference Select 1	0.000 CLEARED	See Control Flag Menus 33/34	E,N	0-4	CF List *
P21.18	CF32: Fixed Reference Select 2	0.000 CLEARED	See Control Flag Menus 33/34	E,N	0-4	CF List *
P21.19	CF33: Fixed Reference Select 3	0.000 CLEARED	See Control Flag Menus 33/34	E,N	0-4	CF List *
P21.20	Fixed Reference Output	0.00	–100.00 % to +100.00 %	R	0-4	

5.4.21 Menu 22 – Skip Speed Settings

NOTE: Parameters in this table are described in Section 0.

Par No.	Function	Default	Range	Attrib	Mode No.	Comments
P22.00	Skip Band 1 Centre	0.00	–100.00 % Top Speed to +100.00 % Top Speed	E	1-3	
P22.01	Skip Band 1 Width	0.00	0.00.00 % Top Speed to 50.00 % Top Speed	E	1-3	
P22.02	Skip Band 2 Centre	0.00	–100.00 % Top Speed to +100.00 % Top Speed	E	1-3	
P22.03	Skip Band 2 Width	0.00	0.00.00 % Top Speed to 50.00 % Top Speed	E	1-3	
P22.04	Skip Band 3 Centre	0.00	–100.00 % Top Speed to +100.00 % Top Speed	E	1-3	
P22.05	Skip Band 3 Width	0.00	0.00.00 % Top Speed to 50.00 % Top Speed	E	1-3	
P22.06	Skip Band 4 Centre	0.00	–100.00 % Top Speed to +100.00 % Top Speed	E	1-3	
P22.07	Skip Band 4 Width	0.00	0.00.00 % Top Speed to 50.00 % Top Speed	E	1-3	

5.4.22 Menu 23 – Dynamic Brake Control

NOTE: Parameters in this table are described in Section 6.23.

Par No.	Function	Default	Range	Attrib	Mode No.	Comments
P23.00	DB Resistor Value	Drive size dependent	0.1 Ω to 1000.0 Ω	E	0-4	Per effective switched resistor
P23.01	DB Resistor Average Power	Drive size dependent	0.1 kW to 3000.0 kW	E	0-4	Continuous capability of each effective DB resistor.
P23.02	DB Resistor Maximum Power	Drive size dependent	Value in P23.01 to 3000.0 kW	E	0-4	Overload capability of each effective DB resistor.
P23.03	Duration of DB Resistor Maximum Power	18.0 s	0.1s to 1800.0s	E	0-4	Combined with P23.02 this gives thermal characteristic of the resistor.
P23.04	DB Voltage Threshold	Drive size dependent	Drive Size to 1500V	E	0-4	Voltage for switching in the DB.
P23.05	Motor Regenerative Power Limit	Drive size dependent	–0.1kW to 3000.0kW	E	0-4	
P23.06	Action on DB Overload	2	0 = No Action 1 = Warn at 25% Remaining 2 = Warn at 25% Remaining Trip at 0% Remaining 3 = Reduce Regen Power Limit to DB Average Power, and Warn at 25% Remaining Trip at 0% Remaining	E,N,L	0-4	
P23.07	Resistor I^2T Remaining	100 %	0% to 100 %	R	0-4	
P23.08	CF110: DB Enable	2.008 Flag SF8	–5.216 to +5.216 See Control Flag Menus 33/34	E,N	0-4	
P23.09	CF111: DB Resistor Thermostat	0.000 CLEARED	–5.216 to +5.216 See Control Flag Menus 33/34	E,N	0-4	
P23.10	DB Vdc Reference Source	1	1 = Drive Vdc 2 = Analogue Ref 1 3 = Analogue Ref 2	E,N,L	0-4	
P23.11	DB Vdc Reference Scale	0	-2000 to +2000 V/100%	E	0-4	Volts for 100% input
P23.12	DB Vdc Reference	0	-2000 to +2000 V	R	0-4	Volts
P23.13	DB Control Mode	0	0 = Threshold 1 = Proportional*	E,N,L	0-4	

NOTE: Parameters in this table are described in Section 6.23.

Par No.	Function	Default	Range	Attrib	Mode No.	Comments
P23.14	DB Ref Source	1	1= Keypad reference 2= Analogue ref. 1 3= Analogue ref. 2 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 potentiometer 12= Trim reference 13= Fixed 0% (not used) 14= Fixed 0% (not used) 15= High speed digital output 16= Position Control 17= Summing Node A 18= Summing Node B 19= Summing Node C 20= Summing Node D 21= Pointer 28	E,N		
P23.15	Max. DB Ref	100%	0.00% to 100.00%	E		
P23.16	DB Ref.	0	0.00% to 100.00%	R		
P23.17	DB Ramp Time	50ms	0 to 100ms	E		0% to 100% modulation
P23.18	DB Demand	0	0.00% to 100.00%	R		Ref. After Ramp and limit
P23.19	DB output Select	0	0= DB port 1= Motor Bridge	S,E,N,L		May need to edit P99.01 to zero
P23.20	Non-MV DB Unit Fitted	0	0 = Not fitted 1 = Fitted	S,E,N,L	0-4	
P23.21	DB Current	0	0.0 A to 2000.0 A	R	0-4	DB Irms per resistor
P23.22	DB Power	0	0.0 kW to 3000.0 kW	R	0-4	DB kW per resistor
P23.23	Internal DB Fitted	0	0 = Not fitted 1 = Fitted	S,L,N,E	0-4	Applies to BDM Drives only. Does not apply to DELTA systems.

5.4.23 Menu 24 – Speed Trim Settings

NOTE: Parameters in this table are described in Section 6.24 and Control Flags in Section 5.4.75 where marked CF List *.

Par No.	Function	Default	Range	Attrib	Mode No.	Comments
P24.00	Speed Trim Source	1	1 = Keypad Speed Ref. 2 = Analogue REF1 3 = Analogue REF2 4 = RS485 REF 1 5 = RS485 REF2 6 = RS232 REF1 7 = RS232 REF2 8 = PID Controller 9 = Ref. Sequencer 10 = Fixed Ref. Menu 11 = Motorised Pot. 12 = Trim Reference 13 = Fixed 0% (Not used) 14 = Fixed 0% (Not used) 15 = High Speed Digital input 16 = Position Control 17 = Summing Node A 18 = Summing Node B 19 = Summing Node C 20 = Summing Node D 21 = Pointer 7	E,N,L	0-3	
P24.01	Speed Trim Scale 1	0.0	–100.0% to +100.0%	E	0-3	
P24.02	Speed Trim Scale 2	0.0	–100.0% to +100.0%	E	0-3	
P24.03	CF70: Enable Speed Trim	0.000 CLEARED	See Control Flag Menus 33/34	E,N	0-3	CF List *
P24.04	CF75: Speed Trim Scale Select	0.000 CLEARED	See Control Flag Menus 33/34	E,N	0-3	CF List **
P24.05	Speed Trim Slew Rate	0	0%/s to 5000 %/s	E	0-3	

5.4.24 Menu 25 – Inertia Compensation Settings

NOTE: Parameters in this table are described in Section 6.25 and Control Flags in Section 5.4.75 where marked CF List *

Par No.	Function	Default	Range	Attrib	Mode No.	Comments
P25.00	Inertia Compensation Acceleration Time	0.0	0.0 s to 300.0 s	E	2	
P25.01	Inertia Compensation Time Constant	5	0 scans to 500 scans	E	2	1 scan = 5 ms
P25.02	Inertia Compensation Speed Source	1	1 = From Speed Demand 2 = From Speed Feedback	E,N,L	2	
P25.03	CF74: Enable Inertia Compensation	0.000 CLEARED	See Control Flag Menus 33/34	E,N	2	CF List *
P25.04	Inertia Compensation Output Time Constant	0	0 scans to 500 scans	E	2	1 scan = 5 ms

5.4.25 Menu 26 – History Log Settings

NOTE: Parameters in this table are described in Section 6.26 and Control Flags in Section 5.4.75 where marked CF List *.

Par No.	Function	Default Basic Drive	Default SFE	Range	Attrib	Mode No.	Comments
P26.00	Number of Scans/ History Sample	1	1	1 scan to 20000 scans	E,N	0-4	1 scan = 5 ms
P26.01	Channel 1 Data	9.02	51.04	1.00 to 99.99 (any Parameter)	E,N	0-4	
P26.02	Channel 1 Mode	1	1	1 = Take Average 2 = Take Maximum 3 = Take Minimum	E,N,L	0-4	
P26.03	Channel 2 Data	9.06	51.01	1.00 to 99.99 (any Parameter)	E,N	0-4	
P26.04	Channel 2 Mode	2	2	1 to 3 (see P26.02)	E,N,L	0-4	
P26.05	Channel 3 Data	9.08	51.06	1.00 to 99.99 (any Parameter)	E,N	0-4	
P26.06	Channel 3 Mode	2	2	1 to 3 (see P26.02)	E,N,L	0-4	
P26.07	Channel 4 Data	9.09	51.03	1.00 to 99.99 (any Parameter)	E,N	0-4	
P26.08	Channel 4 Mode	2	2	1 to 3 (see P26.02)	E,N,L	0-4	
P26.09	Channel 5 Data	9.10	9.10	1.00 to 99.99 (any Parameter)	E,N	0-4	9.10 not visible in SFE – see P51.19
P26.10	Channel 5 Mode	2	2	1 to 3 (see P26.02)	E,N,L	0-4	
P26.11	Channel 6 Data	11.05	11.05	1.00 to 99.99 (any Parameter)	E,N	0-4	
P26.12	Channel 6 Mode	1	1	1 to 3 (see P26.02)	E,N,L	0-4	
P26.13	Channel 7 Data	11.03	51.00	1.00 to 99.99 (any Parameter)	E,N	0-4	
P26.14	Channel 7 Mode	2	2	1 to 3 (see P26.02)	E,N,L	0-4	
P26.15	Channel 8 Data	9.01	50.00	1.00 to 99.99 (any Parameter)	E,N	0-4	
P26.16	Channel 8 Mode	1	1	1 to 3 (see P26.02)	E,N,L	0-4	
P26.17	Channel 9 Data	9.00	51.10	1.00 to 99.99 (any Parameter)	E,N	0-4	
P26.18	Channel 9 Mode	1	1	1 to 3 (see P26.02)	E,N,L	0-4	
P26.19	Channel 10 Data	10.10	10.10	1.00 to 99.99 (any Parameter)	E,N	0-4	
P26.20	Channel 10 Mode	1	1	1 to 3 (see P26.02)	E,N,L	0-4	
P26.21	Trigger Parameter	0	0	1.00 to 99.99 (any Parameter, 0 = None)	E,N	0-4	
P26.22	Lower Trigger Level	–32767	–32767	–32767 to +32767	E,N	0-4	
P26.23	Upper Trigger Level	+32767	+32767	–32767 to +32767	E,N	0-4	
P26.24	Samples after Trigger	5	5	0 to 99	E,N	0-4	
P26.25	CF78: Run History	2.008 SF8, O/P Bridge Enable	2.008 SF8, O/P Bridge Enable	See Control Flag Menus 33/34	E,N	0-4	CF List *

NOTE: Parameters in this table are described in Section 6.26 and Control Flags in Section 5.4.75 where marked CF List *.

Par No.	Function	Default Basic Drive	Default SFE	Range	Attrib	Mode No.	Comments
P26.26	CF79: Stop History	2.005 SF5, Drive Tripped	2.005 SF5, Drive Tripped	See Control Flag Menus 33/34	E,N	0-4	CF List *
P26.27	History Command	0	0	0 = No Effect 1 = Arm History 2 = Trigger History	E,N,L	0-4	
P26.28	Single Element Ch1 Data	26.30	26.30	1.00 to 99.99	E,N	0-4	
P26.29	Single Element Ch2 Data	26.31	26.31	1.00 to 99.99	E,N	0-4	
P26.30	Global Time Var 1	0	0	–30000 to +30000	E	0-4	
P26.31	Global Time Var 2	0	0	–30000 to +30000	E	0-4	

5.4.26 Menu 27 – History Log Playback Settings

NOTE: Parameters in this table are described in Section 9.7.

Par No.	Function	Default	Range	Attrib	Mode No.	Comments
P27.00	History Sample Display Number	0	0 to 99	O	0-4	
P27.01	History Playback Channel 1	0	Value recorded in the channel, as per parameter set in P26.01	R	0-4	
P27.02	History Playback Channel 2	0	Value recorded in the channel, as per parameter set in P26.03	R	0-4	
P27.03	History Playback Channel 3	0	Value recorded in the channel, as per parameter set in P26.05	R	0-4	
P27.04	History Playback Channel 4	0	Value recorded in the channel, as per parameter set in P26.07	R	0-4	
P27.05	History Playback Channel 5	0	Value recorded in the channel, as per parameter set in P26.09	R	0-4	
P27.06	History Playback Channel 6	0	Value recorded in the channel, as per parameter set in P26.11	R	0-4	
P27.07	History Playback Channel 7	0	Value recorded in the channel, as per parameter set in P26.13	R	0-4	
P27.08	History Playback Channel 8	0	Value recorded in the channel, as per parameter set in P26.15	R	0-4	
P27.09	History Playback Channel 9	0	Value recorded in the channel, as per parameter set in P26.17	R	0-4	
P27.10	History Playback Channel 10	0	Value recorded in the channel, as per parameter set in P26.19	R	0-4	
P27.11	Single Element Playback Channel 1	0	Value recorded in the channel, as per parameter set in P26.28	E	0-4	
P27.12	Single Element Playback Channel 2	0	Value recorded in the channel, as per parameter set in P26.29	E	0-4	

5.4.27 Menu 28 – Auto-Reset Settings

NOTE: Parameters in this table are described in Section 6.28.

Par No.	Function	Default	Range	Attrib	Mode No.	Comments
P28.00	Number of Auto-reset Attempts	0	0 to 20	S,E,N	0-4	
P28.01	Auto-reset Delay	1	1 s to 30 s	S,E,N	0-4	
P28.02	Supply Loss Timeout	0	0 s to 3200 s	E	0-4	
P28.03	Auto-reset Healthy Time	30	10 s to 3600 s	E,N	0-4	
P28.04	Auto-resets Remaining	0	0 to value set in P28.00	R	0-4	
P28.05	Force Synchro Start	0	0 = Disabled 1 = Enabled	S,E,L	1-3	If = 1, then a synchro start is requested after an auto restart, even if not required as the normal start mode.
P28.06	Instantaneous Overcurrent Auto-reset Enable	0	0 = Disabled 1 = Enabled	E,L	0-4	
P28.07	Timed Overcurrent Auto-reset Enable	0	0 to 1 (see P28.06)	E,L	0-4	
P28.08	Under voltage Auto-reset Enable	0	0 to 1 (see P28.06)	E,L	0-4	Also resets Trip 29 for pre-charge failure
P28.09	Over voltage Auto-reset Enable	0	0 to 1 (see P28.06)	E,L	0-4	
P28.10	Motor Thermal Trips Auto-reset Enable	0	0 to 1 (see P28.06)	E,L	1-3	
P28.11	Interlock Auto-reset Enable	0	0 to 1 (see P28.06)	E,L	0-4	
P28.12	Control and Reference Loss Auto-reset Enable	0	0 to 1 (see P28.06)	E,L	0-4	
P28.13	Drive Temperature Trips Auto-reset Enable	0	0 to 1 (see P28.06)	E,L	0-4	
P28.14	Serial Link Loss Auto-reset Enable	0	0 to 1 (see P28.06)	E,L	0-4	
P28.15	User Trip Auto-reset Enable	0	0 to 1 (see P28.06)	E,L	0-4	
P28.16	Over speed Trip Auto-reset Enable	0	0 to 1 (see P28.06)	E,L	0-3	
P28.17	Load Fault Auto-reset Enable	0	0 to 1 (see P28.06)	E,L	1-3	
P28.18	DB Resistor Fault Auto-reset Enable	0	0 to 1 (see P28.06)	E,L	0-4	
P28.19	SFE Mains Auto-reset Enable	0	0 to 1 (see P28.06)	E,L	4	Resets all trips 93-98, for SFE, automatically if selected.
P28.20	Interlock terminal. Auto preset enable	0	0 to 1 (see P28.06)	E,L	0-4	Resets interlock trip, if the interlock terminal has been remade.

5.4.28 Menu 29 – Speed & Torque Monitor Settings

NOTE: Parameters in this table are described in Section 6.29.

Par No.	Function	Default	Range	Attrib	Mode No.	Comments
P29.00	Forward Over speed Level	120.0	10.0% Top Speed to 300.0% Top Speed	E	1-3	
P29.01	Reverse Over speed Level	120.0	10.0% Top Speed to 300.0% Top Speed	E	1-3	
P29.02	Over speed Action	3	1 = Suicide Torque 2 = Suicide Torque + Warning 3 = Trip	E,N,L	1-3	
P29.03	Speed Monitor Level 1	0.0	–300.0% Top Speed to +300.0% Top Speed	E	1-3	
P29.04	Speed Monitor Level 2	0.0	–300.0% Top Speed to +300.0% Top Speed	E	1-3	
P29.05	Speed Monitor Hysteresis	5.0	0.0% Top Speed to 50.0% Top Speed	E	1-3	
P29.06	Torque Monitor Level 1	0.0	–300.0% Nominal Torque to +300.0% Nominal Torque	E	1-3	
P29.07	Torque Monitor Level 2	0.0	–300.0% Nominal Torque to +300.0% Nominal Torque	E	1-3	
P29.08	Torque Monitor Hysteresis	0.0	0.0% Nominal Torque to 100.0% Nominal Torque	E	1-3	
P29.09	Zero Speed Tolerance	0.50	0.00 % to 10.00 %	E	1-3	

5.4.29 Menu 30 – Logic Block Settings

NOTE: Parameters in this table are described in Section 6.30 and Control Flags in Section 5.4.75 where marked CF List *.

Par No.	Function	Default	Range	Attrib	Mode No.	Comments
P30.00	Comparator A Input	9.01	1 to 99.99	E,N	0-4	
P30.01	Comparator A Threshold	0	As Input Parameter	E	0-4	
P30.02	Comparator A Hysteresis	0	As Input Parameter	E	0-4	
P30.03	Comparator A Mode	1	1 = Input = Threshold 2 = Input <> Threshold 3 = Input > Threshold (signed) 4 = Input<= Threshold (signed) 5 = Input< Threshold (signed) 6 = Input>= Threshold (signed) 7 to 10, as 3 to 6, but Absolute value.	E,N,L	0-4	
P30.04	Delay A Input Source	1	1 = From Comparator A 2 = From Control Flag	E,N,L	0-4	
P30.05	Delay A Time	0	0 s to 600 s	E	0-4	

NOTE: Parameters in this table are described in Section 6.30 and Control Flags in Section 5.4.75 where marked CF List *.

Par No.	Function	Default	Range	Attrib	Mode No.	Comments
P30.06	Logic Block A Functions	1	1 = Three Input AND 2 = Three Input NAND 3 = Three Input OR 4 = Three Input NOR 5 = Three Input XOR 6 = Three Input XNOR 7 to 12 = Two input versions of 1 to 6	E,N,L	0-4	CF37 and CF38 are inputs when Two Input versions chosen for Logic Block A
P30.07	Latch A Input Selection	1	1 = From Logic Block A 2 = From Control Flag	E,N,L	0-4	
P30.08	CF36: Delay A Input	0.000 CLEARED	See Control Flag Menus 33/34	E,N	0-4	CF List *
P30.09	CF37: Logic Block A Input 1	0.000 CLEARED	See Control Flag Menus 33/34	E,N	0-4	CF List *
P30.10	CF38: Logic Block A Input 2	0.000 CLEARED	See Control Flag Menus 33/34	E,N	0-4	CF List *
P30.11	CF39: Latch A Set	0.000 CLEARED	See Control Flag Menus 33/34	E,N	0-4	CF List *
P30.12	CF40: Latch A Reset	0.000 CLEARED	See Control Flag Menus 33/34	E,N	0-4	CF List *
P30.13 to P30.20	General Purpose Logic Block B Parameters	As P30.00 to P30.07		E,N	0-4	CF42 and CF43 are inputs when Two Input versions chosen for Logic Block B
P30.21 to P30.25	General Purpose Logic Block B Control Flags CF41 to CF45	0.000 CLEARED	See Control Flag Menus 33/34	E,N	0-4	CF List *
P30.26 to P30.33	General Purpose Logic Block C Parameters	As P30.00 to P30.07		E,N	0-4	CF47 and CF48 are inputs when Two Input versions chosen for Logic Block C
P30.34 to P30.38	General Purpose Logic Block C Control Flags CF46 to CF50	0.000 CLEARED	See Control Flag Menus 33/34	E,N	0-4	CF List *
P30.39 to P30.46	General Purpose Logic Block D Parameters	As P30.00 to P30.07		E,N	0-4	CF52 and CF53 are inputs when Two Input versions chosen for Logic Block D
P30.47 to P30.51	General Purpose Logic Block D Control Flags CF51 to CF55	0.000 CLEARED	See Control Flag Menus 33/34	E,N	0-4	CF List *
P30.52	Logic Block E Functions	1	1 = Three Input AND 2 = Three Input NAND 3 = Three Input OR 4 = Three Input NOR 5 = Three Input XOR 6 = Three Input XNOR 7 to 12 = Two input versions of 1 to 6	E,N,L	0-4	Three Input version = CF56, CF57 and CF58 used. Two Input version = CF56 and CF57 used. Four parameters per logic block.

NOTE: Parameters in this table are described in Section 6.30 and Control Flags in Section 5.4.75 where marked CF List *.

Par No.	Function	Default	Range	Attrib	Mode No.	Comments
P30.53	CF56: Logic Block E Input 1	0.000 CLEARED	See Control Flag Menus 33/34	E,N	0-4	CF List * Four parameters per logic block.
P30.54	CF57: Logic Block E Input 2	0.000 CLEARED	See Control Flag Menus 33/34	E,N	0-4	CF List * Four parameters per logic block.
P30.55	CF58: Logic Block E Input 3	0.000 CLEARED	See Control Flag Menus 33/34	E,N	0-4	CF List * Four parameters per logic block.
P30.56	Logic Block F Functions	1	1 to 12 (see P30.52)	E,N,L	0-4	Three Input version = CF59, CF60 and CF61 used. Two Input version = CF59 and CF60 used. Four parameters per logic block.
P30.57 to P30.59	General Purpose Logic Block F Control Flags CF59 to CF61	0.000 CLEARED	See Control Flag Menus 33/34	E,N	0-4	CF List * Four parameters per logic block.
P30.60	Logic Block G Functions	1	1 to 12 (see P30.52)	E,N,L	0-4	Three Input version = CF62, CF63 and CF64 used. Two Input version = CF62 and CF63 used. Four parameters per logic block.
P30.61	CF62: Logic Block G Input 1	0	See Control Flag Menus 33/34	E,N	0-4	CF List * Four parameters per logic block.
P30.62	CF63: Logic Block G Input 2	0	See Control Flag Menus 33/34	E,N	0-4	CF List * Four parameters per logic block.
P30.63	CF64: Logic Block G Input 3	0	See Control Flag Menus 33/34	E,N	0-4	CF List * Four parameters per logic block.
P30.64	Logic Block H Functions	1	1 to 12 (see P30.52)	E,N,L	0-4	Three Input version = CF65, CF66 and CF67 used. Two Input version = CF65 and CF66 used. Four parameters per logic block.
P30.65	CF65: Logic Block H Input 1	0	See Control Flag Menus 33/34	E,N	0-4	CF List * Four parameters per logic block.
P30.66	CF66: Logic Block H Input 2	0.000 CLEARED	See Control Flag Menus 33/34	E,N	0-4	CF List * Four parameters per logic block.

NOTE: Parameters in this table are described in Section 6.30 and Control Flags in Section 5.4.75 where marked CF List *.

Par No.	Function	Default	Range	Attrib	Mode No.	Comments
P30.67	CF67: Logic Block H Input 3	0.000 CLEARED	See Control Flag Menus 33/34	E,N	0-4	CF List * Four parameters per logic block.

5.4.30 Menu 31 – Status Flag Generator Settings

NOTE: Parameters in this table are described in Section 6.31 and Control Flags in Section 5.4.75 where marked CF List *.

Par No.	Function	Default	Range	Attrib	Mode No.	Comments
P31.00	Status Flag Generator Mode	0	0 = Stopped 1 = Manual Trigger Only 2 = Auto Cycle Up 3 = Auto Cycle Down 4 = Auto Cycle Single Sequence Up 5 = Auto Cycle Single Sequence Down	E,N,L	0-4	
P31.01	Status Flag Generator Start Point	0	0 to 15	E,N	0-4	Point at which the flag generator begins after a CF100 Reset.
P31.02	Status Flag Generator Length	1	1 to 16	E,N	0-4	Number of states in the sequence.
P31.03 to P31.18	Time at State 0 to Time at State 15	0.0	0.0 s to 3200.0 s	E	0-4	
P31.19	CF97: Status Flag Generator Freeze	0.000 CLEARED	See Control Flag Menus 33/34	E,N	0-4	CF List *
P31.20	CF98: Status Flag Generator Up	0.000 CLEARED	See Control Flag Menus 33/34	E,N	0-4	CF List *
P31.21	CF99: Status Flag Generator Down	0.000 CLEARED	See Control Flag Menus 33/34	E,N	0-4	CF List *
P31.22	CF100: Status Flag Generator Reset	0.000 CLEARED	See Control Flag Menus 33/34	E,N	0-4	CF List *

5.4.31 Menu 32 – Serial Link Settings

NOTE: Parameters in this table are described in Section 6.32.

Par No.	Function	Default	Range	Attrib	Mode No.	Comments
P32.00	Serial Links Write Enable	0	0 = Serial Link can Monitor Only 1 = Serial Link can Monitor and Write (edit)	E,N,L	0-4	
P32.01	Global Response (Reject/accept Broadcast Messages)	0	0 = Disabled (reject Broadcast messages) 1 = Enabled (accept Broadcast Messaged)	E,N,L	0-4	

NOTE: Parameters in this table are described in Section 6.32.

Par No.	Function	Default	Range	Attrib	Mode No.	Comments
P32.02 to P32.09	Reserved					
P32.10	RS232 Baud Rate	6	4 = 9.6 kbits/s 5 = 19.2 kbits/s 6 = 38.4 kbits/s	E,L	0-4	
P32.11	RS232 Address	0	0 to 255	E,N	0-4	
P32.12	RS232 Protocol	1	0 = No Protocol 1 = GEM80 ESP 2 = MODBUS RTU 3 = MODBUS ASCII 4 = KEYPAD (ESP) 5 = Serial Printer	E,N,L	0-4	
P32.13	RS232 Link Parity	1	1 = 8 bit data, no parity 2 = 8 bit data, even parity 3 = 8 bit data, odd parity 4 = 7 bit data, even parity 5 = 7 bit data, odd parity 6 = 7 bit data, reset parity 7 = 7 bit data, set parity	E,N,L	0-4	
P32.14	RS232 Timeout	10.0	0.0 s = No Timeout 0.1 s to 99.9 s	E,N	0-4	
P32.15	RS232 Loss Action (after timeout	0	0 = No Warning 1 = Warning 2 = Trip	E,L	0-4	
P32.16	RS232 CRC Failures Count	0	0 to 9999	R	0-4	
P32.17	RS232 Timeouts Count	0	0 to 9999	R	0-4	
P32.18	RS232 Reference 1	0.00	–100.00 % to +100.00 %	E	0-4	Can only be written to by RS232 serial link.
P32.19	RS232 Reference 2	0.00	–100.00 % to +100.00 %	E	0-4	Can only be written to by RS232 serial link.
P32.20	RS232 Control Word 0	0000h	0000h to FFFFh (Also shown in Binary)	E	0-4	Can only be written to by RS232 serial link.
P32.21	RS232 Control Word 1	0000h	0000h to FFFFh (Also shown in Binary)	E	0-4	Can only be written to by RS232 serial link.
P32.22	RS232 Control Words at Loss	0	0 = Remain at Previous State 1 = Go to Default States (as P32.23 and P32.24)	E,L	0-4	
P32.23	RS232 Default for Control Word 0	0000h	0000h to FFFFh (Also shown in Binary)	E,N	0-4	Bit Field
P32.24	RS232 Default for Control Word 1	0000h	0000h to FFFFh (Also shown in Binary)	E,N	0-4	Bit Field
P32.25	User Page 1 Size	20	1 Parameters to 20 Parameters	E,N	0-4	
P32.26 to P32.45	User Page 1 Parameter 1 to User Page 1 Parameter 20	9.00	1.00 to 99.99	E,N	0-4	Any Drive Parameter
P32.46 to P32.49	Reserved					

NOTE: Parameters in this table are described in Section 6.32.

Par No.	Function	Default	Range	Attrib	Mode No.	Comments
P32.50	RS485 Baud Rate	38.4	1 = 1.2 kbits/s 2 = 2.4 kbits/s 3 = 4.8 kbits/s 4 = 9.6 kbits/s 5 = 19.2 kbits/s 6 = 38.4 kbits/s	E	0-4	
P32.51	RS485 Address	0	0 to 255	E,N	0-4	
P32.52	RS485 Protocol	1	0 = No Protocol 1 = GEM80 ESP 2 = MODBUS™ RTU 3 = MODBUS™ ASCII 4 = Drive to Drive 5 = RSVP	E,N,L	0-4	
P32.53	RS485 Link Parity	1	1 = 8 bit data, no parity 2 = 8 bit data, even parity 3 = 8 bit data, odd parity 4 = 7 bit data, even parity 5 = 7 bit data, odd parity 6 = 7 bit data, reset parity 7 = 7 bit data, set parity	E,N,L	0-4	
P32.54	RS485 Timeout	10.0	0.0s = No Timeout 0.1 s to 99.9 s	E,N	0-4	
P32.55	RS485 Loss Action (after timeout	0	0 = No Warning 1 = Warning 2 = Trip	E,L	0-4	
P32.56	RS485 CRC Failures Count	0	0 to 9999	R	0-4	
P32.57	RS485 Timeouts Count	0	0 to 9999	R	0-4	
P32.58	RS485 Reference 1	0.00	–100.00 % to +100.00 %	E	0-4	Can only be written to by RS485 serial link.
P32.59	RS485 Reference 2	0.00	–100.00 % to +100.00 %	E	0-4	Can only be written to by RS485 serial link.
P32.60	RS485 Control Word 0	0000h	0000h to FFFFh (Also shown in Binary)	E	0-4	Can only be written to by RS485 serial link.
P32.61	RS485 Control Word 1	0000h	0000h to FFFFh (Also shown in Binary)	E	0-4	Can only be written to by RS485 serial link.
P32.62	RS485 Control Words at Loss	0	0 = Remain at Previous State. 1 = Go to Default States (as P32.63 and P32.64)	E,L	0-4	
P32.63	RS485 Default for Control Word 0	0000h	0000h to FFFFh (Also shown in Binary)	E,N	0-4	Bit Field
P32.64	RS485 Default for Control Word 1	0000h	0000h to FFFFh (Also shown in Binary)	E,N	0-4	Bit Field
P32.65	User Page 2 Size	20	1 Parameters to 20 Parameters	E,N	0-4	
P32.66 to P32.85	User Page 2 Parameter 1 to User Page 2 Parameter 20	9.00	1.00 to 99.99	E,N	0-4	Any Parameter
P32.86	Reserved					

NOTE: Parameters in this table are described in Section 6.32.

Par No.	Function	Default	Range	Attrib	Mode No.	Comments
P32.87	Drive to Drive TX Reference 1	0	0 = No Parameter sent 1.00 to 99.99	E,N	0-4	Any Parameter
P32.88	Drive to Drive TX Reference 2	0	0 = No Parameter sent 1.00 to 99.99	E,N	0-4	Any Parameter
P32.89	Drive to Drive TX Control Word 0	0	0 = No Parameter sent 1.00 to 99.99	E,N	0-4	Any Parameter
P32.90	Drive to Drive TX Control Word 1	0	0 = No Parameter sent 1.00 to 99.99	E,N	0-4	Any Parameter
P32.91	Drive to Drive TX Reference 1 Scale	1.00	–100.00 to +100.00	E	0-4	1.0 = Unity Scale
P32.92	Drive to Drive TX Reference 2 Scale	1.00	–100.00 to +100.00	E	0-4	1.0 = Unity Scale
P32.93	Drive to Drive RX Reference 1 Scale	1.00	–100.00 to +100.00	E	0-4	1.0 = Unity Scale
P32.94	Drive to Drive RX Reference 2 Scale	1.00	–100.00 to +100.00	E	0-4	1.0 = Unity Scale

5.4.32 Menu 33 – Control Flags 0 to 99 Connection Settings

NOTE: Parameters in this table are described in Section 6.33 and Control Flags are described in Section 5.4.75 where marked CF List *.

Par No.	Function	Default	Range	Attrib	Mode No.	Comments
P33.00 to P33.99	CF0 Source to CF99 Source	See Control Flag list for defaults and meaning	See Table 6-15	E,N	As defined for the other CF instance	CF List *

5.4.33 Menu 34 – Control Flags 100 to 127 Connection Settings

NOTE: Parameters in this table are described in Section 6.34 and Control Flags are described in Section 5.4.75 where marked CF List *

Par No.	Function	Default	Range	Attrib	Mode No.	Comments

P34.00 to P34.27	CF100 Source to CF127 Source	See Control Flag list for defaults and meaning	See Table 6-15	E, N	As defined for the other CF instance	CF List *

5.4.34 Menu 35 – Miscellaneous Features Settings

NOTE: Parameters in this table are described in Section 6.35.

Par No.	Function	Default	Range	Attrib	Mode No.	Comments
P35.00	PWM Switching Frequency	1.25 kHz for all Motor Control Modes 2.5 kHz in SFE.	1= 1.25 kHz 2 = 2.5 kHz 3 = 5.0 kHz 4 = 7.5 kHz	S,E,L	0-4	1.25 kHz is not used in SFE mode. 7.5 kHz is not available for DELTA Systems
P35.01	Keypad Removal OK	0	0 = Disabled (Trip on keypad removal) 1 = Enabled (allow keypad removal, see comments)	E,L	0-4	MUST PRESS THE ESC KEY (2 or 3 times) AND FOLLOW THE PRESENTED REMOVAL INSTRUCTIONS TO REMOVE THE KEYPAD CORRECTLY, otherwise the drive will trip irrespective of the state of P35.01.
P35.03	Setup Review Mode	0	0 = Disabled 1 = Enabled (scroll through a Review of the user Edits)	E,L	0-4	
P35.04	Auto-Locking	0	0 = Auto-Locking OFF 1 = Lock Engineer Parameters 2 = Lock All Parameters	E,N,L	0-4	
P35.05	RS232 Serial Link Baud Rate	9.6	9.6 kbits/s to 38.4 kbits/s	E	0-4	See Page 6-121 (for printing drive parameters)
P35.06	RS232 Serial Link Message Protocol	4	0 = No Protocol 1 = GEM80 ESP 2 = MODBUS™ RTU 3 = MODBUS™ ASCII 4 = KEYPAD (ESP) 5 = Serial Printer	E,N,L	0-4	See Page 6-121 (for printing drive parameters)
P35.07	Print Out Option	0	0 = Print Nothing 1 = Print All Parameters 2 = Print non Default Parameters (User Edits) 3 = Print User Page 1 4 = Print History Log 5 = Auto Print History ONLY when Tripped. 6 = CANopen EDS Body 7 = DeviceNet EDS Body 8 = AB-DeviceNet EDS Body	E,N,L	0-4	See Page 6-121 (for printing drive parameters)
P35.08	Print Lines/second	0.7	0.5 Lines/Second to 10.0 Lines/Second	E	0-4	See Page 6-121 (for printing drive parameters)
P35.09	Timed Overcurrent Avoidance Enable	0	0 = Disabled 1 = Enabled	E,N,L	1	

NOTE: Parameters in this table are described in Section 6.35.

Par No.	Function	Default	Range	Attrib	Mode No.	Comments
P35.10	Over Temperature Avoidance Enable	0	0 = Disabled 1 = Enabled	E,N,L	1	
P35.11	Expansion Bus Device	0	0 = Non fitted 1 = 1Mbit/s FIP 2 = 2.5Mbit/s FIP 3 = Fieldbus Coupler 5 = MicroPEC interface	R	0-4	Various Communication Boards available from **GE Power Conversion** e.g. FIP. PROFIBUS. These are detailed in separate manuals. Parameter P35.11 indicates which Communication Board is fitted.
P35.12	AC Loss Ride-through	0	0 = Disabled 1 = Enabled	S,E,N,L	0-4	Mains Dip Ridethrough
P35.13	Nominal Mains Voltage	400	300V to 800V	S,E	0-4	
P35.14	Maximum Ambient Temperature	40°C	35°C to 50°C	E,N	0-4	
P35.15	Fan Type	0	0 = Standard 1 = Large	E,N,L	0-4	Only DELTA drives will allow other than the standard fan type to be selected.
P35.16	Drive Continuous Current Rating	Drive size dependent	To display the drive continuous current rating as a function of: P35.00 – PWM Switching Frequency P35.13 – Nominal Input Voltage P35.14 – Maximum Ambient Temperature (35°C to 50°C, default 40°C) P35.15 – Fan Type (default 0 – standard) P99.01 – Control Method P99.02 – Overload Setting	R	0-4	
P35.17	Advanced Temperature Monitoring	0	0 = Disabled 1 = Enabled	L,E,N	1-4	Not available in mode 0. Only available when the MV3000 hardware permits.
P35.18	Action on Sharing Error Detection	1	0 = No action 1 = Warning 2 = Trip	L,N,E	0-4	Applies to multiple DELTA systems only.
P35.19	Disable Sharing	0	0 = Enabled 1 = Disabled	L,N,E	0-4	Applies to multiple DELTA systems only.
P35.20	PWM Sharing Threshold	5	0 to 7	E	0-4	Applies to multiple DELTA systems only.
P35.21	100ms Sharing Threshold	10	1 to 100	E	0-4	Applies to multiple DELTA systems only.

NOTE: Parameters in this table are described in Section 6.35.

Par No.	Function	Default	Range	Attrib	Mode No.	Comments
P35.22	No.100ms Sharings	0		R	0-4	Applies to multiple DELTA systems only.
P35.23	Sharing Event Time	4	1 = 0.4µs 2 = 0.8µs 3 = 1.2µs 4 = 1.6µs 5 = 2.0µs 6 = 2.4µs 7 = 2.8µs 8 = 3.2µs 9 = 3.6µs 10 = 4.0µs 11 = 4.4µs 12 = 4.8µs 13 = 5.2µs 14 = 5.6µs 15 = 6.0µs 16 = 6.4µs	L,E	0-4	
P35.24 to P35.29	Reserved					
P35.30	PWM Synchronisation Offset	0.0	0.0 to 100% PWM Period	E	2, 4	Percentage of the PWM period by which the PWM is advanced from the received synchronisation pulse
P35.31	PWM Synchronisation Delay Compensation	0	0 to 400µs	E	2, 4	Time by which the PWM of the slave drive is advanced to compensate for synchronisation signal delays and PWM frequency transmission delays in the power cables

5.4.35 Menu 36 – Position Control Settings (Vector with Encoder Only)

NOTE: Parameters in this table are described in Section 6.36 and Control Flags in Section 5.4.75 where marked CF List *.

Par No.	Function	Default	Range	Attrib	Mode No. †	Comments
P36.00	Position Control Mode	1	1 = Finite Control 2 = Turntable Mode, Bi-directional 3 = Turntable Mode, Forward only	S,E,N,L	1-3	
P36.01	Position Pulses/Bit	1	1 to 32	E	1-3	Number of encoder pulse/bit of position feedback.
P36.02	Maximum Position Low	9999	–9999 Pulses to +9999 Pulses	E	1-3	P36.02+P36.03 forms the value for Max position.
P36.03	Maximum Position High	9999	–9999 x10k Pulses to +9999 x10k Pulses	E	1-3	P36.02+P36.03 forms the value for Max position.
P36.04	Minimum Position Low	-9999	–9999 Pulses to +9999 Pulses	E	1-3	P36.04+P36.05 forms the value for Min position.
P36.05	Minimum Position High	-9999	–9999 x10k Pulses to +9999 x10k Pulses	E	1-3	P36.04+P36.05 forms the value for Minimum position.
P36.06	0% Position Low	0	–9999 Pulses to +9999 Pulses	E	1-3	P36.06+P36.07 forms the value for 0% position. This value allows an offset for "datum" to be entered.
P36.07	0% Position High	0	–9999 x10k Pulses to +9999 x10k Pulses	E	1-3	P36.06+P36.07 forms the value for 0% position.
P36.08	CF86: High Limit Reached (limit switch	0.000 CLEARED	See Control Flag Menus 33/34	E,N	1-3	CF List *
P36.09	CF87: Low Limit Reached (limit switch	0.000 CLEARED	See Control Flag Menus 33/34	E,N	1-3	CF List *
P36.10	Position Shaper Range Low	0	0 Pulses to 9999 Pulses	E	1-3	P36.10+P36.11 forms the value for position shaper range.
P36.11	Position Shaper Range High	10	0x10k Pulses to 9999x10k Pulses	E	1-3	P36.10+P36.11 forms the value for position shaper range.
P36.12	Position Shaper -X1	–20.00	–100.00 % to 0% position	E	1-3	
P36.13	Position Shaper -Y1	–44.72	–100.00% Top Speed to 0.00% Top Speed	E	1-3	
P36.14	Position Shaper -X2	–40.00	–100.00 % to 0% position	E	1-3	
P36.15	Position Shaper -Y2	–63.25	–100.00% Top Speed to 0.00% Top Speed	E	1-3	
P36.16	Position Shaper -X3	–60.00	–100.00% to 0% position	E	1-3	

NOTE: Parameters in this table are described in Section 6.36 and Control Flags in Section 5.4.75 where marked CF List *.

Par No.	Function	Default	Range	Attrib	Mode No. †	Comments
P36.17	Position Shaper -Y3	–77.46	–100.00% Top Speed to 0.00% Top Speed	E	1-3	
P36.18	Position Shaper -X4	–80.00	–100.00% to 0% position	E	1-3	
P36.19	Position Shaper -Y4	–89.44	–100.00% Top Speed to 0.00% Top Speed	E	1-3	
P36.20	Position Shaper -X5	–100.00	–100.00 % to 0% position	E	1-3	
P36.21	Position Shaper -Y5	–100.00	–100.00 % Top Speed to 0.00% Top Speed	E	1-3	
P36.22	Position Shaper X1	20.00	100.00 % to 0% position	E	1-3	
P36.23	Position Shaper Y1	44.72	100.00 % Top Speed to 0.00% Top Speed	E	1-3	
P36.24	Position Shaper X2	40.00	100.00 % to 0% position	E	1-3	
P36.25	Position Shaper Y2	63.25	100.00 % Top Speed to 0.00% Top Speed	E	1-3	
P36.26	Position Shaper X3	60.00	100.00 % to 0% position	E	1-3	
P36.27	Position Shaper Y3	77.46	100.00 % Top Speed to 0.00% Top Speed	E	1-3	
P36.28	Position Shaper X4	80.00	100.00 % to 0% position	E	1-3	
P36.29	Position Shaper Y4	89.44	100.00 % Top Speed to 0.00% Top Speed	E	1-3	
P36.30	Position Shaper X5	100.00	100.00 % to 0% position	E	1-3	
P36.31	Position Shaper Y5	100.00	100.00 % Top Speed to 0.00% Top Speed	E	1-3	
P36.32	Datum Position Low	0	–9999 Pulses to +9999 Pulses	E	1-3	P36.32+P36.33 forms the value for Datum position, an offset value which can be used e.g. after a “next Z” datum movement.
P36.33	Datum Position High	0	–9999x10k Pulses to 9999x10k Pulses	E	1-3	P36.32+P36.33 forms the value for Datum position, an offset value which can be used e.g. after a “next Z” datum movement.
P36.34	Datum Sequence	1	1 = Low Limit, Z Pulse 2 = High Limit, Z Pulse 3 = Low Limit, Rev, Z Pulse 4 = High Limit, Rev, Z Pulse 5 = Low Limit, No Z Pulse 6 = High Limit, No Z Pulse 7 = Low Limit, Rev, No Z Pulse 8 = High Limit, Rev, No Z Pulse 9 = No Limit, Fwd, Z Pulse 10 = No Limit, Rev, Z Pulse 11 = Datum Input Only	E, L	1-3	
P36.35	Datum Speed 1	0.00	0.00 % Top Speed to 100.00 % Top Speed		1-3	

NOTE: Parameters in this table are described in Section 6.36 and Control Flags in Section 5.4.75 where marked CF List *.

Par No.	Function	Default	Range	Attrib	Mode No. †	Comments
P36.36	Datum Speed 2	0.00	0.00% Top Speed to 00.00% Top Speed		1-3	
P36.37	Datum Speed 3	0.00	0.00 % Top Speed to 100.00% Top Speed		1-3	
P36.38	CF80: Force Position Valid	0.000 CLEARED	See Control Flag Menus 33/34	E, N	1-3	CF List *
P36.39	CF81: Force Position Invalid	0.000 CLEARED	See Control Flag Menus 33/34	E, N	1-3	CF List *
P36.40	CF82: Datum Move Permit	0.000 CLEARED	See Control Flag Menus 33/34	E, N	1-3	CF List *
P36.41	CF83: Perform Datum Movement	0.000 CLEARED	See Control Flag Menus 33/34	E, N	1-3	CF List *
P36.42	CF84: Datum Approach	0.000 CLEARED	See Control Flag Menus 33/34	E, N	1-3	CF List *
P36.43	CF85: Datum Input	0.000 CLEARED	See Control Flag Menus 33/34	E, N	1-3	CF List *
P36.44	Approach Bias Low	0	–9999 Pulses to +9999 Pulses	E	1-3	P36.44+P36.45 forms the value for Datum bias.
P36.45	Approach Bias High	0	–9999 x10k Pulses to +9999 x10k Pulses	E	1-3	P36.44+P36.45 forms the value for Datum bias.
P36.46	CF90: Uni-directional Approach Enable	0.000 CLEARED	See Control Flag Menus 33/34	E, N	1-3	CF List *
P36.47	Incher Step UP Low	0	–9999 Pulses to +9999 Pulses	E	1-3	P36.47+P36.48 forms the value for Incher Step UP.
P36.48	Incher Step UP High	0	–9999 x10k Pulses to +9999 x10k Pulses	E	1-3	P36.47+P36.48 forms the value for Incher Step UP.
P36.49	Incher Step DOWN Low	0	–9999 Pulses to +9999 Pulses	E	1-3	P36.49+P36.50 forms the value for Incher Step Down.
P36.50	Incher Step DOWN High	0	–9999 x10k Pulses to +9999 x10k Pulses	E	1-3	P36.49+P36.50 forms the value for Incher Step Down.
P36.51	CF89: Enable Inching	0.000 CLEARED	See Control Flag Menus 33/34	E, N	1-3	CF List *
P36.52	CF95: Inching UP	0.000 CLEARED	See Control Flag Menus 33/34	E, N	1-3	CF List *
P36.53	CF96: Inching DOWN	0.000 CLEARED	See Control Flag Menus 33/34	E, N	1-3	CF List *
P36.54	Position Monitor Tolerance Low	50	0 Pulses to 9999 Pulses	E	1-3	P36.54+P36.55 forms the value for Position Monitor Tolerance.
P36.55	Position Monitor Tolerance High	0	0x10k Pulses to 9999x10k Pulses	E	1-3	P36.54+P36.55 forms the value for Position Monitor Tolerance.

5.4.36 Menu 37 – Position Reference Settings

NOTE: Parameters in this table are described in Section 6.37 and Control Flags in Section 5.4.75 where marked CF List *.

Par No.	Function	Default	Range	Attrib	Mode No. †	Comments
P37.00	Position Reference Source 1	1	1 = Fixed Posn Ref Menu 2 = Analogue Input 1 3 = Analogue Input 2 4 = Fixed 0% (Not used) 5 = Fixed 0% (Not used) 6 = RS485 Double Word 7 = RS232 Double Word 8 = RS485 REF1 (0.01%) 9 = RS485 REF2 (0.01%) 10 = RS232 REF1 (0.01%) 11 = RS232 REF2 (0.01%) 12 = PID Controller (0.01%) 13 = Motorised Pot (0.01%) 14 = Pointer 16 15 = Double Pointer (Pointer 16 = Lo, Pointer 17 = Hi)	E,N,L	1-3	
P37.01	Position Reference Source 2	4	1 to 15 (see P37.00)	E,N,L	1-3	
P37.02	Backup Position Reference	0	0 = No Backup 1 to 15 (see P37.00)	E,N,L	1-3	
P37.03	CF88: Position Reference 1/2 Selection	0.000 CLEARED	See Control Flag Menus 33/34	E,N	1-3	CF List *
P37.04	Position to Learn	0	0 to 15	E,N	1-3	
P37.05	CF101: Position Learn NOW	0.000 CLEARED	See Control Flag Menus 33/34	E,N	1-3	CF List *
P37.06	Fixed Position Reference #0 Low	0	-9999 Pulses to 9999 Pulses	E	1-3	P37.06+P37.07 forms the value for Position Reference #0.
P37.07	Fixed Position Reference #0 High	0	–9999 x10k Pulses to +9999 x10k Pulses	E	1-3	P37.06+P37.07 forms the value for Position Reference #0.
P37.08 to P37.37	Fixed Position Reference #1 to Fixed Position Reference #15, Low/ High	0	–9999 Pulses to +9999 Pulses –9999 x10k Pulses to +9999 x10k Pulses	E	1-3	
P37.38	CF91: Position Reference Select 0	0.000 CLEARED	See Control Flag Menus 33/34	E,N	1-3	CF List *
P37.39	CF92: Position Reference Select 1	0.000 CLEARED	See Control Flag Menus 33/34	E,N	1-3	CF List *
P37.40	CF93: Position Reference Select 2	0.000 CLEARED	See Control Flag Menus 33/34	E,N	1-3	CF List *
P37.41	CF94: Position Reference Select 3	0.000 CLEARED	See Control Flag Menus 33/34	E,N	1-3	CF List *

5.4.37 Menu 38 – Position Control Monitor

NOTE: Parameters in this table are described in Section 6.38.

Par No.	Function	Default	Range	Attrib	Mode No. †	Comments
P38.00	Position Reference Low	0	–9999 Pulses to +9999 Pulses	R	1-3	P38.00+P38.01 forms the value for Position Reference.
P38.01	Position Reference High	0	–9999 x10k Pulses to +9999 x10k Pulses	R	1-3	P38.00+P38.01 forms the value for Position Reference.
P38.02	Position Feedback Low	0	–9999 Pulses to +9999 Pulses	R	1-3	P38.02+P38.03 forms the value for Position Feedback.
P38.03	Position Feedback High	0	–9999 x10k Pulses to +9999 x10k Pulses	R	1-3	P38.02+P38.03 forms the value for Position Feedback.
P38.04	Position Error Low	0	–9999 Pulses to +9999 Pulses	R	1-3	P38.04+P38.05 forms the value for Position Error.
P38.05	Position Error High	0	–9999 x10k Pulses to +9999 x10k Pulses	R	1-3	P38.04+P38.05 forms the value for Position Error.
P38.06	Position Reference	0.00	–100.00 % to +100.00 %	R	1-3	
P38.07	Position Feedback	0.00	–100.00 % to +100.00 %	R	1-3	
P38.08	Position Error (%)	0.00	–100.00 % to +100.00 %	R	1-3	
P38.09	Position Status Word 0	0000h	0000h to FFFFh (Also shown in Binary)	R	1-3	
P38.10	Position Control Flags 0	0000h	0000h to FFFFh (Also shown in Binary)	R	1-3	
P38.11	Position Control Flags 1	0000h	0000h to FFFFh (Also shown in Binary)	R	1-3	
P38.12	Position Control Output	0.00	–100.00% to +100.00%	R	1-3	

NOTE: †: For operation with any of these Mode Numbers an encoder is required.

5.4.38 Menu 39 – User Configurable Menu (Menu 1) Settings

NOTE: Parameters in this table are described in Section 6.39.

Par No.	Function	Default Modes 0-3	Default Mode 4	Range	Attrib	Comments
P39.00	User Menu Element 0	9.00	50.00	1.00 to 99.99 (0 = No Parameter)	E,N	Any Parameter
P39.01	User Menu Element 1	9.01	51.00	1.00 to 99.99 (0 = No Parameter)	E,N	Any Parameter
P39.02	User Menu Element 2	9.05	51.01	1.00 to 99.99 (0 = No Parameter)	E,N	Any Parameter
P39.03	User Menu Element 3	9.09	51.03	1.00 to 99.99 (0 = No Parameter)	E,N	Any Parameter
P39.04	User Menu Element 4	9.07	51.04	1.00 to 99.99 (0 = No Parameter)	E,N	Any Parameter

NOTE: Parameters in this table are described in Section 6.39.

Par No.	Function	Default Modes 0-3	Default Mode 4	Range	Attrib	Comments
P39.05	User Menu Element 5	9.08	51.06	1.00 to 99.99 (0 = No Parameter)	E,N	Any Parameter
P39.06	User Menu Element 6	10.00	10.00	1.00 to 99.99 (0 = No Parameter)	E,N	Any Parameter
P39.07	User Menu Element 7	10.10	10.10	1.00 to 99.99 (0 = No Parameter)	E,N	Any Parameter
P39.08	User Menu Element 8	10.11	10.11	1.00 to 99.99 (0 = No Parameter)	E,N	Any Parameter
P39.09	User Menu Element 9	99.10	99.10	1.00 to 99.99 (0 = No Parameter)	E,N	Any Parameter
P39.10	User Menu Element 10	2.01	50.01	1.00 to 99.99 (0 = No Parameter)	E,N	Any Parameter
P39.11	User Menu Element 11	2.00	50.02	1.00 to 99.99 (0 = No Parameter)	E,N	Any Parameter
P39.12	User Menu Element 12	2.02	50.03	1.00 to 99.99 (0 = No Parameter)	E,N	Any Parameter
P39.13	User Menu Element 13	2.04	50.04	1.00 to 99.99 (0 = No Parameter)	E,N	Any Parameter
P39.14	User Menu Element 14	2.05	52.08	1.00 to 99.99 (0 = No Parameter)	E,N	Any Parameter
P39.15	User Menu Element 15	5.15	52.09	1.00 to 99.99 (0 = No Parameter)	E,N	Any Parameter
P39.16	User Menu Element 16	5.16	52.10	1.00 to 99.99 (0 = No Parameter)	E,N	Any Parameter
P39.17	User Menu Element 17	5.17	52.11	1.00 to 99.99 (0 = No Parameter)	E,N	Any Parameter
P39.18	User Menu Element 18	5.18	53.03	1.00 to 99.99 (0 = No Parameter)	E,N	Any Parameter
P39.19	User Menu Element 19	3.00	51.10	1.00 to 99.99 (0 = No Parameter)	E,N	Any Parameter
P39.20	User Menu Element 20	3.01	51.13	1.00 to 99.99 (0 = No Parameter)	E,N	Any Parameter
P39.21	User Menu Element 21	3.31	7.27	1.00 to 99.99 (0 = No Parameter)	E,N	Any Parameter
P39.22	User Menu Element 22	6.00	7.28	1.00 to 99.99 (0 = No Parameter)	E,N	Any Parameter
P39.23	User Menu Element 23	6.02	7.29	1.00 to 99.99 (0 = No Parameter)	E,N	Any Parameter
P39.24	User Menu Element 24	4.00	33.00	1.00 to 99.99 (0 = No Parameter)	E,N	Any Parameter
P39.25	User Menu Element 25	4.07	33.01	1.00 to 99.99 (0 = No Parameter)	E,N	Any Parameter
P39.26	User Menu Element 26	3.05	34.16	1.00 to 99.99 (0 = No Parameter)	E,N	Any Parameter
P39.27	User Menu Element 27	99.05	99.05	1.00 to 99.99 (0 = No Parameter)	E,N	Any Parameter
P39.28	User Menu Element 28	4.12	99.11	1.00 to 99.99 (0 = No Parameter)	E,N	Any Parameter
P39.29	User Menu Element 29	99.02	99.02	1.00 to 99.99 (0 = No Parameter)	E,N	Any Parameter
P39.30	User Menu Element 30	99.00	99.00	1.00 to 99.99 (0 = No Parameter)	E,N	Any Parameter

5.4.39 Menu 40 – Summing Nodes Settings

NOTE: Parameters in this table are described in Section 0 and Control Flags in Section 5.4.75 where marked CF List *.

Par No.	Function	Default	Range	Attrib	Mode No.	Comments
P40.00	Summing Node A Input 1	9.01	1.00 to 99.99	E,N	0-4	Any Parameter
P40.01	Summing Node A Input 2	9.01	1.00 to 99.99	E,N	0-4	Any Parameter
P40.02	Summing Node A Scale 1	100.00	–300.00 to +300.00	E	0-4	
P40.03	Summing Node A Scale 2	100.00	–300.00 to +300.00	E	0-4	
P40.04	Summing Node A Output	0.00	–100.00 to +100.00	R	0-4	
P40.05	Summing Node B Input 1	9.01	1.00 to 99.99	E,N	0-4	Any Parameter
P40.06	Summing Node B Input 2	9.01	1.00 to 99.99	E,N	0-4	Any Parameter
P40.07	Summing Node B Scale 1	100.00	–300.00 to +300.00	E	0-4	
P40.08	Summing Node B Scale 2	100.00	–300.00 to +300.00	E	0-4	
P40.09	Summing Node B Output	0.00	–100.00 to +100.00	R	0-4	
P40.10	Summing Node C Input 1	9.01	1.00 to 99.99	E,N	0-4	Any Parameter
P40.11	Summing Node C Input 2	9.01	1.00 to 99.99	E,N	0-4	Any Parameter
P40.12	Summing Node C Scale 1	100.00	–300.00 to +300.00	E	0-4	
P40.13	Summing Node C Scale 2	100.00	–300.00 to +300.00	E	0-4	
P40.14	Summing Node C Output	0.00	–100.00 to +100.00	R	0-4	
P40.15	Summing Node D Input 1	9.01	1.00 to 99.99	E,N	0-4	Any Parameter
P40.16	Summing Node D Input 2	9.01	1.00 to 99.99	E,N	0-4	Any Parameter
P40.17	Summing Node D Scale 1	100.00	–300.00 to +300.00	E	0-4	
P40.18	Summing Node D Scale 2	100.00	–300.00 to +300.00	E	0-4	
P40.19	Summing Node D Output	0.00	–100.00 to +100.00	R	0-4	
P40.20	Summing Node A Mode	1	1 = Add I/P 1 + I/P 2 2 = Sub I/P 1 - I/P 2 3 = Mult I/P 1 * I/P 2 4 = Div I/P 1 / I/P 2	E,N,L	0-4	
P40.21	Summing Node B Mode	1	1 = Add I/P 1 + I/P 2 2 = Sub I/P 1 - I/P 2 3 = Mult I/P 1 * I/P 2 4 = Div I/P 1 / I/P 2	E,N,L	0-4	
P40.22	Summing Node C Mode	1	1 = Add I/P 1 + I/P 2 2 = Sub I/P 1 - I/P 2 3 = Mult I/P 1 * I/P 2 4 = Div I/P 1 / I/P 2	E,N,L	0-4	
P40.23	Summing Node D Mode	1	1 = Add I/P 1 + I/P 2 2 = Sub I/P 1 - I/P 2 3 = Mult I/P 1 * I/P 2 4 = Div I/P 1 / I/P 2	E,N,L	0-4	
P40.24	Summing Node E Input 1	9.01	1.00 to 99.99	E,N	0-4	Any Parameter
P40.25	Summing Node E Input 2	9.01	1.00 to 99.99	E,N	0-4	Any Parameter
P40.26	Summing Node E Scale 1	100.00	–300.00 to +300.00	E	0-4	
P40.27	Summing Node E Scale 2	100.00	–300.00 to +300.00	E	0-4	
P40.28	Summing Node E Output	0.00	–100.00 to +100.00	R	0-4	
P40.29	Summing Node F Input 1	9.01	1.00 to 99.99	E,N	0-4	Any Parameter
P40.30	Summing Node F Input 2	9.01	1.00 to 99.99	E,N	0-4	Any Parameter
P40.31	Summing Node F Scale 1	100.00	–300.00 to +300.00	E	0-4	
P40.32	Summing Node F Scale 2	100.00	–300.00 to +300.00	E	0-4	

NOTE: Parameters in this table are described in Section 0 and Control Flags in Section 5.4.75 where marked CF List *.

Par No.	Function	Default	Range	Attrib	Mode No.	Comments
P40.33	Summing Node F Output	0.00	–100.00 to +100.00	R	0-4	
P40.34	Summing Node G Input 1	9.01	1.00 to 99.99	E,N	0-4	Any Parameter
P40.35	Summing Node G Input 2	9.01	1.00 to 99.99	E,N	0-4	Any Parameter
P40.36	Summing Node G Scale 1	100.00	–300.00 to +300.00	E	0-4	
P40.37	Summing Node G Scale 2	100.00	–300.00 to +300.00	E	0-4	
P40.38	Summing Node G Output	0.00	–100.00 to +100.00	R	0-4	
P40.39	Summing Node H Input 1	9.01	1.00 to 99.99	E,N	0-4	Any Parameter
P40.40	Summing Node H Input 2	9.01	1.00 to 99.99	E,N	0-4	Any Parameter
P40.41	Summing Node H Scale 1	100.00	–300.00 to +300.00	E	0-4	
P40.42	Summing Node H Scale 2	100.00	–300.00 to +300.00	E	0-4	
P40.43	Summing Node H Output	0.00	–100.00 to +100.00	R	0-4	
P40.44	Summing Node E Mode	1	1 = Add I/P 1 + I/P 2 2 = Sub I/P 1 - I/P 2 3 = Mult I/P 1 * I/P 2 4 = Div I/P 1 / I/P 2	E,N,L	0-4	
P40.45	Summing Node F Mode	1	1 = Add I/P 1 + I/P 2 2 = Sub I/P 1 - I/P 2 3 = Mult I/P 1 * I/P 2 4 = Div I/P 1 / I/P 2	E,N,L	0-4	
P40.46	Summing Node G Mode	1	1 = Add I/P 1 + I/P 2 2 = Sub I/P 1 - I/P 2 3 = Mult I/P 1 * I/P 2 4 = Div I/P 1 / I/P 2	E,N,L	0-4	
P40.47	Summing Node H Mode	1	1 = Add I/P 1 + I/P 2 2 = Sub I/P 1 -I/P 2 3 = Mult I/P 1 * I/P 2 4 = Div /P 1 / I/P 2	E,N,L	0-4	
P40.48	Square Root A Input	1.00	1.00 to 99.99	E,N	0-4	Any Parameter
P40.49	Square Root of A	Monitor	As Input A parameter	R	0-4	
P40.50	Square Root B Input	1.00	1.00 to 99.99	E,N	0-4	Any Parameter
P40.51	Square Root of B	Monitor	As Input B parameter	R	0-4	
P40.52	Comparator U Input 1	1.00	1.00 to 99.99	E,N	0-4	Any Parameter
P40.53	Comparator U Input 2	40.54	1.00 to 99.99	E,N	0-4	Any Parameter
P40.54	Fixed Reference Comparator U	0	As Comparator U Input 1Parameter	E	0-4	
P40.55	Comparator U Hysteresis	0	As Comparator U Input 1 Parameter	E	0-4	
P40.56	Comparator U Mode	1	1 = 'Input 1 = Input 2' 2 = 'Input 1 <> Input 2' 3 = 'Input 1 > Input 2' 4 = 'Input 1 <= Input 2' 5 = 'Input 1 < Input 2' 6 = 'Input 1 >= Input 2'	E,N,L	0-4	
P40.57	Comparator U Output	Monitor	As Comparator U Input 1Parameter	R		
P40.58	Comparator V Input 1	1.00	1.00 to 99.99	E,N	0-4	Any Parameter
P40.59	Comparator V Input 2	40.60	1.00 to 99.99	E,N	0-4	Any Parameter
P40.60	Fixed Reference Comparator V	0	As Comparator V Input 1Parameter	E	0-4	

NOTE: Parameters in this table are described in Section 0 and Control Flags in Section 5.4.75 where marked CF List *.

Par No.	Function	Default	Range	Attrib	Mode No.	Comments
P40.61	Comparator V Hysteresis	0	As Comparator V Input 1Parameter	E	0-4	
P40.62	Comparator V Mode	1	1 = 'Input 1 = Input 2' 2 = 'Input 1 <> Input 2' 3 = 'Input 1 > Input 2' 4 = 'Input 1 <= Input 2' 5 = 'Input 1 < Input 2' 6 = 'Input 1 >= Input 2'	E,N,L	0-4	
P40.63	Comparator V Output	Monitor	As Comparator V Input 1Parameter	R		
P40.64	Comparator W Input 1	1.00	1.00 to 99.99	E,N	0-4	Any Parameter
P40.65	Comparator W Input 2	40.66	1.00 to 99.99	E,N	0-4	Any Parameter
P40.66	Fixed Reference Comparator W	0	As Comparator W Input 1Parameter	E	0-4	
P40.67	Comparator W Hysteresis	0	As Comparator W Input 1 Parameter	E	0-4	
P40.68	Comparator W Mode	1	1 = 'Input 1 = Input 2' 2 = 'Input 1 <> Input 2' 3 = 'Input 1 > Input 2' 4 = 'Input 1 <= Input 2' 5 = 'Input 1 < Input 2' 6 = 'Input 1 >= Input 2'	E,N,L	0-4	
P40.69	Comparator W Output	Monitor	As Comparator W Input 1 Parameter	R		
P40.70	Comparator X Input 1	1.00	1.00 to 99.99	E,N	0-4	Any Parameter
P40.71	Comparator X Input 2	40.72	1.00 to 99.99	E,N	0-4	Any Parameter
P40.72	Fixed Reference Comparator X	0	As Comparator X Input 1 Parameter	E	0-4	
P40.73	Comparator X Hysteresis	0	As Comparator X Input 1Parameter	E	0-4	
P40.74	Comparator X Mode	1	1 = 'Input 1 = Input 2' 2 = 'Input 1 <> Input 2' 3 = 'Input 1 > Input 2' 4 = 'Input 1 <= Input 2' 5 = 'Input 1 < Input 2' 6 = 'Input 1 >= Input 2'	E,N,L	0-4	
P40.75	Comparator X Output	Monitor	As Comparator X Input 1Parameter	R		
P40.76	Switch A Input 1	40.78	1.00 to 99.99	E,N	0-4	Any Parameter
P40.77	Switch A Input 2	40.79	1.00 to 99.99	E,N	0-4	Any Parameter
P40.78	Fixed Value A1	0.00	-300.00 to 300.00	E	0-4	
P40.79	Fixed Value A2	0.00	-300.00 to 300.00	E	0-4	
P40.80	CF140: Switch A State	0	See Control Flag Menus 33/34	E,N	0-4	0 selects Input 1 1 selects Input 2
P40.81	Switch A Output	Monitor	As Switch A Input Parameter 1	R		
P40.82	Switch B Input 1	40.84	1.00 to 99.99	E,N	0-4	Any Parameter
P40.83	Switch B Input 2	40.85	1.00 to 99.99	E,N	0-4	Any Parameter
P40.84	Fixed Value B1	0.00	-300.00 to 300.00	E	0-4	
P40.85	Fixed Value B2	0.00	-300.00 to 300.00	E	0-4	

NOTE: Parameters in this table are described in Section 0 and Control Flags in Section 5.4.75 where marked CF List *.

Par No.	Function	Default	Range	Attrib	Mode No.	Comments
P40.86	CF141: Switch B State	0	See Control Flag Menus 33/34	E,N	0-4	0 selects Input 1 1 selects Input 2
P40.87	Switch B Output	Monitor	As Switch B Input Parameter 1	R		
P40.88	Switch C Input 1	40.90	1.00 to 99.99	E,N	0-4	Any Parameter
P40.89	Switch C Input 2	40.91	1.00 to 99.99	E,N	0-4	Any Parameter
P40.90	Fixed Value C1	0.00	-300.00 to 300.00	E	0-4	
P40.91	Fixed Value C2	0.00	-300.00 to 300.00	E	0-4	
P40.92	CF142: Switch C State	0	See Control Flag Menus 33/34	E,N	0-4	0 selects Input 1 1 selects Input 2
P40.93	Switch C Output	Monitor	As Switch C Input Parameter 1	R		
P40.94	Switch D Input 1	40.96	1.00 to 99.99	E,N	0-4	Any Parameter
P40.95	Switch D Input 2	40.97	1.00 to 99.99	E,N	0-4	Any Parameter
P40.96	Fixed Value D1	0.00	-300.00 to 300.00	E	0-4	
P40.97	Fixed Value D2	0.00	-300.00 to 300.00	E	0-4	
P40.98	CF143: Switch D State	0	See Control Flag Menus 33/34	E,N	0-4	0 selects Input 1 1 selects Input 2
P40.99	Switch D Output	Monitor	As Switch D Input Parameter 1	R		

5.4.40 Menu 41 – Programmable Status Words Settings

NOTE: Parameters in this table are described in Section 6.41.

Par No.	Function	Default	Range	Attrib	Mode No.	Comments
P41.00 to P41.15	Programmable Status Word 0 Bit 0 Source to Programmable Status Word 0 Bit 15 Source	0.000 CLEARED	Allowed selections as per Control Flag Menus 33/34	E,N	0-4	
P41.16 to P41.31	Programmable Status Word 1 Bit 0 Source to Programmable Status Word 1 Bit 15 Source	0.000 CLEARED	Allowed selections as per Control Flag Menus 33/34	E,N	0-4	
P41.32	Programmable Status Word 0	0000h	0000h to FFFFh (Also shown in Binary)	R	0-4	
P41.33	Programmable Status Word 1	0000h	0000h to FFFFh (Also shown in Binary)	R	0-4	

5.4.41 Menu 42 – Reference Pointers – Source Settings

NOTE: Parameters in this table are described in Section 6.42.

Par No.	Function	Default	Range	Attrib	Mode No.	Comments
P42.00 to P42.38	Pointer 1 Source to Pointer 20 Source	1.00	1.00 to 99.99	E,N	0-4	Any Parameter
P42.01 to P42.39	Pointer 1 Scale to Pointer 20 Scale	100.00	–300.00 to +300.00	E	0-4	Any Parameter
P42.40 to P42.52	Pointer 21 Source to Pointer 27 Source	1.00	1.00 to 99.99	E,N	4	For SFE Mode
P42.41 to P42.53	Pointer 21 Scale to Pointer 27 Scale	100.00	–300.00 to +300.00	E	4	For SFE Mode
P42.54	Pointer 28 Source	1.00	1.00 to 99.99	E,N	0-4	For DB Mode
P42.55	Pointer 28 Scale	100.00	-300.00 to +300.00	E	0-4	For DB Mode
P42.56 to P42.74	Pointer 29 Source to Pointe 38 Source	1.00	1.00 to 99.99	E,N	0-4	
P42.57 to P42.75	Pointer 29 Scale to Pointer 38 Scale	100.00	-300.00 to +300.00	E	0-4	

5.4.42 Menu 43 – Load Fault Detection Window Settings

NOTE: Parameters in this table are described in Section 6.43.

Par No.	Function	Default	Range	Attrib	Mode No.	Comments
P43.00	Load Fault Action	0	0 = No Action (Status Flags 60 & 61 are still active) 1 = Warning 2 = Trip	E,N,L	1-3	
P43.01	Load Fault Input	1	1 = Drive Current 2 = Torque Demand	E,N,L	1-3	
P43.02	Load Fault Time	10	1s to 100s	E	1-3	
P43.03	Forward Speed 1	10.00	1.00 % to 100.00 %	E	1-3	
P43.04	Forward Maximum Load 1	100.00	1.00 % to 300.00 %	E	1-3	
P43.05	Forward Minimum Load 1	1.00	1.00 % to 300.00 %	E	1-3	
P43.06	Forward Speed 2	10.00	1.00 % to 100.00 %	E	1-3	
P43.07	Forward Maximum Load 2	100.00	1.00 % to 300.00 %	E	1-3	
P43.08	Forward Minimum Load 2	1.00	1.00 % to 300.00 %	E	1-3	
P43.09	Forward Speed 3	10.00	1.00 % to 100.00 %	E	1-3	
P43.10	Forward Maximum Load 3	100.00	1.00 % to 300.00 %	E	1-3	
P43.11	Forward Minimum Load 3	1.00	1.00 % to 300.00 %	E	1-3	
P43.12	Reverse Speed 1	10.00	1.00 % to 100.00 %	E	1-3	
P43.13	Reverse Maximum Load 1	100.00	1.00 % to 300.00 %	E	1-3	
P43.14	Reverse Minimum Load 1	1.00	1.00 % to 300.00 %	E	1-3	
P43.15	Reverse Speed 2	10.00	1.00 % to 100.00 %	E	1-3	
P43.16	Reverse Maximum Load 2	100.00	1.00 % to 300.00 %	E	1-3	
P43.17	Reverse Minimum Load 2	1.00	1.00 % to 300.00 %	E	1-3	
P43.18	Reverse Speed 3	10.00	1.00 % to 100.00 %	E	1-3	
P43.19	Reverse Maximum Load 3	100.00	1.00 % to 300.00 %	E	1-3	
P43.20	Reverse Minimum Load 3	1.00	1.00 % to 300.00 %	E	1-3	

5.4.43 Menu 44 – Reference Shaper Settings

NOTE: Parameters in this table are described in Section 6.44.

Par No.	Function	Default	Range	Attrib	Mode No.	Comments
P44.00	Reference Shaper X1	–100.00	–100.00 % to +100.00 %	E	0-4	
P44.01	Reference Shaper Y1	–100.00	–100.00 % to +100.00 %	E	0-4	
P44.02	Reference Shaper X2	–80.00	–100.00 % to +100.00 %	E	0-4	
P44.03	Reference Shaper Y2	–80.00	–100.00 % to +100.00 %	E	0-4	
P44.04	Reference Shaper X3	–60.00	–100.00 % to +100.00 %	E	0-4	
P44.05	Reference Shaper Y3	–60.00	–100.00 % to +100.00 %	E	0-4	
P44.06	Reference Shaper X4	–40.00	–100.00 % to +100.00 %	E	0-4	
P44.07	Reference Shaper Y4	–40.00	–100.00 % to +100.00 %	E	0-4	
P44.08	Reference Shaper X5	–20.00	–100.00 % to +100.00 %	E	0-4	
P44.09	Reference Shaper Y5	–20.00	–100.00 % to +100.00 %	E	0-4	
P44.10	Reference Shaper X6	20.00	–100.00 % to +100.00 %	E	0-4	
P44.11	Reference Shaper Y6	20.00	–100.00 % to +100.00 %	E	0-4	
P44.12	Reference Shaper X7	40.00	–100.00 % to +100.00 %	E	0-4	
P44.13	Reference Shaper Y7	40.00	–100.00 % to +100.00 %	E	0-4	
P44.14	Reference Shaper X8	60.00	–100.00 % to +100.00 %	E	0-4	
P44.15	Reference Shaper Y8	60.00	–100.00 % to 100.00 %	E	0-4	
P44.16	Reference Shaper X9	80.00	–100.00 % to +100.00 %	E	0-4	
P44.17	Reference Shaper Y9	80.00	–100.00 % to +100.00 %	E	0-4	
P44.18	Reference Shaper X10	100.00	–100.00 % to +100.00 %	E	0-4	
P44.19	Reference Shaper Y10	100.00	–100.00 % to +100.00 %	E	0-4	
P44.20	Reference Shaper O/P	0.00	–100.00 % to +100.00 %	R	0-4	

5.4.44 Menu 45 – Temperature

NOTE: Parameters in this table are described in Section 6.45.

Par No.	Function	Default	Range	Attrib	Mode No.	Comments
P45.00	IGBT U1 Temperature	0	-40 °C to 150 °C	R	0-4	
P45.01	IGBT V1 Temperature	0	-40 °C to 150 °C	R	0-4	
P45.02	IGBT W1 Temperature	0	-40 °C to 150 °C	R	0-4	
P45.03	Rectifier 1 Temperature	0	-40 °C to 150 °C	R	0-3	
P45.04	Rectifier 2 Temperature	0	-40 °C to 150 °C	R	0-3	
P45.05	DB 1 Temperature	0	-40 °C to 150 °C	R	0-4	
P45.06	DB 2 Temperature	0	-40 °C to 150 °C	R	0-4	
P45.07	IGBT U2 Temperature	0	-40 °C to 150 °C	R	0-4	
P45.08	IGBT V2 Temperature	0	-40 °C to 150 °C	R	0-4	
P45.09	IGBT W2 Temperature	0	-40 °C to 150 °C	R	0-4	
P45.10	IGBT U3 Temperature	0	-40 °C to 150 °C	R	0-4	
P45.11	IGBT V3 Temperature	0	-40 °C to 150 °C	R	0-4	
P45.12	IGBT W3 Temperature	0	-40 °C to 150 °C	R	0-4	

NOTE: Parameters in this table are described in Section 6.45.

Par No.	Function	Default	Range	Attrib	Mode No.	Comments
P45.13	IGBT U4 Temperature	0	-40 °C to 150 °C	R	0-4	
P45.14	IGBT V4 Temperature	0	-40 °C to 150 °C	R	0-4	
P45.15	IGBT W4 Temperature	0	-40 °C to 150 °C	R	0-4	
P45.16	IGBT U5 Temperature	0	-40 °C to 150 °C	R	0-4	
P45.17	IGBT V5 Temperature	0	-40 °C to 150 °C	R	0-4	
P45.18	IGBT W5 Temperature	0	-40 °C to 150 °C	R	0-4	
P45.19	IGBT U6 Temperature	0	-40 °C to 150 °C	R	0-4	
P45.20	IGBT V6 Temperature	0	-40 °C to 150 °C	R	0-4	
P45.21	IGBT W6 Temperature	0	-40 °C to 150 °C	R	0-4	
P45.22	Temperature Warn/Trip Type	0	0 to 4 States 0 = None 1 = Over Temperature 2 = Under Temperature 3 = Rate of Temp. Rise 4 = Junction Temperature	R	0-4	
P45.23	Temperature Warn/Trip Cause	0	0 to 23 0 = None 1 = I/P 1 2 = I/P2 3 = O/P U1 4 = O/P V1 5 = O/P W1 6 = DB 1 7 = O/P U2 8 = O/P V2 9 = O/P W2 10 = O/P U3 11 = O/P V3 12 = O/P W3 13 = DB 2 14 = O/P U4 15 = O/P V4 16 = O/P W4 17 = O/P U5 18 = O/P V5 19 = O/P W5 20 = O/P U6 21 = O/P V6 22 = O/P W6 23 = ELECTRONICS	R	0-4	
P45.24	Temperature at Warn/Trip	0	-40 °C to 150 °C	R	0-4	
P45.25	IGBT Silicon Temperature		0 to 100% of Tj max	R	1-4	Only active when P35.17 is enabled
P45.26	Free Wheel Diode Silicon Temperature		0 to 100% of Tj max	R	1-4	Only active when P35.17 is enabled
P45.27	Maximum Silicon Temperature		0 to 100% of Tj max	R	1-4	Only active when P35.17 is enabled

5.4.45 Menu 46 – AC Loss Ridethrough (Vector Control Only)

NOTE: Parameters in this table are described in Section 6.46.

Par No	Function	Default	Range	Attrib	Mode no.	Comment
P46.00	AC Loss Ridethrough Enable	0	0 =disable 1 = enable	E,N,L	2	
P46.01	Nominal Mains Voltage	Drive size dependent	300 to 900V	S,E	2	
P46.02	Mains Voltage Scaling	100	10 to 1000%	E	2	
P46.03	Vrms mains	Monitor	300 to 900V	R	2	Only used in Ridethrough if MVM is fitted.
P46.04	Mains Amplitude	Monitor	0.00 to 300.00%	R	2	Only used in Ridethrough if MVM is fitted.
P46.05	Ridethrough Threshold	80.00	0.00 to 100.00%	E	2	Only used in Ridethrough if MVM is fitted.
P46.06	Mains Filter Bandwidth	1	0 = 100Hz 1 = 200Hz 2 = 400Hz 4 = 800Hz	E,N,L	2	Only used in Ridethrough if MVM is fitted.
P46.07	Ridethrough Active	Monitor	0 = Not Active 1 = Active	R	2	
P46.08	Mains Loss Action	1	0 = Ignore 1 = Warning	S,E,L	2	
P46.09 to P46.19	Reserved					
P46.20	Vdc Controller Bandwidth	100	0 to 200rad/s	E	2	
P46.21	Vdc Controller Gains Auto-Manual	0	0 = Automatic 1 = Manual	L,E	2	
P46.22	DC Link Control Kp	Drive size dependent	0 to 16000	E	2	Automatically calculated when P46.21 = 0
P46.23	DC Link Control Ki	Drive size dependent	0 to 16000	E	2	Automatically calculated when P46.21 = 0

5.4.46 Menu 47 – Second Logic Menu

NOTE: Parameters in this table are described in Section 6.47 and Control Flags in Section 5.4.75 where marked CF List *.

Par No.	Function	Default	Range	Attrib	Mode No.	Comments
P47.00	Comparator I Input	9.01	1.00 to 99.99	E,N	0-4	Any Drive Parameter
P47.01	Comparator I Threshold	0	As Input Parameter	E	0-4	
P47.02	Comparator I Hysteresis	0	As Input Parameter	E	0-4	

NOTE: Parameters in this table are described in Section 6.47 and Control Flags in Section 5.4.75 where marked CF List *.

Par No.	Function	Default	Range	Attrib	Mode No.	Comments
P47.03	Comparator I Mode	1	1 = ‘Input = Threshold’ 2 = ‘Input <> Threshold’ 3 = ‘Input > Threshold’ (signed) 4 = ‘Input <= Threshold’ (signed) 5 = ‘Input < Threshold’ (signed) 6 = ‘input >= Threshold’ (signed) 7 to 10 as 3 to 6 but Absolute Value	E,N,L	0-4	
P47.04	Delay I Input Source	1	1 = From Comparator I 2 = From Control Flag	E,N,L	0-4	
P47.05	Delay I Time	0	0 to 600s	E		
P47.06	Logic Block I Function	1	1 = Three Input AND 2 = Three Input NAND 3 = Three Input OR 4 = Three Input NOR 5 = Three Input XOR 6 = Three Input XNOR 7 to 12 = Two Input versions of 1 to 6	E,N,L	0-4	CF145 and CF146 are inputs when TWO Input versions are chosen for Logic Block I
P47.07	CF144: Delay I Input	0.000 CLEARED	See Control Flag Menus 33/34	E,N		CF List *
P47.08	CF145: Logic Block I Input 1	0.000 CLEARED	See Control Flag Menus 33/34	E,N		CF List *
P47.09	CF146: Logic Block I Input 2	0.000 CLEARED	See Control Flag Menus 33/34	E,N		CF List *
P47.10	Comparator J Input	9.01	1.00 to 99.99	E,N	0-4	Any Drive Parameter
P47.11	Comparator J Threshold	0	As Input Parameter	E	0-4	
P47.12	Comparator J Hysteresis	0	As Input Parameter	E	0-4	
P47.13	Comparator J Mode	1	1 = ‘Input = Threshold’ 2 = ‘Input <> Threshold’ 3 = ‘Input > Threshold’ (signed) 4 = ‘Input <= Threshold’ (signed) 5 = ‘Input < Threshold’ (signed) 6 = ‘input >= Threshold’ (signed) 7 to 10 as 3 to 6 but Absolute Value	E,N,L	0-4	
P47.14	Delay J Input Source	1	1 = From Comparator J 2 = From Control Flag	E,N,L	0-4	
P47.15	Delay J Time	0	0 to 600s	E		

NOTE: Parameters in this table are described in Section 6.47 and Control Flags in Section 5.4.75 where marked CF List *.

Par No.	Function	Default	Range	Attrib	Mode No.	Comments
P47.16	Logic Block J Function	1	1 = Three Input AND 2 = Three Input NAND 3 = Three Input OR 4 = Three Input NOR 5 = Three Input XOR 6 = Three Input XNOR 7 to 12 = Two Input versions of 1 to 6	E,N,L	0-4	CF148 and CF149 are inputs when TWO Input versions are chosen for Logic Block I
P47.17	CF147: Delay J Input	0.000 CLEARED	See Control Flag Menus 33/34	E,N		CF List *
P47.18	CF148: Logic Block J Input 1	0.000 CLEARED	See Control Flag Menus 33/34	E,N		CF List *
P47.19	CF149: Logic Block J Input 2	0.000 CLEARED	See Control Flag Menus 33/34	E,N		CF List *
P47.20	Comparator K Input	9.01	1.00 to 99.99	E,N	0-4	Any Drive Parameter
P47.21	Comparator K Threshold	0	As Input Parameter	E	0-4	
P47.22	Comparator K Hysteresis	0	As Input Parameter	E	0-4	
P47.23	Comparator K Mode	1	1 = 'Input = Threshold' 2 = 'Input <> Threshold' 3 = 'Input > Threshold' (signed) 4 = 'Input <= Threshold' (signed) 5 = 'Input < Threshold' (signed) 6 = 'input >= Threshold' (signed) 7 to 10 as 3 to 6 but Absolute Value	E,N,L	0-4	
P47.24	Delay K Input Source	1	1 = From Comparator K 2 = From Control Flag	E,N,L	0-4	
P47.25	Delay K Time	0	0 to 600s	E		
P47.26	Logic Block K Function	1	1 = Three Input AND 2 = Three Input NAND 3 = Three Input OR 4 = Three Input NOR 5 = Three Input XOR 6 = Three Input XNOR 7 to 12 = Two Input versions of 1 to 6	E,N,L	0-4	CF151 and CF152 are inputs when TWO Input versions are chosen for Logic Block I
P47.27	CF150: Delay K Input	0.000 CLEARED	See Control Flag Menus 33/34	E,N		CF List *
P47.28	CF151: Logic Block K Input 1	0.000 CLEARED	See Control Flag Menus 33/34	E,N		CF List *
P47.29	CF152: Logic Block K Input 2	0.000 CLEARED	See Control Flag Menus 33/34	E,N		CF List *
P47.30	Comparator L Input	9.01	1.00 to 99.99	E,N	0-4	Any Drive Parameter
P47.31	Comparator L Threshold	0	As Input Parameter	E	0-4	
P47.32	Comparator L Hysteresis	0	As Input Parameter	E	0-4	

NOTE: Parameters in this table are described in Section 6.47 and Control Flags in Section 5.4.75 where marked CF List *.

Par No.	Function	Default	Range	Attrib	Mode No.	Comments
P47.33	Comparator L Mode	1	1 = 'Input = Threshold' 2 = 'Input <> Threshold' 3 = 'Input > Threshold' (signed) 4 = 'Input <= Threshold' (signed) 5 = 'Input < Threshold' (signed) 6 = 'input >= Threshold' (signed) 7 to 10 as 3 to 6 but Absolute Value	E,N,L	0-4	
P47.34	Delay L Input Source	1	1 = From Comparator L 2 = From Control Flag	E,N,L	0-4	
P47.35	Delay L Time	0	0 to 600s	E		
P47.36	Logic Block L Function	1	1 = Three Input AND 2 = Three Input NAND 3 = Three Input OR 4 = Three Input NOR 5 = Three Input XOR 6 = Three Input XNOR 7 to 12 = Two Input versions of 1 to 6	E,N,L	0-4	CF154 and CF155 are inputs when TWO Input versions are chosen for Logic Block I
P47.37	CF153: Delay L Input	0.000 CLEARED	See Control Flag Menus 33/34	E,N		CF List *
P47.38	CF154: Logic Block L Input 1	0.000 CLEARED	See Control Flag Menus 33/34	E,N		CF List *
P47.39	CF155: Logic Block L Input 2	0.000 CLEARED	See Control Flag Menus 33/34	E,N		CF List *
P47.40	Logic Block M Function	1	1 = AND 2 = NAND 3 = OR 4 = NOR 5 = XOR 6 = XNOR	E,N,L		
P47.41	CF156: Logic Block M Input 1	0.000 CLEARED	See Control Flag Menus 33/34	E,N		CF List *
P47.42	CF157: Logic Block M Input 2	0.000 CLEARED	See Control Flag Menus 33/34	E,N		CF List *
P47.43	CF158: Logic Block M Input 3	0.000 CLEARED	See Control Flag Menus 33/34	E,N		CF List *
P47.44	CF159: Logic Block M Input 4	0.000 CLEARED	See Control Flag Menus 33/34	E,N		CF List *
P47.45	Logic Block N Function	1	1 = AND 2 = NAND 3 = OR 4 = NOR 5 = XOR 6 = XNOR	E,N,L		
P47.46	CF160: Logic Block N Input 1	0.000 CLEARED	See Control Flag Menus 33/34	E,N		CF List *
P47.47	CF161: Logic Block N Input 2	0.000 CLEARED	See Control Flag Menus 33/34	E,N		CF List *
P47.48	CF162: Logic Block N Input 3	0.000 CLEARED	See Control Flag Menus 33/34	E,N		CF List *

NOTE: Parameters in this table are described in Section 6.47 and Control Flags in Section 5.4.75 where marked CF List *.

Par No.	Function	Default	Range	Attrib	Mode No.	Comments
P47.49	CF163: Logic Block N Input 4	0.000 CLEARED	See Control Flag Menus 33/34	E,N		CF List *
P47.50	Logic Block O Function	1	1 = AND 2 = NAND 3 = OR 4 = NOR 5 = XOR 6 = XNOR	E,N,L		
P47.51	CF164: Logic Block O Input 1	0.000 CLEARED	See Control Flag Menus 33/34	E,N		CF List *
P47.52	CF165: Logic Block O Input 2	0.000 CLEARED	See Control Flag Menus 33/34	E,N		CF List *
P47.53	CF166: Logic Block O Input 3	0.000 CLEARED	See Control Flag Menus 33/34	E,N		CF List *
P47.54	CF167: Logic Block O Input 4	0.000 CLEARED	See Control Flag Menus 33/34	E,N		CF List *
P47.55	Logic Block P Function	1	1 = AND 2 = NAND 3 = OR 4 = NOR 5 = XOR 6 = XNOR	E,N,L		
P47.56	CF168: Logic Block P Input 1	0.000 CLEARED	See Control Flag Menus 33/34	E,N		CF List *
P47.57	CF169: Logic Block P Input 2	0.000 CLEARED	See Control Flag Menus 33/34	E,N		CF List *
P47.58	CF170: Logic Block P Input 3	0.000 CLEARED	See Control Flag Menus 33/34	E,N		CF List *
P47.59	CF171: Logic Block P Input 4	0.000 CLEARED	See Control Flag Menus 33/34	E,N		CF List *
P47.60	Logic Block Q Function	1	1 = AND 2 = NAND 3 = OR 4 = NOR 5 = XOR 6 = XNOR	E,N,L		
P47.61	CF172: Logic Block Q Input 1	0.000 CLEARED	See Control Flag Menus 33/34	E,N		CF List *
P47.62	CF173: Logic Block Q Input 2	0.000 CLEARED	See Control Flag Menus 33/34	E,N		CF List *
P47.63	CF174: Logic Block Q Input 3	0.000 CLEARED	See Control Flag Menus 33/34	E,N		CF List *
P47.64	CF175: Logic Block Q Input 4	0.000 CLEARED	See Control Flag Menus 33/34	E,N		CF List *
P47.65	Logic Block R Function	1	1 = AND 2 = NAND 3 = OR 4 = NOR 5 = XOR 6 = XNOR	E,N,L		
P47.66	CF176: Logic Block R Input 1	0.000 CLEARED	See Control Flag Menus 33/34	E,N		CF List *
P47.67	CF177: Logic Block R Input 2	0.000 CLEARED	See Control Flag Menus 33/34	E,N		CF List *
P47.68	CF178: Logic Block R Input 3	0.000 CLEARED	See Control Flag Menus 33/34	E,N		CF List *

NOTE: Parameters in this table are described in Section 6.47 and Control Flags in Section 5.4.75 where marked CF List *.

Par No.	Function	Default	Range	Attrib	Mode No.	Comments
P47.69	CF179: Logic Block R Input 4	0.000 CLEARED	See Control Flag Menus 33/34	E,N		CF List *
P47.70	Logic Block S Function	1	1 = AND 2 = NAND 3 = OR 4 = NOR 5 = XOR 6 = XNOR	E,N,L		
P47.71	CF180: Logic Block S Input 1	0.000 CLEARED	See Control Flag Menus 33/34	E,N		CF List *
P47.72	CF181: Logic Block S Input 2	0.000 CLEARED	See Control Flag Menus 33/34	E,N		CF List *
P47.73	CF182: Logic Block S Input 3	0.000 CLEARED	See Control Flag Menus 33/34	E,N		CF List *
P47.74	CF183: Logic Block S Input 4	0.000 CLEARED	See Control Flag Menus 33/34	E,N		CF List *
P47.75	Logic Block T Function	1	1 = AND 2 = NAND 3 = OR 4 = NOR 5 = XOR 6 = XNOR	E,N,L		
P47.76	CF184: Logic Block T Input 1	0.000 CLEARED	See Control Flag Menus 33/34	E,N		CF List *
P47.77	CF185: Logic Block T Input 2	0.000 CLEARED	See Control Flag Menus 33/34	E,N		CF List *
P47.78	CF186: Logic Block T Input 3	0.000 CLEARED	See Control Flag Menus 33/34	E,N		CF List *
P47.79	CF187: Logic Block T Input 4	0.000 CLEARED	See Control Flag Menus 33/34	E,N		CF List *
P47.80	Enable Brake Function	0	0 = Disable 1 = Enable	E,N		**This brake control is for operational purposes only and must form part of the functional safety of the system. If application of the brakes is required for the functional safety of the system, then there must be a means of applying the brakes (and keeping them applied) independently of the MV3000e**
P47.81	CF188: Run Request	0.000 CLEARED	See Control Flag Menus 33/34	E,N		CF List *
P47.82	CF189: Brake Release Input	0.000 CLEARED	See Control Flag Menus 33/34	E,N		CF List *
P47.83	Torque Prove Threshold	10.0	As P11.00	E		
P47.84	Zero Speed Threshold	10.0	As P9.01	E		
P47.85	Torque Prove Time	5	0 to 600s	E		
P47.86	Release Reference Time	1	0 to 600s	E		
P47.87	Brake Hold Off Time	5	0 to 600s	E		

NOTE: Parameters in this table are described in Section 6.47 and Control Flags in Section 5.4.75 where marked CF List *.

Par No.	Function	Default	Range	Attrib	Mode No.	Comments
P47.88	Brake Release Time	1	0 to 600s	E		
P47.89	Start Reset Time	3	0 to 600s	E		
P47.90	Release Fail Time	1	0 to 600s	E		
P47.91	Preset Parameters	0	0 = Normal 1 = Default	S,E,L,C		

5.4.47 Menu 50 – Basic SFE Setup Menu

NOTE: Parameters in this table are described in Section 6.48.

Par No.	Function	Default	Range	Attrib	Mode No.	Comments
P50.00	DC Link Voltage Reference	Drive Size	550 V to 850 V or 700 V to 1100 V or 700 V to 1140 V	E	4	The DC link voltage to be controlled
P50.01	Line Choke Inductance	Drive Size	30 μH to 10 000 μH	E,N	4	Line choke inductance, per phase
P50.02	DC Fed Drives Rating	100 %	0 % to 10 000 % (SFE rating)	E	4	See below
P50.03	Active Current Pos Limit	110.00 %	0.00 % to 150.00 % (SFE nom current)	E	4	See below
P50.04	Active Current Neg Limit	110.00 %	0.00 % to 150.00 % (SFE nom current)	E	4	See below
P50.05	CF0: Normal Stop	1.001 Dig In 1	As P33.00	E,N	4	Copy of P33.00
P50.06	CF1: Start	1.002 Dig In 2	As P33.01	E,N	4	Copy of P33.01
P50.07	CF25: Output Enable	1.003 Dig In 3	As P33.25	E,N	4	Copy of P33.25
P50.08	CF116: Keypad/ Remote	1.004 Dig In 4	As P34.16	E,N	4	Copy of P34.16
P50.09	Nominal Mains Voltage	400	300 to 900V	S,E	4	

5.4.48 Menu 51 – Basic SFE Monitoring Menu

NOTE: Parameters in this table are described in Section 6.49.

Par No.	Function	Default	Range	Attrib	Mode No.	Comments
P51.00	DC Link Voltage	0	0V to 30 000V	R	4	Copy of P11.03
P51.01	Current Feedback (A)	0	0.0A to 9999.0A	R	4	
P51.02	Current Feedback (%)	0	0.0% to 300.0% (SFE nom current)	R	4	
P51.03	Mains Frequency	0	+40.00Hz to +70.00Hz -40.00Hz to –70.00Hz	R	4	Measured ac supply frequency. See below.
P51.04	Measured Mains Voltage	0	0V to 1000V rms	R	4	Measured ac supply volts, line-line
P51.05	AC PWM Voltage	0	0V to 1000V rms	R	4	
P51.06	Power from Mains	0	-999.0 to 999.9kW	R	4	

NOTE: Parameters in this table are described in Section 6.49.

Par No.	Function	Default	Range	Attrib	Mode No.	Comments
P51.07	Feedforward Power Demand	0	-999.0 to 999.9kW	R	4	kW demanded from load power feedforward
P51.08	DC Link Current	0	0.0A to 9999.0A	R	4	AC power / DC link volts
P51.09	Vdc controller Current Demand	0	-9999.0A to 9999.0A	R	4	Current demanded from DC link controller
P51.10	Feedforward Current Demand	0	-9999.0A to 9999.0A	R	4	Current demanded from load power feedforward
P51.11	Active Current Demand (%)	0	-150.00% to +150.00%	R	4	Total active current demand
P51.12	Active Current Demand (A)	0	-9999.0A to 9999.0A	R	4	Total active current demand
P51.13	Active Current (%)	0	-150.0% to +150.0%	R	4	Current in phase with mains volts
P51.14	Active Current (A)	0	-9999.0A to 9999.0A	R	4	Current in phase with mains volts
P51.15	Reactive Current Demand (%)	0	-150.00% to +150.00%	R	4	
P51.16	Reactive Current Demand (A)	0	-9999.0A to 9999.0A	R	4	
P51.17	Reactive Current (%)	0	-150.0% to +150.0%	R	4	Current in quadrature with mains volts
P51.18	Reactive Current (A)	0	0.0A to 9999.0A	R	4	Current in quadrature with mains volts
P51.19	SFE Overload Remaining	100 %	100 to 0%	R	4	% of total overload capacity remaining.
P51.20	Measured PTC Resistance		Max. = 10.00kΩ Min. = 0.10kΩ	R	4	
P51.21	Vq Mains	Monitor		R	4	
P51.22	Vd mains	Monitor		R	4	
P51.23	Mains Amplitude	Monitor		R	4	

5.4.49 Menu 52 – Advanced SFE Setup Menu

NOTE: Parameters in this table are described in Section 6.50.

Par No.	Function	Default	Range	Attrib	Mode No.	Comments
P52.00	Vdc Cntrl Bandwidth	100	0 to 200rad/s	E	4	See below.
P52.01	Vdc Cntrl Gain Adjust	0	0 = Automatic Adjust 1 = Manual Adjust	E,N,L	4	See below.
P52.02	DC Link Cntrl Kp	4000	0 to 16 000	E / R	4	See below. Only editable if P52.01=1
P52.03	DC Link Cntrl Ki	20	0 to 800	E / R	4	See below. Only editable if P52.01=1
P52.04	Current Bandwidth	750	10 to 2000rad/s	E	4	Copy of P12.27 See below.
P52.05	Reactive Current Reference	0.00	-150.00% to 150.00% (SFE nom current)	E	4	See below

NOTE: Parameters in this table are described in Section 6.50.

Par No.	Function	Default	Range	Attrib	Mode No.	Comments
P52.06	Reactive Current Positive Limit	0.00	0.00% to 150.00% (SFE nom current)	E	4	See below
P52.07	Reactive Current Negative Limit	0.00	0.00% to 150.00% (SFE nom current)	E	4	See below
P52.08	Mains Under-frequency Trip	45.00	40.00Hz to 70.00Hz	E	4	Lower threshold for trip 93, mains frequency trip
P52.09	Mains Under-frequency Warning	45.00	40.00Hz to 70.00Hz	E	4	Lower threshold for warn 133, mains frequency warn
P52.10	Mains Over-frequency Warning	63.00	40.00Hz to 70.00Hz	E	4	Upper threshold for warn 133, mains frequency warn
P52.11	Mains Over-frequency Trip	63.00	40.00Hz to 70.00Hz	E	4	Upper threshold for trip 93, mains frequency trip
P52.12	Mains Synch Offset	0.0	-360.0 to 360.0 degrees	E	4	See below.
P52.13	Supply Inductance Compensation	0H	0 to 10 000μH	E	4	See below.
P52.14	Mains Volts Scaling	100.0	10.0% to 1000.0%	E	4	See below.
P52.15	Current Sensor Turns	1000:1	1000:1 to 10000:1	E	4	See below.
P52.16	Current Sensor Burden	10.0	0.1Ω to 500.0Ω	E	4	See below.
P52.17	DC Link Pre-charge Threshold	Drive Size	Drive Size	E	4	See below.
P52.18	Active Current Offset	0.00	-5.00% to 5.00%	E	4	Adjusts the value of P51.13
P52.19	Choke ptc Trip Resistance	3.00	0.10kΩ to 10.00kΩ	E	4	
P52.20	Action on Choke ptc Loss	1	0 = no action 1 = warning 2 = trip	E,N,L	4	
P52.21	Frequency Timer	-1.00	-1.00 to 1.00s	E,N	4	-1.00 = Infinite
P52.22	Minimum Amplitude	80	0 to 100%	E,N	4	Of nominal mains volts
P52.23	Maximum Amplitude	115	100 to 120%	E,N	4	Of nominal mains volts
P52.24	Amplitude Timer	-1.00	-1.00 to 1.00s	E,N	4	-1.00 = Infinite
P52.25 to P52.29	Reserved					
P52.30 to P52.63	Application Specific not described in this manual.					

5.4.50 Menu 53 – SFE Reference Setup Menu

NOTE: Parameters in this table are described in Section 6.51.

Par No.	Function	Default	Range	Attrib	Mode No.	Comments
P53.00	Vdc Reference Source	1	1 = P50.00 2 = Analogue Ref 1 3 = Analogue Ref 2 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 0 % 14 = Fixed 0 % 15 = Sum Node A 16 = Sum Node B 17 = Sum Node C 18 = Sum Node D 19 = Pointer 21	E,L,N	4	See below
P53.01	Vdc Reference Scale	100.0 %	-300.0 % to +300.0 %	E,R	4	See below
P53.02	Vdc Feedback Source	0	0 = Standard F/B 1 = Alternative F/B	E,S,L	4	Only available on MicroCubicle™ products
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	E,N,L,S	4	See below.
P53.04	Active Current Reference Source	1	1 = Vdc Controller 2 = Analogue Ref 1 3 = Analogue Ref 2 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 0% 14 = Fixed 0% 15 = Sum Node A 16 = Sum Node B 17 = Pointer 22	E,L,N	4	See below
P53.05	Active Current Reference Scale	100.0	-300.0% to +300.0%	E,R	4	See below

NOTE: Parameters in this table are described in Section 6.51.

Par No.	Function	Default	Range	Attrib	Mode No.	Comments
P53.06	Active Current Demand Positive Limit Source	1	1 = P50.03 2 = Analogue Ref 1 3 = Analogue Ref 2 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 0% 14 = Fixed 0% 15 = Sum Node A 16 = Sum Node B 17 = Pointer 24	E,L,N	4	See below
P53.07	Scale Active Current Demand Positive Limit	100.0	-300.0% to +300.0%	E,R	4	See below
P53.08	Active Current Demand Negative Limit Source	1	1 = P50.04 2 = Analogue Ref 1 3 = Analogue Ref 2 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 0% 14 = Fixed 0% 15 = Sum Node A 16 = Sum Node B 17 = Pointer 23 18 = P52.54	E,L,N	4	See below
P53.09	Scale Active Current Demand Negative Limit	100.0	-300.0% to +300.0%	E,R	4	See below

NOTE: Parameters in this table are described in Section 6.51.

Par No.	Function	Default	Range	Attrib	Mode No.	Comments
P53.10	Reactive Current Reference Source	1	1 = P52.05 2 = Analogue Ref 1 3 = Analogue Ref 2 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 0% 14 = Fixed 0% 15 = Sum Node A 16 = Sum Node B 17 = Pointer 25 18 = P52.46	E,L,N	4	See below
P53.11	Scale Reactive Current Reference	100.0	-300.0% to +300.0%	E,R	4	See below
P53.12	Reactive Current Positive Limit Source	1	1 = P52.06 2 = Analogue Ref 1 3 = Analogue Ref 2 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 0% 14 = Fixed 0% 15 = Sum Node A 16 = Sum Node B 17 = Pointer 26	E,L,N	4	See below
P53.13	Scale Reactive Current Demand Positive Limit	100.0	-300.0% to +300.0%	E,R	4	See below

NOTE: Parameters in this table are described in Section 6.51.

Par No.	Function	Default	Range	Attrib	Mode No.	Comments
P53.14	Reactive Current Negative Limit Source	1	1 = P52.07 2 = Analogue Ref 1 3 = Analogue Ref 2 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 0% 14 = Fixed 0% 15 = Sum Node A 16 = Sum Node B 17 = Pointer 27	E,L,N	4	See below
P53.15	Scale Reactive Current Demand Negative Limit	100.0	-300.0% to +300.0%	E,R	4	See below
P53.16	Action on SFE Reference Loss	2	0 = no action 1 = warning 2 = trip	E,L,N	4	Warning code 105; Trip code 2
P53.17	Frequency Method	1	0 = PLL 1 = ZCD	S,L,N,E	4	
P53.18	Mains Filter Bandwidth	1	0 = 100Hz 1 = 200Hz 2 = 400Hz 3 = 800Hz	L,N,E	4	Copy of P54.01
P53.19	Mains Loss Action	2	0 = Ignore 1 = Warn Only 2 = warn and Trip	L,N,E	4	
P53.20	Ride-Through Threshold	80.00	0.00 to 100.00%	E	4	
P53.21	Regen Power Limit Source	1	1 = P52.54 2 = Analog Ref. 1 3 = Analog Ref. 2 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 Potentiometer 12 = Trim Reference 13 = Fixed 0% 14 = Fixed 0% 15 = Summing Node A 16 = Summing Node B	E,L,N	4	
P53.22	Regen Power Limit Scale	100.0	-300.0 to 300.0%	R,E	4	

5.4.51 Menu 54 – Mains Monitor Menu

NOTE: Parameters in this table are described in Section 6.52.

Par No.	Function	Default	Range	Attrib	Mode No.	Comments
P54.00	MVM Mode	0 in SFE Mode 2 in Motor Mode	0 = SFE mode 1 = Over voltage Trip Avoidance 2 = Disabled	L,N,E	0-4	
P54.01	Mains Filter Bandwidth	1	0 = 100Hz 1 = 200Hz 2 = 400Hz 3 = 800Hz	L,N,E	0-4	
P54.02	Auto Restart Factor	1.04	0.90 to 1.5	E	0-4	
P54.03	Vq Mains	Monitor	V	R	0-4	
P54.04	Vd Mains	Monitor	V	R	0-4	
P54.05	Vrms Mains	Monitor	V	R	0-4	
P54.06	Mains Frequency	Monitor	Hz, resolution 0.1Hz	R	0-4	Same as P51.03
P54.07	DC Link Voltage	Monitor	V	R	0-4	Same as P11.03
P54.13	Frequency Method	1	0 = PLL 1 = ZCD	E,L,S	0-4	Same as P33.17
P54.14	Mains Loss Action	2 in SFE Mode 1 in Motor Mode	0 = Ignore 1 = Warning Only 2 = Warn and Trip	E,L	0-4	Maximum depends on Control Mode
P54.15	Ridethrough Threshold	80	0 to 100%	E	0-4	Of nominal mains volts
P54.16	Mains Amplitude	Monitor	%	R	0-4	Of P54.17
P54.17	Nominal Mains Supply	Drive size dependent	Vrms	E,S	0-4	Same as P12.02

5.4.52 Menu 55 – Machine Bridge Control Menu

NOTE: Parameters in this table are for a specific application.

Par No.	Function	Default	Range	Attrib	Mode No.	Comments
P55.00 to P55.21	Application Specific not described in this manual					

5.4.53 Menu 56 – AC Voltage Control Menu

NOTE: Parameters in this table are described in Section 6.54.

Par No.	Function	Default	Range	Attrib	Mode No.	Comments
P56.00	AC Voltage Reference	400	300 to 900V	E	4	
P56.01	Filtered AC Voltage	0.00	% Nominal	R	4	
P56.02	Droop Resistance	10.0	0.0 to 300.0mOhms	E	4	
P56.03	Drooped Reference	100.00	% Nominal	R	4	
P56.04	AC Voltage Kp	0.400	0.000 to 10.000%Id/%Vac nominal	E	4	
P56.05	AC Voltage Ki	100	0 to 5000%Id/%Vac nominal/s	E	4	
P56.06	Unclamped Id Demand	Monitor	%	R	4	
P56.07	Modulation Limit	97.50	82 to 107%	E	4	
P56.08	Modulation Depth	Monitor	%	R	4	
P56.09	Modulation Controller Kp	0.300	0.000 to 0.500%Id/% modulation depth	E	4	
P56.10	Modulation Controller Ki	630	0 to 2000%Id/% modulation depth/s	E	4	
P56.11	Clamped Id Demand	Monitor	%	R	4	
P56.12	Unclamped Id Demand Source	56.00	1.00 to 99.99 (any parameter)	E	4	

5.4.54 Menu 58 - Extended I/O CAN Port 2

Menu 58 is used with the 2nd CAN Port facility and all the parameters, P58.00 to P58.84, are listed and described in the MV3000e 2nd CAN Port CANopen and DeviceNet Fieldbus Facility Technical Manual T1968. An Extended I/O parameter menu is provided to process and hold inputs and prepare outputs.

5.4.55 Menu 59 - Extended I/O

Menu 59 is used with the CANopen facility and all the parameters, P59.00 to P59.84, are listed and described in the MV3000e CANopen Fieldbus Facility Technical Manual T2013. An Extended I/O parameter menu is provided to process and hold inputs and prepare outputs.

5.4.56 Menu 60 - Scale

Menu 60 is used with the CANopen and DeviceNet facilities and all the parameters, P60.00 to P60.29, are listed and described in the MV3000e CANopen Fieldbus Facility Technical Manual T2013 and the MV3000e DeviceNet Fieldbus Facility Technical Manual T2017. This menu allows the scaling between drives and Fieldbus to be specified for different data types.

5.4.57 Menu 61 - CDC CAN Port

Menu 61 is used with the CANopen and DeviceNet facilities and all the parameters, P61.00 to P61.45 and P61.50, are listed and described in the MV3000e CANopen Fieldbus Facility Technical Manual T2013 and the MV3000e DeviceNet Fieldbus Facility Technical Manual T2017. This menu enables the communication protocol to be configured.

5.4.58 Menu 62 - CDC CANopen

Menu 62 is used with the CANopen facility and all the parameters, P62.00 to P62.99, are listed and described in the MV3000e CANopen Fieldbus Facility Technical Manual T2013. This menu enables the 10 CANopen PDO (Process Data Object) packets to be configured.

5.4.59 Menu 63 - CDC DeviceNet

Menu 63 is used with the DeviceNet Facility and all the parameters, P63.00 to P63.99, are listed and described in the MV3000e DeviceNet Fieldbus Facility Technical Manual T2017. This menu enables DeviceNet assembly object instances to be configured.

5.4.60 Menu 65 - CAN Port 2

Menu 65 is used with the 2nd CAN Port facility and all the parameters, P65.00 to P65.45 and P65.50, are listed and described in the MV3000e 2nd CAN Port CANopen and DeviceNet Fieldbus Facility Technical Manual T1968. This menu enables the communication protocol to be configured.

5.4.61 Menu 66 - CAN 2 CANopen

Menu 66 is used with the 2nd CAN Port facility and all the parameters, P66.00 to P66.99, are listed and described in the MV3000e 2nd CAN Port CANopen and DeviceNet Fieldbus Facility Technical Manual T1968. This menu enables the 10 CANopen PDO (Process Data Object) packets to be configured.

5.4.62 Menu 67 - CAN 2 DeviceNet

Menu 67 is used with the DeviceNet Facility and all the parameters, P67.00 to P67.99, are listed and described in the MV3000e 2nd CAN Port CANopen and DeviceNet Fieldbus Facility Technical Manual T1968. This menu enables DeviceNet assembly object instances to be configured.

5.4.63 Menus 70 to 72 - Application Code Developer

Menus 70 to 72 are used for Application Code Developer. The separate parameters are not listed in this manual.

5.4.64 Menu 74 - Fieldbus Coupler

Menu 74 is used with the PROFIBUS facility, and all the parameters P74.00 to P74.89 are listed and described in the PROFIBUS Fieldbus Coupler MVS3007-4001 7 MVS3007-4002 Technical Manual T1694 Rev 0002 or later.

5.4.65 Menu 75 - PROFIBUS

Menu 75 is used with the PROFIBUS facility and all the parameters, P75.00 to P75.46, are listed and described in the MV3000 PROFIBUS Fieldbus Coupler Technical Manual T1694. This menu enables the PROFIBUS board to be configured.

5.4.66 Menu 78 - MicroPEC™ Module - Configuration and Diagnostics

Menu 78 is used with the MicroPEC™ Module and all the parameters, P78.00 to P78.34 (less P78.03, P78.04 and P78.09 that are reserved), are listed and described in the MV3000e MicroPEC™ Instruction Sheet T1933. This menu enables the MicroPEC™ Module to be configured.

5.4.67 Menu 80 - FIP Configuration
Menu 83 - FIP Produced VCOMS
Menu 84 - FIP Consumed VCOMS
Menu 85 - FIP Slow VCOMS

Parameters accessed by these menus are used to configure the optional FIP Communication Boards. Full details are provided in the Direct FIP MVS3002-4001 and MVS3002-4002 Technical Manual T1686 supplied with the option module.

5.4.68 Menu 86 - Ethernet Interface Menu

Menu 86 is used with the optional Ethernet Modules MVS3012-4001 and MVS3012-4002. All the parameters are listed and described in the MV3000e Ethernet Interface Technical Manual T2034 supplied with the option module.

5.4.69 Menu 89 - Spy Setup

This menu is used with the FIP, PROFIBUS and Ethernet option modules as well as CANopen and DeviceNet to view the raw data coming in to the drive via the appropriate communications port. The meaning of the data changes with the protocol employed. Full details of its usage is given in the various communications technical manuals.

5.4.70 Menu 90 - Manufacturer's Service Menu

Parameters P90.00 to P90.99 are for use by **GE Power Conversion** staff.

5.4.71 Menu 91 – Fast Analogue Menu

NOTE: Parameters in this table are described in Section 6.55.

Par No.	Function	Default	Range	Attrib	Mode No.	Comments
P91.00	Fast Analogue 1 Global	0	0 to 9999	E	0-4	Internal Global value to be viewed
P91.01	Fast Analogue 1 Scale	0	-3276 to 3276 bits/V	E	0-4	Scale of output
P91.02 to P91.04	Reserved					
P91.05	Fast Analogue 2 Global	0	0 to 9999	E	0-4	Internal Global value to be viewed
P91.06	Fast Analogue 2 Scale	0	-3276 to 3276 bits/V	E	0-4	Scale of output
P91.07 to P91.09	Reserved					
P91.10	Fast Analogue 3 Global	0	0 to 9999	E	0-4	Internal Global value to be viewed
P91.11	Fast Analogue 3 Scale	0	-3276 to 3276 bits/V	E	0-4	Scale of output
P91.12 to P91.14	Reserved					
P91.15	Fast Analogue 4 Global	0	0 to 9999	E	0-4	Internal Global value to be viewed
P91.16	Fast Analogue 4 Scale	0	-3276 to 3276 bits/V	E	0-4	Scale of output

5.4.72 Menu 98 – Menu Enable Selection Settings

NOTE: Parameters in this table are described in Section 6.56.

Par No.	Function	Default	Range	Attrib	Mode No.	Comments
P98.00	Reserved					
P98.01	User Configuration Menu Enable	1	1 to 1	E, N, L	0-4	
P98.02	Basic Motor Menu Enable	0	0 = Invisible 1 = Visible	E, N, L	0-3	
P98.03	Frequency Control Menu Enable	0	0 = Invisible 1 = Visible	E, N, L	0-3	
P98.04	Start/Stop Menu	0	0 = Invisible 1 = Visible	E, N, L	0-3	
P98.05	Speed Reference Menu Enable	0	0 = Invisible 1 = Visible	E, N, L	0-4	
P98.06	Ramp Setup Menu Enable	0	0 = Invisible 1 = Visible	E, N, L	0-4	
P98.07	I/O Setup Menu Enable	0	0 = Invisible 1 = Visible	E, N, L	0-4	
P98.08	Torque Limit Menu Enable	0	0 = Invisible 1 = Visible	E, N, L	0-3	
P98.09	Basic Monitor Menu Enable	0	0 = Invisible 1 = Visible	E, N, L	0-3	
P98.10	Trips/Warning Menu Enable	0	0 = Invisible 1 = Visible	E, N, L	0-4	
P98.11	Advanced Monitor Menu Enable	0	0 = Invisible 1 = Visible	E, N, L	0-4	
P98.12	Advanced Motor Menu Enable	0	0 = Invisible 1 = Visible	E, N, L	0-3	
P98.13	Speed Feedback Menu Enable	0	0 = Invisible 1 = Visible	E, N, L	0-3	
P98.14	Speed Loop Menu Enable	0	0 = Invisible 1 = Visible	E, N, L	0-3	
P98.15	Torque Reference Menu Enable	0	0 = Invisible 1 = Visible	E, N, L	0-3	
P98.16	PID Setup Menu Enable	0	0 = Invisible 1 = Visible	E, N, L	0-4	
P98.17	Reference Sequencer Menu Enable	0	0 = Invisible 1 = Visible	E, N, L	0-4	
P98.18	Motorised Potentiometer Menu Enable	0	0 = Invisible 1 = Visible	E, N, L	0-4	
P98.19	Trim Reference Menu Enable	0	0 = Invisible 1 = Visible	E, N, L	0-4	
P98.20	HSIO Menu Enable	0	0 = Invisible 1 = Visible	E, N, L	0-4	
P98.21	Fixed Reference Menu Enable	0	0 = Invisible 1 = Visible	E, N, L	0-4	
P98.22	Skip Speeds Menu Enable	0	0 = Invisible 1 = Visible	E, N, L	0-3	

NOTE: Parameters in this table are described in Section 6.56.

Par No.	Function	Default	Range	Attrib	Mode No.	Comments
P98.23	DB Control Menu	0	0 = Invisible 1 = Visible	E, N, L	0-4	
P98.24	Speed Trim Menu Enable	0	0 = Invisible 1 = Visible	E, N, L	0-3	
P98.25	Inertia Compensation Menu Enable	0	0 = Invisible 1 = Visible	E, N, L	0-3	
P98.26	History Setup menu Enable	0	0 = Invisible 1 = Visible	E, N, L	0-4	
P98.27	History Read Menu Enable	0	0 = Invisible 1 = Visible	E, N, L	0-4	
P98.28	Auto Reset Menu Enable	0	0 = Invisible 1 = Visible	E, N, L	0-4	
P98.29	Speed/Torque Monitor Menu Enable	0	0 = Invisible 1 = Visible	E, N, L	0-3	
P98.30	Logic Blocks Menu Enable	0	0 = Invisible 1 = Visible	E, N, L	0-4	
P98.31	Status Flag Generator Menu Enable	0	0 = Invisible 1 = Visible	E, N, L	0-4	
P98.32	Serial Link Setup Menu Enable	0	0 = Invisible 1 = Visible	E, N, L	0-4	
P98.33	CF0-99 Source Menu Enable	0	0 = Invisible 1 = Visible	E, N, L	0-4	
P98.34	CF100-127 Menu Enable	0	0 = Invisible 1 = Visible	E, N, L	0-4	
P98.35	Miscellaneous Setup Menu Enable	0	0 = Invisible 1 = Visible	E, N, L	0-4	
P98.36	Position Control Setup Menu Enable	0	0 = Invisible 1 = Visible	E, N, L	0-3	
P98.37	Position Reference Menu Enable	0	0 = Invisible 1 = Visible	E, N, L	0-3	
P98.38	Position Control Monitor Menu Enable	0	0 = Invisible 1 = Visible	E, N, L	0-3	
P98.39	Menu 1 Setup Menu Enable	0	0 = Invisible 1 = Visible	E, N, L	0-4	
P98.40	Summing Nodes Settings Menu Enable	0	0 = Invisible 1 = Visible	E, N, L	0-4	
P98.41	Programmable Status Words Settings Menu Enable	0	0 = Invisible 1 = Visible	E, N, L	0-4	
P98.42	Pointer Menu	0	0 = Invisible 1 = Visible	E, N, L	0-4	
P98.43	Load Fault detection Window Settings Menu Enable	0	0 = Invisible 1 = Visible	E, N, L	0-3	
P98.44	Reference: Shaper Menu Enable	0	0 = Invisible 1 = Visible	E, N, L	0-3	
P98.45	Temperatures Menu Enable	0	0 = Invisible 1 = Visible	E, N, L	0-4	
P98.46	Ridethrough Menu Enable	0	0 = Invisible 1 = Visible	E, N, L	0-3	

NOTE: Parameters in this table are described in Section 6.56.

Par No.	Function	Default	Range	Attrib	Mode No.	Comments
P98.47	Second Logic Blocks Menu Enable	0	0 = Invisible 1 = Visible	E, N, L	0-4	
P98.48 to P98.49	Reserved					
P98.50	SFE Basic Setup Menu	0	0 = Invisible 1 = Visible	E, N, L	4	
P98.51	SFE Monitor Menu	0	0 = Invisible 1 = Visible	E, N, L	4	
P98.52	SFE Adv Setup Menu	0	0 = Invisible 1 = Visible	E, N, L	4	
P98.53	SFE Ref Setup Menu	0	0 = Invisible 1 = Visible	E, N, L	4	
P98.54	Mains Monitor Menu	0	0 = Invisible 1 = Visible	E, N, L	0-4	
P98.55	Machine Bridge Control Menu	0	0 = Invisible 1 = Visible	E, N, L	1-3	
P98.56	AC Voltage Control Menu	0	0 = Invisible 1 = Visible	E, N, L	4	
P98.57	Reserved					
P98.58	Menu 58 Extended I/O Enable	0	0 = Invisible 1 = Visible	E, N, L	0-4	See 2nd CAN Port Technical Manual T1968
P98.59	Menu 59 Extended I/O Enable	0	0 = Invisible 1 = Visible	E, N, L	0-4	See CANopen Fieldbus Facility Technical Manual T2013
P98.60	Menu 60 Scale Enable	0	0 = Invisible 1 = Visible	E, N, L	0-4	See CANopen Fieldbus Facility Technical Manual T2013 and DeviceNet Fieldbus Facility Technical Manual T2017
P98.61	Menu 61 CDC CAN Port Enable	0	0 = Invisible 1 = Visible	E, N, L	0-4	See CANopen Fieldbus Facility Technical Manual T2013 and DeviceNet Fieldbus Facility Technical Manual T2017
P98.62	Menu 62 CDC CANopen Enable	0	0 = Invisible 1 = Visible	E, N, L	0-4	See CANopen Fieldbus Facility Technical Manual T2013 and DeviceNet Fieldbus Facility Technical Manual T2017
P98.63	Menu 63 CDC DeviceNet Enable	0	0 = Invisible 1 = Visible	E, N, L	0-4	See DeviceNet Fieldbus Facility Technical Manual T2017
P98.64	Reserved					
P98.65	Menu 65 CAN Port 2 Enable	0	0 = Invisible 1 = Visible	E,N,L	0-4	See 2nd CAN Port Technical Manual T1968

NOTE: Parameters in this table are described in Section 6.56.

Par No.	Function	Default	Range	Attrib	Mode No.	Comments
P98.66	Menu 66 CAN 2 CANopen Enable	0	0 = Invisible 1 = Visible	E,N,L	0-4	See 2nd CAN Port Technical Manual T1968
P98.67	Menu 67 CAN 2 DeviceNet Menu Enable	0	0 = Invisible 1 = Visible	E,N,L	0-4	See 2nd CAN Port Technical Manual T1968
P98.68 to P98.69	Reserved					
P98.70 to P98.72	Menus 70, 71 and 72 – Application Code Developer Enable	0	0 = Invisible 1 = Visible	E	0-3	
P98.73	Reserved					
P98.74	Menu 74 Fieldbus Coupler Enable	0	0 = Invisible 1= Visible	E,N,L	0-4	See PROFIBUS Fieldbus Coupler Technical Manual T1694
P98.75	Menu 75 PROFIBUS Enable	0	0 = Invisible 1 = Visible	E, N, L	0-4	See PROFIBUS Fieldbus Coupler Technical Manual T1694
P98.76 to P98.77	Reserved					
P98.78	Menu 78 MicroPEC™ Enable	0	0 = Invisible 1 = Visible	E, N, L	0-4	See MicroPEC™ Instruction Sheet T1933
P98.79	Reserved					
P98.80 to P98.85	FIP Communications Modules Menus Enable	0	0 = Invisible 1 = Visible	E, N, L	0-4	Dependent on which options are fitted.
P98.86	Ethernet Interface Menu Enable	0	0 = Invisible 1 = Visible	E, N, L	0-4	See Ethernet Interface Technical Manual T2034
P98.87 to P98.88	Reserved					
P98.89	Spy Configure Menu Enable		0 = Invisible 1 = Visible	E, N, L	0-4	
P98.90	Menu 90 Manufacturer Service Use Enable	0	0 = Invisible 1 = Visible		0-4	**GE Power Conversion** use.
P98.91	Fast Analogue Menu Enable	0	0 = Invisible 1 = Visible	E, N, L	0-4	
P98.92 to P98.97	Reserved					
P98.98	Menu Control Menu	1	1 to 1	L	0-4	
P98.99	Configuration Menu	1	1 to 1	L	0-4	

5.4.73 Menu 99 – Configuration Settings

NOTE: Parameters in this table are described in Section 6.57.

Par No.	Function	Default	Range	Attrib	Mode No.	Comments
P99.00	Number of DELTAs	0	0 to 6	R	0-4	
P99.01	Control Structure	1	0 = No Motor Control 1 = Frequency Control 2 = Vector Control 3 = Scalar Control 4 = SFE Mode	S,E,L,C	0-4	
P99.02	Overload Duty	1	0 = 150% Overload 1 = 110% overload	S,E,N,L,C	0-4	Causes drive to re-boot
P99.03	Firmware Type	6	6 = MV3000 series	R	0-4	
P99.04	Firmware Revision Number	As Issue	0.00 to 99.99	R	0-4	
P99.05	Drive Nominal Current	As drive size	Dependent on drive size	R	0-4	
P99.06	Security Code	0	0 to 9999	O	0-4	Enter code here, if it matches the codes stored in P99.07 or P99.08, then the relevant parameters will be editable. Also used for the 'Master Password' code.
P99.07	Operator Security Code	0	0 to 9999	E	0-4	Choose a code to access parameters with attribute "O".
P99.08	Engineer Security Code	0	0 to 9999	E	0-4	Choose a code to access parameters with attribute "E" and "O".
P99.09	Manufacturer Security Code	0	0 to 9999		0-4	Secret, no user access.
P99.10	User Text Language	1	1 = English 2 = French 3 = Portuguese 4 = German	S,E,N,L, O	0-4	
P99.11	Drive Voltage Code	0	0 = Standard Voltage Grade 1 = Alternative Voltage Grade	S,E,N,L,C	0-4	Some drives have two possible options. Causes drive to re-boot
P99.12	Firmware Downloader	0	0 = Not Enabled 1 = Download	S,E,N,L	0-4	Initiate a firmware upgrade download.
P99.13	Drive Security ID 1	0	0 to30000	E,N	0-4	
P99.14	Drive Security ID 2	0	0 to 30000	E,N	0-4	
P99.15	Upload Template	As drive size	1 to 999	E	0-4	
P99.16	Backup Parameters	0	0 = No Action 1 = Save (to drive) 2 = Recall (from drive) 3 = Erase (drive backup) 4 = Save (to) Keypad 5 = Recall (from) Keypad 6 = Check Keypad Data	S,E,N,L	0-4	

NOTE: Parameters in this table are described in Section 6.57.

Par No.	Function	Default	Range	Attrib	Mode No.	Comments
P99.17	Restore Defaults	0	0 = Normal 1 = Default Current 3 = Default All Parameter Sets	S,E,N,L,C	0-4	Causes drive to re-boot
P99.20	Active Parameter Set	Monitor		R	0-4	Indicates Active Parameter Set
P99.21	Parameter Set Select		0 = Parameter Set selected by control flags 1 = Parameter Set 1 Activated 2 = Parameter Set 2 Activated 3 = Parameter Set 3 Activated	S,E,L	0-4	
P99.22	CF190: P-Set Select	0.000 CLEARED	See Control Flag Menus 33/34	E	0-4	
P99.22	CF191: Alt. P-Set Select	0.000 CLEARED	See Control Flag Menus 33/34	E	0-4	
P99.24	Copy Parameter Set	0	0 = 1 = Copy	E,L	0-4	

5.4.74 Status Flag Listing

Status Flags (SF) are digital outputs from the drive control system. They are shown on the Control Block Diagrams (A3 sheets) at Section 7 and their function is described in Section **6.33**. The Status Flags are listed in Table 5-1.

The Status Flags can be connected to a number of places to facilitate the creation of user application specific code. Typically, they can be connected to Control Flags (see Control Flag options in Menus 33/34) or to Digital Outputs (see options for P7.27 to P7.29 in Table 6-15).

5.4.75 Control Flag Listing

Controls Flags (CF) are digital inputs to the drive control system. They are shown on the Control Block Diagrams (A3 sheets) in Section 7 and their function is described in Section 7.

To make programming easier, the drive parameters and all of the Control and Status Flags are drawn on the Control Block Diagrams in Section 7. Refer to these diagrams to see, pictorially, how the parameters and flags interact.

The Control Flags are listed in Table 5-2 in order of their parameter numbers in menus 33 and 34. Menus 33 and 34 show the allowed values that can be edited into the first 200 (0 to 199) parameters.

The CF can also be accessed from the drive Local menus, e.g. CF0: Normal Stop, is also available in Menu 4, the Start and Stop Control menu. The Control Flags can be connected to a number of places to facilitate the creation of user application specific code. The list below shows the equivalent Local Menu parameter numbers and the default connection for each CF.

For control flags 200 onwards Table 5-2 shows the Equivalent Local Parameter and default connection only.

Table 5-1. – Status Flag Listing

Status Flag Number	Value to be used as CF or DIGOUT Source if connecting to a CONTROL FLAG or DIGITAL OUTPUT etc. Note: -ve value = INV of the flag	Description A high output indicates The state shown below.	Comments Or What might affect the Status Flag?
SF0	2.000	Drive Running (steady state or accelerating)	
SF1	2.001	Drive Stopped	
SF2	2.002	Drive Starting (Pre-fluxing or Synchro-starting)	
SF3	2.003	Drive Stopping (Decelerating or DC injecting) or zero speed holding.	
SF4	2.004	Drive Healthy (no Warnings or Trips)	HI for Healthy, LO if a warning or trip is present.
SF5	2.005	Drive Tripped	HI for Tripped - Latched
SF6	2.006	Drive Warning	HI for Warning present – not latched if warning goes.
SF7	2.007	Auto-resets Remaining are Non-zero (Menu 28)	Remains HI if P28.04 ≠0
SF8	2.008	Output Bridge is Enabled (IGBTs are Switching)	CF25 and Run/Stop affect it.
SF9	2.009	Reverse Speed (motor going in Reverse)	Motor goes reverse if the reference is –ve or if CF3 is activated.
SF10	2.010	Over speed detected (Menu 29)	The speed feedback is monitored via P9.01 in either Vector or Frequency Control. The speed detection window sets the relevant flag depending on the values programmed into the various trigger levels set in P29.00 – P29.05.
SF11	2.011	Zero Speed Detected	
SF12	2.012	At Speed (speed feedback = Speed Ref) (Menu 29)	
SF13	2.013	In Speed Window (Menu 29)	
SF14	2.014	Outside Speed Window (Menu 29)	
SF15	2.015	Above Speed Window (Menu 29)	
SF16	2.016	Below Speed Window (Menu 29)	
SF17	2.017	Comparator A Output (Menu 30)	Mode set by P30.03. Sets up Comparator Conditions.
SF18	2.018	Delay A Output (Menu 30)	HI when delay expires.
SF19	2.019	Logic Block A Output (Menu 30)	Obeys the Logical Function of the Block. P30.06 sets Logic Block Function.
SF20	2.020	Latch A Output (Menu 30)	HI when the latch is set.
SF21	2.021	Comparator B Output (Menu 30)	Mode set by P30.16 Sets Up Comparator Conditions.
SF22	2.022	Delay B Output (Menu 30)	HI when delay expires.
SF23	2.023	Logic Block B Output (Menu 30)	Obeys the Logical Function of the Block. P30.19 sets Logic Block Function.
SF24	2.024	Latch B Output (Menu 30)	HI when the latch is set.
SF25	2.025	Drive Skipping a disallowed Reference (Menu 22)	
SF26	2.026	Analogue REF 1 4-20mA ON	4-20mA is healthy. Will go LO if 4-20mA ref is lost.
SF27	2.027	Analogue REF 2 4-20mA ON	4-20mA is healthy. Will go LO if 4-20mA ref is lost.

Table 5-1. – Status Flag Listing

Status Flag Number	Value to be used as CF or DIGOUT Source if connecting to a CONTROL FLAG or DIGITAL OUTPUT etc. Note: -ve value = INV of the flag	Description A high output indicates The state shown below.	Comments Or What might affect the Status Flag?
SF28	2.028	In Torque Limit (Menu 8, Menu 29)	Torque flowing to the motor is being monitored and these flags show the status of the TQ monitor function in Menu 29.
SF29	2.029	Inside Torque Window (Menu 29)	
SF30	2.030	Outside Torque Window (Menu 29)	
SF31	2.031	Above Torque Window (Menu 29)	
SF32	2.032	Below Torque Window (Menu 29)	
SF33	2.033	Reference Sequencer Running (Menu 17)	Sequencer runs if CF29 is LO and CF28 has been triggered.
SF34	2.034	Reference Sequencer Outputnot 0% Ref (Menu 17)	P17.21 is currently ≠0% ref.
SF35	2.035	Comparator C Output (Menu 30)	Mode set by P30.29 Sets Up Comparator Conditions.
SF36	2.036	Delay C Output (Menu 30)	HI when delay expires.
SF37	2.037	Logic Block C Output (Menu 30)	Obeys the Logical Function of the Block. P30.32 sets Logic Block Function.
SF38	2.038	Latch C Output (Menu 30)	HI when the latch is set.
SF39	2.039	Comparator D Output (Menu 30)	Mode set by P30.42 Sets Up Comparator Conditions.
SF40	2.040	Delay D Output (Menu 30)	HI when delay expires.
SF41	2.041	Logic Block D Output (Menu 30)	Obeys the Logical Function of the Block. P30.45 sets Logic Block Function.
SF42	2.042	Latch D Output (Menu 30)	HI when the latch is set.
SF43	2.043	Logic Block E Output (Menu 30)	Obeys the Logical Function of the Block. P30.52 sets Logic Block Function.
SF44	2.044	Logic Block F Output (Menu 30)	Obeys the Logical Function of the Block. P30.56 sets Logic Block Function.
SF45	2.045	Logic Block G Output (Menu 30)	Obeys the Logical Function of the Block. P30.60 sets Logic Block Function.
SF46	2.046	Logic Block H Output (Menu 30)	Obeys the Logical Function of the Block. P30.64 sets Logic Block Function.
SF47	2.047	Pre-charge Contactor 1N	On MicroCubicle ™ drives this is set by the CDC internally. On DELTA drives Pre-charge acknowledge PL12 16 sets this bit.
SF48	2.048	Motor Braking	The Power flow to the motor is –ve, i.e. motor is regenerating. There is an offset to avoid "chatter" at changeover.
SF49	2.049	Motor Calibration Run in Progress	
SF50	2.050	High Speed Digital I/O ON (Menu 20)	HI when HSIO being used as a reference input, LO when used as an output.
SF51	2.051	Drive is Pre-Fluxing the Motor	If combined with SF2, could determine if motor is synchro-starting or pre-fluxing.
SF52	2.052	Open Loop Test Enabled	P13.11 has been set to enable an open loop test.
SF53	2.053	In Speed Error Deadband	Speed error is ≤± P14.14; can be used to detect "strip break" condition when using deadband as a speed catch.

Table 5-1. – Status Flag Listing

Status Flag Number	Value to be used as CF or DIGOUT Source if connecting to a CONTROL FLAG or DIGITAL OUTPUT etc. Note: -ve value = INV of the flag	Description A high output indicates The state shown below.	Comments Or What might affect the Status Flag?
SF54	2.054	DB Unit Connected (Menu 23)	Only goes HI if a MVDB is fitted. External DBs do not affect this flag.
SF55	2.055	DB Resistor Healthy (Menu 23)	Only effective with MV DBs.
SF56	2.056	Fieldbus Communications Healthy (Menus 75, 78, 80 etc.)	
SF57	2.057	RS485 Link Healthy (Menu 32)	
SF58	2.058	RS232 Link Healthy (Menu 32)	
SF59	2.059	Encoder Loss (Menu 13)	The conditions set in P13.08, P13.19 & P13.20 have been violated. Use the flag to select alternative PID speed gains, via CF76 if Encoderless ridethrough is required.
SF60	2.060	Load Fault Detection Window – High (Menu 43)	
SF61	2.061	Load Fault Detection Window – Low (Menu 43)	
SF62	2.062	Ridethrough Active	Drive is allowed to ridethrough a mains power failure. Enabled using P35.12.
SF63	2.063	History Record Running (Menu 26, 27)	History record is storing data.
SF64	2.064	Position Valid (Menus 36,37,38)	Actual Position is within Max/Min limits)
SF65	2.065	Datum Movement in Progress (Menus 36,37,38)	The position controller is performing a datum movement, as defined by P36.34, and triggered by CF82 & CF83.
SF66	2.066	Either limit (at either limit switch connected to CF86 or CF87) (Menus 36,37,38)	CF86, CF87 detect HI, LO Position Limit and should be connected to Limit Switches.
SF67	2.067	At Position (Menus 36,37,38)	Position Ref = Position Feedback.
SF68	2.068	Above Position (Menus 36,37,38)	Position Feedback is > Position Ref Value
SF69	2.069	Below Position (Menus 36,37,38)	Position Feedback is < Position Ref Value
SF70	2.070	Status Flag Generator Bit 0 (Menu 31)	Status flag generator produces a binary sequence from 0000 – 1111 and can be programmed with delays etc. Very useful for automatically sequencing stored positions or sequencing through the fixed speed menu automatically.
SF71	2.071	Status Flag Generator Bit 1 (Menu 31)	
SF72	2.072	Status Flag Generator Bit 2 (Menu 31)	
SF73	2.073	Status Flag Generator Bit 3 (Menu 31)	
SF74	2.074	Status Flag Generator Running (Menu 31)	This flag is HI, when CF100 is LO and next (CF98) or previous (CF99) are triggered.
SF75	2.075	VCOM 1 Healthy (FIP Menus 80 etc.)	All 32 words within Communication Variable (VCOM) 1 are healthy.
SF76	2.076	VCOM 3 Healthy (FIP Menus 80 etc.)	All 32 words within Communication Variable (VCOM) 3 are healthy.
SF77	2.077	VCOM 5 Healthy (FIP Menus 80 etc.)	All 32 words within Communication Variable (VCOM) 5 are healthy.
SF78	2.078	VCOM 7 Healthy (FIP Menus 80 etc.)	All 32 words within Communication Variable (VCOM) 7 are healthy.
SF79	2.079	SYNC. VCOM Healthy (FIP Menus 80 etc.)	Data within synchronisation communications variable (VCOM) is healthy.

Table 5-1. – Status Flag Listing

Status Flag Number	Value to be used as CF or DIGOUT Source if connecting to a CONTROL FLAG or DIGITAL OUTPUT etc. Note: -ve value = INV of the flag	Description A high output indicates The state shown below.	Comments Or What might affect the Status Flag?
SF80	2.080	PWM in Sync.	Indicates that the drive is 'in synchronisation' with one or more other drives
SF81 to SF86	2.081 to 2.086	Not Yet Defined	
SF87	2.087	Ethernet Interface Channel 1 Healthy	False when no protocol message has been received for a time specified in P86.33. Always True if P86.34 = 0
SF88	2.088	Ethernet Interface Channel 2 Healthy	False when no protocol message has been received for a time specified in P86.83. Always True if P86.84 = 0
SF89	2.089	Ethernet Interface Channel 3 Healthy	Future – Not used
SF90	2.089	Ethernet Interface Channel 4 Healthy	Future – Not used
SF91	2.091	In Power Limit	In an AEM Drive indicates that the Machine Bridge has limited the torque demand because of the power limit constraint imposed by enabling P12.50
SF92	2.092	Dip Detected	In an AEM Drive indicates that the network supply is below the threshold specified by P52.32, or has not risen back above the dip Hysteresis level specified by P52.33. Can be used to indicate that the voltage-support reactive current reference is in force.
SF93	2.093	Mains Voltage Monitor (MVM) Fitted	
SF94	2.094	Pending PIB Trip	Over voltage trip suppression is active, if the condition lasts long enough then the suppression is removed and a PIB over voltage trip will occur.
SF95	2.095	P PID in Limit	Indicates that Active Power PID has limited, i.e. its output is in limit or that the associated limit block is in limit.
SF96	2.096	Q PID in Limit	Indicates that Reactive Power PID has limited, i.e. its output is in limit or that the associated limit block is in limit.
SF97	2.097	Field bus Controller 1 healthy	FBC associated with Menu 74 is healthy
SF98	2.098	Reserved	
SF99	2.099	Reserved	
SF100	2.100	VDC at reference (SFE)	DC link volts reference (P59.00) DC link volts feedback (P53.02)
SF101	2.101	Active Current Positive Limit applied (SFE)	The current limits for the SFE Bridge are being applied, that is, current has risen to these limits and is being 'clipped' by the controller.
SF102	2.102	Active Current Negative Limit applied (SFE)	
SF103	2.103	Reactive Current Positive Limit applied (SFE)	
SF104	2.104	Reactive Current Negative Limit applied (SFE)	

Table 5-1. – Status Flag Listing

Status Flag Number	Value to be used as CF or DIGOUT Source if connecting to a CONTROL FLAG or DIGITAL OUTPUT etc. Note: -ve value = INV of the flag	Description A high output indicates The state shown below.	Comments Or What might affect the Status Flag?
SF105	2.105	Mains Synchronisation is valid (SFE)	The SFE code monitors the mains voltage via the mains voltage monitor board. SF105 is set upon seeing consistent mains zero crossings, and reset upon seeing spurious zero crossings, or no zero crossings.
SF106	2.106	SFE Ref. Loss	One (or more) of SFE reference sources configured via Menu 53 has been lost (SFE)
SF107	2.107	Ramp Override	Current limit is overriding the ramp (VVVF only).
SF108	2.108	PWM in Limit	Indicates that an AEM drive is unable to deliver the active/reactive current demand.
SF109	2.109	CAN2 Healthy	True when all required CAN2 reference signals have been received within time-out period.
SF110	2.110	Backup Parameter Set in Use	If main parameter set is corrupt at power up, drive reverts to the backup parameter set (if stored via P99.16). SF110 is set HI to indicate Backup set being used.
SF111	2.111	CAN1 Healthy	True when all required CAN1 reference signals have been received within time-out period.
SF112	2.112	Comparator I Output (Menu 47)	Mode set by P47.03 Sets Up Comparator Conditions.
SF113	2.113	Delay I Output (Menu 47)	HI when delay expires.
SF114	2.114	Logic Block I Output (Menu 47)	Obeys the Logical Function of the Block. P47.06 sets Logic Block Function.
SF115	2.115	Comparator J Output (Menu 47)	Mode set by P47.13 Sets Up Comparator Conditions.
SF116	2.116	Delay J Output (Menu 47)	HI when delay expires.
SF117	2.117	Logic Block J Output (Menu 47)	Obeys the Logical Function of the Block. P47.16 sets Logic Block Function.
SF118	2.118	Comparator K Output (Menu 47)	Mode set by P47.23 Sets Up Comparator Conditions.
SF119	2.119	Delay K Output (Menu 47)	HI when delay expires.
SF120	2.120	Logic Block K Output (Menu 47)	Obeys the Logical Function of the Block. P47.26 sets Logic Block Function.
SF121	2.121	Comparator L Output (Menu 47)	Mode set by P47.33 Sets Up Comparator Conditions.
SF122	2.122	Delay L Output (Menu 47)	HI when delay expires.
SF123	2.123	Logic Block L Output (Menu 47)	Obeys the Logical Function of the Block. P47.36 sets Logic Block Function.
SF124	2.124	Logic Block M Output (Menu 47)	Obeys the Logical Function of the Block. P47.40 sets Logic Block Function.

Table 5-1. – Status Flag Listing

Status Flag Number	Value to be used as CF or DIGOUT Source if connecting to a CONTROL FLAG or DIGITAL OUTPUT etc. Note: -ve value = INV of the flag	Description A high output indicates The state shown below.	Comments Or What might affect the Status Flag?
SF125	2.125	Logic Block N Output (Menu 47)	Obeys the Logical Function of the Block. P47.45 sets Logic Block Function.
SF126	2.126	Logic Block O Output (Menu 47)	Obeys the Logical Function of the Block. P47.50 sets Logic Block Function.
SF127	2.127	Logic Block P Output (Menu 47)	Obeys the Logical Function of the Block. P47.55 sets Logic Block Function.
SF128	2.128	Logic Block Q Output (Menu 47)	Obeys the Logical Function of the Block. P47.60 sets Logic Block Function.
SF129	2.129	Logic Block R Output (Menu 47)	Obeys the Logical Function of the Block. P47.65 sets Logic Block Function.
SF130	2.130	Logic Block S Output (Menu 47)	Obeys the Logical Function of the Block. P47.70 sets Logic Block Function.
SF131	2.131	Logic Block T Output (Menu 47)	Obeys the Logical Function of the Block. P47.75 sets Logic Block Function.
SF132	2.132	Comparator U Output (Menu 40)	Mode set by P40.56 Sets Up Comparator Conditions.
SF133	2.133	Comparator V Output (Menu 40)	Mode set by P40.62 Sets Up Comparator Conditions.
SF134	2.134	Comparator W Output (Menu 40)	Mode set by P40.68 Sets Up Comparator Conditions.
SF135	2.135	Comparator X Output (Menu 40)	Mode set by P40.74 Sets Up Comparator Conditions.
SF136	2.136	Holding Torque OK (Menu 47)	Status Flag in Brake Logic Function enabled by P47.80
SF137	2.137	Torque Prove OK (Menu 47)	Status Flag in Brake Logic Function enabled by P47.80
SF138	2.138	Latched Run (Menu 47)	Status Flag in Brake Logic Function enabled by P47.80
SF139	2.139	Release Reference (Menu 47)	Status Flag in Brake Logic Function enabled by P47.80
SF140	2.140	Brake Release Request (Menu 47)	Status Flag in Brake Logic Function enabled by P47.80
SF141	2.141	At Zero Speed (Menu 47)	Status Flag in Brake Logic Function enabled by P47.80

Table 5-2. – Control Flag Listing

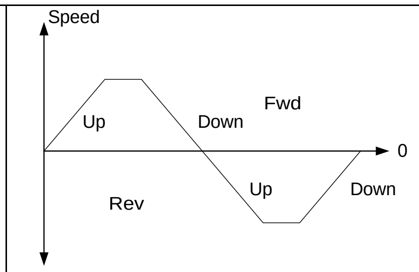
Control Flag Parameter Number	Equivalent Local Menu Parameter Number	Control Flag Name	Default Control Flag Connection	Connection Meaning	Comments
P33.00	P4.05	CF0: Normal Stop	1.001	Digital Input 1	Must be Hi to allow motor to run, when 'remote' control selected. Uses stop mode programmed in P4.07. Not active when Keypad control selected.
P33.01	P4.04	CF1: Start	1.002	Digital Input 2	Pulse Hi to generate a start (assuming CF0=1), not active when Keypad control selected – see Note (1) at the end of this table.
P33.02	P4.06	CF2: Rapid Stop	0.001	SET (on)	Operates like normal stop, except uses stop mode programmed in P4.08; works in either Keypad or Remote modes.
P33.03	P5.12	CF3: Direction	1.003	Digital Input 3	The resulting motor direction will depend on the setting of P5.11.
P33.04	P5.07	CF4: Reference 1 Selector	–1.004	INV Digital Input 4	These flags control and select the active speed reference. The actual speed reference choices are programmed into P5.01 to P5.04. CF4 selects the reference programmed into P5.01 (Reference Source 1), and so on. If two references are selected simultaneously, the flag with the lowest number takes priority.
P33.05	P5.08	CF5: Reference 2 Selector	–1.005	INV Digital Input 5	
P33.06	P5.09	CF6: Reference 3 Selector	1.005	Digital Input 5	
P33.07	P5.10	CF7: Reference 4 Selector	0	CLEARED (off)	
P33.08	P5.13	CF8: Jog Enable	0	CLEARED (off)	Used in conjunction with P5.14 & P5.27 and CF121.
P33.09	P10.34	CF9: Trip Reset	1.006	Digital Input 6	Only requires a Pulse. All trips must be healthy before a reset can occur.
P33.10	P10.32	CF10: User Trip1	0	CLEARED (off)	Connect, via digital I/O or Fieldbus, to create a user generated trip (See CF112 also) – see Note (5) at the bottom of this table.
P33.11	P5.19	CF11: Reverse Inhibit	0	CLEARED (off)	These flags, when Hi, prevent the speed reference from requesting a FWD or REV speed, thus inhibiting movement in that direction.
P33.12	P5.20	CF12: Forward Inhibit	0	CLEARED (off)	
P33.13	P5.21	CF13: Clamp Zero Ref	0	CLEARED (off)	The speed reference is clamped to zero, before the speed ramps.
P33.14	P6.05	CF14: Ramp Freeze UP FWD	0	CLEARED (off)	The ramps have 4 settable parameters, these flags, when applied, freeze ramping in the relevant quadrant, and the resultant ramp output will remain at the 'frozen' value until the freeze is removed. 
P33.15	P6.06	CF15: Ramp Freeze UP REV	0	CLEARED (off)	
P33.16	P6.07	CF16: Ramp Freeze DOWN FWD	0	CLEARED (off)	
P33.17	P6.08	CF17: Ramp Freeze DOWN REV	0	CLEARED (off)	
P33.18	P6.09	CF18: Ramp Bypass	0	CLEARED (off)	This 'short circuits' the ramp function, useful when tuning the speed loops.
P33.19	P14.07	CF19: Clamp Zero Speed	0	CLEARED (off)	The speed reference is clamped to zero, after the ramps and the droop control.
P33.20	P14.08	CF20: Disable Speed Loop	0	CLEARED (off)	The speed controller is disabled and its output prevented from influencing the Tq reference.
P33.21	P8.07	CF21: Torque Limit Select	0	CLEARED (off)	Either one of two possible Tq limits can be selected (Lo=Limit1, Hi=Limit2) refer to Menu 8 for Tq Limit programming.
P33.22	P8.05	CF22: Inhibit Positive Torque	0	CLEARED (off)	These flags allow +ve and –ve Tq limits to be applied, or indeed remove the Tq request altogether. One of two limits can be applied (see CF21) thus making the control of Tq very flexible.
P33.23	P8.06	CF23: Inhibit Negative Torque	0	CLEARED (off)	
P8.04	CF24	Disable Torque	0	CLEARED (off)	
P33.25	P4.17	CF25: Output Enable	0.001	SET (on)	The IGBT bridge is enabled or disabled with this flag 'ANDED' with Run signals. If disabled here no programmed stop modes are used, the bridge is simply switched off.
P33.26	P16.10	CF26: PID Integral Gain Freeze	0	CLEARED (off)	Can be applied to prevent the speed controller from integrating away. Requesting Hi Tq.
P33.27	P17.18	CF27: Reference Sequencer Freeze	0	CLEARED (off)	Stops the reference sequencer (Menu 17) at its current position.
P33.28	P17.19	CF28: Reference Sequencer Trigger	0	CLEARED (off)	Start the reference sequencer (Menu 17). The sequencer will execute the desired sequence, assuming sequencer mode and sequencer reset allow the sequencer to run.
P33.29	P17.20	CF29: Reference Sequencer Reset	0.001	SET (on)	Resets the reference sequencer (Menu 17) to the beginning point. Hi = Reset. Note: must be Lo to allow sequencer to run.
P33.30	P21.16	CF30: Fixed Reference Select 0	0	CLEARED (off)	These four flags generate a Binary sequence (0000 to 1111) that in turn selects fixed reference 0 to fixed reference 15 (these fixed references are programmed into Menu 21). The Binary sequence can be generated internally if these flags are connected to the 'Status Flag Generator', (Menu 31).
P33.31	P21.17	CF31: Fixed Reference Select 1	0	CLEARED (off)	
P33.32	P21.18	CF32: Fixed Reference Select 2	0	CLEARED (off)	
P33.33	P21.19	CF33: Fixed Reference Select 3	0	CLEARED (off)	
P33.34	P18.04	CF34: Motorised Potentiometer Raise	0	CLEARED (off)	Combined with CF71 and Menu 18, these flags allow a Motorised Potentiometer feature to be generated. Connect the flags to push buttons via Digital I/O.
P33.35	P18.05	CF35: Motorised Potentiometer Lower	0	CLEARED (off)	
P33.36	P30.08	CF36: Delay A Input	0	CLEARED (off)	
P33.37	P30.09	CF37: Logic Block A Input 1	0	CLEARED (off)	

Table 5-2. – Control Flag Listing

Control Flag Parameter Number	Equivalent Local Menu Parameter Number	Control Flag Name	Default Control Flag Connection	Connection Meaning	Comments
P33.38	P30.10	CF38: Logic Block A Input 2	0	CLEARED (off)	The MV3000e contains an amount of freely connectable logic to emulate PLC functionality. Refer to the Control Block diagram to view the functions pictorially. The delay, set and reset, and logic inputs, are all +ve edge triggered. The logic block mode (And, OR etc.) can all be chosen. If a 2-input Gate is selected, then CF43 is ignored.
P33.39	P30.11	CF39: Latch A Set	0	CLEARED (off)	
P33.40	P30.12	CF40: Latch A Reset	0	CLEARED (off)	
P30.21	CF41	Delay B Input	0	CLEARED (off)	The MV3000e contains an amount of freely connectable logic to emulate PLC functionality. Refer to the Control Block diagram to view the functions pictorially. The delay, set and reset, and logic inputs, are all +ve edge triggered. The logic block mode (And, OR etc.) can all be chosen. If a 2-input Gate is selected, then CF43 is ignored.
P33.42	P30.22	CF42: Logic Block B Input 1	0	CLEARED (off)	
P33.43	P30.23	CF43: Logic Block B Input 2	0	CLEARED (off)	
P33.44	P30.24	CF44: Latch B Set	0	CLEARED (off)	
P33.45	P30.25	CF45: Latch B Reset	0	CLEARED (off)	
P33.46	P30.34	CF46: Delay C Input	0	CLEARED (off)	The MV3000e contains an amount of freely connectable logic to emulate PLC functionality. Refer to the Control Block diagram to view the functions pictorially. The delay, set and reset, and logic inputs, are all +ve edge triggered. The logic block mode (And, OR etc.) can all be chosen. If a 2-input Gate is selected, then CF48 is ignored.
P33.47	P30.35	CF47: Logic Block C Input 1	0	CLEARED (off)	
P33.48	P30.36	CF48: Logic Block C Input 2	0	CLEARED (off)	
P33.49	P30.37	CF49: Latch C Set	0	CLEARED (off)	
P33.50	P30.38	CF50: Latch C Reset	0	CLEARED (off)	
P33.51	P30.47	CF51: Delay D Input	0	CLEARED (off)	The MV3000e contains an amount of freely connectable logic to emulate PLC functionality. Refer to the Control Block diagram to view the functions pictorially. The delay, set and reset, and logic inputs, are all +ve edge triggered. The logic block mode (And, OR etc.) can all be chosen. If a 2-input Gate is selected, then CF53 is ignored.
P33.52	P30.48	CF52: Logic Block D Input 1	0	CLEARED (off)	
P33.53	P30.49	CF53: Logic Block D Input 2	0	CLEARED (off)	
P33.54	P30.50	CF54: Latch D Set	0	CLEARED (off)	
P30.51	CF55	Latch D Reset	0	CLEARED (off)	
P33.56	P30.53	CF56: Logic Block E Input 1	0	CLEARED (off)	More General Purpose Logic to generate PLC functionality. The logic gate function is set by P30.52. If a 2-input gate is selected then CF58 is ignored.
P33.57	P30.54	CF57: Logic Block E Input 2	0	CLEARED (off)	
P33.58	P30.55	CF58: Logic Block E Input 3	0	CLEARED (off)	
P33.59	P30.57	CF59: Logic Block F Input 1	0	CLEARED (off)	More General Purpose Logic to generate PLC functionality. The logic gate function is set by P30.56. If a 2-input gate is selected then CF61 is ignored.
P33.60	P30.58	CF60: Logic Block F Input 2	0	CLEARED (off)	
P33.61	P30.59	CF61: Logic Block F Input 3	0	CLEARED (off)	
P33.62	P30.61	CF62: Logic Block G Input 1	0		More General Purpose Logic to generate PLC functionality. The logic gate function is set by P30.60. If a 2-input gate is selected then CF64 is ignored.
P33.63	P30.62	CF63: Logic Block G Input 2	0		
P33.64	P30.63	CF64: Logic Block G Input 3	0		
P33.65	P30.65	CF65: Logic Block H Input 1	0		More General Purpose Logic to generate PLC functionality. The logic gate function is set by P30.64. If a 2-input gate is selected then CF67 is ignored.
P33.66	P30.66	CF66: Logic Block H Input 2	0	CLEARED (off)	
P33.67	P30.67	CF67: Logic Block H Input 3	0	CLEARED (off)	
P33.68	P12.25	CF68: Flux Limit (Enable)	0	CLEARED (off)	Enables Flux Limits programmed in Menu 12 to become active (Vector Control only). This allows CF68 to be programmed for operation at a pre-condition to switch the flux limit in and out as an alternative to achieving that function by parameter editing.
P33.69	P16.11	CF69: Suicide PID Controller	–2.000	INV Status Flag SF0	Speed Amp is “suicided” to prevent output integrating away. Default connected to ‘Not Running’
P33.70	P24.03	CF70: Enable Speed Trim	0	CLEARED (off)	The Speed Reference can be trimmed after the ramps (useful for Draw Control on Paper Mills) set up in Menu 24. See also CF75.
P33.71	P18.06	CF71: Motorised Potentiometer Preset	0	CLEARED (off)	Applies the preset value programmed in P18.03 to the Motorised Potentiometer output. See also CF34 and CF35.
P33.72	P15.02	CF72: Enable Torque Reference	0	CLEARED (off)	Applies the Torque reference, configured in Menu 15, to the speed loop output – see Note (2) at the end of this table.
P33.73	P14.16	CF73: Enable Speed Loop Deadband	0	CLEARED (off)	The deadband, configured by Menu 14, will be enabled – see Note (2) at the end of this table for Application Example.
P33.74	P25.03	CF74: Enable Inertia Compensation	0	CLEARED (off)	Inertial Compensation, configured by Menu 25, will be enabled.
P33.75	P24.04	CF75: Speed Trim Scale Select	0	CLEARED (off)	The ‘Trim Applied’ can have 2 gain factors, set by P24.01, P24.02. This flag selects between them.
P33.76	P14.06	CF76: Speed Loop Gain Select	0	CLEARED (off)	Select from two sets of P20 values for the Speed Loop. Useful if two quite different loads are being turned, or for storing speed loop gains in case encoder loss ride-through is used – see Menu 20.
P33.77	P12.05	CF77: Enable Manual Temperature Compensation	0.001	SET (on)	Rotor Temperature Compensation is only effective in Vector Control with Encoder. This flag allows an external measurement or calculation of rotor temperature to be used – see P12.06.
P33.78	P26.25	CF78: Run History	2.008	Status Flag SF8	Connect these flags to allow manual or automatic start/stop of History Record so that chosen events can be stored and recalled in the History Log.

Table 5-2. – Control Flag Listing

Control Flag Parameter Number	Equivalent Local Menu Parameter Number	Control Flag Name	Default Control Flag Connection	Connection Meaning	Comments
P33.79	P26.26	CF79: Stop History	2.005	Status Flag SF5	
P33.80	P36.38	CF80: Force Position Valid	0	CLEARED (off)	Forces the current position to be a valid one, SF64 forced Hi.
P33.81	P36.39	CF81: Force Position Invalid	0	CLEARED (off)	Forces the current position invalid, SF64 forced Lo.
P33.82	P36.40	CF82: Datum Move Permit	0	CLEARED (off)	Must be Hi before datum movements can occur. Prevent accidental Datumizing
P33.83	P36.41	CF83: Perform Datum Movement	0	CLEARED (off)	If CF82 Hi, then a rising edge causes datum movement set in P36.34 to occur. t
P33.84	P36.42	CF84: Datum Approach	0	CLEARED (off)	Used to signal 'start datum position is approaching', when carrying out a datum move.
P33.85	P36.43	CF85: Datum input	0	CLEARED (off)	Used to signal 'at datum position' when carrying out a datum move.
P33.86	P36.08	CF86: High Limit Reached (limit switch	0	CLEARED (off)	A mechanical limit switch connected here, will generate a high limit for the Position Controller, stopping the item which is moving, from being damaged.
P33.87	P36.09	CF87: Low Limit Reached (limit switch	0	CLEARED (off)	A mechanical limit switch connected here, will generate a low limit for the Position Controller, stopping the item which is moving, from being damaged.
P33.88	P37.03	CF88: Position Reference 1 or 2 Selection	0	CLEARED (off)	Allows the selection of either of two pre-programmed position references. The references are programmed in P37.00 and P37.01.
P33.89	P36.51	CF89: Enable Inching	0	CLEARED (off)	An 'Inch Mode' can be enabled for the Position Controller. Position reference comes from the Position Incher (Menu 36).
P33.90	P36.46	CF90: Uni-directional Approach Enable	0	CLEARED (off)	Allows a particular position to always be approached from the same direction, thus removing backlash in gears. The position is "overshot" to allow approach from the same direction.
P33.91	P37.38	CF91: Position Reference Select 0	0	CLEARED (off)	Pre-set positions (stored in the Position Reference Teacher - Menu 37) can be individually selected by these four flags working together to produce a binary sequence 0000 = position 0, 1111 = position 15. The positions can be chosen by selecting them individually, or cycled by connecting these flags to the Status Flag Generator (Menu 31).
P33.92	P37.39	CF92: Position Reference Select 1	0	CLEARED (off)	
P33.93	P37.40	CF93: Position Reference Select 2	0	CLEARED (off)	
P33.94	P37.41	CF94: Position Reference Select 3	0	CLEARED (off)	
P33.95	P36.52	CF95: Inching Up	0	CLEARED (off)	Connect the flags to pushbuttons, and the current position can be 'inched' up or down, assuming 'inching' is enabled (CF89) and inching has been configured (Menu 36).
P33.96	P36.53	CF96: Inching Down	0	CLEARED (off)	
P33.97	P31.19	CF97: Status Flag Generator Freeze	0	CLEARED (off)	The Status Flag Generator produces a 0000 to 1111 binary sequence with individual times between each binary pattern (Menu 31). These flags control which way the sequence 'counts' and whether it is frozen, running or reset.
P33.98	P31.20	CF98: Status Flag Generator Up	0	CLEARED (off)	
P33.99	P31.21	CF99: Status Flag Generator Down	0	CLEARED (off)	
P34.00	P31.22	CF100: Status Flag Generator Reset	0	CLEARED (off)	
P34.01	P37.05	CF101: Position Learn NOW	0	CLEARED (off)	The drive can be taught 16 positions using this flag and P37.04. These positions are played back using CF91 to CF94.
P34.02 to P34.05	Not Defined	CF102 to CF105: Not Defined	Not Defined	Not Defined	
P34.06	P12.06	CF106: Auto Temperature Compensation	0	CLEARED (off)	Set enables Automatic Temperature Compensationof changes in the motor's rotor resistance. It is only valid in Vector Control with Encoder.
P34.07	P14.20	CF107: Speed Loop Integral Freeze	0	CLEARED (off)	Speed loop integral term is frozen when either this flag is set or if the speed loop is in limit
P34.08	None	CF108: DC Link Off	0	CLEARED (off)	When this flag is set, no DC Link is expected to be present, running it is prohibited. Trips that are expected, as a result of no DC link, are masked out by the drive so that it is "healthy".
P34.09	P72.00	CF109: Application Enable	0	CLEARED (off)	This flag enables the Application Code Developer environment - see Menu 98 - if you set this flag Lo, all code written in Application Code Developer area stops and so is a good debug feature.
P34.10	P23.08	CF110: DB Enable	2.008	Status Flag SF8 Output Running	Enable/Disable a dynamic brake connected to the MV CDC. Its default is a connection to output running
P34.11	P23.09	CF111: DB Resistor Thermostat	0	CLEARED (off)	To protect the dynamic brake resistor, connect its thermostat here; invert the connection for a N/C thermostat – see Note (5) at the end of this table.
P34.12	P10.33	CF112: User Trip2	0	CLEARED (off)	Connect via Digital I/O or Fieldbus, to create a user generated trip (See CF 10) - see Note (5) at the end of this table.
P34.13	P2.11	CF113: MTRIP (see P2.10)	0	CLEARED (off)	Connect the motor thermostat, via a Digital Input, to protect the motor (configure P2.10) - see Note (5) at the end of this table.
P34.14	P3.08	CF114: Current Limit Defeat	0	CLEARED (off)	Operate in frequency control only. See P3.08 and P3.11 to understand the risks and benefits of disabling or enabling current and Tq Controls in frequency control – see Table 6-2.
P34.15	P3.11	CF115: Torque limit enable	0	CLEARED (off)	
P34.16	P4.09	CF116: Keypad/Remote	1.004	Digital Input 4	Allows selection between 1 Keypad start/stop or Remote start/stop - (Lo=Keypad) - see also CF0,1, 2,123,124,125 and Control Block Diagram Sheets SFE-1 and Sheet 1.
P34.17	P5.25	CF117: Enable Speed Demand Clamp	0	CLEARED (off)	Speed reference clamps can be programmed by P5.23, P5.24. They are applied before the ramps when CF117 = Hi.

Table 5-2. – Control Flag Listing

Control Flag Parameter Number	Equivalent Local Menu Parameter Number	Control Flag Name	Default Control Flag Connection	Connection Meaning	Comments
P34.18	P13.03	CF118: Select Backup Speed Feedback	0	CLEARED (off)	Alternative speed feedbacks can be selected. This either happens automatically when the encoder fails, or manually when CF118 is driven HI. Be sure to have tuned the speed amplifier using the backup feedback, and select the second set of PID gains using CF76 as backup is selected.
P34.19	P13.17	CF119: Force Encoder Loss	0	CLEARED (off)	This flag is offered to allow external Encoder monitors to force an Encoder loss situation and either trip the drive or cause backup feedbacks to be chosen.
P34.20	P13.18	CF120: Reset Encoder Loss	0	CLEARED (off)	After an Encoder loss (either internally or externally determined) has been cleared. This CF **MUST** be pulsed to cause the drive to return to Encoder feedback.
P34.21	P5.28	CF121: Jog speed 1/2 select	0	CLEARED (off)	Allows the selection between two jog speeds, programmed by P5.14 and P5.27 respectively.
P34.22	P6.11	CF122: Limit Ramp	0.001	SET (on) RTN (Vector Mode only)	Enables the 'max ramp deviation' set by P6.10 – see 6.37 for an explanation.
P34.23	P4.18	CF123: Backup Run/Stop select	0	CLEARED (off)	A second set of remote Run/Stop flags are available, referred to as backup. CF123 allows selection between CF0/CF1 and CF124/CF125. Ensure CF116 is =1 to select remote Run/Stop in the first place.
P34.24	P4.19	CF124: Backup Stop	0	CLEARED (off)	
P34.25	P4.20	CF125: Backup Start	0	CLEARED (off)	
P34.26	P3.26	CF126: Enable Variable Volts boost	0	CLEARED (off)	VVVF mode only. Volts boost is used to enhance starting Tq. This flag enables volts boost from an external source (selected by P3.25). This feature requires a certain level of drive expertise. The drive also offers two other methods of controlling volts boost (Fixed Boost via P3.01 and Autoboost via P3.02), these methods should be tried first.
P34.27	P6.16	CF127: Select Ramp 2	0	CLEARED (off)	The second set of speed ramps can be selected using this flag.
P34.28	P54.28	CF128: PPID Freeze	2.108	Status Flag SF108	Freezes the Active Power PID Controller in SFE Mode
P34.29	P54.29	CF129: P PID Zero	-2.000	INV Status Flag SF2.000	Sets Active Power PID Controller to zero when SFE bridge is not running
P34.30	P54.32	CF130: P Limit Enable	1.000	SET (on)	When set this control flag causes a limit to be applied to the output of the Active Power PID Controller plus the Feedforward.
P34.31	P54.48	CF131: QPID Freeze	2.108	Status Flag SF108	Freezes the Reactive Power PID Controller in SFE Mode
P34.32	P54.49	CF132: Q PID Zero	-2.000	INV Status Flag SF2.000	Sets Reactive Power PID Controller to zero when SFE bridge is not running
P34.33	P54.52	CF133: Q Limit Enable	1.000	SET (on)	When set this control flag causes a limit to be applied to the output of the Reactive Power PID Controller plus the Feedforward.
P34.34	P6.26	CF134: Ramp Freeze Up +ve	0.000	CLEARED (off)	The user ramp has 4 settable parameters, these flags, when applied, freeze ramping in the relevant quadrant, and the resultant ramp output will remain at the 'frozen' value until the freeze is removed.
P34.35	P6.27	CF135: Ramp Freeze Up –ve	0.000	CLEARED (off)	
P34.36	P6.28	CF136: Ramp Freeze Down +ve	0.000	CLEARED (off)	
P34.37	P6.29	CF137: Ramp Freeze Down -ve	0.000	CLEARED (off)	
P34.38	P6.30	CF138: Ramp Bypass	0.000	CLEARED (off)	The User Ramp function is by-passed altogether if this control flag is set
P34.39	P6.35	CF139: Select Ramp Rate 2	0.000	CLEARED (off)	An alternative set of User Ramp rates is provided by parameters P61.31 to P61.34. This set of rates is selected when this control flag is set.
P34.40	P40.80	CF140: Switch A State	0.000	CLEARED (off)	Switch A Input 1 is selected when CF140 = 0, otherwise Switch A Input 2 is selected.
P34.41	P40.86	CF141: Switch B State	0.000	CLEARED (off)	Switch B Input 1 is selected when CF141 = 0, otherwise Switch B Input 2 is selected.
P34.42	P40.92	CF142: Switch C State	0.000	CLEARED (off)	Switch C Input 1 is selected when CF142 = 0, otherwise Switch C Input 2 is selected.
P34.43	P40.98	CF143: Switch D State	0.000	CLEARED (off)	Switch D Input 1 is selected when CF143 = 0, otherwise Switch D Input 2 is selected.
P34.44	P47.07	CF144: Delay I Input	0.000	CLEARED (off)	The MV3000e contains an amount of freely connectable logic to emulate PLC functionality. Refer to the Control Block diagram to view the functions pictorially. The delay, set and reset, and logic inputs, are all +ve edge triggered. The logic block mode (And, OR etc.) can all be chosen. If a 2-input Gate is selected, then CF146 is ignored.
P34.45	P47.08	CF145: Logic I Input 1	0.000	CLEARED (off)	
P34.46	P47.09	CF146: Logic I Input 2	0.000	CLEARED (off)	
P34.47	P47.17	CF147: Delay J Input	0.000	CLEARED (off)	The MV3000e contains an amount of freely connectable logic to emulate PLC functionality. Refer to the Control Block diagram to view the functions pictorially. The delay, set and reset, and logic inputs, are all +ve edge triggered. The logic block mode (And, OR etc.) can all be chosen. If a 2-input Gate is selected, then CF149 is ignored.
P34.48	P47.18	CF148: Logic J Input 1	0.000	CLEARED (off)	
P34.49	P47.19	CF149: Logic J Input 2	0.000	CLEARED (off)	
P34.50	P47.27	CF150: Delay K Input	0.000	CLEARED (off)	The MV3000e contains an amount of freely connectable logic to emulate PLC functionality. Refer to the Control Block diagram to view the functions pictorially. The delay, set and reset, and logic inputs, are all +ve edge triggered. The logic block mode (And, OR etc.) can all be chosen. If a 2-input Gate is selected, then CF152 is ignored.
P34.51	P47.28	CF151: Logic K Input 1	0.000	CLEARED (off)	
P34.52	P47.29	CF152: Logic K Input 2	0.000	CLEARED (off)	
P34.53	P47.37	CF153: Delay L Input	0.000	CLEARED (off)	The MV3000e contains an amount of freely connectable logic to emulate PLC functionality. Refer to the Control Block diagram to view the functions pictorially. The delay, set and reset, and logic inputs, are all +ve edge triggered. The logic block mode (And, OR etc.) can all be chosen. If a 2-input Gate is selected, then CF155 is ignored.
P34.54	P47.38	CF154: Logic L Input 1	0.000	CLEARED (off)	
P34.55	P47.39	CF155: Logic L Input 2	0.000	CLEARED (off)	
P34.56	P47.41	CF156: Logic M Input 1	0.000	CLEARED (off)	
P34.57	P47.42	CF157: Logic M Input 2	0.000	CLEARED (off)	

Table 5-2. – Control Flag Listing

Control Flag Parameter Number	Equivalent Local Menu Parameter Number	Control Flag Name	Default Control Flag Connection	Connection Meaning	Comments
P34.58	P47.43	CF158: Logic M Input 3	0.000	CLEARED (off)	The MV3000e contains an amount of freely connectable logic to emulate PLC functionality. Refer to the Control Block diagram to view the functions pictorially. The logic inputs are all +ve edge triggered. The logic block modes (AND, OR etc.) can all be chosen. If a 2-or 3 input Gate is required then this can be realised by setting the unused inputs high (1.000) or low (0.000) depending upon the function type.
P34.59	P47.44	CF159: Logic M Input 4	0.000	CLEARED (off)	
P34.60	P47.46	CF160: Logic N Input 1	0.000	CLEARED (off)	The MV3000e contains an amount of freely connectable logic to emulate PLC functionality. Refer to the Control Block diagram to view the functions pictorially. The logic inputs are all +ve edge triggered. The logic block modes (AND, OR etc.) can all be chosen. If a 2-or 3 input Gate is required then this can be realised by setting the unused inputs high (1.000) or low (0.000) depending upon the function type.
P34.61	P47.47	CF161: Logic N Input 2	0.000	CLEARED (off)	
P34.62	P47.48	CF162: Logic N Input 3	0.000	CLEARED (off)	
P34.63	P47.49	CF163: Logic N Input 4	0.000	CLEARED (off)	
P34.64	P47.51	CF164: Logic O Input 1	0.000	CLEARED (off)	The MV3000e contains an amount of freely connectable logic to emulate PLC functionality. Refer to the Control Block diagram to view the functions pictorially. The logic inputs are all +ve edge triggered. The logic block modes (AND, OR etc.) can all be chosen. If a 2-or 3 input Gate is required then this can be realised by setting the unused inputs high (1.000) or low (0.000) depending upon the function type.
P34.65	P47.52	CF165: Logic O Input 2	0.000	CLEARED (off)	
P34.66	P47.53	CF166: Logic O Input 3	0.000	CLEARED (off)	
P35.67	P47.54	CF167: Logic O Input 4	0.000	CLEARED (off)	
P34.68	P47.56	CF168: Logic P Input 1	0.000	CLEARED (off)	The MV3000e contains an amount of freely connectable logic to emulate PLC functionality. Refer to the Control Block diagram to view the functions pictorially. The logic inputs are all +ve edge triggered. The logic block modes (AND, OR etc.) can all be chosen. If a 2-or 3 input Gate is required then this can be realised by setting the unused inputs high (1.000) or low (0.000) depending upon the function type.
P34.69	P47.57	CF169: Logic P Input 2	0.000	CLEARED (off)	
P34.70	P47.58	CF170: Logic P Input 3	0.000	CLEARED (off)	
P34.71	P47.59	CF171: Logic P Input 4	0.000	CLEARED (off)	
P34.72	P47.61	CF172: Logic Q Input 1	0.000	CLEARED (off)	The MV3000e contains an amount of freely connectable logic to emulate PLC functionality. Refer to the Control Block diagram to view the functions pictorially. The logic inputs are all +ve edge triggered. The logic block modes (AND, OR etc.) can all be chosen. If a 2-or 3 input Gate is required then this can be realised by setting the unused inputs high (1.000) or low (0.000) depending upon the function type.
P34.73	P47.62	CF173: Logic Q Input 2	0.000	CLEARED (off)	
P34.74	P47.63	CF174: Logic Q Input 3	0.000	CLEARED (off)	
P34.75	P47.64	CF175: Logic Q Input 4	0.000	CLEARED (off)	
P34.76	P47.66	CF176: Logic R Input 1	0.000	CLEARED (off)	The MV3000e contains an amount of freely connectable logic to emulate PLC functionality. Refer to the Control Block diagram to view the functions pictorially. The logic inputs are all +ve edge triggered. The logic block modes (AND, OR etc.) can all be chosen. If a 2-or 3 input Gate is required then this can be realised by setting the unused inputs high (1.000) or low (0.000) depending upon the function type.
P34.77	P47.67	CF177: Logic R Input 2	0.000	CLEARED (off)	
P34.78	P47.68	CF178: Logic R Input 3	0.000	CLEARED (off)	
P34.79	P47.69	CF179: Logic R Input 4	0.000	CLEARED (off)	
P34.80	P47.71	CF180: Logic S Input 1	0.000	CLEARED (off)	The MV3000e contains an amount of freely connectable logic to emulate PLC functionality. Refer to the Control Block diagram to view the functions pictorially. The logic inputs are all +ve edge triggered. The logic block modes (AND, OR etc.) can all be chosen. If a 2-or 3 input Gate is required then this can be realised by setting the unused inputs high (1.000) or low (0.000) depending upon the function type.
P34.81	P47.72	CF181: Logic S Input 2	0.000	CLEARED (off)	
P34.82	P47.73	CF182: Logic S Input 3	0.000	CLEARED (off)	
P34.83	P47.74	CF183: Logic S Input 4	0.000	CLEARED (off)	
P34.84	P47.76	CF184: Logic R Input 1	0.000	CLEARED (off)	The MV3000e contains an amount of freely connectable logic to emulate PLC functionality. Refer to the Control Block diagram to view the functions pictorially. The logic inputs are all +ve edge triggered. The logic block modes (AND, OR etc.) can all be chosen. If a 2-or 3 input Gate is required then this can be realised by setting the unused inputs high (1.000) or low (0.000) depending upon the function type.
P34.85	P47.77	CF185: Logic R Input 2	0.000	CLEARED (off)	
P34.86	P47.78	CF186: Logic R Input 3	0.000	CLEARED (off)	
P34.87	P47.79	CF187: Logic R Input 4	0.000	CLEARED (off)	
P34..88	P47.81	CF188: Run Request	0.000	CLEARED (off)	Inputs to Brake Logic Function enabled by P47.80. **This brake control is for operational purposes only and must form part of the functional safety of the system. If application of the brakes is required for the functional safety of the system, then there must be a means of applying the brakes (and keeping them applied) independently of the MV3000e**
P34.89	P47.82	CF189: Brake Release Input	0.000	CLEARED (off)	
P34.90	P99.22	CF190: P Set Select	0.000	CLEARED (off)	Used, in conjunction with CF190, to select the active parameter set in response to a change in a digital input, status bit or some other control flag source.
P34.91	P99.23	CF191: Alt P-Set Select	0.000	CLEARED (off)	Used, in conjunction with CF191, to select the active parameter set in response to a change in a digital input, status bit or some other control flag source.
P34.92 to P34.97	Not Defined	CF193 to CF197: Not Defined	Not Defined	Not Defined	
P34.98	P10.40	CF198: User Alert 1	0.000	CLEARED (off)	Unlike User Trips 1 and 2, User Alerts, although functionally similar, cannot be set for auto-reset in Menu 28
P34.99	P10.42	CF199: User Alert 1	0.000	CLEARED (off)	
	P10.44	CF200: User Alert 3	0.000	CLEARED (off)	Unlike User Trips 1 and 2, User Alerts, although functionally similar, cannot be set for auto-reset in Menu 28
	P10.46	CF201: User Alert 4	0.000	CLEARED (off)	
	P10.48	CF202: User Alert 5	0.000	CLEARED (off)	
	P10.50	CF203: User Alert 6	0.000	CLEARED (off)	

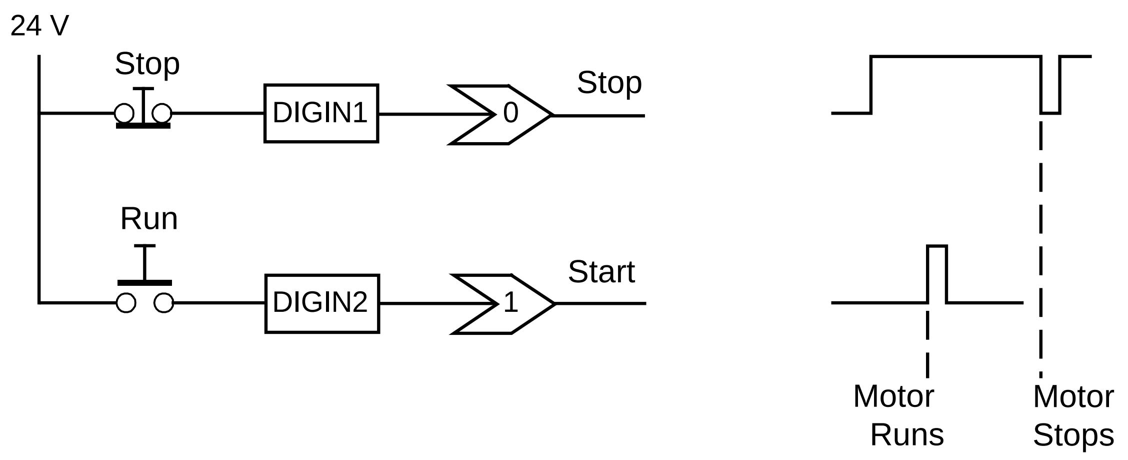
Table 5-2. – Control Flag Listing

Control Flag Parameter Number	Equivalent Local Menu Parameter Number	Control Flag Name	Default Control Flag Connection	Connection Meaning	Comments
	P10.52	CF204: User Alert 7	0.000	CLEARED (off)	
	P10.52	CF205: User Alert 8	0.000	CLEARED (off)	
	P10.54	CF206: User Alert 9	0.000	CLEARED (off)	
	P10.56	CF207: User Alert 10	0.000	CLEARED (off)	

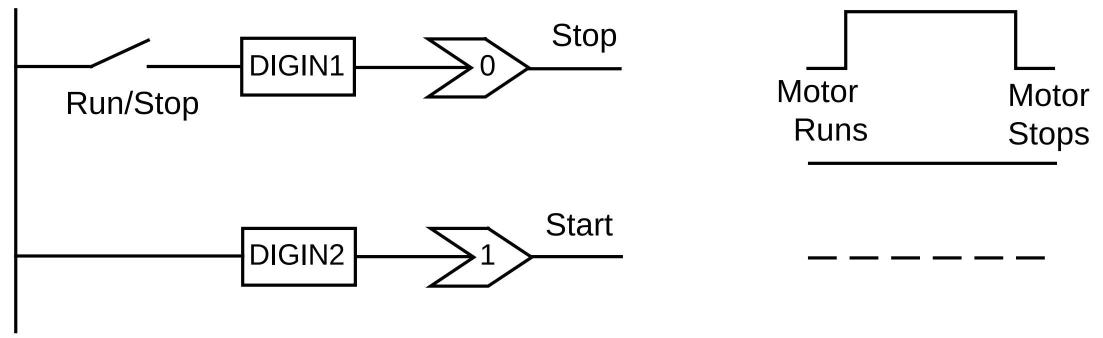
t = See 6.36.3 for an explanation of how these flags interact.

5.5 USING CF0 AND CF1 TO GENERATE START/STOP COMMANDS:

Mode 1 – Preferred UK Method using Pushbuttons



Mode 2 – Preferred Method in Germany and France using a Switch



5.5.1 Configuring the Tq Reference

When configuring the MV3000e for Tq Control (Vector Mode only) there will be two major modes:

a) Just Tq control – useful if noisy second drive as a Tq slave to another drive.

b) Tq control with a speed catch.

Also note that P11.49 will show the absolute limit to the Tq that can be requested, based on current motor and mains voltage data.

5.5.2 Configuring Simple Tq Control

a) Select Tq reference source using P15.05.

b) Adjust Tq scale factor P15.01, so that the desired Tq reference is produced (% of motor Full Load Torque).

c) Enable Tq reference with CF72 = 1.

d) If the Tq reference needs to be "ramped" in set a slew rate in P15.03. A slew rate can help if in Tq helper configuration to prevent 'fighting' between master and slave drives.

e) Disable the speed loop CF20 = 1.

f) Run the drive, ensuring that there is a load on the motor, otherwise the Tq Controller will cause the speed to increase to 'find' the Tq.

5.5.3 Setting up Tq Control with a Speed Catch

If the drive is to be used to 'pull' against material that could break, like strip steel, cables for ship etc. then a speed catch will prevent motor run-away in the event of a break.

a) Set Tq Controller up as outlined above.

b) Do not disable the speed loop – leave CF20 = 0.

c) Enable speed deadband CF73 = 1.

d) Configure the speed deadband using Menu 14.

e) The drive MUST have been fully commissioned in speed control, gains, ramps etc. in place, before running like this.

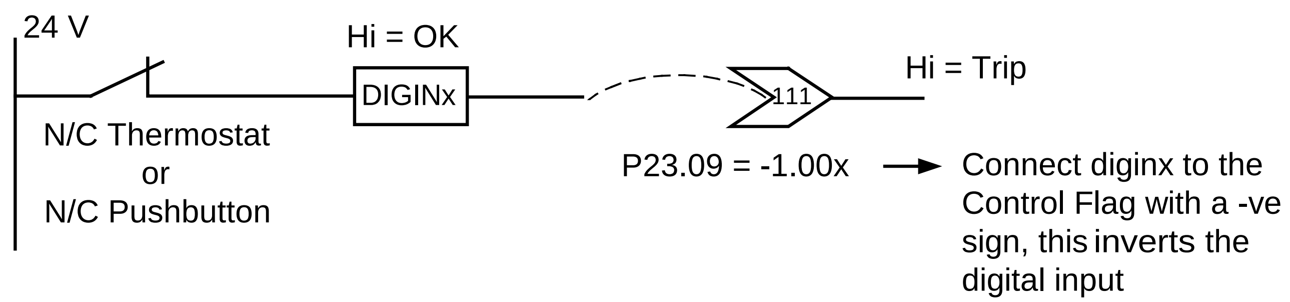
f) Run the drive, ensuring that there is a load on the motor, otherwise the Tq Controller will cause the speed to increase to 'find' the Tq.

5.5.4 Connecting Thermostats / N/C Push Buttons to Control Flags (Use Trips, MTRIP & Thermostats)

- Most control flags 'activate' the function they control, when they are driven Hi.
- Thermostats and normally closed Push buttons would therefore 'activate' the function when they were healthy, as they open when there is a problem. A simple –ve sign in the programming of the flag will solve this problem.

The example shows DB resistor thermostat, but can be used for MTRIP, user trip 1 and 2.

a) Connect control flag 111 to the INV of the DIGIN thus:



6. PARAMETER DESCRIPTIONS

6.1 INTRODUCTION

This section contains a full description of the parameters controlling the drive.

The drive parameters are grouped into menus, each containing the parameters and control flags required to control and monitor a particular feature. The parameters are described in order of menu as shown in Table 6-1. Each menu is cross-referred to the relevant sheet of the Control Block Diagram in Section 7, which gives a graphic representation of the effect of parameters on drive operation.

Menu	Description	Menu	Description
1	User configured menu	41	Programmable status word settings
2	Basic motor settings	42	Pointer source settings
3	Frequency control settings	43	Load fault detection window settings
4	Start and stop control	44	Reference shaper settings
5	Speed reference settings	45	Temperature
6	Ramp settings	46	Ridethrough Menu
7	Plant I/O settings	47	Second Logic Menu
8	Torque limit settings	50	Basic SFE Setup
9	Basic drive monitoring	51	SFE Monitoring
10	Trips and warnings	52	Advanced SFE Setup
11	Advanced drive monitoring	53	SFE Reference Setup
12	Motor advanced settings (vector only)	54	Mains Monitor Menu
13	Speed feedback settings (vector only)	55	Machine Bridge Control Menu
14	Speed loop settings (vector only)	56	AC Voltage Control Menu
15	Torque reference settings (vector only)	58*	CANopen Extended I/O settings Can Port 2
16	PID controller settings	59*	CANopen Extended I/O settings CAN Port 1
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	65*	CAN Port 2
22	Skip speed settings	66*	CAN 2 CANopen
23	Dynamic brake control settings	67*	CAN 2 DeviceNet
24	Speed trim settings	70-72	Application Code Developer
25	Inertia compensation settings	74	PROFIBUS Fieldbus Coupler
26	History log settings	75*	PROFIBUS Fieldbus Coupler
27	History log playback settings	78*	MicroPEC™
28	Auto-reset settings	76	Reserved
29	Speed and torque monitor settings	77	Reserved
30	Logic block settings	80*	Fieldbus - Configuration and status data
31	Status Flag generator settings	83*	Fieldbus - Fast produced VCOMs
32	Serial links settings	84*	Fieldbus - Fast consumed VCOMs
33	Control Flag 0 to 99 source settings	85*	Fieldbus - Slow VCOMs and FIP refs.
34	Control Flag 100 to 127 source settings	86	Ethernet interface Menu
35	Miscellaneous features	89*	Fieldbus - Data spy module
36	Position controller settings (encoder only)	90	Manufacturer's Menu
37	Position reference settings (encoder only)	91	Fast Analogue Output
38	Position controller monitor (encoder only)	98	Menu enable selection settings
39	Menu 1 Setup Menu	99	Configuration settings
40	Summing nodes settings		

Table 6-1. – Menu Listing

NOTE: * These menus are described in associated product documentation:
Menus 58, 65, 66 and 67 in the 2nd CAN Port product manual;
Menus 59, 60, 61 and 62 in the CANopen product manual;
Menus 60, 61 and 63 in the DeviceNet Manual,
Menus 74 and 75 in the PROFIBUS Manual;
Menu 78 in the MicroPEC™ Instruction Sheet;
Menus 80, 83, 84 and 85 in the FIP Manual and
Menu 89 is used for all documentation with Fieldbus applications.

6.1.1 Advanced Features and Parameters

An understanding of Control and Status Flags is fundamental to understanding how to program the advanced features of the drive. Users who are not familiar with the MV3000e product should read Section 6.33 before attempting to program advanced features of the drive. A list of status flags is given in Table 5-1 and a list of control flags is given in Table 5-2.

6.2 MENU 2 – BASIC MOTOR SETTINGS

(Refer to Control Block Diagram Sheet 8 for most settings)

Menu 2 gives access to the parameters required to configure the basic motor settings.

6.2.1 Basic Motor Data

P2.00 - Motor Base Frequency

Specifies the frequency at which the base voltage is achieved and is the normal operating frequency for the motor.

a) Set the value to that given on the motor nameplate.

Allowed values are: 5Hz to 200Hz.

P2.01 - Motor Base Voltage

Specifies the voltage applied to the motor terminals when the motor is operating at base frequency.

a) Set the motor base voltage to the value given on the motor nameplate.

Allowed values are: 25V to 1000V (rms)

NOTES:

The maximum output voltage of the drive cannot be greater than the input supply voltage.

Motors rated for a lower voltage than the input supply voltage to the drive can be used with MV3000e. The drive controls the power of the motor by PWM switching of the output voltage. The motor therefore can be subject to a voltage equal to the supply voltage. If there is a considerable difference between motor base voltage and the input supply voltage to the drive, the motor manufacturer should be consulted, to ensure the motor insulation is suitable for operation up to the input supply voltage of the drive.

P2.02 - Motor Full Load Current

The motor full load current (FLC) setting is used by the drive to provide motor protection and optimum motor control. The range of allowed values depends on the size of the drive, obtained by reading P99.05, and on whether Frequency Control or Vector mode is used.

Allowed values are:

For Frequency Control mode: 0.125 x Drive FLC to 1.5 x Drive FLC

For Vector mode: 0.5 x Drive FLC to 1.5 x Drive FLC

NOTE: The Full Load Current of the drive is given by P99.05.

P2.03 - Motor Nominal Full Load Power

The motor nominal full load power is used by the drive to calculate the motor nominal torque, required by the internal control software. This value is usually given on the motor nameplate.

a) Set the value to that given on the motor nameplate.

The allowed values depend on the size of the drive.

P2.04 - Motor Nominal Full Load Speed

The motor nominal full load speed is used by the drive to calculate the motor nominal torque, required by the internal control software.

Allowed values are: 100r/minute to 9999r/minute

P2.05 - Motor Full Load Power Factor

This parameter is used to define the level of in-phase current corresponding to 100 % torque. This value is usually given on the motor nameplate. The default value is set for a typical 4-pole motor for the particular rating of drive.

Allowed values depend on the drive rating.

P2.06 - Number of Motor Poles

Normally the drive estimates the number of motor poles from the nominal speed. However if the number of poles is high, the drive may make an erroneous estimate. In this case the number of motor poles should be entered manually.

Allowed values (even numbers) are:

0 to 28 (0 shows drive has estimated the number)

6.2.2 Motor I²T Protection

P2.07 - Motor 150% Overload Duration

The motor can withstand 150% full load current overload at base frequency. This can be obtained from the motor manufacturer's motor data sheets.

Allowed values are: 10s to 3600s

P2.08 - Cooling Fan Type

This is used in the I²T calculation to derate the motor according to the type of motor cooling.

Allowed values are

1 = Motor is cooled by a shaft driven fan. MV3000e uses the derate curve for motor full load current shown at Figure 6-1.

2 = Motor is cooled by a separately powered fan, allowing the full motor rating to be used down to zero speed.

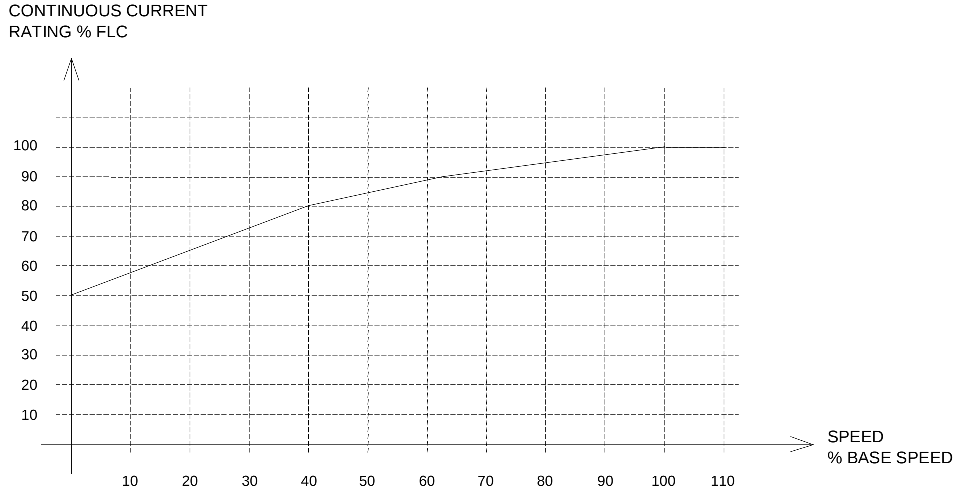


Figure 6-1. – Motor Derate Curve

P2.09 - Action on Motor I^2T Fault

Defines the action to be taken by the drive when the percentage of I^2T overload remaining falls below the prescribed limits.

Allowed values are:
0 = No action
1 = Warning at 75% I^2T limit
2 = Warning at 75% I^2T limit, Trip at 100 % I^2T limit
3 = Current Limit at 75% I^2T limit

NOTE: Total motor protection against sustained overloads requires direct measurement of motor temperature using embedded thermostats or PTC (positive temperature co-efficient) devices (see Sections 6.2.3 and 6.2.4).

6.2.3 Motor Thermostat Protection

(Refer to Control Block Diagram Sheet 9).

P2.11 - Control Flag 113 - Motor Thermostat Input

Motor Thermostat protection can be provided by connecting the motor thermostat to a digital input (DIGIN 1 to 6) on terminal block TB3 on the I/O Panel. Connect this digital input to MTRIP, Control Flag 113 (P2.11) by editing in the value 1.001 to 1.006 for DIGIN 1-6. The motor thermostat input is normally held high (logic 1). In the event of the motor overheating the thermostat becomes open circuit (logic 0).

The motor thermostat input is considered healthy when CF113 is set to 1.

P2.10 - Action on MTRIP (Over-temperature)

This parameter controls the action of the drive when the MTRIP digital

Input = (logic) 0. Options are:
0 = No Action
1 = Warning (No. 101)
2 = Trip (No. 21)

P2.12 - Motor Continuous Duty

This feature allows the motor to operate continuously at a different current than specified in P2.02; in certain applications this allows continuous running at a higher load.

Allowed range: 75% to 125% of value in P2.02 (Default value: 100%).

6.2.4 Motor PTC Protection

Connecting the motor PTC device between TB5/1 and TB5/3 on the I/O Panel can provide motor PTC protection. If an encoder is used the PTC wiring should share a common screen with the encoder wiring, as shown in Figure 6-2.

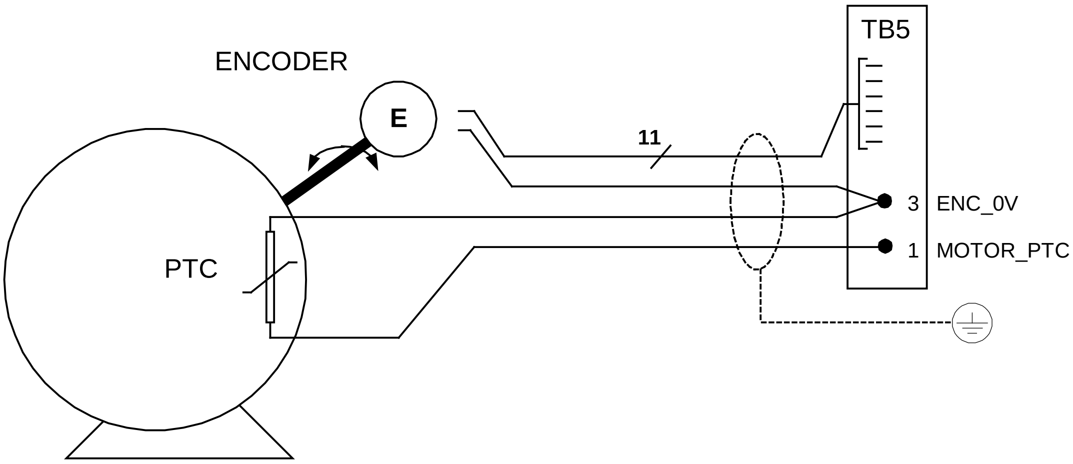


Figure 6-2. – Motor PTC Connection

P2.13 - Motor PTC Trip Resistance

This is the value of motor PTC resistance to be determined as the trip level, i.e. above this value the motor is too hot; there is ±0.1kΩ hysteresis on this value.

Allowed range: 0.10kΩ to 10.00kΩ

P2.14 - Measured PTC Resistance

This is the value of resistance that the drive has determined between TB5/1 and TB5/3.

Allowed range: 0.10kΩ to 10.00kΩ

P2.15 - Motor PTC Action

This parameter specifies the action to be taken by the drive when the measured PTC resistance is above the Trip value, i.e. when P2.14 > P2.13.

Options are:
0 = No Action (default)
1 = Warning - drive issues a PTC Warning (No. 103)
2 = Trip - drive issues a PTC Trip (No. 66)
3 = Warning and Current Limit - drive issues a PTC Warning as Option 1 and additionally the current limit is reduced to the motor's capability at this speed. This capability will depend upon the motor cooling type, described at P2.08, and follows the same speed/current characteristic as described for the motor I^2T limit.

The motor PTC Trip is made auto-resettable by setting P28.10 (Motor Trips Auto-Reset Enable).

6.3 MENU 3 - FREQUENCY CONTROL SETTINGS

(Refer to Control Block Diagram Sheet 6).

Menu 3 gives access to the parameters required to configure the drive for Frequency Control (VVVF) operation.

6.3.1 Fluxing Control

P3.00 - Fluxing Control

The output voltage/frequency characteristics of the drive can be changed to suit different types of motor load. Three options are provided:

Option 1 - Linear V to F

Linear V to F, the voltage is directly proportional to the frequency (Hz). See below.

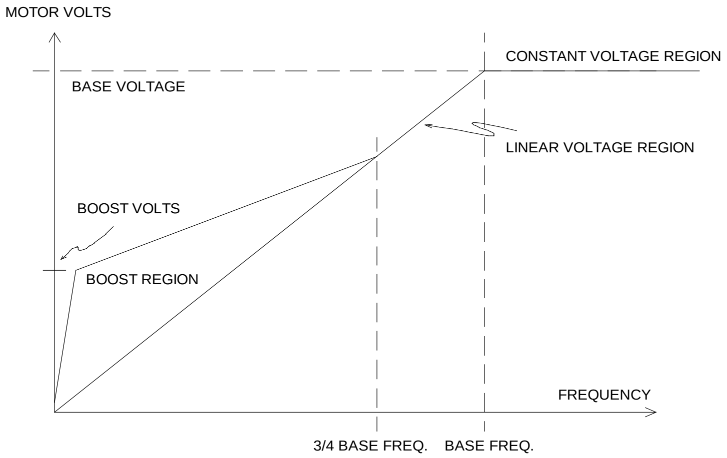


Figure 6-3. – Linear V to F (Option 1)

Option 2 - Square Law V to F

Square law V to F, where the voltage is proportional to Hz^2. This option is more suitable for loads that obey a square law such as pumps and fans. See below.

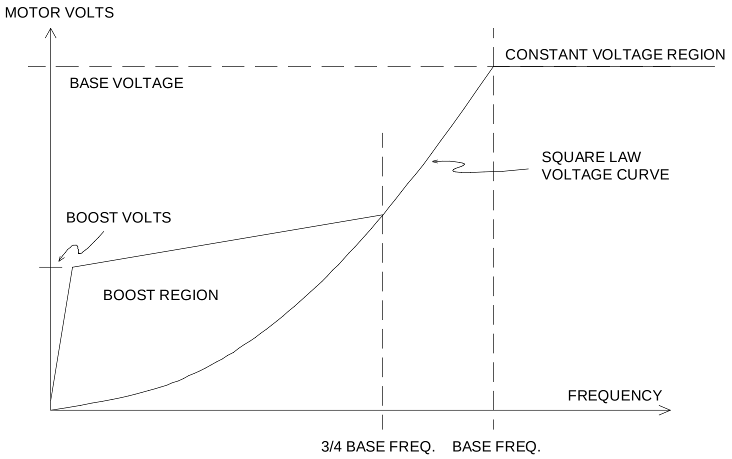


Figure 6-4. – Square Law V to F (Option 2)

Option 3 - Economy Flux Mode

Economy flux mode, where the magnetic flux level can vary according to the load (magnetic flux is defined as motor volts divided by output frequency). This can reduce the losses in a lightly loaded motor, giving an additional energy saving. P3.31 allows adjustment of the flux reduction at no load.

6.3.2 Economy Flux Mode

The MV3000e has the possibility, in frequency control, to vary the magnetic flux level according to the load (magnetic flux is defined as motor volts divided by output frequency). This can reduce the losses in a lightly loaded motor, thus giving an additional energy saving.

Economy flux mode is selected as Option 3 of P3.00 - Fluxing Control (see Section 6.3.1).

The extent to which the flux is reduced at no load is defined by P3.31.

P3.31 - Economy Factor (Frequency Control Mode)

P3.31 defines, as a % of nominal flux, the reduction that is to occur at no load. The range of P3.31 is 0% to 50%.

The actual magnetic flux level varies with load, as shown below.

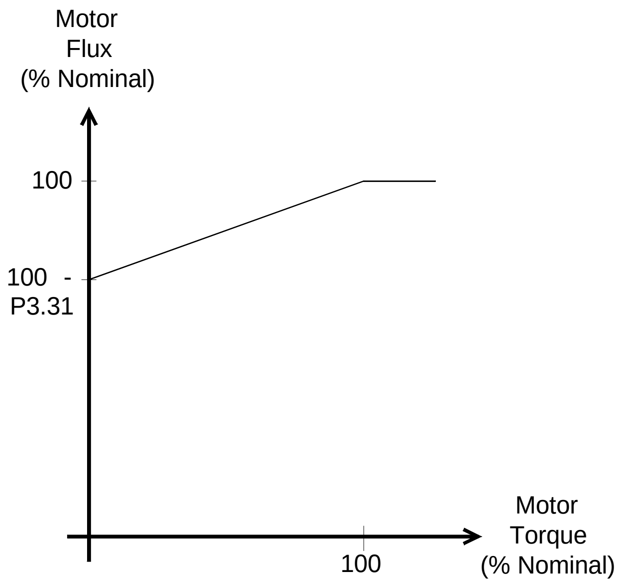


Figure 6-5. – Variation of Magnetic Flux with Load

As the load increases the motor flux is increased quickly to avoid stalling, as the load is decreased the flux is reduced only slowly to prevent instability.

Applications suitable for economy mode flux control are where:

- Loading varies only slowly
- Speed ramps are relatively slow
- The load is often below the nominal load for the motor

Figure 6-6 to Figure 6-8 show typical graphs illustrating use of the P3.31 Economy Factor and showing a comparison of Economy Factors for varying conditions of motor volts, torque and current, and drive output frequency. The vertical scale on the graphs is shown in Unit % and the units vary in relation to each curve shown. The principle illustrated is the energy saving with reduced motor voltage for a reduced load as set by the P3.31 Economy Factor.

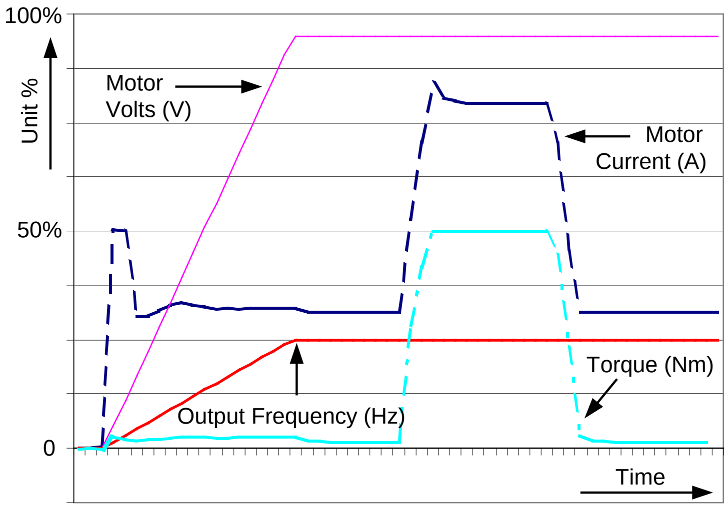


Figure 6-6. – Motor Volts with no Economy Factor

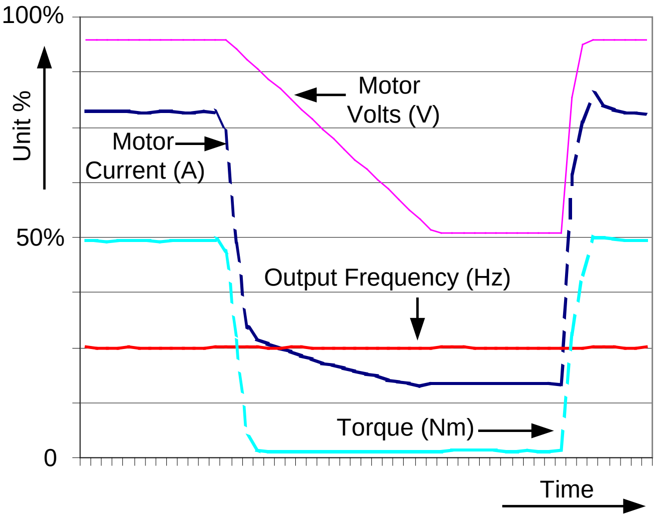


Figure 6-7. – Motor Volts with a 50% Economy Factor

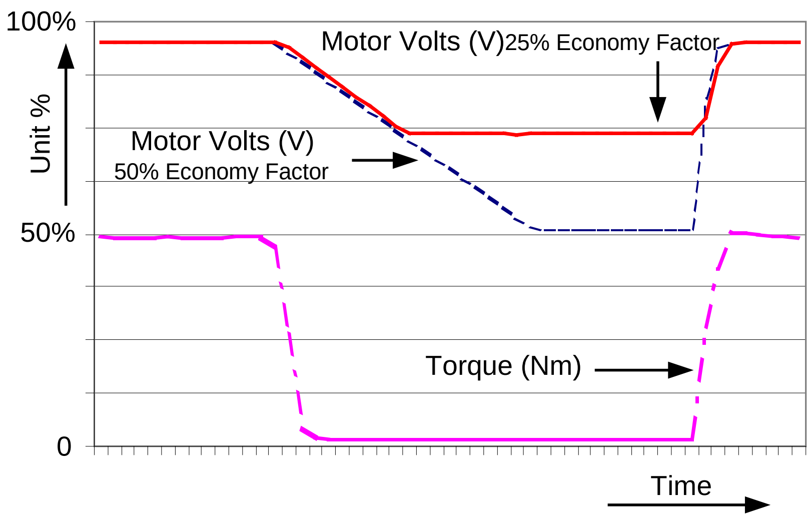


Figure 6-8. – Motor Volts with economy Factors at 50% & 25%

6.3.3 Volts Boost

P3.01 - Fixed Volts Boost

Fixed Voltage Boost is used when high motor torque is required at low frequency. The value set in this parameter specifies the number of volts added to the motor voltage at zero frequency to overcome winding resistance effects in the motor. This voltage boost is gradually reduced as the frequency increases as shown in Figure 6-3 and Figure 6-4.

Allowed values are: 0.0Vrms to 50.0Vrms @ 0 Hz

P3.02 - Auto Volts Boost

Auto Volts Boost (load dependent) may be used to compensate for unpredictable start loads. The value entered represents the voltage boost to be applied at Start Frequency and Full Load Current. The amount of voltage boost applied is proportional to load current and reduces as the drive frequency increases.

Allowed values are in the range: 0.0% to 200% Nominal

6.3.4 Variable Volts Boost

(Refer to Control Block Diagram Sheet 6)

Parameters P3.24 to P3.27 allow control of the adjustable voltage boost.

P3.24 - Variable Volts Boost

This is the maximum value of the variable volts boost. It has a range of 0 - 100.0V in 0.1V steps.

P3.25 - Variable Volts Boost Source

The source can be chosen from:

1 = Fixed 100 %

2 = Analogue Ref. 1

3 = Analogue Ref. 2

4 = Fixed 0% (Not used)

5 = Fixed 0% (Not used)

6 = RS485 Ref. 1

7 = RS485 Ref. 2

8 = RS232 Ref. 1

9 = RS232 Ref. 2

10 = PID Controller

11 = Pointer 19

P3.26 - Control Flag 126 - Enable Variable Volts Boost

The Enable Variable Volts Boost function is active when CF126 is set to 1.

P3.27 - Rectification Mode

This parameter defines how negative boost references are to be handled:

0 = Clamp	:	Negative boosts are clamped to zero
1 = Rectify	:	Negative boosts are treated as positive
2 = Allow Negative	:	Negative boosts (i.e. reduction in volts) are allowed.

P3.28 - Variable Boost Output

This parameter monitors the Variable Volts Boost output (read only).

Values are in the range: -3276.7V to +3276.7V

6.3.5 Slip Compensation Gain

P3.03 - Slip Compensation Gain

Slip compensation increases the output frequency of the drive with the load, to compensate for the decrease in motor speed as the torque demand increases. The value entered is the slip compensation to be applied by the drive, expressed as a percentage of that which the drive calculates as necessary.

Allowed values are: -200% to +200% Hz @ FLC and unity PF

6.3.6 Absolute Minimum Frequency

P3.04 - Absolute Minimum Frequency

The absolute minimum frequency is the output frequency of the drive at the instant of start up. This feature is useful for transformer fed motors, multi-motor applications or very high starting torque applications.

The drive output frequency is not allowed to go below the value in P3.04. E.g. if P3.04 is set to 2 Hz and the ramp is demanding a frequency of 1 Hz the output frequency will be 2 Hz although the output voltage will be as for 1 Hz.

Allowed values are: 0.0Hz to 50.0Hz.

6.3.7 Current Limit (Frequency Control Mode

P3.05 - Fixed Current Limit

A fixed current limit provides protection for the drive and the motor in the event of current overload. For example, this could occur if a motor is used with a higher rated drive where the overload current is set too high. If the current limit is reached, the drive takes measures to prevent a trip due to instantaneous Overcurrent (Trip No. 7) by load shedding:

For an accelerating motor

Reducing the acceleration rate. In this case the current limit may determine the maximum acceleration of high inertia loads and requested acceleration levels may not be achieved.

For a motor at steady-state speed

Reducing the motor speed, by reducing the output frequency.

The rate at which load shedding is applied depends upon the amount of overload and is controlled by the value set in P3.07. This is shown in Figure 6-9.

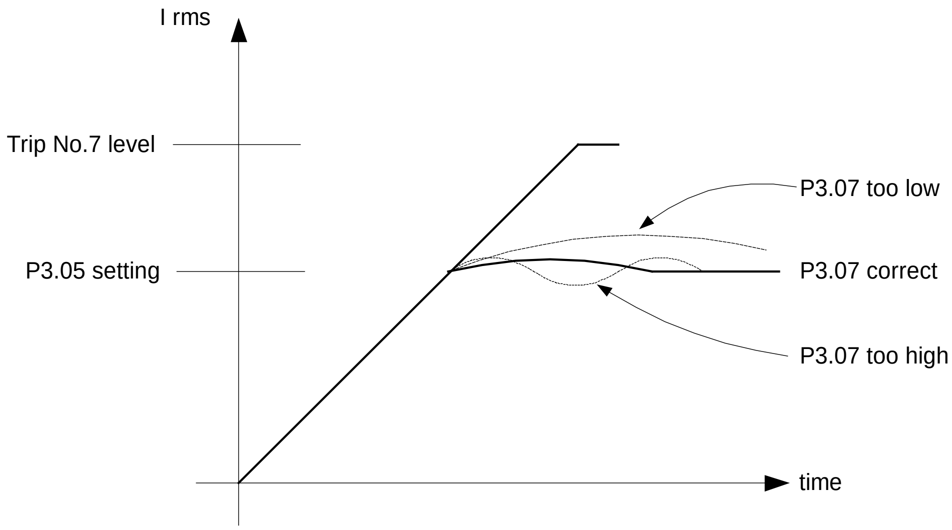


Figure 6-9. – Effect of Current limit & Response Speed on Drive Nominal Current

The current limit value set in P3.05 is simply a percentage of the nominal drive current indicated by P99.05 i.e.

$$\text{P3.05 value} = \frac{\text{Desired peak current} \times 100\ \%}{\text{P99.05 value}}$$

NOTE: P3.05 is independent of the motor current set in P2.02.

Example:

A motor has a nominal drive current of 150A and it is required to limit the current to 120A.

Then the value entered in P3.05 is $\frac{120}{150} \times 100\ (\%) = 80$

Range of values

The range of values of current limit that may be used to obtain P3.05 depends on the overload rating set in P99.02. This may be 110% (default) or 150%, so allowed values are in the range:

For 110% rating - 10% x P99.05 to 110% x P99.05

For 150% rating - 10% x P99.05 to 150% x P99.05

Scaling

The current limit set in P3.05 may be scaled by any of 17 sources, selectable by P3.06, and the scaled value becomes the Fixed Current Limit. The default source (Option 1) gives 100% scaling.

P3.06 - Current Limit Source

P3.06 is used to select the source of the current limit value.

Allowed options:

1 = Fixed Value (fixed 100 %)
2 = REF1
3 = 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 Speed
11 = Motorised Pot.
12 = Trim Reference
13 = Fixed 0% (Not used)
14 = Fixed 0% (Not used)
15 = Summing Node A
16 = Summing Node B
17 = Pointer 13

For all options the applied current limit is given by:

$$\frac{\text{Current Limit (\% of drive FLC)}}{100} = \text{P3.05 x [Selected Source]}$$

P3.07 - Current Limit Response Speed (Frequency Control Mode Only)

The value set in P3.07 represents the rate at which the frequency is reduced when the current limit is reached and the drive load sheds.

Allowed values are: 0.0%/s to 500.0%/s.

The effect of P3.07 on drive nominal current is shown in Figure 6-9. If P3.07 is set too low the current limit will be slow to respond, if set too high instability of the output current may occur.

P3.08 - Control Flag 114 - Current Limit Defeat

This parameter allows the source for Control Flag 114 to be programmed.

When Control Flag 114 is set, the Current Limit function is disabled. The drive will accelerate at the programmed rate to the set speed regardless of the current required. This flag also disables the Torque Limit (even if it is enabled) and the limit on regeneration power.

This feature can be used to achieve high dynamic performance but must be used with care, since it increases the possibility of trips.

Interaction between CF114 and CF115 is shown in Table 6-2.

Current and Tq Limit Disable CF114	**Tq Limit Enable CF115**	**VVVF Current Limit operational?**	**VVVF Tq Limit operational?**	**Remarks**
0	0	✓	X	
0	1	✓	✓	
1	0 or 1	X	X	See P3.08 and P3.11

Table 6-2. – Interaction of CF114 & CF115

6.3.8 Torque Limit (Frequency Control Mode Only)

Torque limit provides a method of limiting the torque produced by the motor to a maximum level. When the torque limit is reached, the drive load sheds to prevent this level being exceeded. This is done by:

Reducing the acceleration rate

In this case the torque limit may determine the maximum acceleration rate of high inertia loads.

Reducing the speed of the motor

The rate at which the frequency is reduced depends upon the amount of torque-overload and is controlled by the value set in P3.09.

The torque value used by the drive is an estimated value and can be monitored at P9.04; this estimate is accurate at high speeds but becomes less accurate at lower speeds. The torque limits are defined for +ve (clockwise) and -ve (anti-clockwise) directions using the parameters in Menu 8, see 6.8 for details.

Figure 6-10 shows the effect of torque limiting and response speed on estimated torque.

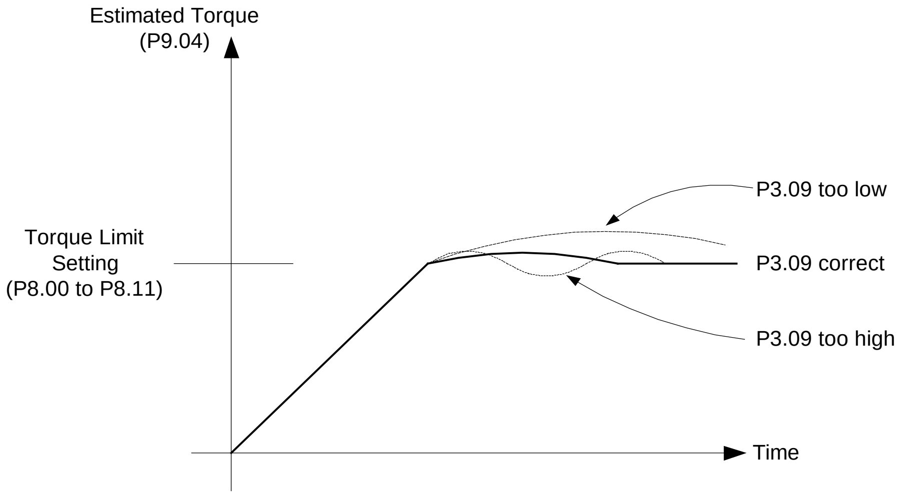


Figure 6-10. – Effect of Torque Limiting & Response Speed on Estimated Torque

P3.09 - Torque Limit Response Speed

This defines the rate at which the output speed is reduced in response to a torque overload. If this parameter is set too high, instability in output current may be observed when in torque limit. If this parameter is set too low then the torque limit will be slow to respond.

Allowed values: 0.0%/s to 500.0%/s.

P3.10 - Torque Limit Cut-in Frequency

This defines the frequency above which the torque limit becomes active. Due to the inaccuracy of torque limit at low speeds, this value should normally not be set below 5 Hz.

Allowed values are: 0.20Hz to 50.0Hz.

P3.11 - Control Flag 115 - Torque Limit Enable

The torque limit function is active when CF115 is set to 1.

Interaction between CF114 and CF115 is shown at Table 6-2.

6.3.9 Estimation of Torque

When accurate torque estimation is required in frequency control mode, the drive uses a mathematical model based on the equivalent circuit of the motor stator, as shown Figure 6-11.

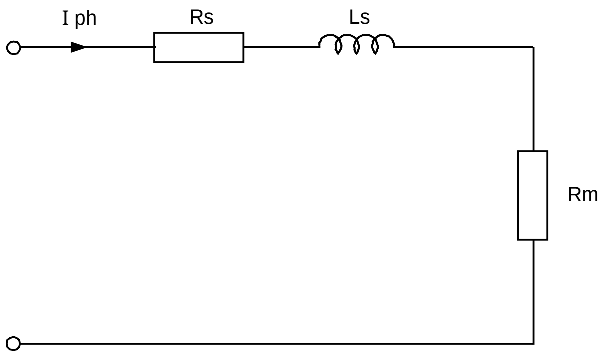


Figure 6-11. – Stator Equivalent Circuit

Where: Rs = Motor Stator Resistance (P3.13)
Ls = Motor Stator Leakage Inductance (P3.14)
Rm = Motor Magnetising Resistance (P3.15).

These parameters can be entered into the drive in any of three different ways, as selected by P3.12. Ideally the parameters should be obtained from the motor manufacturer for the exact motor in use. If this is not possible, the drive can estimate the values from other data, and can provide a good estimation if a calibration run is performed with the motor mechanically uncoupled.

The parameters should be entered for a "star" equivalent connected motor. If the parameters are known for a "delta" equivalent, these should be divided by 3.

6.3.9.1 P3.12 - Motor Parameterisation Method

Options available:

Option 1= Direct entry from motor manufacturers data

P3.13 to P3.15 must be specified from the motor manufacturers data. If data is not available, choose Option 2 or 3.

Option 2 = Estimate from nameplate data

The drive will estimate the equivalent circuit data from the values placed in parameters P2.00 and P2.04 and will write these values to P3.13 to P3.15. Existing data in P3.13 to P3.15 will be overwritten and P3.12 will be reset to 1.

Option 3 = Calibration run

The drive measures various motor and drive parameters, then uses this data to calculate values for the equivalent circuit. This option produces the most accurate estimation of torque. When performing a calibration run it is important that the motor load must not be connected, though the coupling may be left in place. As for Option 2, existing data in P3.13 to P3.15 will be overwritten and P3.12 will be reset to 1.

P3.13 - VVVF Stator Resistance

Enter the stator resistance (Rs) in mΩ.

Allowed values: 0.1mΩ to 3000mΩ.

P3.14 - VVVF Stator Leakage Inductance

Enter the stator leakage inductance (Ls) in mH.

Allowed values: 0.1mH to 30.0mH

P3.15 - VVVF Magnetising Resistance

Enter the Magnetising resistance (Rm) in Ohms.

Allowed values: 1Ω to 20,000Ω

6.3.10 Motor Stability (P3.16, P3.17)

Under conditions of light load some induction motors may be prone to instability. This is seen as uneven motor speed and current and may cause the drive to trip (probably on over-volts).

Motor instability can be made worse by having incorrect flux (defined by the motor base frequency and base voltage) on the motor. Firstly check that parameters P2.00 and P2.01 are set correctly. Additionally, motor instability is often worse at higher switching frequencies. If it is possible, reduce the drive's switching frequency by changing the setting in parameter P35.00.

To avoid the occurrence of motor instability the drive continually executes a stabilising function. In most cases the default settings of this function will be adequate to prevent an occurrence of motor instability. If the motor is particularly prone to instability or the duty/load is very light it may be necessary to increase the amount of stabilisation.

To change the motor stabilisation adjust parameters P3.16 and P3.17 as follows:

a) Increase the Stability Gain (P3.16) in small increments until the motor runs smoothly.

b) If the motor fails to stabilise and the gain becomes too high (which will introduce other modes of instability) then set P3.16 back to the default value (1.000 Hz/(%/scan)).

c) Increase the stability time constant (P3.17) by 10% at a time and then adjust the Stability Gain (P3.16) through its range until stability is achieved.

P3.16 - Stability Gain

Allowed values: 0.000Hz/(%/scan) to 4.000Hz/(%/scan).

P3.17 - Stability Time Constant

Allowed values: 0 scans to 2000 scans.

P3.18 to P3.23 and P99.01

Parameters P3.18 to P3.23 and the configuration parameter P99.01 are concerned with Scalar Control of the drive. This is a specialised motor control method, used on certain process lines.

6.3.11 Feedback Compensation

P3.29 - Feedback Compensation

This parameter causes the drive's power bridge compensation algorithm to be based upon current feedback, rather than current estimation, when operating in VVVF mode.

If severe motor stability problems are experienced, that cannot be resolved by changing the values of P3.16 & P3.17, this parameter should be set to a value of 1.

Allowed values: 0 = Disabled
1 = Enabled

6.3.12 Scalar Control

(Refer to Control Block Diagram Sheet 16)

It is selected as Option 3 for P99.01 Control Structure.

In general, this control method should not be used, please refer to **GE Power Conversion** for more information.

6.3.13 Frequency Multiplier

P3.30 - Frequency Multiplier

This parameter has been added for certain specialised applications. In general, this feature should not be enabled without obtaining the appropriate application note from **GE Power Conversion**.

Allowed values: 0 = Disabled
1 = Enabled

6.3.14 VVVF Modulation Limit

P3.32 - VVVF Modulation Limit

Restrictions are imposed on the minimum PWM pulse width produced by the drive. These restrictions have consequences on the drive's maximum output modulation depth, and, consequently, output voltage.

Table 6-3, below, shows the reduction in linear output modulation depth resulting from the minimum pulse width limitations.

PWM Period	Switching Frequency	Pulse Limit, on Terminals of Drive	Maximum Modulation Depth
800µs	1.25kHz	5.0µs	98.75%
400µs	2.5kHz	5.0µs	97.50%
200µs	5kHz	5.0µs	95.00%
133µs	7.5kHz	5.0µs	92.49%

Table 6-3. – Consequences of Minimum Output PWM Pulses

The default value of modulation limit[1] is set from the table above.

To compensate for the above instantaneous modulation depth limit (or modulation clipping), the modulation depth is boosted when the required modulation depth is greater than the maximum instantaneous achievable, so as to restore the amplitude of the fundamental component. This, unavoidably, increases the amplitude of the harmonic distortion components.

Additionally, the quiescent operating modulation depth of the drive is reduced to the Maximum Modulation Depth in the above table so that it does not sit at 100% modulation, but at a lower value so that harmonic distortion is not the normal operating condition. Over modulation is still possible for transient conditions.

If the application demands it, this value can be increased up to 107.00%. However, it should be noted that values greater than those above necessarily result in output voltage distortion, which in turn result in current distortion. In particular, 5th and 7th harmonic components of current will result in increased motor heating, and torque ripple.

[1] Early versions of firmware had modulation depths defaulting to 100%. Also V6.03 Firmware at 105% modulation depth (maximum applied in VVVF) is equivalent to V8.00 to V11.73 firmware at 101% modulation depth.
An application note in Section 10 gives magnitude of harmonic voltages for a function of modulation depth.
With P3.32=101% the same harmonic voltage that will be applied to the machine is equivalent to 105% in firmware versions up to V6.03

6.4 MENU 4 - START AND STOP CONTROL

(Refer to Control Block Diagram Sheet 5).

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.**

Menu 4 gives access to the parameters required to configure the stop and start controls for the drive. The Start mode controls (see text) apply only to applications where speed feedback is not available i.e. VVVF or Encoderless Vector Control. The DC injection controls apply only to VVVF applications.

6.4.1 Start Mode

P4.00 - Start Mode

The action taken by the drive when RUN and STOP commands are received is controlled by the settings in P4.00 and P4.07 respectively. However, in Vector Control with Encoder any values entered in P4.00 will not affect the way the drive starts up.

Allowed values for P4.00 are:

1 = Immediate low frequency start - the drive starts at the start up frequency (set in P3.04), and increases the frequency at the acceleration rate (set in P6.00 or P6.01) to the reference frequency. If the motor is spinning when the drive is started, it is decelerated to a standstill, at current limit, and then accelerated to the reference frequency.

2 = Synchrostart - the drive synchronises the output frequency to the motor speed, allowing the motor to be brought up to speed without stopping. This mode, used in conjunction with the auto-reset trips, allows the motor to recover from transient faults with minimum interruption. The synchrostart options are defined in P4.01.

The synchrostart function (starting onto a spinning motor without speed measurement) is available for both VVVF and Encoderless Vector modes. In both cases the feature is enabled and set up by Menu 4. In general the parameters have the same meaning for either VVVF or Encoderless Vector. The only exception to this is P4.02 - Synchrostart Current/Flux, see P4.02.

P4.01 - Synchrostart Mode

Defines the method used by the drive to synchronise the drive output frequency with the motor speed during a restart in synchrostart mode.

Allowed values are:

1 = Search in the reference direction only.

2 = Search, first in the reference direction, then in the opposite direction.

If the motor speed is not found, i.e. if the motor is stationary at start up, then the drive performs a normal low frequency start.

P4.02 - Synchrostart Current

Reduces the current output to the motor when the drive is searching for the motor speed. This can be used to help reduce the disturbance to the motor while scanning.

In VVVF mode this parameter sets the current level, as a percentage of drive full load current. Generally this should be set somewhere just above the motor no-load current.

In Encoderless Vector mode, this parameter sets the motor flux level, as a % of the nominal flux level of the motor. Typically this should be set to 15%.

Allowed values are: 0% to 100% (of the drive rated current)

NOTES:

1 The default value of 10% will suit most applications but may need to be increased when using high efficiency motors or when there is a large difference between the maximum frequency and the actual motor speed. If the value is set too low for the application, this may result in incorrect synchronisation detection by the drive.

2 Premature Synchronisation: If the excitation level (current or flux) is set too low, the drive may incorrectly detect synchronous speed immediately it is enabled. This can be seen as very high current levels. If this problem occurs, the excitation level should be slowly increased.

P4.03 - Synchrostart Scan Rate

(Refer to Control Block Diagram Sheet 6)

This parameter defines the rate at which the output frequency is scanned whilst the drive searches for the motor speed during synchrostarting. For some combinations of motor and load, it may be necessary to reduce this value to avoid over voltage trips during the synchronisation period, for large motors the synchronisation point may be missed if scanning is too fast.

Allowed values are: 0%/s to 250%/s

NOTES:

1 Over voltage Trips. If synchronisation is detected late, and no DB unit is fitted, the drive may trip on over voltage. If this problem occurs, the Synchrostart Scan Rate should be reduced.

2 Drive has a 'Re-enable' Delay, where it cannot be re-started until it is stopped for at least this time. This is defaulted to 3.0 x Tr (Rotor Time Constant). To ensure Tr is the correct value determine the motor parameters i.e. P12.03 = 2.

P4.21 - Synchrostart Minimum Speed (VVVF Control Mode Only)

When this parameter is set, it gives a threshold below which the synchronous start (fly catching) function is disabled/terminated.

Allowed values are: 0% to 100% of Top Speed

P4.25 - VVVF Synchrostart Maximum Speed

This parameter is used to specify from where the synchrostart scan starts. The default is 100%, i.e. 100% of Top Speed. If the P9.00 – ‘Speed Reference’ value is used synchronisation may be achieved more quickly.

However, by using the P9.00 value any shaft speeds greater than this value will not be found. Thus only choose this option if there is no chance of the shaft speed increasing above the P9.00 value.

P4.26 - Tr Period

This parameter displays the value of the motor’s rotor time constant.

P4.27 – Re-enable Delay

This parameter allows the user to vary the re-enable delay (after a stop or trip). The default value of 3 times the motor's rotor time constant is used to allow the motor flux to decay before re-enabling. This is the normal setting and should not be reduced without fully understanding the implications.

P4.28 – Restart Time

This value is the time allowed to restart following a PWM inhibit due to a supply derived over voltage condition (i.e. one that has not caused a hard trip). If the drive has not restarted within this time, the supply derived over voltage condition will be treated as a true trip and the drive will trip.

6.4.2 Selecting RUN/STOP Control by Drive Data Manager™ (Keypad) or by Control Flags

Selection between Drive Data Manager™ (Keypad) and Control Flags is made by P4.09.

P4.09 - Control Flag 116 - Keypad/Remote

P4.09 (CF116) determines whether the drive is controlled by the Keypad or remotely via Control Flags, and therefore selects the source of the normal STOP and RUN commands, as follows:

CF116 = Cleared (0) Run/Stop source = Keypad

CF116 = Set (1) Run/Stop source = CF0 and CF1 (or Backups CF123, CF124, CF125)

NOTE: CF116 = 1 is also a requirement for removing the Keypad.

Using the Keypad for RUN/STOP Control

With P4.09 set to 0 (Keypad RUN/STOP selected). The drive will respond to commands from the STOP and START buttons on the Keypad.

Using Control Flags for RUN/STOP Control

With P4.09 set to 1, three Control Flags control the RUN and STOP sequences:

P4.04 (CF 1) - Start
P4.05 (CF 0) - Normal Stop
P4.06 (CF 2) - Rapid Stop

These can be connected to many sources, see 6.33.

To configure the RUN/STOP commands:

a) Connect Control Flags 0, 1 and 2 to desired sources (e.g. digital inputs) as required.

b) Set the Normal and Rapid Stop Modes in P4.07 and P4.08 respectively.

c) Set the Zero Hold Speed Time in P4.10.

The drive will now respond to RUN and STOP demands from the configured external sources.

6.4.3 Starting and Stopping Parameters

The starting and stopping status is shown in Figure 6-12.

P4.04 - Control Flag 1 - Start

Start is enabled when CF1 is set to 1, the drive will run if CF0 (Normal Stop) is set to 1.

P4.05 - Control Flag 0 - Normal Stop

Normal Stop is enabled when CF0 is set to 0, when the Stop circuit is opened. To start the drive the Stop circuit must be closed.

P4.06 - Control Flag 2 - Rapid Stop

Rapid Stop is enabled when CF2 is set to 0. The drive will rapid stop when the Rapid Stop circuit is opened.

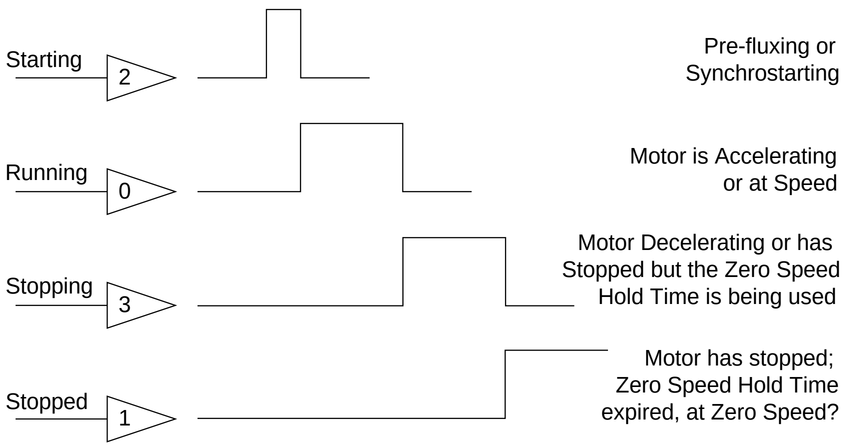


Figure 6-12. – Starting & Stopping Status

6.4.4 Stop Modes

(Refer to Control Block Diagram Sheet 5)

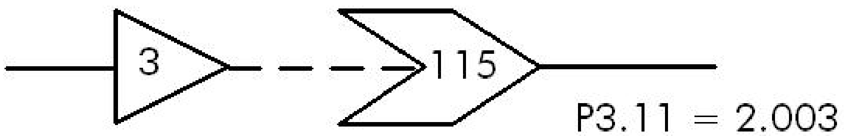
The drive may be commanded to stop in either a Normal or Rapid mode (these are defined by parameters P4.07 and P4.08 respectively). These stop modes are selected by Control Flags 0 and 2 respectively.

P4.07 - Normal Stop Mode
P4.08 - Rapid Stop Mode

Each Stop Mode may be programmed to stop in a variety of ways.

Allowed values:
1 = Disable & Coast
2 = Ramp to Stop
3 = Torque Limit 1 Stop (Vector only)
4 = Torque Limit 2 Stop (Vector only)
5 = DC Injection (Frequency Control only)

Hint: Make a Torque Limit, in Frequency Control, by using Status Flag 3 and Control Flag 115, Set P8.00 for the required Torque Limit. Then set Ramp Stop (Menu 6) with a reasonably quick value.   Then the Torque Limit in VVVF is low bandwidth.



P4.10 - Zero Speed Hold Time

Several of the allowed stop modes include holding zero speed for this period of time before disabling. This parameter has no action if "Disable & Coast" is the active stop mode being used.

Allowed values: are: 0.0s to 500.0s

P4.11 - Stop Time Limit

Disables the drive if the motor has not been brought to rest within the specified time limit. This parameter has no action if "Disable & Coast" is the active stop mode being used.

Allowed values: 0 = No stop time limit
1 s to 3600 s

P4.12 - Motor Regeneration Power Limit

This defines the maximum power that the drive will regenerate from the load. It is entered in kW and is used in the case when the Dynamic Braking Unit connected to the drive has its peak power dissipation less than the drive's peak regeneration power. See Menu 23 for Dynamic Brake operation.

Allowed values: -0.1kW to 6000.0kW

NOTE: -0.1 means NO LIMIT, the energy is to be absorbed by the DB unit.

6.4.5 DC Injection Braking

(Refer to Control Block Diagram Sheet 6)

DC Injection Braking applies only to Frequency Control mode applications and is invoked by setting the value of Stop Mode parameter P4.07 or P4.08 to 5. When a STOP command is received, if the output frequency is below the DC injection frequency, a DC current is injected into the motor for a short period (the DC injection duration) to produce a braking torque, and a resulting zero speed torque. If the output frequency is above the DC injection frequency the output decelerates to the DC injection frequency, before DC injection takes place. The braking sequence is shown in Figure 6-13.

P4.13 - DC Injection Speed

Sets the speed at which DC injection braking is to be started.

Allowed values are: 0% to 100% (of rated speed)

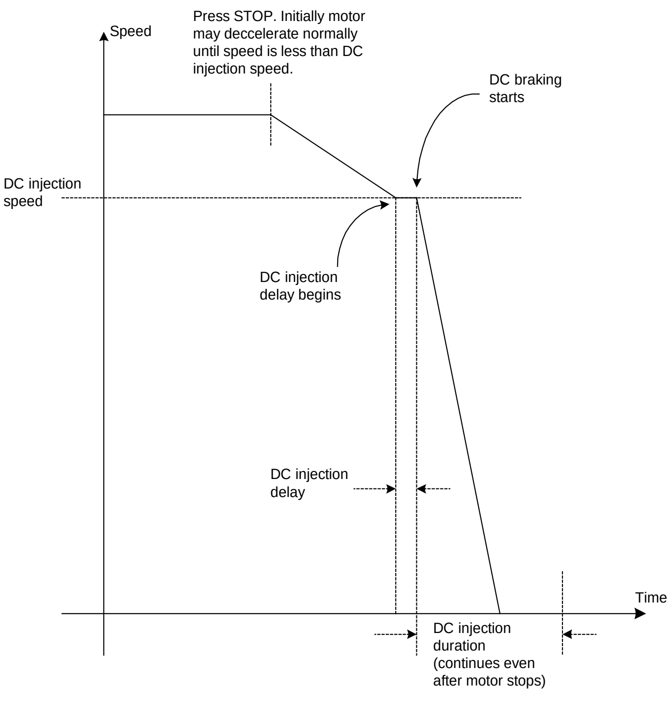


Figure 6-13. – DC Injection Braking Sequence

P4.14 - DC Injection Current

Sets the DC injection current.

Allowed values are: 0% to 150% (of drive rated current)

P4.15 - DC Injection Duration

Sets the duration of the DC injection, in seconds.

Allowed values are: 1s to 120s

P4.16 - DC Injection Delay

If a `Stop' command is asserted while the drive output frequency is already below the DC injection frequency the drive may trip. This parameter defines an adjustable delay to allow the motor to de-flux and so prevent the drive from tripping.

Allowed values are in the range: 0.0 s to 20.0 s

6.4.6 Output Enable

(Refer to Control Block Diagram Sheet 6).

P4.17 - Control Flag 25 - Output Enable

When set to 1 (default) enables the output bridge.

6.4.7 Backup Start/Stop

(Refer to Control Block Diagram Sheet 5).

The Control Flag Stop/Starts are only active if the Drive Data Manager™ (Keypad) is NOT being used i.e. when CF 116 = 1.

P4.18 - Control Flag 123 - Backup Run/Stop Select

When set to 0 (off) (default) disables selection of Backup Stop and Run inputs.

When set to 1 (on) enables selection of Backup Run/Stop.

P4.19 - Control Flag 124 - Backup Stop

Refer to Table 6-4 for Backup Start/Stop details.

1 = Allows Run
0 = Stop

P4.20 - Control Flag 125 - Backup Start

Refer to Table 6-4 for Backup Start/Stop details.

1 = Run
0 = Remains Running

Backup Start/ Stop CF 123	Normal Stop CF 0	Normal Start CF 1	Backup Stop CF 124	Backup Start CF 125
0	1 = Allows Run 0 = Stop	1 = Run (if Stop = 1) 0 = Remains Running	*	*
1	*	*	1 = Allows Run 0 = Stop	1 = Run (if Stop = 1) 0 = Remains Running

Table 6-4. – Backup Start/Stop details

NOTE: *= Function not available.

6.4.8 Synchrostart Power Factor Control

During the final phase of the VVVF synchrostarting algorithm, the drive returns to its V/F setpoint, whilst adjusting the output frequency, by controlling power factor. This is done so that, as the voltage is re-established, regeneration should not take place, and prevent the drive from tripping on over voltage. Under some circumstances it may be necessary to adjust the parameters involved in this power factor control.

P4.22 - Synchrostart Power Factor Demand

Allowed values: -1.00 to +1.00

The default value of 0.10 indicates a slightly motoring power factor condition.

P4.23 - Synchrostart Power Factor Kp

This is the proportional gain for the power factor controller.

Allowed values: 0 to 1000

P4.24 - Synchrostart Power Factor Ki

This is the integral gain for the power factor controller.

Allowed values: 0 to 1000

6.5 MENU 5 - SPEED REFERENCE SETTINGS

(Refer to Control Block Diagram Sheet 5)

Menu 5 gives access to the parameters required to configure speed references.

6.5.1 Speed References

P5.00 - Speed Reference

P5.00 toggles between a read-only or an editable speed value.

When the Keypad reference is the active reference, then P5.00 can be edited by the Keypad, or the ↑ and ↓ keys can control the speed.

When the Keypad reference is not active, then P5.00 simply reports the current value of the reference, like a monitor point.

P5.01 - Speed Reference 1 Source
P5.02 - Speed Reference 2 Source
P5.03 - Speed Reference 3 Source
P5.04 - Speed Reference 4 Source

Each of these parameters contains an identical list of options from which a choice of speed reference can be made.

The options are:

1 = Keypad Speed Reference

2 = REF1 Analogue input

3 = REF2 Analogue input

4 = RS485 Link Ref 1

5 = RS485 Link Ref 2

6 = RS232 Link Ref 1

7 = RS232 Link Ref 2

8 = PID Controller

9 = Reference Sequencer

10 = Fixed Reference Menu

11 = Motorised Pot.

12 = Trim Reference

13 = Fixed 0% (Not used)

14 = Fixed 0% (Not used)

15 = High Speed Digital Input

16 = Position Control

17 = Summing Node A

18 = Summing Node B

19 = Summing Node C

20 = Summing Node D

21 = Pointer 1

22 = Pointer 2

NOTE: Option 15 is a frequency input. The speed reference is defined by the frequency of pulses on the High Speed Digital Inputs (connections TB4/8 and TB4/9 on the I/O Panel).
A Speed Reference source is selected, or may be changed "on-line", by P5.07 - P5.10.

P5.05 - Backup Speed Reference

If the drive sees a selected Reference Source as "unhealthy" it issues a warning, subject to P5.06 setting, and switches to the Backup Reference Source if this is enabled by P5.05. If Backup is not enabled, or if Backup is also unhealthy, the drive will trip on REFERENCE LOSS.

Allowed values:	0 = No Backup 1 to 22 = same meaning as P5.01.

P5.06 - Warning on Backup

Switching from principal control or reference sources to backup normally causes the drive to issue a warning. If the drive is required to switch between principal and backup reference sources as part of its normal operating cycle, this may not be required. This warning can be suppressed by setting P5.06.

Allowed values are:	0 = Warning on loss of principal reference. 1 = No Warning on loss of principal reference.

P5.07 - Control Flag 4 - Reference 1 Select
P5.08 - Control Flag 5 - Reference 2 Select
P5.09 - Control Flag 6 - Reference 3 Select
P5.10 - Control Flag 7 - Reference 4 Select

The four Speed References, P5.01 to P5.04, are individually selected by using Control Flags CF4 to CF7.

If more than one of these references is selected, the lowest number CF will take priority, this allows references to be changed smoothly by external logic or computer control. To avoid unwanted intermediate reference selections it is recommended that unused flags should be set to 0.

Examples:

To change from Reference Source 2 to Reference Source 1, set CF4 to 1. This will change the reference immediately.

To change from Reference Source 1 to Reference Source 2, first set CF5 to 1 then set CF4 to 0. The reference will only change when the higher priority flag is set to 0.

6.5.2 Direction Control

P5.11 - Direction Control
P5.12 - Control Flag 3 - Direction

Control Flag 3 may be combined with the reference polarity to determine the direction, or, may determine the direction directly.

Allowed values:	P5.11 = 1 = Polarity of Speed Reference is combined with CF3, meaning CF3 = 1 will invert the sign of the reference. P5.11 = 2 = Positive Speed References input only. The sign of the actual speed reference is ONLY defined by the state of CF3, 1 = Reverse.

6.5.3 Jog Speeds

P5.13 - Control Flag 8 - Jog Enable

This Control Flag sets the drive to the jog speed entered in P5.14 or P5.27.

Allowed values:	0 = Disable jogging 1 = Enable jogging

P5.14 - Jog Speed 1

This parameter sets the drive jog speed when Jog Speed 1 is selected by P5.28. It is simply another reference but the value is not fed back to the Keypad reference for bumpless transfer. The jog speed is set in units of 0.1% Top Speed.

Allowed values: -100.0% to +100 % (of Top Speed)

(See also P5.13, P5.27 and P5.28)

P5.27 - Jog Speed 2

This parameter sets the drive jog speed when Jog Speed 2 is selected by P5.28. It is simply another reference but the value is not fed back to the Keypad reference for bumpless transfer.

Allowed values: -100.0% to +100.0% (of Top Speed)

P5.28 - Control Flag 121 - Jog Speed 1/2 Select

Selects between Jog Speeds 1 and 2.

0 = Jog Speed 1 (P5.14)
1 = Jog Speed 2 (P5.27)

6.5.4 Speed Limits

Maximum Speeds

In Vector Mode the maximum speed values in P5.15 and P5.16 cannot be edited above base speed until the de-magnetisation curve is known. This requires a Calibration Run (P2.03 = 3) or an edit, manually, of P12.17 to P12.21.

Table 6-5 shows the limits on maximum speeds, these are determined by a combination of the control mode and the PWM switching frequency. For any combination, the maximum speed limit is the first occurring limit of either the maximum drive output frequency or the number of times motor base speed or the motor r/minute limit.

Control Mode	PWM Frequency	Limit caused by first reached of:				
		Maximum Output Frequency	OR	Number of Times Base Speed	OR	R/min Limit
Frequency	1.25 kHz	100 Hz		-		6,000
	≥ 2.5 kHz	200 Hz		-		12,000
Vector	1.25 kHz	125 Hz		3 X		15,000
	≥ 2.5 kHz	250 Hz		3 X		15,000

Table 6-5. – Maximum Speed Limit Criteria

P5.15 - Maximum Speed Forward

Sets the maximum forward speed of the motor.

Allowed values: 10r/minute to See Table 6-5.

P5.16 - Maximum Speed Reverse

Sets the maximum reverse speed of the motor.

Allowed values: 0r/minute to See Table 6-5.

P5.17 - Minimum Speed Forward

Sets the minimum forward speed of the motor.

Allowed values: 0 to Value set in P5.15 (r/minute).

P5.18 - Minimum Speed Reverse

Sets the minimum reverse speed of the motor.

Allowed values: 0 to Value set in P5.16 (r/minute).

Maximum/Minimum Speed Examples

Example 1

P5.15 = 1500 r/minute maximum forward
P5.16 = 1000 r/minute maximum reverse
P5.17 = 0 r/minute minimum forward
P5.18 = 0 r/minute minimum reverse

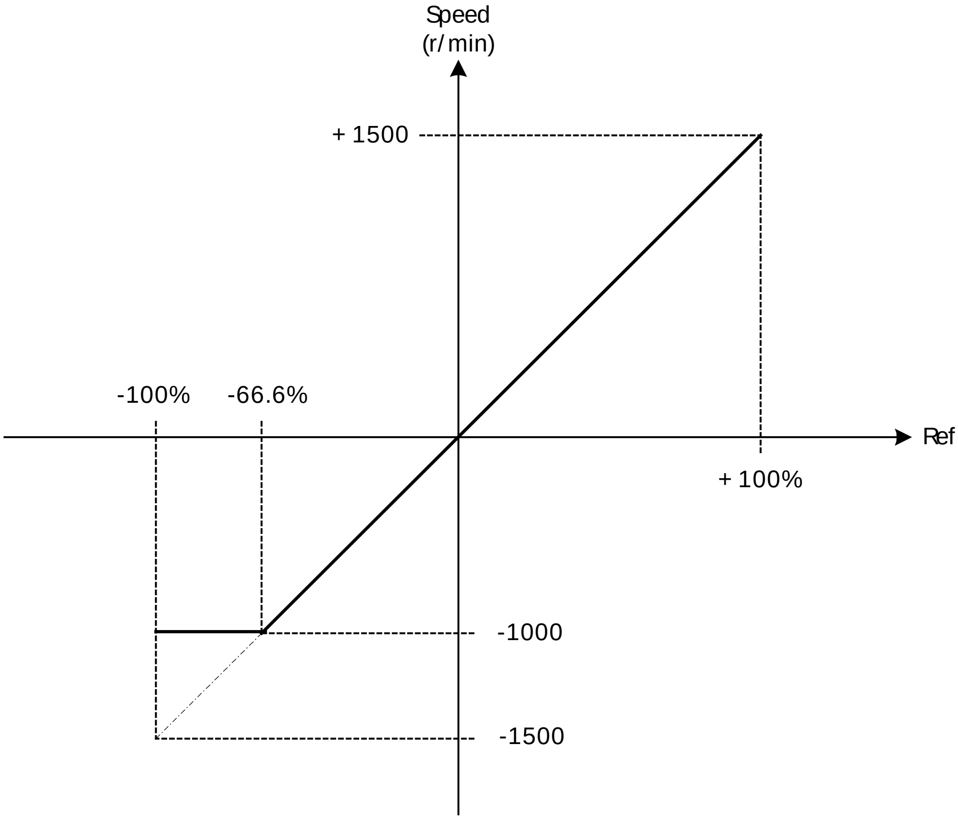


Figure 6-14. – Speed References: Example 1

Referring to Figure 6-14,

Speed Reference is scaled to be 100 % = the largest of the maximum speeds.

Thus speed scaled ±100 % Ref = ±1500 r/minute (as 1500 r/minute > 1000 r/minute)

But - 1500 r/minute is not allowed, therefore a reverse reference of 66.6% will be active, from -66.6% to -100 % which will have no effect.

Example 2

P5.15 = 1500 r/minute maximum forward
P5.16 = 1000 r/minute maximum reverse
P5.17 = 150 r/minute minimum forward
P5.18 = 300 r/minute minimum reverse

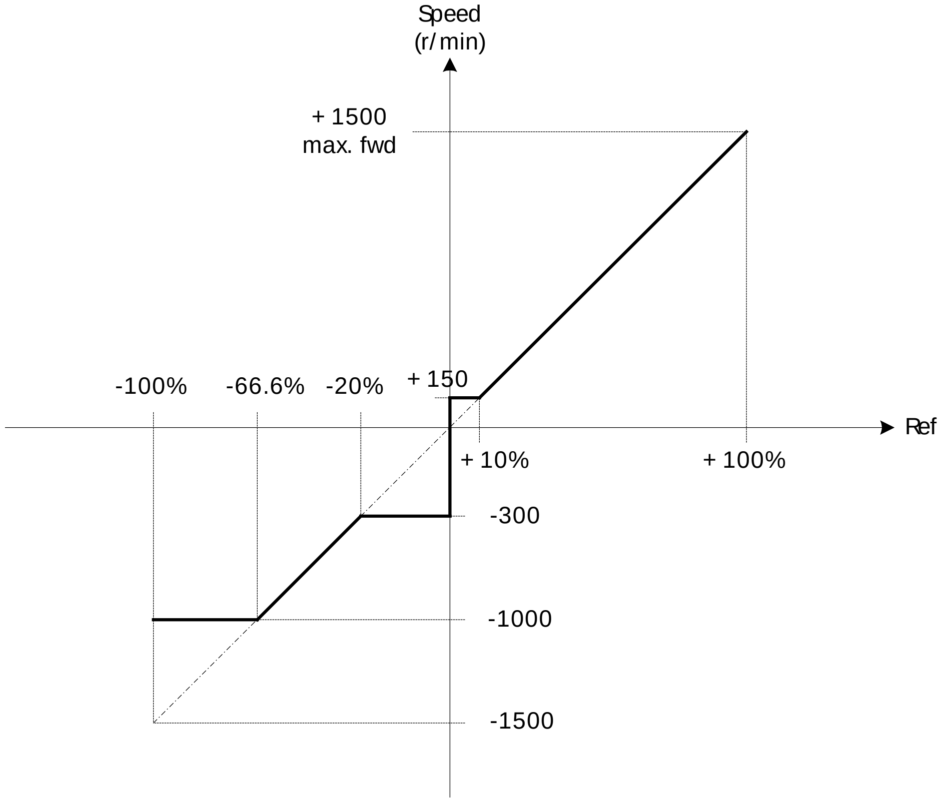


Figure 6-15. – Speed References: Example 2

If Speed Reference is between 0 and +10%, then motor will run at +150 r/minute when the ramps have been exhausted.

If Speed Reference is between 0 and -20%, then motor will run at -300 r/minute when the ramps have been exhausted.

NOTE: To scale Analogue Inputs to line up with the Minimum/Maximum speeds, see Menu 7.

P5.19 - Control Flag 11 - Reverse Inhibit
P5.20 - Control Flag 12 - Forward Inhibit

When set, CF11 and CF12 inhibit reverse and forward rotation of the motor, respectively.

P5.21 - Control Flag 13 - Clamp Zero Reference

CF13 sets the input to the ramp (Menu 6) to zero, over-riding the current speed reference.

P5.22 - Process Top Speed

The output speed of the drive can be monitored in terms of process speed rather than drive frequency. This may be used to indicate, for example, the output of a pump or the speed of a conveyor belt. The process speed output is obtained by reading P9.02. To use the process speed facility it must be scaled. To scale, enter a value in P5.22.

The value set in P5.22 defines the Process Top Speed i.e. the calculated process speed when the drive is operating at Motor Top Speed (see P5.15 and P5.16).

Allowed values: -9999 to +9999 (the units are not defined).

P5.23 - Speed Clamp Limit 1
P5.24 - Speed Clamp Limit 2
P5.25 - Control Flag 117 - Enable Speed Demand Clamp

Parameters P5.23 and P5.24 allow the setting of a permitted range of speed demands. Each can be set to any value between -100 % and +100 % of top speed, the defaults being set to:

P5.23 = +100 % and P5.24 = -100 % top speed to give a full range.

These parameters allow a wide choice of demand clamp settings. For example setting P5.23 to +80% and P5.24 to +20% top speed, clamps speed demands to a range of forward speeds.

The clamp is activated by setting CF117 = 1, i.e. ON.

6.5.5 Speed Reference Time Constant

P5.26 - Speed Reference Time Constant

A low pass filter in the speed reference system is particularly useful when the speed reference for the drive comes from the line speed feedback of a control process, allowing smoothing of the reference.

Permitted range is: 0.00s to 5.00s

6.5.6 Top Speed

Defined as being the greater of Max Speed forward (P5.15) and Max Speed rev (P5.16).

6.6 MENU 6 - RAMP SETTINGS

(Refer to Control Block Diagram Sheet 7)

Menu 6 gives access to the parameters required to configure the acceleration and deceleration characteristics of the system.

Since the drive would have minimum and maximum speeds set, scaling a time can be irrelevant, hence the ramp rates are given in terms of acceleration and deceleration.

A graphical representation is shown below.

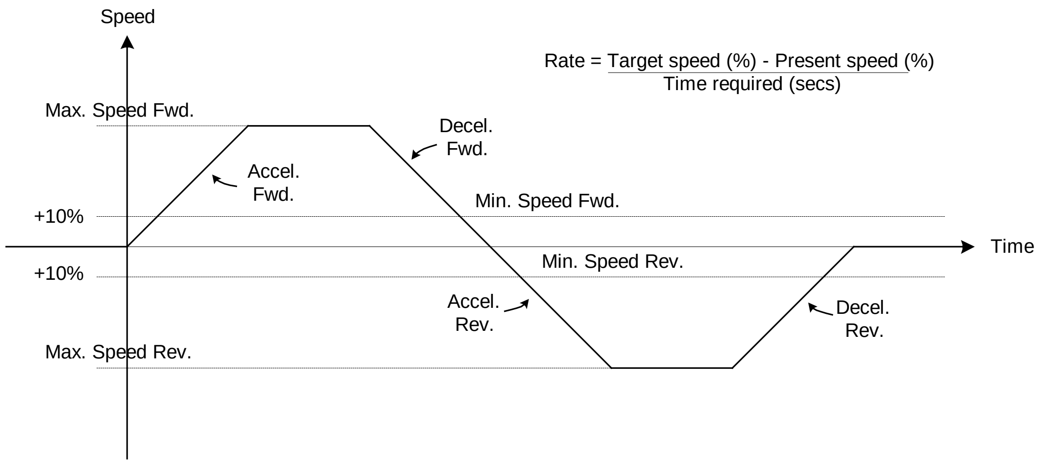


Figure 6-16. – Acceleration/Deceleration Rates

If minimum and maximum speeds are set, then the ramps will apply the relevant rate because the ramps are applied after the maximum and minimum speed clamps (shown at Sheet 5 of the Control Block Diagram). If the reference is changed to reverse, the deceleration forward ramp is followed to zero speed then the acceleration reverse ramp is followed to reverse minimum speed or to the required reference.

6.6.1 Ramp Rates

P6.00 - Acceleration Rate Forward

Allowed values: 0.1% to 3000.0% of Top Speed per second

P6.01 - Acceleration Rate Reverse

Allowed values: 0.0% to 3000.0% of Top Speed per second (0 = As Forward)

P6.02 - Deceleration Rate Forward

Allowed values: 0.1% to 3000.0% of Top Speed per second

P6.03 - Deceleration Rate Reverse

Allowed values: 0.0% to 3000.0% of Top Speed per second (0 = As Forward)

P6.04 - Speed to Reach Full Acceleration/Deceleration Rate

This parameter is used to enable S-Shaping and Enhanced S-shaping. A value of Zero disabled S-shaping and Enhanced S-shaping. A value greater than zero enabled standard S-shaping, the value determines the motor speed at which the full acceleration and deceleration rates are achieved.

Allowed values: -1% to 50% of Top Speed

A Value of -1 (any negative value up to -1) enabled the enhanced S-Shaping. The parameters P6.37 to P6.40 then define the speed at which the full acceleration and deceleration rates are achieved in each quadrant.

P6.05 - Control Flag 14 - Ramp Freeze Up Forward
P6.06 - Control Flag 15 - Ramp Freeze Up Reverse
P6.07 - Control Flag 16 - Ramp Freeze Down Forward
P6.08 - Control Flag 17 - Ramp Freeze Down Reverse
P6.09 - Control Flag 18 - Ramp Bypass

While the motor is accelerating or decelerating in either direction, Control Flags 14 to 17 can freeze the ramp. Acceleration or deceleration is then stopped and the motor speed is held constant.

The ramp may be bypassed altogether by setting Control Flag 18. This is useful when running the drive in position control mode.

P6.10 - Maximum Ramp Deviation (Vector only)

P6.10 limits the deviation between the Ramp Output and the Speed Feedback, thereby preventing the ramp from "ramping off" when the speed is unable to follow the speed demand for any reason. The ramp output will also be increased in value (to keep the speed feedback and ramp output within the deviation limit set by P6.10) as the load overhauls the motor.

Ramp Deviation's Speed Error Deadband

From Version 4.0 Firmware Code onwards, the ramp deviation is automatically disabled if speed error deadband is enabled (via CF73). Consider the following:

Error deadband in P14.14 = 10%

Ramp deviation in P6.10 = 5%

Normally if the motor was "running away" (e.g. a strip break etc.) the speed feedback would rise and at 10% speed error the deadband would 'catch' the spinning motor and return to speed control. If ramp deviation was enabled and set to 5% the speed error would be fixed at 5% (ramp output rises) and the deadband would never trigger, thus damaging the motor, hence the automatic disabling of the deviation feature.

NOTE: For Code versions of Firmware <4.00 ensure this situation has not been programmed.

Allowed values: 0.00 % to 100.00 %

NOTE: If P6.10 is set to < Deadband Value (P14.14) and the feature is enabled, then the deadband will never operate.

If deadband is enabled, via CF73, the minimum value in P14.14 (deadband) will set the minimum allowed limit of P6.10, thus preventing incorrect programming of these two features i.e. to prevent mal-operation of the speed catch.

P6.11 - Control Flag 122 - Limit Ramp Deviation

Control Flag 122 enables P6.10 when set.

6.6.2 Alternative Set of Ramp Rates

Parameters P6.12 to P6.15 provide an alternative set of ramp rates, scaling and range is the same as for the standard ramp rates. These rates are selected by CF127. The parameters and control flag are described below.

P6.12 - Acceleration Rate Forward 2

Allowed values: 0.1% to 3000.0% of Top Speed per second

P6.13 - Deceleration Rate Forward 2

Allowed values: 0.1% to 3000.0% of Top Speed per second

P6.14 - Acceleration Rate Reverse 2

Allowed values: 0.0% to 3000.0% of Top Speed per second (0 = As Forward)

P6.15 - Deceleration Rate Reverse 2

Allowed values: 0.0% to 3000.0% of Top Speed per second (0 = As Forward)

P6.16 - Control Flag 127 - Select Ramp 2

When set, CF127 enables the second set of ramp rates.

P6.17 - Trip Avoidance Threshold

The trip avoidance function, based on DC Link Voltage, reduces the need for Dynamic Braking when a drive is connected to an overhauling load. The function is automatically disabled when a Dynamic Brake is fitted. Parameter P6.17 is used with Status Flag 107, viewable in Parameter P11.35 'Status Flags 96-111, and is specified as 2.107 when used as a status flag source.

Status Flag 107 indicates when the VVVF ramp output is undergoing modification due to one of the following:

1. Drive in Current Limit;
2. Drive in Regen Limit;
3. Trip Avoidance Threshold exceeded.

Allowed values: 685 to 1500 V

6.6.3 Second User Ramp

The following parameters are used to set a user ramp whose output can be pointed to any other suitable drive parameter.

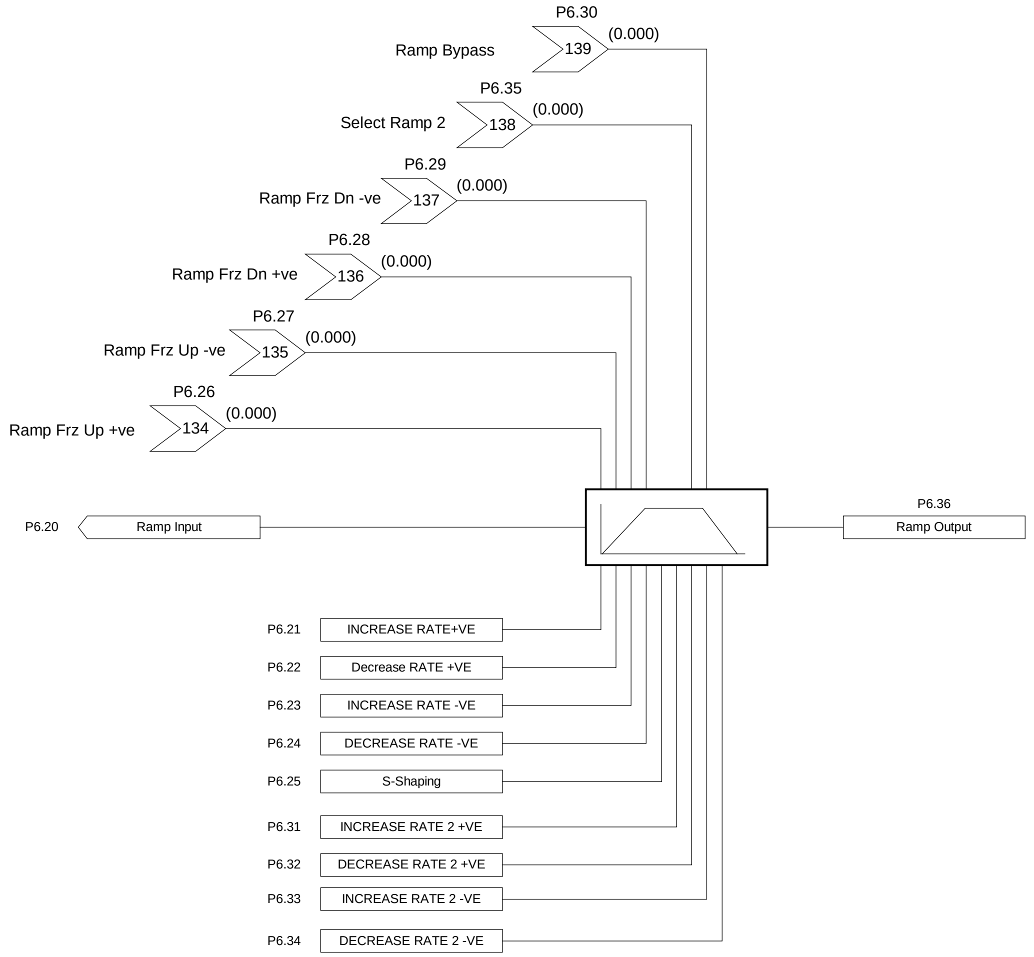


Figure 6-17. – Second User Ramp

P6.20 - Ramp Input

Allowed values: 1.00 to 99.99 (any parameter number)

P6.21 - Increase Rate Positive

Allowed values: 0.1% to 3000.0% per second

P6.22 - Increase Rate Negative

Allowed values: 0.0% to 3000.0% per second

(0 = As Increase Rate Positive)

P6.23 - Decrease Rate Positive

Allowed values: 0.1% to 3000.0% per second

P6.24 - Decrease Rate Negative

Allowed values: 0.0% to 3000.0% per second

(0 = As Decrease Rate Positive)

P6.25 - S-Shape range

This parameter determines the input at which the full Increase and Decrease rates are achieved.

Allowed values: 0% to 50%

P6.26 - Control Flag 134 - Ramp Freeze Up Positive
P6.27 - Control Flag 135 - Ramp Freeze Up Negative
P6.28 - Control Flag 136 - Ramp Freeze Down Positive
P6.29 - Control Flag 137 - Ramp Freeze Down Negative
P6.30 - Control Flag 138 - Ramp Bypass

While the output is ramping in either direction, Control Flags 134 to 137 freeze the ramp to 137. Ramping is then stopped and the output is constant.

The ramp may be bypassed altogether by setting Control Flag 138.

Alternative Set of Ramp Rates

Parameters P6.31 to P6.34 provide an alternative set of ramp rates, scaling and range is the same as for the standard ramp rates. These rates are selected by CF139. The parameters and control flag are described below.

P6.31 - Increase Rate Positive 2

Allowed values: 0.1% to 3000.0% per second

P6.32 - Decrease Rate Positive 2

Allowed values: 0.1% to 3000.0% per second

P6.33 - Increase Rate Negative 2

Allowed values: 0.0% to 3000.0% per second

(0 = As Increase Rate Positive)

P6.34 - Decrease Rate Negative 2

Allowed values: 0.0% to 3000.0% per second

(0 = As Decrease Rate Positive)

P6.35 - Control Flag 139 - Select Ramp 2

When set, CF139 enables the second set of ramp rates. (Default state: CLEARED).

P6.36 - Ramp Output

This is the output of the ramp function after imposing the various conditions imposed by the ramp parameters.

P6.37 – S-Shape Acc Fwd

This parameter sets the S shaping applied during the forward acceleration of the motor. It has a default value of 0.50% Top speed, a maximum of 50.00% Top speed and a minimum of 0.50% Top speed. This parameter is enabled by setting P6.04 to -1 (any negative value)

The value of P6.37 determines the motor speed at which the full acceleration rate forward is achieved.

P6.38 – S-Shape Dec Fwd

This parameter sets the S shaping applied during the forward deceleration of the motor. It has a default value of 0.50% Top speed, a maximum of 50.00% Top speed and a minimum of 0.50% Top speed. This parameter is enabled by setting P6.04 to -1 (any negative value)

The value of P6.38 determines the motor speed at which the full deceleration rate forward is achieved.

P6.39 – S-Shape Acc Rev

This parameter sets the S shaping applied during the Reverse acceleration of the motor. It has a default value of 0.50% Top speed, a maximum of 50.00% Top speed and a minimum of 0.50% Top speed. This parameter is enabled by setting P6.04 to -1 (any negative value)

The value of P6.39 determines the motor speed at which the full acceleration rate reverse is achieved.

P6.40 – S-Shape Dec Rev

This parameter sets the S shaping applied during the Reverse deceleration of the motor. It has a default value of 0.50% Top speed, a maximum of 50.00% Top speed and a minimum of 0.50% Top speed. This parameter is enabled by setting P6.04 to -1 (any negative value)

The value of P6.40 determines the motor speed at which the full deceleration rate reverse is achieved.

6.7 MENU 7 - PLANT I/O SETTINGS

(Refer to Control Block Diagram Sheet 4).

Menu 7 gives access to the parameters required to configure and monitor the Digital and Analogue I/O.

P7.00 - Analogue Reference 1 Input Mode
P7.04 - Analogue Reference 2 Input Mode

Parameters P7.00 and P7.04 set the input mode for Analogue Refs 1 and 2 respectively.

Four voltage modes and four current modes are available for each input, depending on I/O DIP switch settings (see Wiring Diagram in relevant manual). The default mode is Option 1. The various options and their meanings are shown in the table below.

P7.00, P7.04 Analogue Input Options (% of Top Speed)	Meaning in Voltage/Current Mode	DIP Settings
1 = 0% to ±100 %	0 V to ±10 V	Switches 3 and 4 to the 10 V Position
2 = ±(0% to 100 %)	±(2 V to 10 V) *	
3 = -100 % to +100 %	0 V to 10 V	
4 = ±(0% to 100 %)	±(10 V to 2 V) *	
5 = 0% to ±100 %	0mA to ±20mA	Switches 3 and 4 to the 20mA Position
6 = ±(0% to 100 %)	±(4mA to 20mA) **	
7 = -100 % to +100 %	0mA to ±20mA	
8 = ±(0% to 100 %)	±(20mA to 4mA) **	

Table 6-6. – Analogue Input Options

* Drive will detect <2V

** Drive will detect <4mA

6.7.1 Analogue Input Offset and Gain

This section shows how to use the Analogue Input gain and offset parameters.

Usually these parameters only need to be considered if the drive has a minimum speed set and the Analogue Input is expected to request Minimum speed to Maximum speed for the whole input range, while not having a dead spot at the beginning of the travel.

P7.01 - Analogue Reference 1 Offset Adjust
P7.05 - Analogue Reference 2 Offset Adjust

Sets the input offset for the associated Analogue Reference.

See the worked example that follows.

Allowed values are in range: -100.0% to +100.0%

P7.02 - Analogue Reference 1 Gain Adjust
P7.06 - Analogue Reference 2 Gain Adjust

Sets the input gain for the associated Analogue Ref.

See the worked example that follows.

Allowed values are in range: -2.00 per unit to +2.00 per unit
(= -200% to +200%)

Worked Example of Analogue Offset and Gain Adjustment

The example shown here is for a motor required to have a maximum forward speed of 1500 r/minute and a minimum forward speed of 150 r/minute. Proceed as follows:

Set P5.15 = Maximum Speed Fwd = 1500 r/minute
Set P15.17 = Minimum Speed Fwd = 150 r/minute

Then set: (Offset) P7.01 = $\frac{150 \times 100}{1500}$ = 10% (of top speed)

P7.02 (Gain) = $\frac{1500 - 150}{1500}$ = 0.9 = remaining speed range

This will set Analogue Input 1 such that minimum speed is requested with minimum reference, maximum speed with maximum reference.

Analogue Reference Values

P7.03 - Analogue Reference 1 Value
P7.07 - Analogue Reference 2 Value

These parameters allow monitoring of the Analogue Reference values after the gains and offsets have been set.

Monitoring range: -100.00% to +100.00% of full scale

Where full scale is 10V or 20mA

P7.16 - Analogue Reference Filter Time Constant

In environments liable to high frequency noise, P7.16 allows adjustment of low pass filters on both Analogue References to reduce high frequency noise effects.

Allowed values: 0ms to 5000ms

6.7.2 Analogue Outputs

Two identical analogue output channels provide analogue indication, for meters etc. Each channel can provide a signal in either voltage or current form, depending on I/O DIP switch settings (see Wiring Diagram in relevant manual). Reading Parameters P11.40 and P11.41 respectively can monitor the outputs from Analogue Outputs 1 and 2.

P7.17 - Analogue Output 1 Signal
P7.22 - Analogue Output 2 Signal

Allowed values: Any Parameter number

NOTE: **While any parameter number may be specified, not all parameters contain suitable data.**

P7.18 - Analogue Output 1 Mode
P7.23 - Analogue Output 2 Mode

Parameters P7.18 and P7.23 control the form of the output representing the zero to full-scale values of the analogue output.

Five options are available as shown in Table 6-7; these can be in voltage or current mode depending on I/O DIP switch settings (see Wiring Diagram in relevant manual).

P7.18, P7.23 Analogue Output Options	Meaning in Voltage Mode	Meaning in Current Mode
1 = 0 - 10V or 0 - 20mA	0% to ±100% of signal gives 0V to ±10V	0% to ±100% of signal gives 0mA to ±20mA
2 = 2 - 10V or 4 - 20mA	±(0% to 100 %) of signal gives ±(2V to 10V)	±(0% to 100%) of signal gives ±(4mA to 20mA)
3 = 10 - 0V or 20 - 0mA	±100 % to 0% of signal gives 0V to ±10V	±100% to 0% of signal gives 0 to ±20mA
4 = 10 - 2V or 20 - 4mA	±(100 % to 20%) of signal gives ±(2V to 10V)	±(100% to 20%) of signal gives ±(4 to 20mA)
5 = 0 - 20mA Fast Power	Not used in Voltage Mode	See 6.7.3 and **6.51** (P53.03)

Table 6-7. – Analogue Output Options

P7.19 - Analogue Output 1 Polarity
P7.24 - Analogue Output 2 Polarity

These parameters control the polarity of the output signals:

0 = Output is positive only
1 = Output is bipolar, e.g. when indicating speed,
positive = forward rotation
negative = reverse rotation

6.7.3 Analogue Output Scaling

The analogue outputs can be used to monitor any drive parameter. The scaling and offset parameters "take on" the units etc. of the parameter being monitored; this means their use is quite intuitive.

P7.20 - Analogue Output 1 Scaling
P7.25 - Analogue Output 2 Scaling

Scales the analogue output to match the external metering requirement. The value set should correspond to the full-scale output of the analogue Signal set in P7.17 or P7.22.

Range of P7.20 depends upon value of P7.17
Range of P7.25 depends upon value of P7.22

Allowed values: 0 ± Maximum value of selected input

Worked Example of Analogue Output Scaling

To "send" DC link volts to an analogue output, then:

P7.17 = 11.03 (DC Link Volts)

Then simply edit the scaling parameter to a value that is required to represent 100% of analogue output e.g.

P7.20 = 560

At 560VDC the Analogue Output will now read full scale.

P7.21 - Analogue Output 1 Value
P7.26 - Analogue Output 2 Value

These read only parameters give the instantaneous value of analogue outputs 1 and 2 respectively.

Monitored values: -100.0% to +100.0% of full scale, where full scale is 10V or 20mA.

6.7.4 Digital Outputs

P7.27 to P7.29 - Digital Output Signal 1 to 3

The Digital outputs have parameters and are programmed like Control Flags, having access to all of the same connections (see Table 6-15). Sheet 4 of the Control Block Diagram shows the digital I/O.

Example: How the "O/P Running" output is connected.

6.7.5 Digital Inputs

These six inputs do not have associated parameters. They are used as inputs to Control Flags or Digital Outputs and are designated as shown in Table 6-8. A typical use could be as shown in the example below.

Digital Input	Designation
Digital Input 1	1.001
Digital Input 2	1.002
Digital Input 3	1.003
Digital Input 4	1.004
Digital Input 5	1.005
Digital Input 6	1.006

Table 6-8. – Digital Inputs - Designation

Example: How to connect Control and Status Flags together

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:

6.8 MENU 8 - TORQUE LIMIT SETTINGS

(Refer to Control Block Diagram Sheet 7)

Menu 8 gives access to the parameters required to configure the Torque Limit feature.

P8.00 - Torque Limit

This parameter is the overall torque limit when P8.01 to P8.03 are set. Otherwise P8.00 becomes an autonomous value and can be regarded as Positive Torque Limit 1.

Allowed values: 0.0% to 300.0% of nominal torque

NOTES:

1 There are limitations when using Torque Limit in VVVF e.g. the bandwidth is poor at low speed.

2 The actual value of Torque Limit is also limited by P11.49 which is the maximum torque vector control can produce, and is speed dependent

P8.01 - Negative Torque Limit 1
P8.02 - Positive Torque Limit 2
P8.03 - Negative Torque Limit 2

Allowed values: 0.0% to 300.0% of nominal torque

-0.1 = Value set in P8.00

What happens when the torque limit is reached depends upon the load characteristic. The motor may slow down or stay at the same speed. See also the Control Block Diagram.

P8.04 - Control Flag 24 - Disable Torque

When set, CF24 disables the Torque demand.

P8.05 - Control Flag 22 - Inhibit Positive Torque

When set, CF22 inhibits generation of positive torque, i.e. when motoring with forward rotation or braking with reverse rotation (see Figure 6-18).

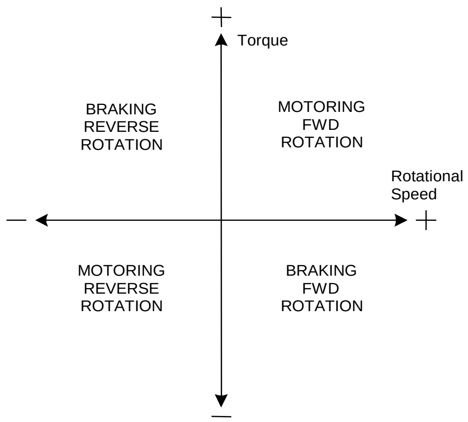


Figure 6-18. – Speed Torque

P8.06 - Control Flag 23 - Inhibit Negative Torque

When set, CF23 inhibits generation of negative torque, i.e. when motoring with reverse rotation or braking with forward rotation (see Figure 6-18).

P8.07 - Control Flag 21 - Torque Limit Selection

Control Flag 21 is used to switch between the Torque Limit 1 settings defined in P8.00 and P8.01 and the Torque Limit 2 setting defined in P8.02 and P8.03 as follows:

0 = OFF = Torque Limit 1 (+ve and -ve)
1 = ON = Torque Limit 2 (+ve and -ve)

Each +ve and -ve Torque Limit has its own scale source, selectable by P8.08 to P8.11.

P8.08 - Positive Torque Limit Scale Source 1
P8.09 - Negative Torque Limit Scale Source 1
P8.10 - Positive Torque Limit Scale Source 2
P8.11 - Negative Torque Limit Scale Source 2

These parameters select the source for the torque limits scale. They allow adjustment of torque limits "on-line" via the selections shown. Refer to Sheet 5 of the Control Block Diagram for a pictorial representation.

Allowed values:

1 = Fixed 100 %

2 = Analogue REF1

3 = Analogue REF2

4 = RS485 REF1

5 = RS485 REF2

6 = RS232 REF1

7 = RS232 REF2

8 = PID Controller

9 = Ref. Sequencer

10 = Fixed Ref. Menu

11 = Motorised Pot.

12 = Trim Reference

13 = Fixed 0% (Not used)

14 = Fixed 0% (Not used)

15 = Summing Node A

16 = Summing Node B

17 = Pointer 9

18 = Pointer 10

NOTE: Option 1 gives 100 % of the value set in the Torque Limit parameters P8.00 to P8.03.

6.9 MENU 9 - BASIC DRIVE MONITORING

Menu 9 gives access to read-only parameters required for monitoring basic drive functions with the exception of P9.00, which is Operator accessible.

P9.00 - Speed Reference

Shows the value of the speed reference input.

Allowed range: -100.00% to +100.00% Top Speed

P9.01 - Speed Feedback

This parameter shows the drive output speed as a percentage of maximum speed.

Allowed range: -300.00% to +300.00% Top Speed

P9.02 - Process Speed

This parameter contains the calculated process speed, derived from the output frequency of the drive and the scaling factor placed in P5.22.

Allowed range: -9999 Units to +9999 Units (not defined)

NOTE: This calculated process speed might be inaccurate, particularly at low speeds.

P9.03 - Speed Feedback

This parameter shows the motor speed in r/minute.

Allowed range: 0 ±30,000r/minute

P9.04 - Torque Demand

The value in P9.04 is an estimate of the motor torque calculated by the drive.

Allowed range: -300.0% to +300.0% of nominal torque

P9.05 - Motor Current

The drive output current in amps rms

Values are in the range: 0.0A to 9999.9A (for MicroCubicle™ Drives) 0A to 9999A (for DELTAs)

P9.06 - Drive Current

The drive output current as a percentage of the drive full load current, where
100% = drive FLC as P99.05.

Values are in the range: 0.0% to 300.0%

P9.07 - Motor Volts

The output voltage applied to the motor, in volts rms

Values are in the range: 0 V to 1000V

P9.08 - Motor Power

The drive output power, in kW. This is the "real" power to the motor.

Power measurement is in the drive's software via the following equation:

$$Power = (Vd \times Id) + (Vq \times Iq)$$

Where

Vd and Vq are the two components of voltage, and
Id and Iq are the two components of current

In VVVF the voltage is defined as being on the q-axis. Iq is therefore the real current (active current) and Id the imaginary component of current (reactive current).

Values are in the range:

-999.0kW to +999.9kW (for MicroCubicle™ Drives)
-9999kW to +9999kW (for DELTAs)

P9.09 - Frequency Feedback

This parameter shows the drive output frequency in Hz.

Range of values: -200Hz to +200Hz

P9.10 - Drive Overload Remaining

Contains the amount of overload capability remaining to be monitored. Its units are % of (1.5 x Drive FLC) for 60 seconds.

Range of values: 100% to 0% of total overload capacity

P9.11 - Motor Overload Remaining

This parameter indicates the percentage of the motor I^2T overload remaining, set in P2.07. When 25% is remaining, 75% has been used and the drive may trip avoid. See P2.09 for action on I^2T fault.

Values are in the range: 100% to 0% of the I^2T overload capability of the motor

6.10 MENU 10 - TRIPS AND WARNINGS

Menu 10 gives access to read-only parameters showing the status of warnings and trips, and also to control flags required for setting user trips. The description and handling of warnings and trips is included at Section 9 (Diagnostics).

6.10.1 Warnings

P10.00 to P10.09 - Warning Nos. 1 to 10

These parameters show warning fault codes for Warning Nos. 1 through 10, Warning No. 1 being the most recent. For a description of Warning codes, refer to Table 9-2.

Allowed range: All available Warning Codes

6.10.2 Trips

P10.10 to P10.19 - Trip Nos. 1 to 10

These parameters show trip fault codes for the "present" ten trips, the first fault being Trip No. 1. For a description of Trip codes, refer to Table 9-3. These parameters show trips when the "Trip LED" is flashing; for a history of trips see P10.20.

Allowed range: All available Trip Codes (Default = 0)

The trip fault codes are cleared on a trip reset, and a record of what they were is stored in P10.20 to P10.29.

6.10.3 Trip History

P10.20 to P10.29 - Trip History 1 to 10

These parameters show trip fault codes for the last ten trips, the most recent being for Trip No. 1. Refer to Table 9-3. When trips are reset they move from "present" trips (P10.10 to P10.19) to trip history (P10.20 to P10.29).

Allowed range: All available Trip Codes (Default = 0)

These trip fault codes are **not** cleared on a trip reset.

6.10.4 Time Since Trip

P10.30 - Seconds Since Trip

When the drive trips, this parameter starts to record the elapsed time in seconds since the occurrence of the trip. The values are reset to zero when the trip is reset.

Values are in the range: 0 to 3599 seconds

P10.31 - Hours Since Trip

When the drive trips, this parameter starts to record the elapsed time in hours since the occurrence of the trip. The values are reset to zero when the trip is reset.

Values are in the range: 0 to 672 hours

6.10.5 User Trips

P10.32 - Control Flag 10 - User Trip 1
P10.33 - Control Flag 112 - User Trip 2

When set, cause User Trip 1 or 2, as selected. They can therefore be "patched" and connected to user-defined signals within plant, allowing the drive to become part of the complete control system.

6.10.6 Trip Reset

P10.34 - Control Flag 9 - Trip Reset

Resets all resettable trips, see Section 9 for definitions.

6.10.7 "New Drive PCB" or "Unknown Drive Size" Trip

P10.35 - Action on "New Drive PCB" or "Unknown Drive Size" Trip

Indicates action which can be taken when a drive has tripped after a "new drive pcb" has been added or the drive ID does not recognise the drive size i.e. it is an "unknown drive size". The actions available are listed in the values in the range. Selection of either value 1 or 2, depending on the reason for the trip, will enable the stored drive ID information to be used and drive operation resumed.

Values in the range:

0 = No action
1 = Use Drive ID information stored in Control PCB (SMPS was replaced)
2 = Use Drive ID information stored in SMPS (Control PCB was replaced)

6.10.8 P10.36 - Delta Identification Source

0 = Delta Bridge
1 = Local Copy

This tells the drive firmware from where to read its power bridge identification.

Option 0 is as previous versions of firmware, i.e. directly from the power bridge itself.

If option 1 is set at power up, it enables the drive to be healthy, when powered from the auxiliary 28V input, as the drive uses the delta bridge information stored previously.

If the drive is powered from auxiliary 28V input, with P10.36=0, then the drive will be tripped with several trips relating to the non-identification of the power bridge. If subsequently, P10.36 is changed to 1, then the drive will erase any previously stored local copy of the bridge identification information. The drive will remain tripped on non-identification of Delta trips, until the main DC link is powered up. At this point, the drive will restart, and will read the Delta information. The Delta information is then stored in the local copy, for use at the next power up.

If the drive is powered from the main DC link, with P10.36=0, and subsequently changed to P10.36=1, the drive will store the Delta bridge information in a local control copy, at this point. This is then available for use at subsequent power ups, when powered from either the main DC link, or auxiliary 28V input.

WARNING

This mechanism opens the Delta systems up to abuse.

For example, if the drive is used in this mode, with P10.36=1. For some reason, it is necessary to change a Delta Interface PCB (DIB - 20x4319). A DIB from a different size of Delta is used. Because P10.36=1, and the drive takes no notice of the data contained in the DIB, the system will operate. Subsequently, this entire Delta is placed in another drive system, with P10.36=0. The controller then believes that the Delta is of a different rating than it really is, as the DIB is incorrect. This may be some time after the original exchange, when no error was apparent.

If P10.36=1, it is possible to put dissimilar Deltas, and DIBs, into a system. The controller ignores the Delta bridge information, and will allow the system to run. As the Deltas are of different ratings, incorrect power bridge operation / sharing will result.

6.10.9 Extra User Trips and Warnings

P10.40 - CF198: User Alert 1
P10.42 - CF199: User Alert 2
P10.44 – CF200: User Alert 3
P10.46 – CF201: User Alert 4
P10.48 – CF202: User Alert 5
P10.50 – CF203: User Alert 6
P10.52 – CF204: User Alert 7
P10.54 – CF205: User Alert 8
P10.56 – CF206: User Alert 9
P10.58 – CF207: User Alert 10

When set, cause User Alert Warning or Trip, as selected in the following associated User Action Parameters. They can therefore be "patched" and connected to user-defined signals within plant, allowing the drive to become part of the complete control system.

P10.41 - User Action 1
P10.43 - User Action 2
P10.45 - User Action 3
P10.47 - User Action 4
P10.49 - User Action 5
P10.51 - User Action 6
P10.53 - User Action 7
P10.55 - User Action 8
P10.57 - User Action 9
P10.59 - User Action 10

Allowed values:

0 = No action
1 = Warning
2 = Trip

6.11 MENU 11 - ADVANCED DRIVE MONITORING

(Refer to Control Block Diagram Sheet 9)

Menu 11 gives access to the parameters required to monitor the advanced features of the drive including current feedbacks, DC link voltage, PID functions, analogue I/O, digital I/O, status flags, temperature monitoring and running time. With the exception of P11.50 all parameters are read-only.

6.11.1 General Advanced Monitoring

P11.00 - Active Current

Indicates the torque-producing component of the motor current, expressed as a percentage of drive Full Load Current. Drive FLC can be found in P99.05.

Allowed range: -150.0% to +150.0% of drive Full Load Current

P11.01 - Magnetising Current

Contains the flux-producing component of the motor current, expressed as a percentage of Drive Full Load Current.

Allowed range: -150.0% to +150.0% of drive Full Load Current

P11.02 - PID Controller Output

This parameter is the output of the PID function. The PID output appears in all reference selection choices as shown at the Control Block Diagrams, and can be connected to Analogue O/P's or pointers etc.

Allowed range: -100.00% to +100.00% of full scale

P11.03 - DC Link Voltage

This parameter indicates the voltage of the DC link.

Allowed range: 0V to 30,000V

When the DC Link voltage at the SMPS falls to a low level, the DC Link voltage measurement will not be representative of the actual DC Link voltage.

- This will result in the DDM (keypad) indicating the value as “uncollated”.
- This data will also show within Drive Coach as “uncollated” but will be represented in the Drive Coach History as the value 0.
- The serial communication links (e.g. Ethernet, RS485) shows a value of 8000h (32768).
- Customers may need to verify that their interface protocol can operate with this value.

NOTE: **Software versions earlier than:**

00S122	**MV3000e Firmware**	**Rev. 20.00**
00S122-3020	**MV3000e Firmware**	**Rev. 12.21**
00S122-3030	**MV3000e DSP Firmware**	**Rev. 2.17**

May show this value as 0 on the DDM (keypad), Drive Coach and serial links.

WARNING

- **This voltage measurement is for indication only and must not be used as verification that the voltage has reduced to a safe level.**

6.11.2 Temperature Feedback

P11.04 to P11.14 are used to indicate the temperature of various parts of the drive. Table 6-9 indicates the trip and warning temperature thresholds of various parts of the drive and is provided for reference purposes.

Table 6-9 provides an indication of the 'average' temperature values for the MV3000e MicroCubicle™ and DELTA bridges. Some MicroCubicle™ Drives will have higher values and some lower values than those stated in the table. The values should only be used as a guide.

The MicroCubicle™ values appear to have a larger tolerance than the other units. This tolerance shows the extent of the possible range of values as the actual value is fixed by a combination of drive frame size, SKiiP type and heatsink MicroCubicle™ Drive rating. The value is programmed into the drive during its testing.

Component/Parameter		Under Temperature		Over Temperature	
		Warning	Trip	Warning	Trip
CDC Electronics Temperature	P11.04	0 °C	-10 °C	65 °C	80 °C
Output Bridge 1: MicroCubicle™	P11.05	5 °C	0 °C	Trip - 5	101.5 °C, +9.5, -11.5
DELTA	P11.05	5 °C	0 °C	107 °C	112 °C
Output Bridge 2, DELTA	P11.06	5 °C	0 °C	107 °C	112 °C
Output Bridge 3, DELTA	P11.07	5 °C	0 °C	107 °C	112 °C
Input Bridge: MicroCubicle™	P11.08	5 °C	0 °C	Trip - 5	103 °C, +17, -10
DELTA	P11.08	5 °C	0 °C	80 °C	85 °C
Output Bridge 4, DELTA	P11.09	5 °C	0 °C	107 °C	112 °C
Output Bridge 5, DELTA	P11.10	5 °C	0 °C	107 °C	112 °C
Output Bridge 6, DELTA	P11.11	5 °C	0 °C	107 °C	112 °C
MicroCubicle™ Internal DB Temperature	P11.12	5 °C	0 °C	Trip - 5	101.5 °C, +9.5, -11.5 **

Table 6-9. – Drive Temperatures

NOTES:

1 Refer to Menu 45 for a complete list of temperature parameters.

2 Refer to Table 9-2 and Table 9-3 for lists of Warning and Trip Fault codes respectively.

3 ** The Dynamic Brake (DB) has two hardware levels, one set at 82 °C ± 2 °C and the other set at 115 °C.

P11.04 - CDC Electronics Temperature

This parameter indicates the temperature of the control electronics on all drive models.

Range of values: -40ºC to +150ºC

P11.05 - Output Bridge 1 Temperature
P11.06 - Output Bridge 2 Temperature
P11.07 - Output Bridge 3 Temperature

These parameters give the temperatures of the heatsinks used on the Output Bridges 1, 2 and 3 of DELTA drives. For MicroCubicle™ Drives, P11.05 only is used.

Range of values: -40ºC to +150ºC

P11.08 - Input Bridge Temperature

This parameter gives the temperature of the Input Bridge heatsink; on DELTA drives this is Input Bridge 1.

Range of values: -40ºC to +150ºC

P11.09 - Output Bridge 4 Temperature
P11.10 - Output Bridge 5 Temperature
P11.11 - Output Bridge 6 Temperature

These parameters give the temperatures of the heatsinks used on the Output Bridges 4, 5 and 6 of parallel DELTA drives.

Range of values: -40ºC to +150ºC

P11.12 - DB Temperature

Shows the temperature of the DB Switch heatsink (when fitted).

Range of values: -40ºC to +150ºC

P11.13 - Maximum CDC Electronics Temperature
P11.14 - Minimum CDC Electronics Temperature

These two parameters record the maximum and minimum ever temperatures of the CDC control electronics. The parameter values are not cleared when the drive is reset to factory defaults.

Range of values: -40ºC to +150ºC

6.11.3 Run/Energised Monitor

P11.15 - Hours Run
P11.16 - Days Run

These two parameters record the total running time of the drive since installation. The parameter values can only be reset to zero by the manufacturer.

Displayed values are in the range: P11.15:- 0 to 23 Hours
P11.16:- 0 to 30,000 Days

P11.17 - Hours Energised
P11.18 - Days Energised

These parameters record the total time the drive has been energised since installation. The parameter values can only be reset to zero by the manufacturer.

Displayed values are in the range: P11.17:- 0 to 23 Hours
P11.18:- 0 to 30,000 Days

P11.19 and P11.20 - Total Energy Consumed

These two parameters record the total energy consumed by the motor (not the total energy consumed from the supply). Only 'Return to Default Settings' resets the values (see 3.2.4).

Displayed range: P11.19:- 0 to 999.9kWh
P11.20:- 0 to 9999MWh

6.11.4 Digital Inputs

P11.21 - Digital Input States

This parameter monitors the state of the six digital inputs, plus the state of the interlock terminal, as part of a 16-bit word, as shown in Figure 6-19.

Values are given in Hex and Binary.

Hex values are in the range: 0000 to 803F

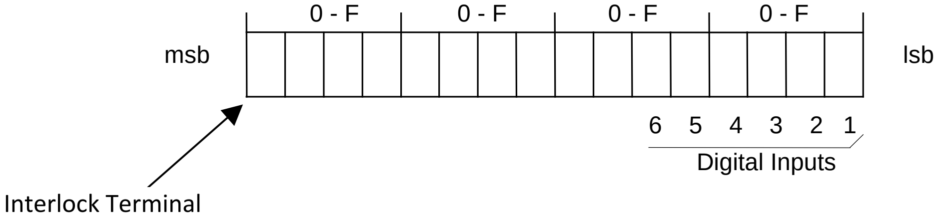


Figure 6-19. – Monitoring Digital Inputs

The Drive Data Manager™ (Keypad) displays this parameter in hex and binary as in Figure 6-20, e.g. typical display showing DIGIN 1 and DIGIN 3 both ON, and DIGIN 2 OFF; and the Interlock terminal = 1.

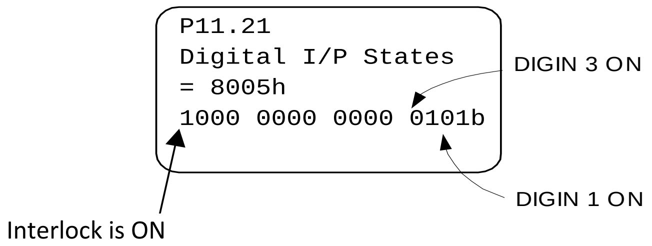


Figure 6-20. – Keypad Display of PL11.21

P11.22 - Digital Output States

This parameter monitors the state of the three digital outputs as part of a 16-bit word, shown in Figure 6-21.

Values are in the range: 0000 to 0007 (Hex)

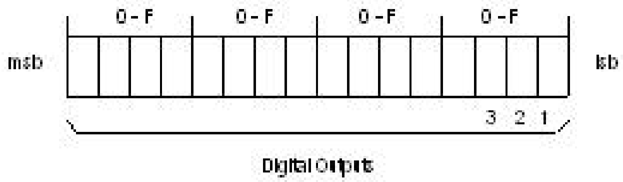


Figure 6-21. –Monitoring Digital Outputs

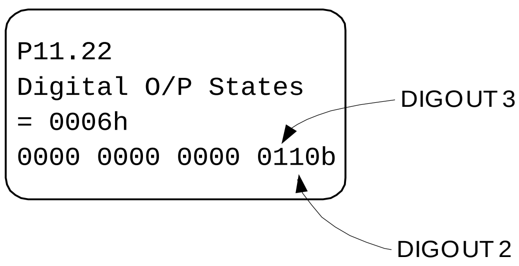


Figure 6-22. – Typical Keypad Display of PL11.22

The Drive Data Manager™ (Keypad) displays this parameter in hex and binary.

Figure 6-22 shows a typical display where DIGOUT 2 and DIGOUT 3 are both ON, and DIGOUT 1 is OFF.

6.11.5 Monitoring Control Flags

P11.23 - Control Flags 0 - 15
P11.24 - Control Flags 16 - 31
P11.25 - Control Flags 32 - 47
P11.26 - Control Flags 48 - 63
P11.27 - Control Flags 64 – 79
P11.28 - Control Flags 112 - 127
P11.29 - Control Flags 96 - 111
P11.43 - Control Flags 128 - 143
P11.53 - Control Flags 144 - 159
P11.54 - Control Flags 160 - 175
P11.55 - Control Flags 176 - 191
P11.56 - Control Flags 192 - 207

Each of these read only parameters contains a four digit hexadecimal number that reflects the state of sixteen control flags.

Values can be in the range: 0000 to FFFF (hex)

The Drive Data Manager™ (Keypad) shows this as a sixteen-bit binary number; each bit gives the state of the corresponding control flag:

1 = ON
0 = OFF

P11.23 corresponds to Control Flags 0 to 15 as shown in Figure 6-23, similarly P11.24 to P11.29 allow monitoring of Control Flags 16 to 111; P11.43 allows monitoring of Control Flags 128 to 143; P11.53 to P11.56 allow monitoring of Control Flags 144 to 207.

	0 - F				**0 - F**				**0 - F**				**0 - F**				
MSB																	**LSB**
P11.23	15	14	13	12	11	10	9	8	7	6	5	4	3	2	1	0	
P11.24	31	30	29	28	27	26	25	24	23	22	21	20	19	18	17	16	
P11.25	47	46	45	44	43	42	41	40	39	38	37	36	35	34	33	32	
P11.26	63	62	61	60	59	58	57	56	55	54	53	52	51	50	49	48	
P11.27	79	78	77	76	75	74	73	72	71	70	69	68	67	66	65	64	
P11.28	127	126	125	124	123	122	121	120	119	118	117	116	115	114	113	112	
P11.29	111	110	109	108	107	106	105	104	103	102	101	100	99	98	97	96	
P11.43	143	142	141	140	139	138	137	136	135	134	133	132	131	130	129	128	
P11.53	159	158	157	156	155	154	153	152	151	150	149	148	147	146	145	144	
P11.54	175	174	173	172	171	170	169	168	167	166	165	164	163	162	161	160	
P11.55	191	190	189	188	187	186	185	184	183	182	181	180	179	178	177	176	
P11.56	207	206	205	204	203	202	201	200	199	198	197	196	195	194	193	192	

Figure 6-23. –Monitoring Control Flags

6.11.6 Monitoring Status Flags

The status flags are set by the control program and reflect the operating status of the drive. Status Flags can be:

- Used to determine the state of the digital outputs.
- Copied to a control flag.
- Used for monitoring.

The following parameters allow monitoring of all the drive status flags.

P11.30 - Status Flags 0-15
P11.31 - Status Flags 16-31
P11.32 - Status Flags 32-47
P11.33 - Status Flags 48-63
P11.34 - Status Flags 64-79
P11.35 - Status Flags 96-111
P11.42 - Status Flags 80-95
P11.57 - Status Flags 112-127
P11.58 - Status Flags 128-143

Each of the read-only parameters P11.30 to P11.35, P11.42, P11.57 and P11.58 contains a four digit hexadecimal number and a binary string that reflect the state of sixteen status flags. Values can be in the range: 0000 to FFFF (hex)

The Drive Data Manager™ (Keypad) displays a sixteen-bit binary number each bit gives the state of the corresponding Status Flag:

1 = ON
0 = OFF

As shown in Figure 6-24, P11.30 corresponds to status flags 0 to 15, similarly parameters P11.31 to P11.35 allow monitoring of Status Flags 16 to 111; P11.42 allows monitoring of Status Flags 80 to 95; P11.57 and P11.58 allow monitoring of Status Flags 112 to 143.

	0 - F				**0 - F**				**0 - F**				**0 – F**				
MSB																	**LSB**
P11.30	15	14	13	12	11	10	9	8	7	6	5	4	3	2	1	0	
P11.31	31	30	29	28	27	26	25	24	23	22	21	20	19	18	17	16	
P11.32	47	46	45	44	43	42	41	40	39	38	37	36	35	34	33	32	
P11.33	63	62	61	60	59	58	57	56	55	54	53	52	51	50	49	48	
P11.34	79	78	77	76	75	74	73	72	71	70	69	68	67	66	65	64	
P11.35	111	110	109	108	107	106	105	104	103	102	101	100	99	98	97	96	
P11.42	95	94	93	92	91	90	89	88	87	86	85	84	83	82	81	80	
P11.57	127	126	125	124	123	122	121	120	119	118	117	116	115	114	113	112	
P11.58	143	142	141	140	139	138	137	136	135	134	133	132	131	130	129	128	

Figure 6-24. – Monitoring Status Flags

6.11.7 Monitoring Analogue Inputs

P11.36 - Analogue Reference 1 Value
P11.37 - Analogue Reference 2 Value

Read-only parameters P11.36 and P11.37 contain the current values of analogue inputs AN I/P 1 and AN I/P 2 respectively.

6.11.8 Monitoring Analogue Outputs

P11.40 - Analogue Output 1 Value
P11.41 - Analogue Output 2 Value

These read-only parameters indicate the values at the analogue output terminals AN O/P 1 and AN O/P 2 as a percentage of the full-scale output.

Values are in the range: -100.0% to +100.0% (of full scale)

6.11.9 Monitoring Speed Loop

P11.45 - Speed Demand

This read only parameter contains the speed demand input into the controller as a percentage of Top Speed, after the trim and droop terms have been imposed.

Values are in the range: -100.00 to +100.00%

P11.46 - Speed Error

This read only parameter contains the error signal input to the speed regulator expressed as a percentage of Top Speed.

Values are in the range: -300.00 to +300.00%

P11.47 - Speed Loop Output

This read only parameter contains the speed loop output expressed as a percentage of Top Speed.

Values are in the range: -300.00 to +300.00%

6.11.10 Inertia Compensation Output

P11.48 - Inertia Compensation Output

Values are in the range: -300.00% to +300.00% of nominal torque

6.11.11 Maximum Torque Available

P11.49 - Maximum Torque Available

This read only parameter contains the maximum percentage of motor nominal torque that is attainable at the present operating point of voltage and frequency. If the value is greater than the customer programmed torque limit (in P8.00, or P8.01 to P8.03), then it is not acted upon. However, if the value is less than the programmed torque limit, then it effectively becomes the active torque limit.

Values are in the range: 0.00% to +300.00%

6.11.12 Torque Reference

P11.50 - Torque Reference

This parameter contains the torque reference expressed as a percentage of Nominal Torque. If Torque Reference is set to Keypad, then the Keypad can be used to directly edit this value.

Allowed values: -100.00% to +100.00%

6.11.13 Encoder Speed

P11.51 - Encoder Speed (VVVF

VVVF Mode of Operation

This read-only parameter is available in Frequency and Vector Control modes and contains the encoder speed feedback expressed as a percentage of motor top speed. It is extremely useful in determining if the encoder is healthy after an encoder loss ridethrough.

Values are in the range: -300.00% to +300.00%

The parameter operates in VVVF with all MV3000e DELTA Controller types, i.e. MVC3001-4001, 4002, 4003 and 4013. It also applies to all MV3000e MicroCubicle™ Drives.

Vector Control Modes of Operation

The parameter reads encoder speed feed when operating in Vector Control with MV3000e DELTA Controller type MVC3001-4002, 4003 and 4013 only and MV3000e MicroCubicle™ Drives fitted with controller type 20X4311 issue E or later.

P11.52 - Modulation Depth

This read only parameter shows the modulation depth at which the drive is running and is useful for checking that the drive is operating correctly.

$$\text{Drive AC Output Voltage} \approx \frac{Vdc \times ModulationDepth}{\sqrt{2}}$$

P11.59 - CPU Usage

This parameter gives an indication of current processor usage.

Values in the range: 0% to 100%

P11.60 - Serial Number of Drive (Low Part)

This number, which is Read Only, is read from MicroCubicle™ SMPS or the DELTA DIB (DELTA Interface Board).

P11.61 - Serial Number of Drive (High Part)

This number, which is Read Only, is read from MicroCubicle™ SMPS or the DELTA DIB (DELTA Interface Board).

P11.62 - Serial Number of Power Interface Board (Low Part)

This number, which is Read Only, is read from the PIB (Power Interface Board).

P11.63 - Serial Number of Power Interface Board (High Part)

This number, which is Read Only, is read from the PIB (Power Interface Board).

P11.64 - Serial Number of SMPS (Low Part)

This number, which is Read Only, is read from the SMPS.

P11.65 - Serial Number of SMPS (High Part)

This number, which is Read Only, is read from the SMPS.

P11.66 - Serial Number of DELTA Interface Board (Low Part)

This number, which is Read Only, is read from the DELTA DIB (DELTA Interface Board).

P11.67 - Serial Number of DELTA Interface Board (High Part)

This number, which is Read Only, is read from the DELTA DIB (DELTA Interface Board).

P11.70 - Bridge Linearisation Time at 1.25kHz
P11.71 - Bridge Linearisation Constant at 1.25kHz
P11.72 - Bridge Linearisation Time at 2.5kHz
P11.73 - Bridge Linearisation Constant at 2.5kHz
P11.74 - Bridge Linearisation Time at 5kHz
P11.75 - Bridge Linearisation Constant at 5kHz
P11.76 - Bridge Linearisation Time at 7.5kHz
P11.77 - Bridge Linearisation Constant at 7.5kHz

The drive enters the values contained in these parameters during a calibration run. They are required for the correct operation of a multiple DELTA based drive and must not be altered manually.

The values are kept as part of the drive's parameter set so that, if for any reason, the drive is 'returned to factory default' it is not necessary to repeat the calibration run.

6.12 MENU 12 - MOTOR ADVANCED SETTINGS (VECTOR ONLY)

(Refer to Control Block Diagram Sheet 8)

Menu 12 gives access to the parameters required to configure the advanced motor settings. These settings are required for vector control operation.

The drive can determine these values for itself by carrying out a Calibration Run (see P12.03).

Following a series of enhancements made to the MV3000e Vector Control, to ensure maximum motor flux on systems with significant DC link voltage regulation, Vector Control can now be run in one of two modes:

High Dynamic Mode. Or

Optimum Voltage Mode.

The features of each mode are as follows:

High Dynamic Mode

High dynamic mode is the same vector control as present on MV3000e up to and including Firmware version 6.03 and is selected by setting P12.35 = 0. [This is not the default setting.]

In this mode of operation 'true' vector performance is realised, with the motor flux being kept constant across the load range. A proportion of the available PWM output voltage is kept in hand, which results in good dynamic torque performance.

Optimum Voltage Mode [Default]

In optimal volt mode, selected by setting P12.35 = 1, the vector control is able to use the full DC link voltage to flux the machine across the load range. In this mode the flux in the machine is not constant across the load/speed range, but controlled to be a maximum (defined by the flux limit of the machine) given the prevailing DC link voltage. In this mode the torque loop bandwidth is typically 400 rads-1, 50% of the bandwidth whilst operating in High Dynamic Mode

6.12.1 Advanced Motor Data

P12.00 - Motor Magnetising Current

This is the no-load motor current at base frequency and voltage (i.e. the magnetising current). This can either be measured (see Getting Started Manual - Commissioning) or obtained from the motor manufacturer.

Allowed values: 0.0A to 9999.0A

P12.01 - Motor Peak Current at Nominal Speed

P12.01 is set to the maximum current that will ever be taken by the motor at nominal speed. It is expressed as a percentage of the motor nominal current. This value is used to select an operating condition for the motor that allows the drive to maintain control of the motor magnetisation even under extremes of load. Note that if this peak value exceeds the peak rating of the drive, the drive will automatically calculate according to its own peak current.

Allowed values: 100% to 300% of Nominal Current

This is an advanced feature for fine tuning vector drives in certain applications. In general the default value of 150% Nominal Current should be used, but reference can be made to **GE Power Conversion** for an Application Note if required.

In many applications, the required overload varies with speed. The need to enter the absolute maximum in P12.01 results in a reduction in motor voltage when operating at higher speeds where this peak is never required. In the present version of firmware P12.01 is used in association with P12.29 and P12.30 to define a speed dependent overload characteristic for the motor.

P12.29 - Motor Peak Current at 0% Speed
P12.30 - Motor Peak Current at Top Speed

These parameters, together with P12.01, allow a speed-dependent overload characteristic to be entered for a specific application. For most applications the default setting of 99% should be used - this sets these parameters to the same value as P12.01.

If the parameter values are set above 150%, the peak current will be limited to this by the drive.

Allowed values: 99% to 300% Motor Nominal Current

NOTE: When 99% is set for P12.29 and P12.30 these parameters are set to give the same value as that for P12.01.

Figure 6-25 shows a typical overload/speed characteristic.

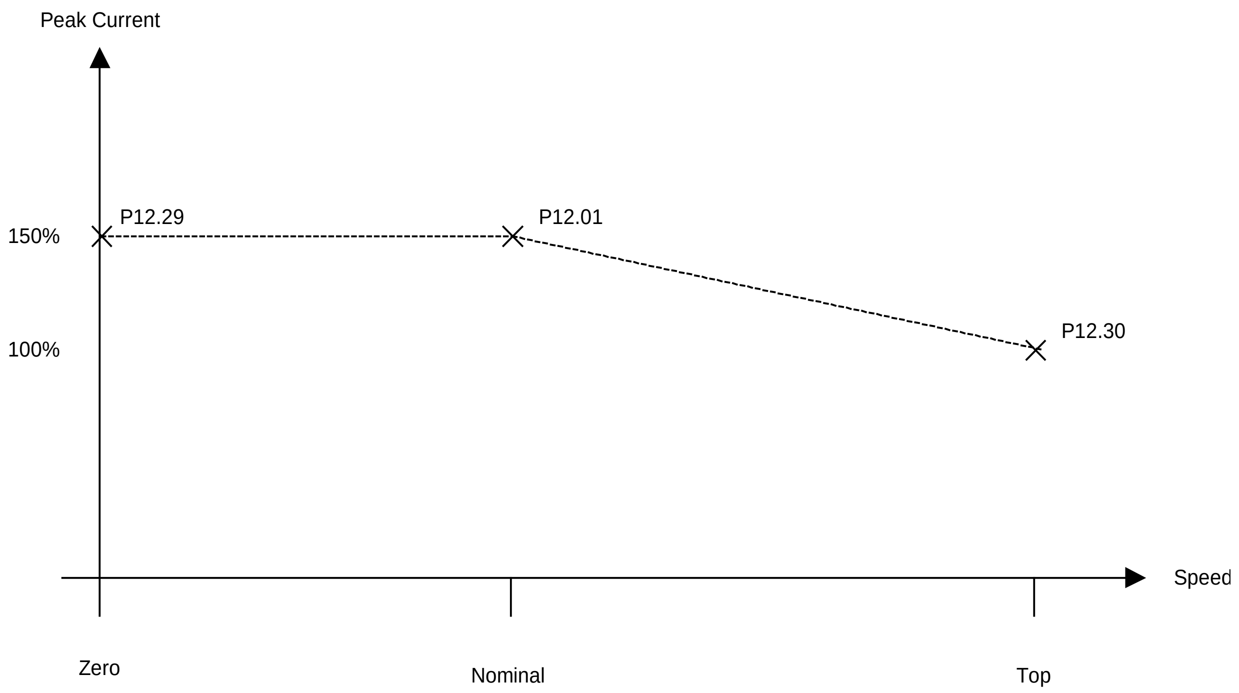


Figure 6-25. – Typical Overload/Speed characteristic

P12.02 - Nominal Mains Supply Volts

This is used by the drive to calculate the maximum voltage available to control the motor. This value should be set to the minimum value that the mains supply can dip to. If problems arise with the performance, this value can be raised to nominal mains volts.

Allowed values: 300V to 900V rms

NOTE: When running the Machine Bridge with an SFE bridge or boosted DC link the nominal mains supply volts needs to be set at Vdc/1.35. This ensures that the machine bridge fully utilises the available DC links voltage.

6.12.2 Motor Equivalent Circuit

The mathematical model used by the drive is expressed as an equivalent electrical circuit. This is shown in Figure 6-26. See P12.03 to allow the drive to determine these values for itself.

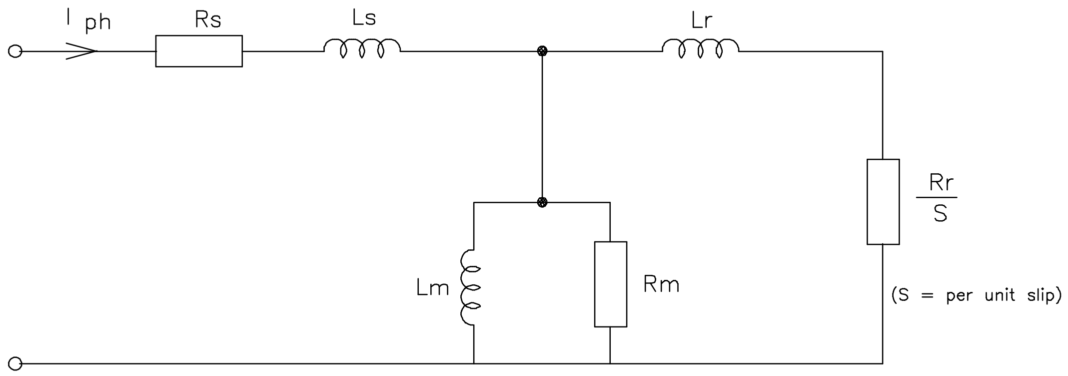


Figure 6-26. – Motor Equivalent Circuit

There are six parameters that define this circuit:

Motor Stator Resistance	(P12.11)
Motor Stator Leakage Inductance	(P12.12)
Motor Magnetising Resistance	(P12.13)
Motor Magnetising Inductance	(P12.14)
Motor Rotor Resistance	(P12.15)
Motor Rotor Leakage Inductance	(P12.16)

These parameters should be entered for a "star" equivalent connected motor. If the parameters are known for a "delta" equivalent, these should be divided by 3.

Ideally these parameters should be obtained from the motor manufacturer for the exact motor in use. If this is not possible, the drive can estimate the values from other data, and can provide a good estimation if a no-load test is performed with the motor mechanically uncoupled (see T1676 and T2002 Getting Started Manuals - Commissioning).

The following parameters, P12.03 to P12.28, are used for motor parameterisation.

P12.03 - Motor Parameterisation Method

Allowed options: 1 = Explicit entry (from motor manufacturers data).
2 = Nameplate guess (estimate from nameplate data).
3 = Calibration run.

Explicit Entry

If P12.03 is set to 1, then P12.11 to P12.16 must also be specified from the motor manufacturer's data.

Nameplate Guess

If P12.03 is set to 2, then the drive will estimate the equivalent circuit data from the values placed in parameters P2.00 to P2.04 and P12.00, and write these values to Parameters P12.11 to P12.16. Existing data in P12.11 to P12.16 will be overwritten and P12.03 will be reset to 1.

Calibration Run

If P12.03 is set to 3, the drive measures various motor and drive parameters, then uses this data to calculate values for the equivalent circuit. This option produces the most accurate estimation of motor characteristics. However, for this function ensure that P12.00 is set to approximately 30% of the motor full load current (if a more accurate figure is required refer to the formula in the relevant Getting Started Manual). When performing a calibration run it is important that the motor load must not be connected, though the coupling may be left in place. As for Option 2, existing data in P12.11 to P12.16 will be overwritten and P12.03 will be reset to 1.

P12.32 - Leakage Test Current

This parameter is the percentage of motor full-load current at which the leakage test, as part of the calibration run (P12.03 = 3), happens.

Allowed values: 50 to 100% Motor Full Load current

An outline of a Calibration Run (CAL Run) for Vector Control is now included.

NOTES: For parameters P12.11, P12.14 and P12.15:

1 On drive models MV3096 and below, the resolution of Rs and Rr is 0.1mΩ; that of Ls is 0.1mH.

2 On drive models MV3099 and above, the resolutions increase by a factor of 10, i.e. to 0.01unit.

Outline of a Vector Control CAL Run

The stages of a Vector Control CAL run are:

DC current injection, performed at two dc levels in each polarity (4 injections), to measure stator resistance + cable resistance.

Very low value of voltage injection, to measure the current, to calibrate drive output bridge errors - the Output Bridge errors are stored in parameters P11.70 to P11.77.

AC current injection, about 1 second, to measure motor leakage inductance values - results stored in P12.22.

Drive disables for approximately one second to do some maths i.e. feed the results above into the vector control - results are stored in P12.11 - P12.16.

Drive performs the motor magnetisation test - running at 90% speed, at varying voltages, to record the currents - results are stored in P12.17 etc.

Drive then disables.

When an encoder is used, the drive measures rotor resistance (quite a long test, minutes maybe, longer on larger motors, as Tr is longer) - results are stored in P12.10.

All of the above results are in customer parameters and are therefore transferred by transferring edits from one drive to another.

NOTE: For best possible performance Output Bridge Linearisation should be repeated. However, for drives of the same size the transferred parameters are expected to give satisfactory performance.

P12.11 - Stator Resistance

Enter the stator resistance (Rs) in mΩ.

Allowed values: 1mΩ to 9999mΩ

P12.12 - Stator Leakage Inductance

Enter the stator leakage inductance (Ls) in mH.

Allowed values: 0.100mH to 30.000mH

P12.13 - Magnetising Resistance

Enter the Magnetising resistance (Rm) in ohms.

Allowed values: 1Ω to 9999Ω

P12.14 - Magnetising Inductance

Enter the magnetising inductance (Lm) in mH.

Allowed values: 0.5mH to 99.9mH

P12.15 - Rotor Resistance

Enter the rotor resistance (Rr) in mΩ.

Allowed values: 100mΩ to 9999mΩ

NOTE: Also refer to P12.10 for the Measured Cold Value of Rotor Resistance.

P12.16 - Rotor Leakage Inductance

Enter the rotor leakage inductance (Lr) in mH.

Allowed values: 0.100mH to 30.000mH

6.12.3 Motor Temperature Compensation (only valid for Vector mode with Encoder)

The rotor resistance value in the motor equivalent circuit is a critical parameter for motor control. This resistance value varies considerably with motor temperature. The effect of this is to impair the accuracy of torque control and in extreme cases can cause the drive to trip.

This effect can be compensated either manually or automatically; Control Flag 77 (P12.05) controls the compensation method.

P12.05 - Control Flag 77 - Enable Manual Temperature Compensation

P12.06 must be cleared to enable manual temperature compensation.
P12.05 is used to enable manual rotor temperature compensation as follows:
P12.05 (CF77) = 1 - Manual Rotor Temperature is SET or ON.
P12.05 (CF77) = 0 - Manual Rotor Temperature Compensation is CLEARED or OFF.

See Section 6.33 for more information on Control Flag programming.

6.12.4 Manual Rotor Temperature Compensation (only valid for Vector mode with Encoder)

The user can modify the value of rotor according to several criteria (e.g. measured motor temperature, or a plant variable that can be used to calculate torque inaccuracies).

P12.04 - Motor Temperature Compensation

(When Auto is disabled by P12.06)

This is the rotor resistance value, expressed as a percentage of the value in P12.15. The actual rotor resistance used is given by the expression:

$$Rr = P12.15 - \left(P12.15 \times \frac{(100 - P12.04)}{100} \times \frac{(\text{Temp. Comp. Scale})}{100}\right)$$

Allowed values: 20% to 300% (of nominal slip)

To tune this parameter, the motor should be running at nominal speed and load and should be temperature stabilised. The parameter is then adjusted until the motor voltage is approximately nominal.

Care should be taken so that the required motor voltage never exceeds the supply voltage. If this occurs (for example at high speeds and high load if the motor temperature exceeds that for which tuning was carried out), the drive will be unable to maintain control of the motor current and will trip.

P12.08 - Temperature Compensation Scale Source

The reduction, or increase, in rotor resistance from P12.15 to its compensated value can be scaled by various user accessible control sources. The actual rotor resistance is given by the above expression - see P12.04.

P12.08 selects the source for the temperature compensation scale value.

Allowed values are:
1 = Fixed value 100%
2 = Analogue Ref 1
3 = Analogue Ref 2
4 = Fixed 0% (Not used)
5 = Fixed 0% (Not used)
6 = RS485 Ref 1
7 = RS485 Ref 2
8 = RS232 Ref 1
9 = RS232 Ref 2
10 = PID Controller
11 = Summing Node C *
12 = Summing Node D *
13 = Pointer 11 **

NOTES: *** Refer to Menu 40 for a description of Summing Nodes.**
**** Reference Pointers are described in Menu 41.**

6.12.5 Automatic Rotor Temperature Compensation

The drive can be set up to automatically compensate for variations in rotor resistance. This compensation is suitable in applications that operate with high torque and without continuous rapid speed changes.

An application note describing the operation of the Rr tracker is included in Section 10.

P12.06 - Control Flag 106 - Enable Auto Temperature Compensation.

Set this Control Flag to enable the automatic compensation. With this set, the manual compensation system is disabled.

See Section 6.33 for more information on Control Flag programming.

P12.07 - Temperature Compensation Gain

This parameter sets up the speed of operation of the automatic compensation. Typically values of 2%/s/% can be used.

Allowed values: 0.0% to 3.0% (of nominal Rr per second per % of VARS error)

P12.09 - Temperature Compensation Estimate (Read Only)

This is the output of the automatic temperature compensation. It is expressed in the same units as P12.04.

Values are in the range: 50% to 150%

P12.10 - Measured Cold Value of Rotor Resistance

The measured value for the rotor resistance when cold is used as a lower limit for the Automatic Rotor Temperature compensation. This measured value is calculated during the P12.03 = 3 Motor Calibration Run. The value should be between 50% and 80% of the hot rotor resistance in P12.15. If this is not the case the value for P12.15 should be checked with the motor manufacturer.

Allowed values for P12.15 are: 0mΩ to 9999mΩ

6.12.6 Additional Parameters for Operation Above Base Speed

These are covered in Section 6.12.7.

6.12.7 Motor Magnetisation Curve

When operating above the base speed of the motor, the magnetic flux level is reduced. This causes the characteristics of the motor to change. The drive compensates for this change by knowing the variation of the motor magnetising current with applied voltage.

P12.17 - Motor Magnetising Current at 50% Base Volts
P12.18 - Motor Magnetising Current at 60% Base Volts
P12.19 - Motor Magnetising Current at 70% Base Volts
P12.20 - Motor Magnetising Current at 80% Base Volts
P12.21 - Motor Magnetising Current at 90% Base Volts

If these parameters are left at their default values of zero, operation above base speed is not allowed. These parameters may be obtained from the motor manufacturer, or they may be measured separately, or the drive itself can perform the measurement automatically (see Getting Started Manual - Commissioning, and P12.03 Option 3).

Allowed values: 0.0A to drive Full Load Current

6.12.8 Flux Limit

The magnetic flux level in the motor is normally controlled to the maximum value that can be sustained at peak overload for the available voltage. This is calculated by the drive from its motor model. At low speeds this is equivalent to the no load flux at base frequency and voltage.

In some cases it is desirable to reduce the flux level below this (e.g. for energy efficiency on light loads). However, be aware that reducing the flux level reduces the available motor torque.

Flux Limit is scaled such that 100% flux is equal to the no-load flux at base frequency and voltage. To activate Flux Limit, set P12.25 (Control Flag 68 - Enable flux limit) to 1; in this mode the drive controls the flux to the limit set by the flux limit source (P12.24). When Control Flag 68 is set to 0 the drive controls the flux limit to the maximum allowed level.

P12.25 - Control Flag 68 - Flux Limit Enable

CF68 enables the flux limit source selected by P12.24.

Allowed values: 0 = Disabled (default)
1 = Enabled

P12.24 - Flux Limit Source

This parameter defines the source for the flux limit.

Allowed values: 1 = Pre-set flux limit (set in P12.23)
2 = Analogue Ref 1
3 = Analogue Ref 2
4 = RS485 Ref 1
5 = RS485 Ref 2
6 = RS232 Ref 1
7 = RS232 Ref 2
8 = PID Controller
9 = Reference Sequencer
10 = Fixed Ref. Menu
11 = Motorised Pot.
12 = Trim Reference
13 = Fixed 0% (Not used)
14 = Fixed 0% (Not used)
15 = Summing Node A
16 = Summing Node B
17 = Pointer 12

NOTE: The value of flux limit is clamped by the drive to the range 20% to 100%.

P12.22 - Leakage Volts

Allowed values: 0.0V to 300.0V

= Calculated using the motor equivalent circuit parameters P12.11 to P12.16).

P12.23 - Fixed Flux Limit

This parameter contains the pre-set value for the flux limit.

Allowed values: 20% to 100% (of maximum flux)

P12.26 - Flux Demand

This read-only parameter is the flux level requested of the vector control. It is scaled such that 100% is the no-load flux at base frequency and voltage.

Values are in the range: 0% to 100%

6.12.9 Current Control Bandwidth

P12.27 - Current Control Bandwidth - High Dynamic Mode

This parameter sets the target bandwidth for the closed loop current control used in vector mode.

Allowed values: 10rads/s to 2000rads/s

The default values are 500rads/s for 1.25 kHz and 750rads/s for all other switching frequencies.

NOTE: When the switching frequency is changed, the value in P12.27 is returned to the default value. In most applications the default value should be correct, but in unusual cases it may be necessary to reduce the value.

6.12.10 Enable Rs Tracker (only valid in Vector mode without Encoder)

P12.28 - Enable Rs Tracker

When this parameter is set to 1, the drive will execute an automatic identification algorithm to correct for errors in stator resistance.

An unwanted side effect of this compensation is that the drive may experience a transient loss of torque during rapid reversal of the motor. This effect is more prevalent on small motors.

Allowed values: 0 = Disabled
1 = Enabled

The Rs Tracker feature is enabled by default.

6.12.11 Flux Controller Output (only valid in Vector mode without Encoder)

P12.31 - Flux Controller Output

This parameter shows the output of the flux controller. The output of the flux controller is added to the magnetising current demand to ensure that the flux demand (as monitored in parameter P12.26) is achieved.

P12.33 - Post Flycatch dFlux/dt Mask Time

This is an Application Specific parameter and its use is not described in this manual.

6.12.12 Vector Control Fluxing Mode

P12.35 - Vector Control Mode

This parameter allows the selection of High Dynamic mode or Optimal Volt mode vector control. High Dynamic mode (default) maintains constant flux across the load range. Optimal Volt mode maintains maximum possible flux across the load range.

It is recommended that on systems subject to DC Link voltage regulation or operation at greater than twice base speed that Optimal Volt mode is selected.

P12.36 - Optimal Volt Mode Maximum Modulation Depth

Restrictions are imposed on the minimum PWM pulse width produced by the drive. These restrictions have consequences on the drive's maximum output modulation depth, and, consequently, output voltage.

Table 6-10, below, shows the reduction in linear output modulation depth resulting from the minimum pulse width limitations.

PWM Period	Switching Frequency	Pulse Limit, on Terminals of Drive	Maximum Modulation Depth
800µs	1.25kHz	5.0µs	98.75%
400µs	2.5kHz	5.0µs	97.50%
200µs	5kHz	5.0µs	95.00%
133µs	7.5kHz	5.0µs	92.49%

Table 6-10. – Consequences of Minimum Output PWM Pulses

The default value of modulation limit[2] is set from the table above.

To compensate for the above instantaneous modulation depth limit (or modulation clipping), the modulation depth is boosted when the required modulation depth is greater than the maximum instantaneous achievable, so as to restore the amplitude of the fundamental component. This, unavoidably, increases the amplitude of the harmonic distortion components.

Additionally, the quiescent operating modulation depth of the drive is reduced to the Maximum Modulation Depth in the above table so that it does not sit at 100% modulation, but at a lower value so that harmonic distortion is not the normal operating condition. Over modulation is still possible for transient conditions.

If the application demands it, this value can be increased up to 107.00%. However, it should be noted that values greater than those above necessarily result in output voltage distortion, which in turn result in current distortion. In particular, 5th and 7th harmonic components of current will result in increased motor heating, and torque ripple.

In optimal volt mode it is possible to allow the PWM modulator to operate in the over modulation region.

This results in:

- A higher fundamental frequency motor voltage for a given DC Link voltage and,
- as previously stated, low order harmonic currents in the machine that will cause torque ripple on the machine shaft.

It may be desirable to operate in this mode in certain applications where the torque loop dynamic performance is not critical, the on-load DC Link voltage is low and motor voltages comparable to MV3000e VVVF mode are desirable.

Within Optimum Voltage Mode the maximum motor voltage that will be applied to the machine can be selected using P12.36.

$$Vmotor_{(l-l)} = P12.36 \times \frac{Vdc}{\sqrt{2}}$$

[2] Early versions of firmware had modulation depths defaulting to 100%. Also V6.03 Firmware at 105% modulation depth (maximum applied in VVVF) is equivalent to V8.00 to V11.73 firmware at 101% modulation depth.
An application note in Section 10 gives magnitude of harmonic voltages for a function of modulation depth.
With P3.32=101% the same harmonic voltage that will be applied to the machine is equivalent to 105% in firmware versions up to V6.03

Whilst running the inverter bridge in over modulation the voltage applied to the machine contains low order harmonic components.

These low order harmonic voltages applied to the machine are a function of the modulation depth and are detailed in an application note in Section **10.9**.

Values are in the range: 95% to 107%

P12.37 - Optimum Voltage Mode Current Loop Bandwidth

This parameter sets the target bandwidth for the closed loop current control used in Optimal Volt mode Vector Control.

Allowed values: 10rads/s to 2000rads/s

The default value of 600rads./s should be correct for most applications, in unusual cases it may be necessary to reduce this value.

6.12.13 DC Link Voltage Feedforward Time-Constant

P12.38 - DC Link Voltage Feedforward Time Constant

This parameter is included for advanced system / personnel only. It is the time constant at which the DC link voltage feedback is filtered, before being fed forward into the modulation system. It has sometimes been found that, on high power systems with "soft" mains supplies, then reducing this value can assist in reduction of instabilities.

It is recommended to leave this value at default, unless specific problems are encountered.

6.12.14 Current Control Gain Factors

P12.39 - Current Controller Kp Factor
P12.40 - Current Controller Ki Factor

These are included for advanced system / personnel only. It is recommended that these be left at default, unless specific problems are encountered.

The current control gains are calculated by the drive, from the appropriate input parameters. P12.38 and P12.39 allow adjustment of the calculated values, for encoderless use, when system instabilities are observed.

6.12.15 Orientation Controller Gains

P12.41 - Orientation Controller Kp
P12.42 - Orientation Controller Ki

These are included for advanced system only. It is recommended that these be left at default, unless specific problems are encountered.

These parameters are the gains used by the drive, to control its estimation of motor speed, in encoderless vector control. The values calculated by the drive are suitable for most applications.

NOTE: **The value of P12.42 is re-calculated by the drive on change of P2.00, P2.04 or P2.06.**

6.12.16 Cross Coupler Gains

P12.43 - Cross Coupler Time Constant

Included for advanced system personnel only. It is recommended that this parameter is left unchanged at default unless specific problems are encountered.

The cross coupler time constant is calculated by the drive from appropriate input parameters and calibration run data. It has been found that for a combination of long motor cables and high efficiency motors that this time constant can become too low, resulting in the drive tripping due to Current Control Failures (Trip Code 58). The parameter allows this time constant to be adjusted and the drive stabilised. For details of how and under what circumstances the adjustment may be required please contact **GE Power Conversion**.

P12.44 - Cross Coupler Gain Factor

Included for advanced system personnel only. It is recommended that this parameter is left unchanged at default unless specific problems are encountered.

The cross coupler time constant is calculated by the drive from appropriate input parameters and calibration run data, however on certain applications it may be necessary to adjust this gain. For details of how and under what circumstances the adjustment may be required please contact **GE Power Conversion**.

6.12.17 Rs Gain Factor (Vector Control Only)

P12.45 - Rs Gain Factor

Included for advanced system personnel only. It is recommended that this parameter is left unchanged at default unless specific problems are encountered.

The use of this parameter is to scale the value of parameter P12.11 – 'Stator Resistance' within the encoderless vector control algorithm, however a change to the default value will also be effective in vector control with encoder.

Its effect is as follows:

Vector Control With Encoder

When P12.45 ≠ 100% the value of the stator resistance used by the drive is

Stator Resistance = P12.11 x P12.45

Vector Control Without Encoder

When P12.45 = 100% the Rs tracker can be enabled (see Section 6.12.11 – Flux Controller Output (only valid in Vector mode without Encoder))

When P12.45 ≠ 100% the Rs Tracker cannot be enables and the value of the stator resistance used by the drive is

Stator Resistance = P12.11 x P12.45

For details of how and under what circumstances to change the default value please contact **GE Power Conversion**.

6.12.18 Power Limit

P12.50 - Power Limit Enable

This enables the application of the power limit signal contained in parameter P12.51 and associated parameters P12.52 and P12.53.

P12.51 - Power Limit

This is the power limit, in kW, to be applied to the power demanded from the drive. This signal is to limit the amount of energy being put into the DC Link in order to prevent the DC Link voltage from exceeding the over voltage trip threshold.

Power limit is converted into a torque limit by dividing by shaft speed.

Typically, the power limit value received via, say, CANopen will be placed directly into this parameter.

This parameter is set zero on each power up.

P12.52 - Power Limit Taper Band

If this parameter is positive and P12.50 is enabled, the power limit in P12.51 is reduced in a straight-line relationship starting at Vdc = Vdc nominal down to zero at Vdc = Vdc + P12.52. This provides a proportional control to prevent a DC Link over voltage situation occurring under re-generative conditions.

P12.53 - Taper Deadband

This parameter provides a deadband below which parameter P12.52, although positive, will not have an effect.

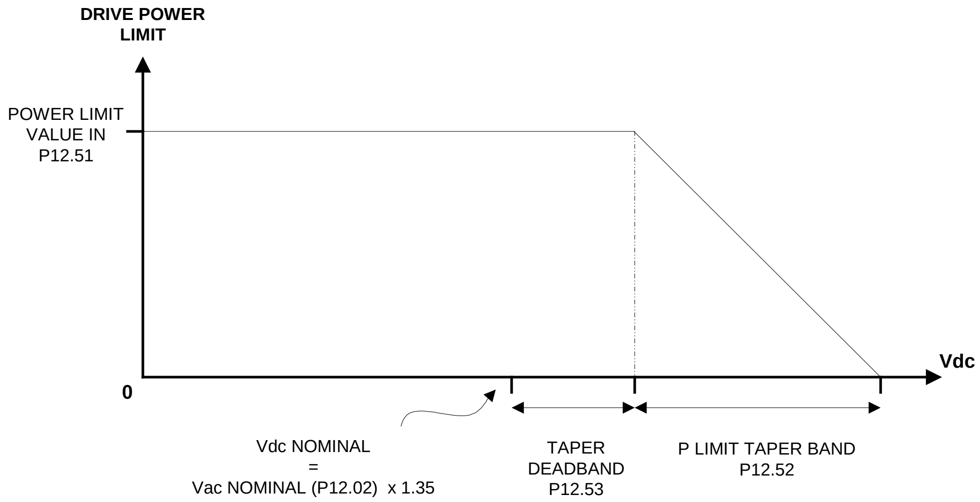


Figure 6-27. – Power Limit Taper Band

P12.54 - Minimum Power Limit

If P12.50 is enabled, the value in this parameter is the minimum power limit (in 0.1kW units) to be applied to the power demanded from the drive. Thus, if the value of P12.51 is less than P12.53 then the value of P12.53 will be used as the power limit.

In wind turbine applications this parameter is particularly useful when the power limit signal becomes zero (for example when the grid voltage collapses to zero). Setting this parameter to a value that represents the bridge losses provides a mechanism for the machine bridge to continue delivering power to the DC Link.

6.13 MENU 13 - SPEED FEEDBACK SETTINGS (VECTOR ONLY)

(Refer to Control Block Diagram Sheet 8).

Menu 13 gives access to the parameters required to configure the speed feedback settings with and without an encoder, and to configure the encoder monitor. This menu is not required for operation in Frequency Control mode.

6.13.1 Speed Feedback Selection

For operation with an encoder, the encoder line count and motor top speed parameters are used to obtain the speed feedback as a percentage of motor top speed.

For encoderless operation the encoder is replaced either by a speed feedback signal (called "Tacho" Mode, although the speed signal need not come from a tachogenerator), or by a mathematical model of the motor within the drive (Encoderless Mode). The mathematical model is calculated from motor parameters entered in Menu 12 (calibration run or manual entry).

For all modes of Vector control, motor parameterisation is very important and the commissioning procedure provided in the Getting Started Manual must be followed.

6.13.2 Limitations of Tacho Speed Feedback

Because the speed feedback is used in the torque and flux control loops of the vector control, it must be accurate.

The speed feedback source will have a time lag imposed by the scan time of the source (10ms for analogue inputs, RS485 link etc). Additional time lags may be caused by the source generating the feedback.

This lag will limit the maximum rate of change of speed, if accurate torque control is to be maintained. As a guide, it is suggested that the speed may not change by more than 10% of the rated slip speed of the motor within one time lag period. This limits this mode of feedback to relatively slowly varying applications.

Example

Speed feedback is via the Drive-Drive Serial link from another drive with an encoder. The motor is 15 kW with a 35 r/minute nominal slip. Top Speed is 1500 r/minute.

Maximum Change of speed per lag period: 3.5 r/minute = 0.0233%

Maximum Lag time = 10ms + 10ms = 20ms

Therefore,

Minimum Ramp Time 0 - 100% = 8.6s

6.13.3 Limitations of Encoderless Vector Control

This method of Vector control is limited to the following frequency ranges:

0.5Hz to 150Hz	Motoring
5Hz to 150Hz	Regenerating, stator resistance compensation disabled
0.5Hz to 150Hz	Regenerating, stator resistance compensation enabled

The speed range to which this corresponds is load dependent, due to the slip frequency of an induction motor.

Parameters P13.00 and P13.01 define the main and backup speed feedback sources as follows:

P13.00 - Speed Feedback Source
P13.01 - Backup Speed Feedback Source

These parameters have the following options:

1 = Encoder
2 = Tacho
3 = Encoderless

Normally the feedback source defined by P13.00 is used. The backup source defined by P13.01 is used if the following conditions occur:

Control Flag 118 - Select Backup Feedback = 1 OR
P13.00 = 1 AND Encoder loss is detected

P13.14 - Tacho Feedback Source

This parameter allows selection between various sources for tachometer feedback.

Allowed values are:

1 = Analogue REF 1

2 = Analogue REF 2

3 = Fixed 0% (Not used)

4 = Fixed 0% (Not used)

5 = RS485 REF 1

6 = RS485 REF 2

7 = RS232 REF1

8 = RS232 REF 2

9 = High Speed digital I/P

10 = Pointer 18

P13.15 - Tacho Feedback Scale

Sets the scale of the feedback selected by P13.14, where:

$$SpeedFeedback\,[\%Top\ Speed] = \frac{Tacho\ Feedback\,[\%\ Full\ Scale]}{P13.15[\%]}$$

i.e. P13.15 is the value of Tacho Feedback that corresponds to Top Speed.

The range of P13.15 is 33.3% to 90.0%, with a default of 90.0%. This allows at least 10% of speed overshoot.

P13.16 - Tacho Feedback Time Constant

This parameter allows filtering of the Tacho Feedback signal.

Allowed range: 0 scans to 100 scans

Where one scan = 5ms

6.13.4 Encoder Monitor

The drive monitors the encoder signal, and may detect its loss. Upon detection of this loss the drive can be programmed to trip, to issue a warning or, in some circumstances, return to encoderless mode without stopping the drive.

Once encoder loss has been detected, the drive will revert to encoder operation only when the user issues a specific instruction to the drive to do so.

Encoder loss is detected under the following conditions:

- The rate of change of measured speed is deemed to be impossible in reality. This is attributed to encoder failure. The threshold for this is set by P13.08
- The drive detects direction change signals from the encoder when operation is at high speed. This detection method is set up by P13.19 & P13.20
- The Force Encoder Loss Control Flag CF119 (P13.17) is set.

NOTES:

The encoder loss detection methods used are not certain to work. Specifically, they will not work at low speeds, and will not work in the event of a progressive, rather than sudden, failure (e.g. failure of a mechanical coupling).

For this reason, the Force Encoder Loss Control Flag (CF119) is provided. This allows the user to define application specific criteria for the detection of encoder loss. A typical example of this would be an application where there is no real possibility of the drive being in torque limit at low speed. The user could configure the Logic Blocks to detect this condition, and to force encoder loss.

On encoder loss the drive takes the following actions:

Status Flag 59 (Encoder Loss) is set to 1.

Depending on the value of P13.02, the drive may trip or issue a warning. If a suitable speed feedback backup source is configured, speed feedback reverts to this.

The drive will revert to encoder feedback if CF120, Reset Encoder Loss (P13.18), is set to a value of 1.

Note: **if this is left at a static value of 1, the drive will just reset any encoder loss detection. Care should be taken when the criteria for this reset signal are defined, since the drive WILL reset to encoder, even if the original fault is still present.**

Setting up Encoder Loss Ridethrough

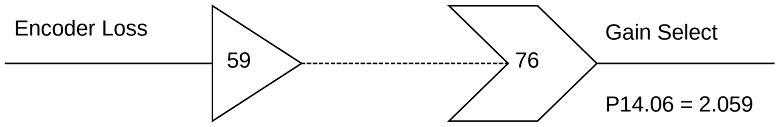
a) With P13.00 set to 1 (encoder), commission the speed loop with the application, tuning P14.00, P14.01 and P14.03.

b) Set P13.00 to 3 (encoderless) and set P14.06 (gain select) to 1 to switch to the second set of speed loop gains.

c) Re-commission the speed loop for encoderless mode editing P14.03, P14.04 and P14.05.

d) Set P13.00 back to Encoder and set P13.01 to Encoderless. Set P13.02 to 1 - (Issue Warning).

e) Connect Control Flag 76 to Status Flag 59:-



Now, when the encoder fails, a warning is issued and the correct speed loop gains will be selected.

f) Monitor P13.07, P13.10 to determine if the encoder is serviceable.

g) Initiate an "Encoder Loss Reset" by toggling P13.18 (CF120) from 0 to1 to 0. The drive will revert to encoder feedback.

NOTE: **This encoder reset can be patched to a digital input - see section 6.7.5.**

P13.02 - Action on Encoder Loss

This parameter determines the action taken by the drive when an error in the encoder signal is detected.

Allowed values:

0 = No Action (Revert to Backup P13.01 if possible and set Status Flag 59)

1 = Warning (Same as Option 0 but issue Warning) – Default option

2 = Trip

P13.03 - Control Flag 118 - Select Backup Feedback

When set ON, manually selects the backup feedback source defined by P13.01.

P13.04 - Encoder Line Count
P13.05 - Encoder 10000 Lines

P13.04 and P13.05 determine the number of lines per signal per revolution of the motor shaft.

Allowed values are: P13.04 = 32 to 9999 lines
P13.05 = 0 to 6 (x 104) lines.

The total line count is calculated as follows:

Line count = (P13.05 x 104)+ P13.04

The total range is from 32 to 64000 lines.

e.g.	for a 2500 line encoder	P13.04 = 2500 P13.05 = 0
	for a 25,000 line encoder	P13.04 = 5000 P13.05 = 2

P13.06 - Encoder Power Supply Volts

This parameter allows the output voltage of the 5V encoder supply on TB5 pin 4 to be adjusted to compensate for voltage drops in the encoder cable.

Allowed values: 4.5V to 6.5V.

NOTES:

1 If sense signals are wired (see Getting Started Manual T1676) adjustment is done automatically.
2 If the current flowing to the Encoder is too great then an encoder power supply failure results.

P13.07 - Number of Encoder Reversals

This read only parameter counts the number of occasions when the encoder signal detects a change in direction. It is reset every 100ms. When the drive is operating away from zero speed, the value should be at zero. Any non-zero value indicates a fault in the encoder, or the presence of noise in the signal. This parameter is provided as a diagnostic aid. Also refer to parameters P13.19 and P13.20 for Maximum Encoder Reversals and Reversals Threshold respectively.

Range allowed: 0/10ms to 32767/10ms

P13.08 - Maximum Speed Change

This is used to set up the encoder lost sensitivity, see Encoder Monitor in Section 6.13.4.

Allowed values: 10r/minute to 1000r/minute (per 5ms)

P13.10 - Motor Angle Feedback

This read only parameter contains the value of the motor angle in degrees. It can be used to determine if the encoder signal is healthy and to determine if P13.04/P13.05 have been programmed correctly. See Commissioning in the Getting Started Manual T1676.

Range: 0 degrees to 360 degrees

NOTE: This motor angle is measured relative to the rotor position when the drive is powered up. The Z pulse of the encoder is not required for this function.

P13.17 - Control Flag 119 - Force Encoder Loss

When set ON, forces the drive to take action on encoder loss (P13.02).

P13.18 - Control Flag 120 - Reset Encoder Loss

When set, forces the drive to revert to encoder feedback source.

P13.19 - Maximum Encoder Reversals

Spurious apparent changes in encoder direction can occur due to noise effects. This parameter sets the maximum number of apparent direction reversals in any 10 ms period, above which encoder loss is assumed (see Section 6.13.4).

Range of values: 0/10 ms to 1000/10 ms

P13.20 - Reversals Threshold

When the encoder speed is close to zero the accuracy of measuring encoder reversals is questionable. This parameter sets a low speed threshold, as a percentage of top speed, below which encoder reversal checks are not made.

Range of values: 0.1% top speed to 100% top speed

6.13.5 Open Loop Test Mode

Open loop test mode allows a drive configured for vector control to be run in open loop mode for test or commissioning purposes. See the Getting Started Manual T1676 for commissioning flowcharts. P13.11, P13.12 and P13.13 are used to select open loop test mode and control the motor as follows:

P13.11 - Open Loop Test

This parameter is used to select open loop test mode.

Allowed values: 0 = Disabled
1 = Enabled

P13.12 - Open Loop Frequency

P13.12 defines the output frequency of the drive in open loop test mode.

Allowed values: -150Hz to +150Hz

P13.13 - Open Loop Ramp Rate

P13.13 defines the acceleration rate used in the open loop test mode.

Allowed values: 0.1Hz/s to 10.0Hz/s

6.14 MENU 14 - SPEED LOOP SETTINGS (VECTOR ONLY)

(Refer to Control Block Diagram Sheet 7).

Menu 14 contains the parameters required to configure the speed loop control in Vector Control mode.

An outline of the procedure for setting drive speed control is:

a) set top speeds - see Menu 5;

b) select speed feedback source - see Menu 13;

c) select speed references - see Menu 5;

d) tune the speed amplifier - see Menu 14;

e) program ramps - see Menu 6.

Refer to the Control Block Diagrams for other speed control functions.

6.14.1 Speed Controller

There are two sets of Proportional, Integral and Derivative Gains for the main speed loop control, selected by P14.06 (Control Flag 76). This allows two separate tunings to be made for the speed loop that can be changed on-line using P14.06.

P14.00 - Speed Loop Proportional Gain 1
P14.03 - Speed Loop Proportional Gain 2

Entered as a Per-Unit value, i.e. a value of 1 will result in a proportional torque demand of 100% of nominal torque for a speed error of 100% of top speed.

Allowed values: 0.01 to 125.00% torque per % speed error

P14.01 - Speed Loop Integral Gain 1
P14.04 - Speed Loop Integral Gain 2

Entered as a Per-Unit-Per-Second value. i.e. a value of 1 will result in an integral torque demand of 100% in 1 second for a 100% speed error.

Allowed values: 0 to 3000% torque per second per % speed error

P14.02 - Speed Loop Derivative Gain 1
P14.05 - Speed Loop Derivative Gain 2

Entered as a Per-Unit value, i.e. a change in speed error of 100 %/s will produce a torque demand of 100% for D gain = 1.000.

Allowed values: 0.000 to 10.000% torque per % speed error seconds

P14.06 - Control Flag 76 - Speed Loop Gain Select

Control Flag 76 is used to switch between PID settings 1 and 2 as follows:

(OFF) selects PID1 as defined by P14.00 to P14.02

(ON) selects PID2 as defined by P14.03 to P14.05

P14.07 - Control Flag 19 - Clamp Zero Speed

When set, inputs a zero speed demand to the speed loop.
When OFF (default state), allows normal speed demand.

P14.08 - Control Flag 20 - Disable Speed Loop

When set, disables the speed loop output, giving zero speed demand. This flag can be used in conjunction with CF72 (Enable Torque Ref) and CF74 (Enable Inertia Comp.) to provide the source for the overall torque demand.

When OFF, enables the speed loop output.

P14.09 - Speed Demand

Contains the speed demand to the speed controller after ramp, trim and droop terms have been taken into account.

Range: -100.00 to +100.00% of Top Speed.

P14.10 - Speed Demand Time Constant

This parameter sets the time constant for speed demand before speed error is calculated.

Allowed values: 0 scans to 500 scans (1 scan = 5ms)

P14.11 - Speed Feedback Time Constant

This parameter sets the time constant for the speed feedback before the speed error is calculated.

Allowed values: 0 scans to 500 scans (1 scan = 5ms)

P14.12 - Speed Error

P14.12 contains the value of the speed error signal to the PID speed regulator.

Range: -300.00% to +300.00% of Top Speed.

P14.13 - Speed Error Time Constant

P14.13 provides an optional low-pass filter on the speed error signal before the PID controller. This is expressed in units of "speed loop scan times" (5ms).

Allowed values: 0 scans to 500 scans (1 scan = 5ms)

6.14.2 Speed Loop Error Deadband

P14.14 - Speed Loop Error Deadband

This parameter determines the width of the speed loop error deadband (see Figure 6-28).

Allowed values: 0.00% to 100.00% of Top Speed

The speed loop error deadband is enabled by setting P14.16 (Control Flag 73) = 1.

NOTE: Ensure that the Ramp Deviation (P6.10), if used and enabled (P6.11), is set to a value greater than P14.14 deadband i.e. P14.14 MUST BE < P6.10. In version 4.00 and above this is done automatically.

P14.15 - Speed Loop Deadband Offset

This parameter controls the offset of the speed loop error deadband (see Figure 6-28).

Allowed range, as a % of Top Speed: 0.00 to Value set in P14.14

P14.19 - Deadband Bias

In applications where the speed error deadband is used to create a "bumpless" changeover between speed and torque control, it is desirable that the Integral term of the PID controller be "discharged" to zero when the speed error enters the deadband. P14.19 provides a deadband bias that ensures that the error applied to the PID is non-zero until the speed loop is discharged.

Units: 0.01% of Top Speed

Allowed range: 0.00% to 00.00% of Top Speed

Outside Deadband

Error out = error in - deadband + offset

Inside Deadband

a) Set error to zero or to Bias Value (P14.19).

Speed amp output = 0 when inside but, if it comes in from outside, the speed Amp output = internal freeze value.

P14.16 - Control Flag 73 - Enable Speed Loop Deadband

When set, enables the speed loop deadband.

When cleared (default state), the speed loop deadband is disabled.

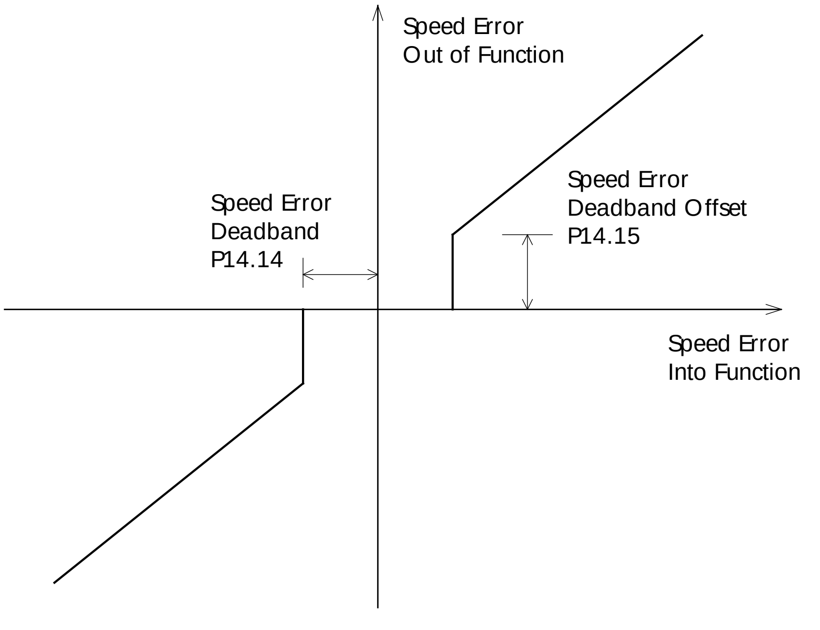


Figure 6-28. – Deadband Offset

6.14.3 Speed Droop

P14.17 - Speed Droop

Used to give a "droop" characteristic to the speed as load torque is increased. This is normally used to ensure load sharing in mechanically coupled drives.

The allowed value entered into P14.17 is the value of droop imposed when Torque demand (P9.04) reaches 100%.

As load increases (P9.04 increases) the speed demand will be driven further down.

To invoke load sharing all drives that are required to load-share must have droop activated.

Allowed values: -100.0 to +100.0% Top Speed for 100 % nominal torque.

P14.18 - Speed Droop Time Constant

This is the time constant of the low-pass filter that is applied to the droop signal before it is subtracted from the speed demand. This is expressed as speed loop scan times.

Allowed values: 0 scans to 9999 scans (1 scan = 5ms)

6.14.4 Speed Loop Integral Term

P14.20 - Control Flag 107 - Speed Loop Integral Freeze.

The speed loop integral term is internally frozen, i.e. not updated, if either:

The speed loop is in limit, or

Control flag 107 is set.

This allows the user to have more flexibility over the operation of the speed loop, by using the ability to freeze the integral term, if desired.

P14.21 - Speed Loop Integral Seed Method

Option 0 = Speed Loop Integral Seeded from Torque Injection (Default Value)
Option 1 = Speed Loop Integral Seeded to 0

When in vector control and the seed loop is disabled (CF20=1), then the integral term of the speed loop may be seeded to one of two values, either 0 or the present value of the torque injection signal, originating from menu 15.

Option 0 is selected.

When the drive is changed from torque control to speed control, i.e. CF72 is cleared simultaneously with CF20 cleared, the speed loop is already at the present value of torque. Thus, no torque transient occurs.

Option 1 is selected.

When the drive is changed from torque control to speed control, i.e. CF72 is cleared simultaneously with CF20 cleared, the speed loop is pre-set to 0. A torque transient, on P9.04, occurs, where the torque steps to 0, and recovers at the speed loop dynamics.

6.15 MENU 15 - TORQUE REFERENCE SETTINGS (VECTOR ONLY)

(Refer to Control Block Diagram Sheet 7).

Menu 15 gives access to the parameters required to configure torque reference settings.

The Torque Reference is added to the output of the speed control loop. If the speed loop is disabled, the drive will operate in torque control mode only. The torque reference may be obtained from many of the sources that can define speed reference.

An outline of the procedure for setting drive torque control is:

a) Set Scale and Enable Torque limits - see Menu 15;

b) Disable speed controller:

   i) Disable speed controller by using CF20 - see Menu 14;

   ii) Set up a "speed catch" (deadband) and remember to tune the speed controller - see Menu 14;

c) Set torque limits - see Menu 8.

Refer to the Control Block Diagrams for other torque control functions.

P15.00 - Torque Reference

P15.00 toggles between a read-only and an editable torque value.

- When the Keypad reference is the active reference, then P15.00 can be edited via the Keypad, or the and keys can control the torque.

- When the Keypad reference is not active, then P15.00 simply reports the current value of the reference, like a monitor point.

The torque demand can be inhibited or disabled by the following control flags:

Control Flag 22 - Inhibit Positive Torque (P8.05)
Control Flag 23 - Inhibit Negative Torque (P8.06)
Control Flag 24 - Disable Torque (P8.04).

P15.01 - Torque Reference Scale Factor

This parameter is a scale factor allowing torque references in excess of 100 % nominal torque to be defined.

Allowed values: 0.0% to 300.0% gain.

P15.02 - Control Flag 72 - Enable Torque Reference

Control Flag 72 is used to enable/disable the torque reference.

When ON, torque reference is enabled.

For details of control flag programming see 6.33.

P15.03 - Torque Demand Slew Rate

This parameter is used to smooth out any change of torque reference, thereby reducing pulsations delivered to the load.

Allowed values: 0 = No slew rate
1% to 5000% of nominal torque per second.

P15.04 - Torque Reference Source

Defines the source of the principal torque reference.

Allowed values:

1 = Keypad Torque Ref.

2 = Analogue REF1

3 = Analogue REF2

4 = RS485 Link Ref 1

5 = RS485 Link Ref 2

6 = RS232 Link Ref 1

7 = RS232 Link Ref 2

8 = PID Controller

9 = Reference Sequencer

10 = Fixed Reference Menu

11 = Motorised Pot.

12 = Trim Reference

13 = Fixed 0% (Not used)

14 = Fixed 0% (Not used)

15 = High Speed Digital Input

16 = Position Control

17 = Summing Node A

18 = Summing Node B

19 = Summing Node C

20 = Summing Node D

21 = Pointer 8

P15.05 - Backup Torque Reference

Allowed values: 0 = No backup

1 to 21 as P15.04

Except when Option 0 is selected, a failure of the principal torque reference will cause an automatic changeover to the selected backup reference.

6.16 MENU 16 - PID CONTROLLER SETTINGS

(Refer to Control Block Diagram Sheet 5)

Menu 16 gives access to the parameters required to configure and monitor the user PID Controller. This can be used to allow the drive to control pressure, flow levels etc., in fact if a transducer can be fitted then the drive will control it.

Firstly, the error term is calculated, from the setpoint, the feedback, and the feedback scale factor:

$$PID\_error = PID\_setpoint - \frac{PID\_feedback.PID\_FB\_scale\_factor}{100\%}$$

Or

$$PID\_error = [P16.00] - \frac{[P16.01].P16.02}{100\%}$$

This error term is filtered by the error time constant, P16.06.

The error may be optionally inverted, by P16.08.

The deadband is then imposed, P16.07.

If the magnitude of the error is less than the deadband, then the error is set to zero, to prevent "hunting" about the set point.

The PID Calculations are then done. The proportional band is the gain term which applies to all of the individual terms, as can be seen below. The Integral time, and Differential time, apply only to the I and D terms, respectively.

Proportional Term, P

$$P = \frac{error.100\%}{proportional\_band} = \frac{error.100\%}{P16.03}$$

The integral term is then calculated, based upon the integral of the error.

$$I = \int \frac{error.100\%}{Integral\_time.proportional\_band} = \int \frac{error.100\%}{P16.04.P16.03}$$

NOTE: An integral time setting of 0.0s means no integral term, which actually equates to an integral time of infinity (∞) in the above equation.

Finally, the derivative term, based upon the differential, or change (δ) of the error:

$$D = \frac{\delta error.differential\_time.100\%}{proportional\_band} = \frac{\delta error.P16.05.100\%}{P16.03}$$

The output of the PID function is the sum of these 3 terms.

Output = P + I + D.

The result is clamped so that it cannot exceed (100.00%.

P16.00 - PID Set point Selection

This parameter selects the source to be used as the set point for the PID controller.

Allowed values:

1 = Fixed Ref 0

2 = Analogue REF1

3 = Fixed 0% (Not used)

4 = Fixed Ref Menu

5 = Reference Sequencer

6 = Motorised Pot

7 = Trim Reference

8 = RS485 Ref 1

9 = RS232 Ref 1

10 = Torque Demand

11 = Speed Demand

12 = Summing Node A

13 = Summing Node B

14 = Pointer 4

When Options 4 and 5 are used, the values returned from the Reference Sequencer and Fixed Speed Menu functions represent 0.01% full scale (rather than 0.01 Hz) and are scaled to represent maximum 100 % full scale before being passed to the PID controller.

NOTE: **It is possible to set up the PID controller in a manner that gives a meaningless result (e.g. Reference Sequencer = PID Controller, PID Controller = Reference Sequencer). Care should be taken to avoid setting up the PID Controller in this manner.**

P16.01 - PID Feedback Selection

This parameter allows the feedback source to be specified.

Allowed values are:

1 = Analogue REF2

2 = Fixed 0% (Not used)

3 = RS485 Ref 2

4 = RS232 Ref 2

5 = Torque Demand

6 = Speed Demand

7 = Speed Error

8 = Active Current

9 = Flux Demand

10 = Summing Node C

11 = Summing Node D

12 = Pointer 5

P16.02 - PID Feedback Scale Factor

This parameter allows the PID feedback to be scaled. Default value is 100%. See customer block diagram.

Allowed values: 0% to +300.0%

NOTE: The PID error term is not clamped, before or after application of this scale factor. The PID error (set point - feedback) is however clamped to 100%.

P16.03 - PID Proportional Band

This sets the proportional band, in %, of the controller.

Allowed values: 0.1% to 500.0%

P16.04 - PID Integral Time

This sets the integral action time of the controller, in seconds.

Allowed values: 0.1 seconds to 3000.0 seconds

= No Integral term

Hint: When tuning the PID controller, initially set P16.04 = 0, then set P16.03 to give the desired response speed. Then add P16.04 to remove any steady state errors, set P16.04 to be slightly faster than the expected time constant of the system being controlled.

P16.05 - PID Differential Time

This sets the differential action time of the controller, in seconds.

Allowed values: 0.0 seconds to 3000.0 seconds.

P16.06 - PID Error Time Constant

Allowed values: 0.00 seconds to 5.00 seconds.

P16.07 - PID Error Deadband

This sets a dead-band function that is imposed on the error signal (in % Full Scale). An error dead-band should be used to prevent "hunting".

Allowed values: 0.0% to 50.0%.

P16.08 - PID Error Invert

This parameter inverts the PID error signal, and is used to correct the signal from a negative acting feedback transducer.

Allowed values are: 0 = Disabled.

1 = Enabled.

P16.09 - PID Output Monitor

This read-only parameter is the output of the PID block; it can be monitored as a diagnostic tool.

Displayed range: -100% to +100% full scale.

P16.10 - Control Flag 26 - PID Integral Freeze

When set, freezes the Integral part of the PID to prevent integral wind-up.

P16.11 - Control Flag 69 - Suicide PID Controller

This flag suicides the output of the PID to zero when set ON. At default this flag is set to the INV of the Running status flag (-2.000) so that when the drive is running the PID is running. The flag allows the user to decide when the PID loop is suicided.

6.17 MENU 17 - REFERENCE SEQUENCER SETTINGS

(Refer to Control Block Diagram Sheet 5).

Menu 17 gives access to the parameters required to configure and monitor the Reference Sequencer function. MV3000e can be programmed to perform a sequence of speed (and direction) changes automatically. The sequence can be timed, or it can be controlled by an external input. The control sequence changes the speed of the drive by changing the reference source and there can be up to five changes in a programmed sequence.

NOTE: By default the sequencer is frozen by holding it in reset (CF29). To allow running set P17.20 to 0 (OFF).

P17.00 - Reference Sequencer Mode

Allowed values (modes):

0 = Stopped.

1 = Manual Trigger - CF28 clocks the sequencer to the next point.

2 = Auto Cycle - Sequence stops at one point for a specified time, then automatically moves to the next point. On completing the last point it returns to the first point in the sequence.

3 = Auto Single Sequence - As Option 2 except that on reaching the last point it stops until reset by activating CF29.

When Options 1 to 3 above are selected the current point in the sequence is stored when the drive is powered down. On power up the sequence continues from where it left off.

P17.01 - Number of Reference Sequence Points

Sets the number of points to be cycled.

Allowed values: 1 to 5.

P17.02 - Present Sequence Point

This read only parameter indicates the current position in the sequence of references defined in Parameters P17.03 to P17.07.

Indicated values are in the range: 0 to 5.

P17.03 - Sequencer Reference Point 1

Choose the source for reference point #1.

Allowed values:

1 = Analogue REF1	11 = Fixed Ref #0 (P21.00)
2 = Analogue REF2	12 = Fixed Ref #1 (P21.01)
3 = RS485 Link REF 1	13 = Fixed Ref #2 (P21.02)
4 = RS232 Link REF 1	14 = Fixed Ref #3 (P21.03)
5 = PID Controller	15 = Fixed Ref #4 (P21.04)
6 = Fixed Ref Menu	16 = Summing Node A
7 = Motorised Pot.	17 = Summing Node B
8 = Trim Reference	18 = Summing Node C
9 = Fixed 0% (Not used)	19 = Summing Node D
10 = Fixed 0% (Not used)	20 = Pointer 3

P17.08 - Reference Sequencer Time 1 (seconds)
P17.09 - Reference Sequencer Time 1 (minutes)

These two parameters define the duration of the first reference.

Allowed values: P17.08:- 0.0 seconds to 59.9 seconds.
P17.09:- 0.0 minutes to 9999 minutes.

Similarly the reference source, duration (seconds) and duration (minutes) for sequence points 2 to 5 are set in parameters P17.04 to P17.17 as follows:

P17.04 - Sequencer Reference Point 2
P17.10 - Reference Sequencer Time 2 (seconds)
P17.11 - Reference Sequencer Time 2 (minutes)

P17.05 - Sequencer Reference Point 3
P17.12 - Reference Sequencer Time 3 (seconds)
P17.13 - Reference Sequencer Time 3 (minutes)

P17.06 - Sequencer Reference Point 4
P17.14 - Reference Sequencer Time 4 (seconds)
P17.15 - Reference Sequencer Time 4 (minutes)

P17.07 - Sequencer Reference Point 5
P17.16 - Reference Sequencer Time 5 (seconds)
P17.17 - Reference Sequencer Time 5 (minutes)

NOTE: The manual and external triggers remain active when Auto (timed) sequence is selected. This allows manual stepping through the sequence for test or commissioning purposes.

When the sequence of references and the mode have been defined the Reference Sequencer is activated and controlled as follows:

a) Set the Speed Reference Source, P5.01 to P5.04 (P5.05 for Backup) or the torque reference source, P15.04 (P15.05 for Backup) to `Reference Sequencer'.

b) Use Control Flags 27, 28 and 29 to, freeze, start or reset the sequence as required.

NOTE: At default the sequencer is held in reset, P17.20 must be set to 0 (OFF) to allow running.

P17.18 - Control Flag 27 - Reference Sequencer Freeze

The sequencer is always frozen at the current position when CF27 is activated.

P17.19 - Control Flag 28 - Reference Sequencer Trigger

CF28 moves the sequencer to the next point in the sequence in modes 1, 2 and 3.

P17.20 - Control Flag 29 - Reference Sequencer Reset

CF29 moves the sequencer to the first point in the sequence.

P17.21 - Reference Sequencer Output

This is a Read-only parameter monitoring the Reference Sequencer output in units of 0.01% motor top speed.

Allowed range: -100.00% to +100.00%.

6.18 MENU 18 - MOTORISED POTENTIOMETER SETTINGS

(Refer to Control Block Diagram Sheet 5).

Menu 18 gives access to the parameters required to configure and monitor the motorised potentiometer function.

6.18.1 Motorised Potentiometer Configuration

MV3000e can be configured for push-button raise/lower (Motorised Potentiometer) control using Control Flags 34 (P18.04) and 35 (P18.05). To achieve this:

a) Ensure that default wiring (see Wiring Diagram in relevant manual) to the digital inputs is changed as follows:

   i) Connect two digital inputs to raise/lower pushbuttons, e.g.
   RAISE pushbutton to DIGIN 4 (P18.04 = 1.004) and
   LOWER pushbutton to DIGIN 5 (P18.05 = 1.005);

   ii) Configure the sources for Control Flags 34 and 35 to the appropriate digital inputs, (i.e. set P18.04 to 1.004 and P18.05 to 1.005 for this example);

b) By default, direction is controlled by DIGIN 3;

c) Set the raise and lower rates in P18.00 and P18.01;

d) Set the Motorised Pot Mode in P18.02;

e) Set the direction of rotation of the motor in P5.11;

f) The motorised potentiometer can be used as a speed reference (P5.01 to P5.05), a torque reference (P15.04) or as an input to many of the other drive functions. Use the Control Block Diagrams to choose the motorised pot from the relevant reference list.

P18.04 - Control Flag 34 - Motorised Potentiometer Raise
P18.05 - Control Flag 35 - Motorised Potentiometer Lower

When set ON, CF34 raises/CF35 lowers the motorised pot respectively.

P18.06 - Control Flag 71 - Motorised Potentiometer Preset

When set ON, CF71 presets the motorised pot to the value entered in P18.03.

P18.00 - Motorised Potentiometer Raise Rate
P18.01 - Motorised Potentiometer Lower Rate

Allowed values: 0.1% to 3000.0% per second.

P18.02 - Motorised Potentiometer Mode

Allowed values:
1 = Forward only.
2 = Reverse only.
3 = Forward and reverse.
4 to 6 = As 1 to 3 but suicides to zero when drive output stopped.

P18.03 - Motorised Potentiometer Preset

This allows the output of the motorised pot to be pre-set to enable this parameter set Control Flag 71 ON.

Allowed values: 0.0% to +100.0% of Top Speed.

P18.07 - Motorised Potentiometer Output

This is a read-only parameter monitoring the Motorised Potentiometer output in units of 0.01% motor top speed.

Allowed range: 100.00% to +100.00%.

6.19 MENU 19 - TRIM REFERENCE SETTINGS

(Refer to Control Block Diagram Sheet 5).

Menu 19 gives access to the parameters required to configure and monitor the Trim References.

6.19.1 Trim Reference Control

Trim reference control allows the active speed reference to be scaled and fine trimmed. Allows two references to be combined to provide advanced referencing features; for example an Analogue Input can be used to scale the output of the PID controller.

The drive calculates the output speed using the following expression:

$$Output\_Speed = \frac{((A \times \mathrm{Re}\ fA) + (B \times \mathrm{Re}\ fB))}{100}$$

Where:

A	= Trim reference A scale factor	(set in P19.02).
Ref A	= Trim reference A Input	(set in P19.00).
B	= Trim reference B scale factor	(set in P19.03).
Ref B	= Trim reference B Input	(set in P19.01).

The purpose of the Trim Reference feature is to apply an offset and gain factor to the reference source, to align the values with the required range.

To set up a trim reference control:

a) Select Trim Reference Input A in P19.00.

b) Set P19.02 to the scaling factor (A).

c) Select Trim Reference Input B in P19.01.

d) Set P19.03 to scaling factor (B).

e) Trim Reference can be used as a speed reference (P5.01 to P5.05), as a torque reference (P15.04) or as an input to many other drive functions. Use the Control Block Diagrams to choose the Trim Reference from the relevant list.

P19.00 - Trim Reference Input A
P19.01 - Trim Reference Input B

Allowed values:	1 = Analogue REF1	9 = Motorised Pot.
	2 = Analogue REF2	10 = Ref. Sequencer
	3 = Fixed 0% (Not used)	11 = Fixed Ref #0 (P21.00)
	4 = Fixed 0% (Not used)	12 = Fixed Ref #1 (P21.01)
	5 = RS485 REF 1	13 = Position Control
	6 = RS232 REF 1	14 = Summing Node A
	7 = PID Controller	15 = Summing Node B
	8 = Fixed Ref. Menu	16 = Pointer 6

P19.02 - Trim Reference Scale A
P19.03 - Trim Reference Scale B

Allowed values: -150.0% to +150.0%.

P19.04 - Trim Reference Output

This read-only parameter monitors the Trim Reference output.

Allowed range: -100.00% to +100.00% of Top Speed.

6.20 MENU 20 - HIGH SPEED DIGITAL I/O SETTINGS

(Refer to Control Block Diagram Sheet 4).

Menu 20 gives access to the parameters required to configure and monitor the High Speed Digital I/O (HSIO).

$$Pulse\ Train\ Freq. = \frac{Encoder\ line\ count \times Speed\ [\mathrm{r/min}]\ (Hz)}{30 \times P20.00}$$

The HSIO connections, TB7/8 and TB7/9 on the DELTA controller (TB4B/8 and TB4B/7 on the MicroCubicle™ Controller), can be inputs or outputs but cannot be both simultaneously.

P20.00 defines the HSIO connections as either inputs or outputs - see Figure 6-29 and Table 6-11.

HSIO Mode P20.00	Meaning	HSIO Direction	Description
4098	PWM Synchronisation Master.	Output	MV3000e produces a 1 second synchronisation pulse. Additionally, the PWM is synchronised to this 'tick' with a programmable offset.
4097	PWM Synchronisation Slave.	Input	MV3000e synchronises its PWM to the 1 second pulse received, with a programmable offset.
2 to 4096	Subdivision of the Encoder Clock.	Output	Output frequency is a subdivision of the encoder clock pulse train, see formula above.
1	Input.	Input	Used for referencing the drive. Input defined by P20.01 and P20.02*.
0	Output at drive frequency.	Output	Useful for triggering an oscilloscope.
-1	1kHz pulse train.	Output	Specialised 1µs Pulse.
-2	Fast Trip Output.	Output	Trips are routed to the HSIO Hardware trips from the power stack have a delay of 0 to 1 PWM scan, before being reported to the HSIO, due to asynchronicity between the actual trip and the PWM scan. These trips are: Instantaneous Overcurrent, Over Voltage. (A PWM scan is 800µs @ 1,25kHz, or 400µs @ 2.5kHz or 5kHz.). Sharing trips are also routed to the HSO with a 0 to 1 PWM scan delay between the Nth sharing event and the HSO being operated. Where N is the sharing trip threshold entered into d2451. When action on sharing is set to 'Warn' or 'No Action' (P35.18 = 1 or 0) the HSO is not operated. The general 'Status Trip' (Status Flag SF5) is also routed to the HSO but this has 10ms of software delay depending on the source of the trip. HSO is set low by the drive attempting a reset. If the reset succeeds it will remain low. If the reset fails it will return high.
-3	Active Sharing Level 1 events.	Output	Whenever the number of consecutive PWM events containing sharing reaches the value set in P35.20 the HSO is activated. The mode is independent of Action Sharing Action set in P35.18
-4	Active Sharing Level 1 events on U phase only.	Output	Whenever the number of consecutive PWM events containing sharing reaches the value set in P35.20, on the U phase, the HSO is activated. The mode is independent of Action Sharing Action set in P35.18.
-5	Active Sharing Level 1 events on V phase only.	Output	Whenever the number of consecutive PWM events containing sharing reaches the value set in P35.20, on the V phase, the HSO is activated. The mode is independent of Action Sharing Action set in P35.18.
-6	Active Sharing Level 1 events on W phase only.	Output	Whenever the number of consecutive PWM events containing sharing reaches the value set in P35.20, on the W phase, the HSO is activated. The mode is independent of Action Sharing Action set in P35.18.

Table 6-11. – HSIO Mode & Function

HSO being High (Tripped) is defined as:

HSIO+ = High (TB7 Pin 8) AND HSIO- = Low (TB7 Pin9).

HSO being Low (Not Tripped) is defined as:

HSIO+ = Low (TB7 Pin 8) AND HSIO- = High (TB7 Pin9).

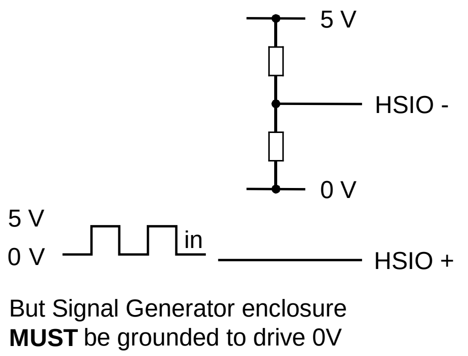


Figure 6-29. – HSIO Connections when RS422 Signal is not available

Note: *** Not applicable when no encoder is present i.e. no output when there is no encoder.**

High Speed Digital Outputs (HSO)

When a value in the range 2 to 4096 is placed in P20.00 the HSIO operates as an output (HSO) and is a pulse train in RS422 format. The pulse train output frequency is a programmable division of the encoder clock frequency and it can be expressed as a function of motor speed:

P20.00 should be configured to 1 for drives using Dynamic Braking Proportional Control.

High Speed Digital Inputs (HIS)

When a value of 1 is entered in P20.00 the HSIO operates as an input (HSI). The HSI is intended for use as a frequency based speed reference source and is controlled by three parameters:

P20.01 - HSI Frequency for zero speed

P20.02 - HSI Frequency for top speed

P20.03 - HSI Speed Reference

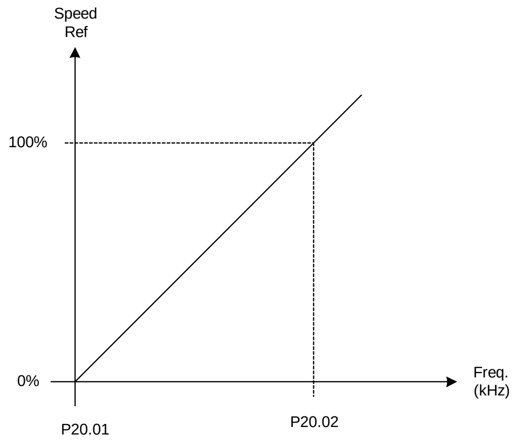


Figure 6-30. –Speed/frequency Relationship

P20.01 and P20.02 define the frequency range, in kHz, for speed reference from 0 to 100% of top speed. P20.03 is a read-only parameter to allow the reference to be monitored.

NOTE: The frequency measurement is achieved by counting the number of transitions on the input over a period of 10 ms. As this 10 ms is not synchronised to the incoming frequency, there is a possible inaccuracy in this measurement of up to one transition per 10 ms. This will be seen as a rapid fluctuation in the input. To minimise this effect, the frequency used should be as high as possible (up to a maximum of 650 kHz).

P20.00 - HSIO Mode

Allowed values:		
	-6	Active Sharing Level 1 Events W Phase only
	-5	Active Sharing Level 1 Events V Phase only
	-4	Active Sharing Level 1 Events U Phase only
	-3	Active Sharing Level 1 Events
	-2:	Fast Trip Out
	-1:	1 kHz Output Pulse
	0:	Output, at drive output frequency
	1:	Input defined by P20.01 and P20.02
	2 to 4096:	Output is given by the expression at 6-4.

When a value of –2 is entered the HSIO can be used to facilitate the triggering of oscilloscopes on a trip event. Trips are routed to the HSIO.

When a value of -1 is entered into P20.00 the HSIO will produce a 1 kHz square wave output in RS 422 format. This can be used for triggering an external event in some applications.

When a value of 0 is entered into P20.00 the HSIO will operate as an output and is a pulse train in RS 422 format. The pulse train output frequency is at the drive power output frequency as given in P9.09. This can be used for triggering an oscilloscope, or to supply a reference to another drive.

P20.01 - HSIO Input Frequency for 0

P20.01 sets the input frequency to the HSI that is required to correspond to zero speed reference.

Allowed values: 0.0kHz to 650.0 kHz.

P20.02 - HSIO Input Frequency for 100 % Speed

P20.02 sets the input frequency to the HSI that is required to correspond to 100% speed reference.

Allowed values: 0.0kHz to 650.0kHz.

P20.03 - HSIO Input Reference Value

This is a read only parameter gives the HSI speed reference value as a percentage of Top Speed.

Range: 0.00% to 100.00% (of Top Speed).

6.20.1 PWM Synchronisation

PWM synchronisation is a feature added to facilitate minimisation of the PWM ripple when multiple network bridges are employed. These multiple network bridges can have their PWM waveforms phase-locked and phase displaced, with respect to each other, in order to reduce the ripple content of the entire network.

The HSIO signal from the controller is used for PWM synchronisation. This is an RS422 signal that can be programmed as either an input or an output.

Two additional modes are provided for PWM synchronisation. These are listed in the table above.

The MV3000e synchronises its PWM to the rising edge of the synchronisation pulse. It applies the offsets described in the two parameters below.

6.20.1.1 Master Mode (P20.00 = 4098)

In this mode the MV3000e will produce an outgoing signal (1 second pulse) for other MV3000e drives to synchronise to. In addition, the MV3000e will synchronise its own PWM to this outgoing signal.

The mark/space ratio of this pulse is 50%.

6.20.1.2 Slave Mode (P20.00 = 4097)

In this mode the MV3000e will synchronise its PWM to the incoming signal (1 second pulse). The mark/space ratio requirement of this pulse is:

5% < M <95%.

6.20.1.3 'In-Synchronisation' Status Flag

Status flag SF80 indicates that the drive is 'In Synchronisation'. It can be viewed in parameter P11.42. The status flag can be used by the drive to perform and action on loss of synchronisation, e.g. by patching it to the User Alert functions in parameters P10.40 onwards.

6.20.1.4 Parameters Associated with PWM Synchronisation

Par No.	Function	Default	Range	Attrib	Mode No.	Comments
P35.30	PWM Synchronisation Offset	0.0	0.0 to 100% PWM Period.	E	2, 4	Percentage of the PWM period by which the PWM is advanced from the received synchronisation pulse
P35.31	PWM Synchronisation Delay Compensation	0	0 to 400µs.	E	2, 4	Time by which the PWM of the slave drive is advanced to compensate for synchronisation signal delays and PWM frequency transmission delays in the power cables.

Table 6-12. – Parameters Associated with PWM Synchronisation

P35.30 - PWM Synchronisation Offset

This parameter is used to program the required PWM phase displacement between MV3000e drives.

For example:

A supervisory master will write to the PWM synchronisation offset from a serial link. In the event of one of a cluster of MV3000e drives going off-line the supervisory master will re-calculate the offsets required of the remaining MV3000e drives. The MV3000e should not step change to the new synchronisation offset. Hundreds of milliseconds to phase lock are desirable.

Say, the third MV3000e drive in a cluster of 5 might have its PWM synchronisation offset set to 144 degrees of PWM (360 * (3-1)/5), i.e. P35.30 = 40%. In the event of one of the MV3000e drives going off-line, this might be changed by the supervisory master to be 50% (third in a cluster of 4).

The MV3000e will adjust its PWM such that the one-second tick will arrive at:

$Tick\_arrival = P35.30 * PWM\_Period + P35.31$ µs into the PWM period.

P35.31 - Synchronisation Delay Compensation

This parameter is set up to compensate for the hardware delays in the system. These are primarily caused by the transmission time of the synchronisation pulse from the synchronisation master and the return transmission time from the drive to the point of common coupling for the PWM harmonics being minimised.

These delays are a significant portion of a PWM period for 10's or 100's of metres of MV3000e separation.

6.21 MENU 21 - FIXED REFERENCE SETTINGS

(Refer to Control Block Diagram Sheet 5)

Menu 21 gives access to the parameters required to configure and monitor the Fixed (pre-set) References.

The fixed references mode allows up to sixteen preset reference speeds, set in parameters P21.00 to P21.15, to be selected by decoding the states of Control Flags 30, 31, 32 and 33 as a 4-bit binary word.

6.21.1 To Configure the Drive for Fixed Reference operation

Proceed as follows:

a) Set the required reference speeds in parameters P21.00 to P21.15.

b) Fixed Reference can be used as a speed reference (P5.01 to P5.05), as a torque reference (P15.04) or as an input to many other drive functions. Use the Control Block Diagrams to choose the Fixed Reference from the relevant list.

c) Use the Control Flags 30 to 33 to select the required fixed speed reference as shown in Table 6-13.

d) Auto cycling of these references can be achieved by connecting the flags to the status flag generator in Menu 31.

See 6.33 for information on Control Flag programming.

P21.16 - Control Flag 30 - Fixed Reference Select 0
P21.17 - Control Flag 31 - Fixed Reference Select 1
P21.18 - Control Flag 32 - Fixed Reference Select 2
P21.19 - Control Flag 33 - Fixed Reference Select 3

The 4-bit word formed by these control flags is decoded to have values from 0 to 15, selecting P21.00 to P21.15, as shown in Table 6-13.

P21.00 to P21.15 - Fixed References #0 to #15

These parameters set the reference speeds that are used when the "Fixed Reference Menu" is selected as the reference source.

Fixed Reference can be used as a speed reference (P5.01 to P5.05), as a torque reference (P15.04) or as an input to many other drive functions. Use the Control Block Diagrams to choose the Fixed Reference from the relevant list.

P21.20 - Fixed Reference Output

This read-only parameter monitors the Fixed Reference output.

Allowed values: -100.00% to +100.00% of Top Speed.

Control Flag				Active Speed Reference
33	32	31	30	
0	0	0	0	P21.00
0	0	0	1	P21.01
0	0	1	0	P21.02
0	0	1	1	P21.03
0	1	0	0	P21.04
0	1	0	1	P21.05
0	1	1	0	P21.06
0	1	1	1	P21.07
1	0	0	0	P21.08
1	0	0	1	P21.09
1	0	1	0	P21.10
1	0	1	1	P21.11
1	1	0	0	P21.12
1	1	0	1	P21.13
1	1	1	0	P21.14
1	1	1	1	P21.15

Table 6-13. –Fixed Speed Reference Selection

6.22 MENU 22 - SKIP SPEED SETTINGS

(Refer to Control Block Diagram Sheet 5).

Menu 22 gives access to the parameters required to configure the Speed Skipping function.

6.22.1 Speed Skipping Set-up

In some installations it is desirable that certain critical speeds are avoided, to prevent mechanical vibrations at resonant frequencies. MV3000e drives can be programmed to disallow up to four critical speeds by setting up to four "skip bands". Only when the motor speed is held at the critical speeds do resonances begin, thus ramping through a skip band is acceptable.

As the speed reference enters a skip band the output speed is held constant and the Status Flag 25 is set to 1 (skipping), until the speed reference emerges from the skip band. The motor then accelerates or decelerates to the reference speed at the relevant rate (set in parameters P6.00 to P6.03 inclusive). If the speed reference stops within a band, the motor sped will be frozen at either the bottom or top of the band, depending on which direction the reference was moving as it entered the band. The action of the speed skipping function is shown in Figure 6-31.

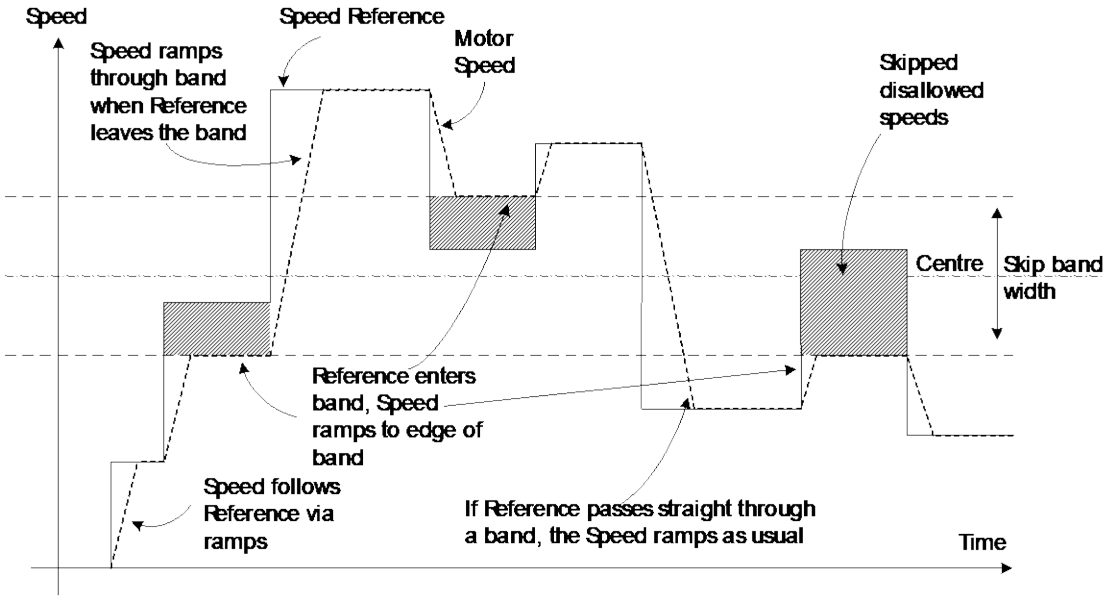


Figure 6-31. – Effect of a Skip Band on Output Speed

To set any of the four skip bands, adjust the relevant centre and width parameters as shown:

P22.00 - Skip Band 1 Centre
P22.02 - Skip Band 2 Centre
P22.04 - Skip Band 3 Centre
P22.06 - Skip Band 4 Centre

Set the value to the centre speed of the required skip band.

Allowed values: -100% to +100% of Top Speed.

P22.01 - Skip Band 1 Width
P22.03 - Skip Band 2 Width
P22.05 - Skip Band 3 Width
P22.07 - Skip Band 4 Width

Set the value to the full width of the required skip band.

Allowed values: 0% to 50% of Top Speed.

NOTES:

1 It is not permissible for a skip band to straddle zero speed.
2 Status Flag 25 - Skipping - is set to 1 when `skipping'.

6.23 MENU 23 - DYNAMIC BRAKE CONTROL

(Refer to Control Block Diagram Sheets 2 and 9).

Menu 23 gives access to parameters required to configure the optional Dynamic Brake (DB) function. The values to be entered for these parameters are associated with the DB resistor, which is external to the drive. See manual T1684 for more data on P23.00 to P23.09 and P23.20.

There are two methods of providing the dynamic braking function, one is referred to as 'Threshold Control' and the other is referred to as 'Proportional Control'. Use of the 'Proportional Control' method should only be undertaken for certain highly specialised drive applications - refer to the Application Note in section 10.

Threshold Control is the normal method used for controlling DC link voltage by use of a DB unit and braking resistor whereby the DC link voltage is maintained below a given threshold value by switching the DB Unit fully on if the threshold is exceeded. This mode is selected by setting P23.19 = 0 to enable the DB unit PWM circuits and setting P23.13 = 0 to select Threshold Control.

6.23.1 Choice of DB Resistor

To avoid the DB resistor overheating, the drive will monitor the power being dissipated by the resistor. Figure 6-32 shows a typical stop/start cycle; the DB resistor should be chosen such that:

DB resistor average power (P23.01) ≥ Average regenerative power, and DB resistor maximum power-time product (P23.02 x P23.03) (Peak regenerative power x t1).

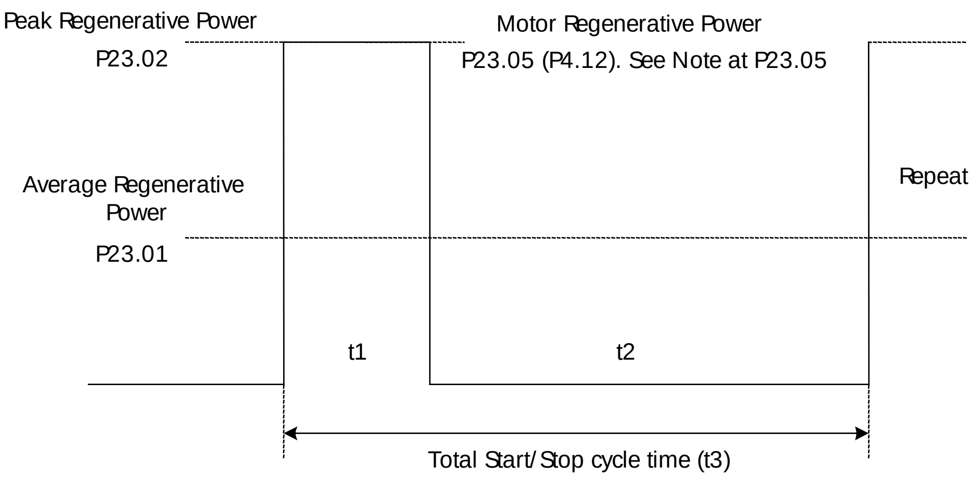


Figure 6-32. – DB Resistor Power Dissipation

P23.00 - DB Resistor Value

Enter the value of the dynamic brake resistor. The DB Unit manual T1684, supplied with the DB Unit, gives allowed maximum/minimum resistor values for all DB models.

Defaults for the DB Resistor value, which are drive size dependent, are for DB resistor values for resistors supplied by **GE Power Conversion**.

Permitted values: 0.1Ω to 1000.0Ω.

P23.01 - DB Resistor Average Power

Enter the average value of the power to be dissipated by the dynamic brake resistor, this being a measure of its continuous capability. The default value is drive size dependent. Calculate this from the application duty cycle.

Permitted values: 0.1kW to 3000.0kW.

P23.02 - DB Resistor Maximum Power

Enter the maximum value of the power to be dissipated by the dynamic brake resistor. This parameter, in conjunction with P23.03, is a measure of its overload capability. The default value is drive size dependent, and can be obtained from application stopping requirements.

Permitted values: Value in P23.01 to 3000.0kW.

P23.03 - Duration of DB Resistor Maximum Power

Enter a value for the maximum permitted duration of dissipating maximum power by the DB resistor (P23.02). Consult the resistor manufacturer's specification sheets.

Permitted values: 0.1s to 1800s.

P23.04 - DB Voltage Threshold

The DC Link voltage will increase due to regenerative braking. Enter the value of DC Link voltage at which the DB unit will switch in.

In general, the default value for the given drive size is suitable. The drive determines this value for itself when powering up.

Permitted values:	Minimum:	Drive dependent.
	Maximum:	1500 V.

P23.05 - Motor Regenerative Power Limit

This is the peak power that the drive will regenerate from the motor.

If this value is greater than the instantaneous peak power which the DB unit can dissipate, i.e. $(P23.04)^2/P23.00$, then the drive may still trip on over voltage. P23.05 should be used to limit the regenerative capability of the drive to match that of the DB unit. This parameter is a repeat of P4.12 in the Start/Stop menu.

Permitted values: -0.1kW to 3000.0kW
(-0.1 means NO LIMIT, the energy is to be absorbed by the DB unit.).

NOTE: The same parameter function (P23.05 or P4.12) is offered in two menus for convenient set up.

P23.06 - Action on DB Overload

This parameter defines the action to be taken by the drive on DB overload, in terms of power dissipation capability. If the DB resistor is healthy (i.e. no warning or trip), Status Flag SF55 is set.

Permitted values:
0 = No action.

1 = Warning (104) at 25% remaining.

2 = Warning at 25% remaining, Trip (67) at 0% remaining.

3 =Reduce motor regenerative power limit to DB average power, issue warning at 25% remaining, trip at 0% remaining.

NOTE: When proportional DB control is selected on the motor DB, Option 3 of P23.06 acts in the same way as Option 2. Option 3 invokes a trip avoidance strategy on non-bridge DBs if the drive is causing the regenerative situation i.e. by braking of a motor. If the drive is not controlling the regenerating motor, then trip avoidance will not function.

P23.07 - Resistor I^2T Remaining

This read-only parameter shows the overload capacity of the resistor remaining.

Permitted values: 0% to 100%.

P23.08 - Control Flag 110 - DB Enable

P23.08 programs the connection to CF110. When set, CF110 enables the dynamic brake.

Default value = 2.008 (SF8) = Drive Output Enabled

P23.09 - Control Flag 111 - DB Resistor Thermostat

For complete protection of DB resistors P23.09 allows the output from the DB resistor thermostat to be patched (via a digital input) as the connection to CF111. Referring to Figure 6-33, when CF111 is set (ON), P23.07 is forced to 0% and disables the dynamic brake. If the thermostat is normally closed, the signal must be inverted.

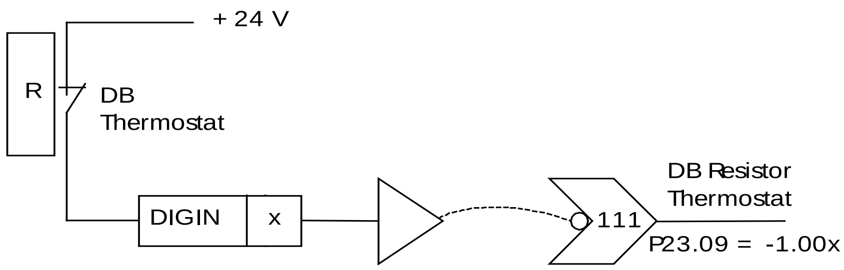


Figure 6-33. – DB Thermostat Protection

NOTE: For -1.00x, the negative sign inverts the signal.

P23.10 - DB Vdc Reference Source Selector

The DB control method, by default, uses the internally measured Vdc value as the input to the comparator. The internal Vdc value is updated at PWM frequency and the comparator also operates at the PWM rate. As the Vdc feedback value is derived from the drive's switched mode power supply, there are some 'builds' of drive that may not be able to generate the Vdc feedback signal. In these cases the Vdc feedback signal will have to be derived externally and fed into one of the analogue inputs.

Allowed values: 1 = Drive Vdc.

2 = Analogue Ref 1.

3 = Analogue Ref 2.

P23.11 - DB Vdc Reference Scale

This value is the percent to voltage scalar. Apart from the internally measured Vdc, all the other Vdc sources are scaled in percent. This parameter is used to convert the percent signals into voltage signals. The value is the voltage represented by 100%.

Allowed values: -2000 to +2000V/100%.

P23.12 - DB Vdc Reference

The selected Vdc reference value is displayed.

Allowed values: -2000 to +2000V.

P23.13 - DB Control Mode

This parameter defines how the DB control is implemented. It allows dynamic braking to be set to either threshold or proportional operation.

Threshold is the existing control method. In this mode a decision to switch the DB in or out is made once per PWM period.

Proportional control generates a mark-space ratio at the PWM frequency that is proportional to the DB modulation demand. The modulation demand is derived from the reference source specified by the next parameter.

For DB control to be active on the motor bridge, this parameter must be set to 1.

Allowed values are:	0 = Threshold.
	1 = Proportional.

P23.14 - DB Ref. Source Selector

The possible references are similar to that of the speed reference selector. This source also has its own unique pointer parameter (pointer 28) that is configured in the pointer set-up menu (P42.54 and P42.55).

P23.15 - Max. Modulation

This value would normally be the default of 100%. This is the maximum modulation demand applied to the resistors in proportional control mode, even if the Vdc feedback threshold value is exceeded. This allows lower rated DB resistors to be used by limiting the power dissipated in them to a value within their specification.

P23.16 - DB Reference

This read-only parameter shows the requested modulation level of the DB. It only has any meaning in proportional control.

P23.17 - DB Ramp Time

A variable ramp rate to achieve 100% modulation change between 0 and 1s is achieved by specifying the ramp rate as a time (in milliseconds) to change by 100%. A time of zero to 5ms (the ramp scan rate) will result in the ramp being bypassed, i.e. the ramp input will pass through to the ramp output on the next scan cycle, giving a step change. A time of 1000ms will result in a maximum of 0.5% change per 5ms scan, i.e. it will take 1 second to implement a 100% step change.

P23.18 - DB Demand

This read-only parameter shows the modulation level of the DB after ramping and limiting. It only has any meaning in proportional control. It resets to zero whenever the DB output is disabled and thus allows the ramp time to operate when the DB output is subsequently enabled.

P23.19 - DB Output Select

This selector routes the DB proportional control output to either the existing DB port or to the output bridge. In order to action the output bridge selection, the motor control method (P99.01) must be set to DB Mode and P23.13 must be 1. If the bridge is the selected output, warning 138 will be active until P99.01 is set to zero. The purpose of the warning is to inform that the DB is inactive.

When using the output bridge, the resulting ripple currents seen on the DC link will be one third the amplitude of that generated by a single equivalent DB resistor. Secondly, the frequency of the ripple current will be 3 times the PWM frequency. This has been done to reduce the stress on the DC link capacitors.

P23.20 - Non-MV DB Unit Fitted

This parameter allows the user to use external DB (Dynamic Brake) units that are not part of the integrated MV3000 range.

A Dynamic Brake may be connected to the drive that is a non-MV3000e DB Unit. When this happens, parameter P23.20 is user set to 1. This allows the drive to perform motor regeneration as if a MV3000e DB Unit is fitted.

The amount of regenerated energy allowed back from the motor and, hence, to the DB Unit is still controlled by parameter P4.12 - 'Regenerative Power Limit' (and parameter P23.05 - 'Motor Regenerative Power Limit'). This parameter is user set to equal the value of the peak power that the DB resistor can absorb (read the Parameter Description for P23.05 for hints on its use).

The MV3000e Drive cannot monitor the state of non-MV3000e DB resistors; hence if a non-MV3000e DB unit is fitted all parameters in Menu 23, other than P23.05, are not applicable. For those applications where an MV3000e DB Unit and a separate unit are both connected then the whole of Menu 23 is again valid.

Allowed values:	0 = Not fitted	i.e. non-MV3000e DB Unit not fitted.
	1 = Fitted	i.e. non-MV3000e DB Unit fitted.

P23.21 - DB Current

This read-only parameter shows the instantaneous rms current through each DB resistor. It is calculated, not measured, and is a function of the resistance, voltage feedback and duty cycle (modulation) of the DB.

The value displayed is per resistor.

Allowed values: 0.0A to 2000.0A.

P23.22 - DB Power

This read-only parameter shows the instantaneous power dissipated in each DB resistor. It is calculated, not measured, and is a function of the resistance, voltage feedback and duty-cycle (modulation) of the DB.

The value displayed is per resistor.

Allowed values: 0.0kW to 3000.0kW.

P23.23 - Internal DB Unit Fitted

When a MicroCubicle™ drive is first powered from Auxiliary 28V then it doesn't recognise the presence of an internal DB unit. Consequently DB operation does not take place after the mains is powered unless the Auxiliary 28V is switched off first.

P23.23 gets around the above problem by telling the MicroCubicle™ drive that the DB unit is fitted.

Applies to DB unit only.

The internal DB unit is "seen" by the drive if either:

a) the drive is initially powered up by the mains

b) P23.23 is set at power up.

i.e. if powered by Auxiliary 28V the P23.23 can be used to tell the MicroCubicle™ drive unit that a DB unit is fitted.

6.24 MENU 24 - SPEED TRIM SETTINGS

(Refer to Control Block Diagram Sheet 6).

Menu 24 gives access to the parameters required to configure the Speed Trim function. This is an additional speed demand added after the ramp function. Setting Control Flag 70 enables Speed Trim.

P24.00 - Speed Trim Source

Allowed values:

1 = Keypad Speed Ref.
2 = Analogue REF1
3 = Analogue REF2
4 = RS485 REF1
5 = RS485 REF2
6 = RS232 REF1
7 = RS232 REF2
8 = PID Controller
9 = Ref. Sequencer
10 = Fixed Ref. Menu
11 = Motorised Pot.
12 = Trim Reference
13 = Fixed 0% (Not used)
14 = Fixed 0% (Not used)
15 = High Speed Digital Input
16 = Position Control
17 = Summing Node A
18 = Summing Node B
19 = Summing Node C
20 = Summing Node D
21 = Pointer 7

P24.01 - Speed Trim Scale 1
P24.02 - Speed Trim Scale 2

The Speed Trim Scale 1 is selected by setting Control Flag 75 to 0 (default).

Speed Trim Scale 2 is selected by setting Control Flag 75 to 1.

Allowed values: -100.0% to +100.0% of selected source input.

P24.03 - Control Flag 70 - Enable Speed Trim

The Speed Trim function is enabled when CF70 is set.

P24.04 - Control Flag 75 - Speed Trim Scale Select

CF75 selects Speed Trim Scale 1 or 2.

When cleared (default state), selects Speed Trim Scale 1.

When set, selects Speed Trim Scale 2.

P24.05 - Speed Trim Slew Rate

This parameter defines the maximum rate of change of the speed trim signal.

Allowed values are: 0 = no limit.

1%/s to 5000%/s.

6.25 MENU 25 - INERTIA COMPENSATION SETTINGS

(Refer to Control Block Diagram Sheet 7).

Menu 25 gives access to the parameters required to configure the Inertia Compensation function. This allows an additional torque to be added to the torque demand; the additional torque is proportional to the rate of change of speed or speed demand.

P25.00 - Inertia Compensation Acceleration Time

This defines the time for the load inertia to accelerate to Top Speed with 100 % applied torque. This is used by the drive to calculate the per-unit inertia of the load.

NOTE: This is the time taken to accelerate the load, assuming that all the torque is available to accelerate the load.

If the actual referred inertia of the load is known, the acceleration time can be calculated from:

$$AccelerationTime = \frac{0.1047 \times Top\ Speed\ (r/\min) \times Referred\ inertia[kgm^2]}{Nominal\ Torque[Nm]}$$

Allowed values: 0.00s to 300.00s.

P25.01 - Inertia Compensation Time Constant

This parameter defines the time constant of the low-pass filter applied to the speed signal before its rate of change is calculated. This is in units of scans (1 scan = 5ms).

Allowed values: 0 scans to 500 scans.

P25.02 - Inertia Compensation Speed Source

This parameter selects between two sources for the input to the inertia compensation circuit.

Allowed values: 1 = Inertia compensation calculated from speed demand.

2 = Inertia compensation calculated from speed feedback.

P25.03 - Control Flag 74 - Enable Inertia Compensation

The Inertia Compensation function is enabled when CF74 is set.

P25.04 - Inertia Compensation Output Time Constant

For very high inertia loads, being accelerated slowly, it is necessary to apply a filter to the calculated inertia compensation. This parameter defines the time constant of the low pass filter applied to the calculated inertia compensation.

Allowed values: 0 scans to 500 scans (1 scan = 5ms)

6.26 MENU 26 - HISTORY LOG SETTINGS

(Refer to Control Block Diagram Sheet 9).

Menu 26 gives access to the parameters required to configure the History Log.

6.26.1 History Logs

The History Log records the instantaneous value or state of 10 selected items of information continuously in 10 separate channels. Each channel can hold 100 samples in chronological order. The sequence of events can be played back later to help diagnose faults, using either the Drive Data Manager™ (Keypad) display or via the serial links.

6.26.2 Operation of the History Log

The History Log can be started via a control flag or the `History Command' parameter (P26.27). The History Log can be stopped via a control flag, the History Command parameter or via its trigger conditions.

NOTE: The term "Trigger" means stopping the History Record.

The History Log is written to non-volatile memory so that it is not lost when power to the drive is shut off. On power-up, the History Log contains the data from when the drive last powered down. The data in the History Log remains in memory and can be played back until the History Log is re-started.

The History Log is configured to suit an application or to help diagnose a particular problem by specifying the following:

- sample period;
- parameters to be recorded;
- logging mode;
- trigger parameter and trigger conditions;
- number of samples to be taken after the History Log triggers.

NOTE: Either the History Command Parameter or the start/stop History Flags can be used at any time to control the History. The record can be started with P26.27 and stopped with the Stop Control Flag.

6.26.3 Configuring the History Log

To configure the History Log, set parameters as follows.

P26.00 - History Log Sample Period

Set the time interval (in scans) between each sample of the History Log.

Allowed values: 1 scan to 20000 scans (1 scan = 5ms).

P26.01 - Channel 1 Data
P26.03 - Channel 2 Data
P26.05 - Channel 3 Data
P26.07 - Channel 4 Data
P26.09 - Channel 5 Data
P26.11 - Channel 6 Data
P26.13 - Channel 7 Data
P26.15 - Channel 8 Data
P26.17 - Channel 9 Data
P26.19 - Channel 10 Data

For each channel the allowed values are:

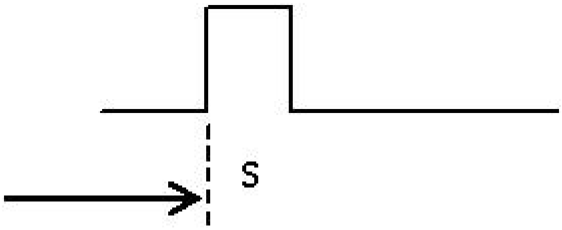
1.00 to 99.99 (Any Parameter Number).

The following parameters specify the method of sampling the data to be recorded.

P26.02 - Channel 1 Mode
P26.04 - Channel 2 Mode
P26.06 - Channel 3 Mode
P26.08 - Channel 4 Mode
P26.10 - Channel 5 Mode
P26.12 - Channel 6 Mode
P26.14 - Channel 7 Mode
P26.16 - Channel 8 Mode
P26.18 - Channel 9 Mode
P26.20 - Channel 10 Mode

Allowed Values are: 1 = Take Average over sample period.
2 = Take Maximum over sample period.
3 = Take Minimum over sample period.

NOTE: A sample period is P26.00 scans of 5 ms



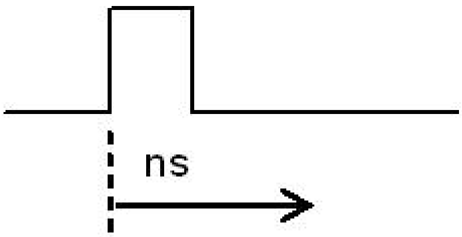
6.26.4 Starting the History Log

At default the History Log starts when the output is enabled, because CF78 (P26.25) is connected to SF8 (Output Bridge Enabled). If this flag is SET, then the history recording will start immediately. Any previous information in the History Log will be overwritten as recording commences. The source for this control flag can be changed so that the History Log can be started independently from the drive.

Setting the History Command parameter P26.27 can also start the History Log:

If P26.27 = 1 The history is armed and the trigger conditions must be satisfied before recording will begin.

i.e. the trigger parameter must be within the upper and lower limits.



If P26.27 = 2 This operates on a one-shot system such that as soon as recording stops, the History Command parameter is forced back to zero. Again, as recording starts any previous information in the History Log will be overwritten.

P26.25 - Control Flag 78 - Run History

P26.25 selects the source for Control Flag 78. The History Log runs when CF78 is momentarily pulsed from 0 to 1 to 0 (any previous data will be overwritten). The default source is Status Flag 8 `Output Bridge Enabled'.

See Section 6.33 for information on Control Flag programming.

The History Log can be stopped using Control Flag 79, by its trigger conditions, or by the History Command parameter as described below.

P26.26 - Control Flag 79 - Stop History

Setting Control Flag 79, whose source is selected by P26.26, can stop the History Log. If this flag is set, then the History recording will stop after the required number of `samples after trigger' (set in P24.24) has been taken. The default source for this flag is 2.005 (Status Flag 5 - `drive tripped') so that the History Log will stop when the drive trips. The source for the control flag can be changed so that the History Log can be stopped independently from the drive.

See Section 6.33 for information on Control Flag programming.

6.26.5 Trigger Settings and Limits for Stop Control of the History Log

The History Log will be stopped when the value in its `Trigger Channel' parameter is less than its lower trigger limit (in P26.22) or greater than its upper trigger limit (in P26.23). Again, the History Log will stop after the required number of `samples after trigger' (set in P26.24) has been taken. The trigger channel parameter is selected by placing the appropriate parameter number in P26.21. If P26.21 is set to zero (which is the default case) then the trigger limit parameters are ignored and the History Record can only be stopped by Control Flag 79 or by the History Command (P26.27).

NOTE: If the history record is armed, when the trigger parameter is NOT between the upper and lower limits, then the history record will trigger (stop recording) immediately.

P26.21 - Trigger Parameter

Defines which parameter will be used as the "Trigger Channel" for the History Log.

Values: 0 = Not Used.

Trigger Limits ignored. History Log can only be triggered via CF78 or History Command.

0.01 - 99.99 (any Parameter Number) = Channel to be used as the trigger channel. For example, if this parameter is set to be the speed feedback P9.01 (i.e. P26.21 = 9.01) then the History Log will stop when the speed feedback goes outside the upper and lower trigger limits (see P26.22 and P26.23).

P26.22 - Lower Trigger Level

Defines the lower level for the trigger channel.

Allowed values: -327.67 to +327.67.

If the value in the trigger channel goes below this value, the History Log will stop after the required number of "samples after trigger".

P26.23 - Upper Trigger Level

Defines the upper level for the trigger channel.

Allowed values: -327.67 to +327.67.

If the value in the trigger channel goes above this value, the History Log will stop after the required number of "samples after trigger".

P26.24 - Samples After Trigger

Defines how many samples of data will be taken after triggering of the History Log.

Values: 0 to 99 (samples).

P26.27 - History Command

Setting the History Command parameter P26.27 to 2 can stop the History Log. This operates on a one-shot system such that as soon as the History Log stops, the History Command parameter is forced back to zero. Again, recording stops after the required number of “samples after trigger” (see later) has been taken.

Value: 0 = No Command or command executed.
1 = Arm History Log.
2 = Trigger History Log (after required number of "samples after trigger").

6.26.6 History Record Time Stamping

Parameters P26.28 to P26.31, and P27.11, P27.12 (playback) allow history records to be time stamped.

P26.28 - Single Element Ch1 Data
P26.29 - Single Element Ch2 Data

These two parameters select which of the drive parameters are recorded in the Single Element History Channels. Unlike the other channels that record 100 samples per channel, these 2 elements record a single sample or instantaneous sample, like a rolling 'snapshot' at the History Record Sample Point. These channels are continuously recorded whilst the History Record is running, and are not recorded when the History Record is halted, taking a 'snapshot' of whatever they are connected to. Results may be read in P27.11/P27.12.

Values: 1.00 to 99.99 (Any Parameter Number).

P26.28 and P26.29 can therefore be configured to record the broadcast Global System Time received by P26.30 and P26.31 (next).

P26.30 - Global Time Variable 1
P26.31 - Global Time Variable 2

These two parameters are to via a serial link, or similar source, broadcasting a global system time. The drive does not write to these parameters at all.

Expected values: -30,000 to +30,000.

6.27 MENU 27 - HISTORY LOG PLAYBACK SETTINGS

Menu 27 gives access to the parameters required to view the History Log. See Section 9 (Diagnostics) for details.

6.28 MENU 28 - AUTO-RESET SETTINGS

(Refer to Control Block Diagram Sheet 9).

Menu 28 gives access to parameters required to configure the trip auto-reset feature.

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.**

To minimise the nuisance caused by the drive tripping due to transient faults, MV3000e can be configured to automatically reset most trip conditions without operator intervention.

The trip conditions are identified by fault codes and these are listed in Table 9-3. The fault code attribute column in this table shows which trips can be reset automatically.

Parameters P28.06 to P28.20 are used to configure one or more of the trip conditions (identified by its fault code) to reset automatically.

6.28.1 Configuring Trips to Auto-reset

To configure trips to reset automatically:

a) Set Parameters P28.06 to P28.20 to enable Auto-reset as required. Where indicated, refer to Table 9-2 for details of which parameters enable the auto-reset of specific trips, as identified by their fault codes.

Allowed values for P28.06 to P28.20 inclusive are:

0 = Auto-reset disabled (default).
1 = Auto-reset enabled.

b) Set P28.00 to the required number of Auto-reset attempts.

c) Set the Auto-reset Delay (P28.01).

d) Set the Auto-reset Healthy Time (P28.03).

NOTES:

1 If more than 1 trip occurs then all of these trips must be reset before the drive becomes healthy.
2 Sheet 7 of the Control Block Diagram shows this function pictorially.

P28.06 - Instantaneous Overcurrent Auto-reset Enable

Resets fault codes specified at Table 9-2.

P28.07 - Timed Overcurrent Auto-reset Enable

Resets fault code 5.

P28.08 – Under Voltage Auto-reset Enable

Resets fault code 4 and Trip Fault Code 29 (for Firmware Version 6 and onwards).

P28.09 – Over Voltage Auto-reset Enable

Resets fault codes specified in Table 9-3.

P28.10 - Motor Thermal Trips Auto-reset Enable

Resets fault codes 21, 22 and 66.

P28.11 - Interlock Auto-reset Enable

Resets fault code 1.

P28.12 - Control and Reference Loss Auto-reset Enable

Resets fault code 2.

P28.13 - Drive Temperature Trips Auto-reset Enable

Resets fault codes specified in Table 9-3.

P28.14 - Serial Link Loss Auto-reset Enable

Resets fault codes 23 and 24.

P28.15 - User Trip Auto-reset Enable

Resets fault codes 62 and 73.

P28.16 – Over Speed Trip Auto-reset Enable

Resets fault code 57.

P28.17 - Load Fault Auto-reset Enable

Resets fault codes 64 and 65.

P28.18 - DB Resistor Fault Auto-reset Enable

Resets fault code 67.

P28.19 - SFE Mains Auto-reset Enable

Resets all trips 93-98, for SFE.

P28.20 - Interlock Terminal Auto-Reset Enable

When the MV3000e is tripped on interlock, if this parameter is set, then auto-reset commences immediately.

If P28.20 = 1 and provided all other active trips can be auto-reset (as defined by P28.06 to P28.19) then when the drive trips on Interlock trip, the number of auto-resets remaining (P28.04) will be reset to the value of P28.00. Auto resets will not be attempted whilst the Interlock terminal (TB3/9) is unhealthy. When TB3/9 becomes healthy then auto-resets will commence, decrementing P28.04 as they are attempted.

P28.00 - Number of Auto-reset Attempts

Controls the number of auto-reset attempts that will be made before the drive will require manually resetting.

Allowed values are: 0 to 20 attempts.

P28.01 - Auto-reset Delay

P28.01 specifies the number of seconds between the drive tripping and an auto-reset attempt being made. This is also the time between subsequent auto-reset attempts.

Allowed values are: 1 second to 30 seconds.

P28.02 - Supply Loss Timeout

If the input supply voltage remains below the minimum allowed for longer than the supply loss timeout period, the auto restart function is disabled. This may be limited by the power supply to the control electronics in the event of an extended input power supply failure.

Allowed values are: 0.0 seconds to 3200.0 seconds.

P28.03 - Auto-reset Healthy Time

Specifies the period of time, after an automatic reset, that the drive must remain healthy before the number of reset attempts remaining returns to the value set in parameter P28.00.

Allowed values are: 10 seconds to 3600 seconds.

P28.04 - Auto-resets Remaining

This read-only parameter indicates the number of auto-reset attempts remaining.

Values are: 0 to Value set in P28.00.

P28.05 - Force Synchro Start

Specifies the start mode when automatically restarting.

Allowed values are: 0 = Disable - the start mode is specified by P4.00.

1 = Enable - a Synchro Start is requested after an auto restart, even if not required as the normal start mode.

6.29 MENU 29 - SPEED AND TORQUE MONITOR SETTINGS

(Refer to Control Block Diagram Sheet 12).

Menu 29 gives access to the parameters required to configure the Speed and Torque Monitoring facilities.

6.29.1 Speed Monitor

The Speed Monitor compares the speed to upper and lower limits set in parameters P29.03 and P29.04 levels. Depending on the result, the speed monitor sets the following status flags:

Status Flag 10 – Over Speed
Status Flag 11 - Zero Speed
Status Flag 12 - At Speed
Status Flag 13 - Inside Speed Window
Status Flag 14 - Outside Speed Window
Status Flag 15 - Above Speed Window
Status Flag 16 - Below Speed Window

P29.00 - Forward Over Speed Level
P29.01 - Reverse Over Speed Level

These are the speeds at which the drive suicides its torque demand, and may be configured to trip. This may be used as an over speed protection when used in torque control operation.

Allowed Values: 10.0% to 300.0% (of Top Speed).

P29.02 – Over Speed Action

Determines the action taken in the event of the over speed levels set in parameters P29.00 and P29.01 being exceeded.

Allowed values:
1 = Suicide Torque.
2 = Suicide Torque + Warning.
3 = Trip.

NOTE: Suicide torque means that the drive output will remain running but the drive will NOT be able to develop torque. The load will react differently depending on its characteristic.

P29.03 - Speed Monitor Level 1
P29.04 - Speed Monitor Level 2

These two parameters define the upper and lower limits of the speed monitoring window.

Allowed values: -300.0% to +300.0% (of top speed).

P29.05 - Speed Monitor Hysteresis

A hysteresis value can be set here to stabilise the output to the status flags.

Allowed values: 0.0% to 50.0% (of top speed).

6.29.2 Torque Monitor

The torque monitor compares the torque to upper and lower limits set in parameters P29.06 and P29.07 levels. Depending on the result, the torque monitor sets the following status flags:

Status Flag 28 - In Torque Limit
Status Flag 29 - Inside Torque Window
Status Flag 30 - Outside Torque Window
Status Flag 31 - Above Torque Window
Status Flag 32 - Below Torque Window

P29.06 - Torque Monitor Level 1
P29.07 - Torque Monitor Level 2

These two parameters define the upper and lower limits of the torque-monitoring window.

Allowed values: -300.0% to +300.0% (of nominal torque).

P29.08 - Torque Monitor Hysteresis

A hysteresis value can be set here to stabilise the output to the status flags.

Allowed values: 0.0% to 100.0% (of nominal torque).

P29.09 - Zero Speed Tolerance

Sets the tolerance for zero speed monitoring.

Allowed values: 0.00% to 10.00% (of Top Speed).

6.30 MENU 30 - LOGIC BLOCK SETTINGS

(Refer to Control Block Diagram Sheet 13).

Menu 30 gives access to the parameters required to configure the eight General Purpose Logic Blocks A to H.

Four identical logic blocks, A to D, each contain the following functions:

Comparator:	This allows any variable to be compared to a fixed threshold.
Delay:	Allows the output of the comparator block to have its rising edge delayed.
Selectable Boolean Function: (Control Flags).	Allows the delay output to be combined with two other digital signals
Latch:	Allows the output of the logic block to be latched.

Each of the logic block functions outputs to a Status Flag, and the inputs come from the previous function and Control Flags.

Each of the four logic blocks are identified by the letters A to D and the parameters, Control Flags and Status Flags for each logic block are described in the following sections:

A second group of four identical logic blocks, E to H, are described in Section 6.30.5.

NOTE: Each of the logic blocks is scanned once every 10 ms. If the blocks are interconnected (by patching the output Status Flags of one logic block to the input Control Flags of another), this will take an additional scan to take effect.

6.30.1 Logic Block A

P30.00 - Comparator A Input

This parameter can point the comparator input at any drive parameter.

Allowed values: 1.00 to 99.99 (any parameter number).

The output from Comparator A can be selected as an input to P30.04 and is echoed in Status Flag 17.

P30.01 - Comparator A Threshold

A fixed value whose range changes to match that of the parameter that is chosen as the comparator input.

P30.02 - Comparator A Hysteresis

A fixed value whose range changes depending on the parameter chosen as the comparator input. The Hysteresis is a % value, producing a band of Hysteresis on either side of the threshold e.g. for a 1% hysteresis you would get Comparator Output SF17 set when Comparator Input = Threshold Setting ± 0.5%.

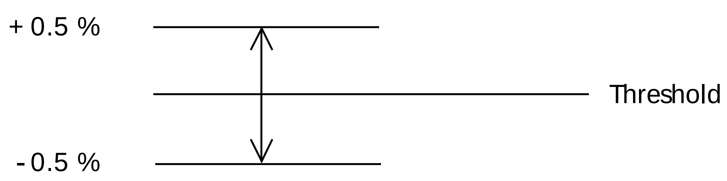


Figure 6-34. –Comparator Threshold

P30.03 - Comparator A Mode

The comparator produces a high output under the following conditions, when selected by P30.03.

Allowed values:

1 = Input = Threshold
2 = Input ≠ Threshold
3 = Input > Threshold (signed)
4 = Input ≤ Threshold (signed)
5 = Input < Threshold (signed)
6 = Input ≥ Threshold (signed)
7 to 10 = As 3 to 6 but the absolute value is used.

P30.04 - Delay A Input Source

Selects the input to the Delay A module.

Allowed values: 1 = Comparator A.

2 = Control Flag 36 (P30.09).

P30.05 - Delay A Time

Allowed values: 0.0 secs to 600.0secs.

The output from Delay A is used as an input to the configurable Logic Block A (P30.06) and is echoed in Status Flag 18.

P30.06 - Logic Block A Functions

The Boolean function of Logic Block A is selectable by the value entered into P30.06.

Permitted values:

1 = Three Input AND
2 = Three Input NAND
3 = Three Input OR
4 = Three Input NOR
5 = Three Input XOR
6 = Three Input XNOR
7 to 12 = Two Input versions of 1 to 6.

3-input Boolean functions use the outputs from Delay A (P30.05), and Control Flags 37 (P30.09) and 38 (P30.10) as inputs.

2-input Boolean functions use Control Flags 37 and 38 as inputs. The output can be selected as a SET input to Latch A, this is echoed in Status Flag 19.

P30.07 - Latch A Input Selection

Determines the source of the SET input to Latch A.

Allowed values: 1 = From Logic Block A.

2 = Control Flag 39 (P30.11).

Control Flag 40 (P30.12) resets the latch and the output is written to Status Flag 20.

P30.08 - Control Flag 36 - Delay A Input

When selected by P30.04, applies a rising edge to the Delay A module input.

P30.09 - Control Flag 37 - Logic Block A Input 1
P30.10 - Control Flag 38 - Logic Block A Input 2

These flags provide inputs to Logic Block A.

P30.11 - Control Flag 39 - Latch A Set

When selected by P30.07, applies a rising edge SET input to Latch A.

P30.12 - Control Flag 40 - Latch A Reset

Applies a rising edge RESET input to Latch A.

6.30.2 Logic Block B

P30.13 to P30.20 - Logic Block B Functions

The description of these parameters is as for parameters P30.00 to P30.07 in Logic Block A.

Logic Block B is identical to Logic Block A except that Control Flags 41 to 45 are inputs and Status Flags 21 to 24 are outputs.

P30.21 to P30.25 - Control Flags 41 to 45

These Control Flags operate on Logic Block B exactly as CF36 to CF40 operate on Logic Block A:

Control Flag 41 - Delay B Input
Control Flag 42 - Logic Block B Input 1
Control Flag 43 - Logic Block B Input 2
Control Flag 44 - Latch B Set
Control Flag 45 - Latch B Reset

6.30.3 Logic Block C

P30.26 to P30.33 - Logic Block C Functions

The description of these parameters is as for parameters P30.00 to P30.07 in Logic Block A.

Logic Block C is identical to Logic Block A except that Control Flags 46 to 50 are inputs and Status Flags 35 to 38 are outputs.

P30.34 to P30.38 - Control Flags 46 to 50

These Control Flags operate on Logic Block C exactly as CF36 to CF40 operate on Logic Block A:

Control Flag 46 - Delay C Input
Control Flag 47 - Logic Block C Input 1
Control Flag 48 - Logic Block C Input 2
Control Flag 49 - Latch C Set
Control Flag 50 - Latch C Reset

6.30.4 Logic Block D

P30.39 to P30.46 - Logic Block D Functions

The description of these parameters is as for parameters P30.00 to P30.07 in Logic Block A.

Logic Block D is identical to Logic Block A except that Control Flags 51 to 55 are inputs and Status Flags 39 to 42 are outputs.

P30.47 to P30.51 - Control Flags 51 to 55

These Control Flags operate on Logic Block D exactly as CF36 to CF40 operate on Logic Block A:

Control Flag 51 - Delay D Input
Control Flag 52 - Logic Block D Input 1
Control Flag 53 - Logic Block D Input 2
Control Flag 54 - Latch D Set
Control Flag 55 - Latch D Reset.

6.30.5 Logic Blocks E, F, G and H

There are four additional logic blocks, each of which comprises a selectable 3-input Boolean function. The inputs to these Boolean functions are three Control Flags and the outputs are to Status Flags. There are four parameters for each logic block.

Logic Block	Function	Control Flag	Parameter	Status Flag
E		CF56	P30.53	
	P30.52	CF57	P30.54	SF43
		CF58	P30.55	
F		CF59	P30.57	
	P30.56	CF60	P30.58	SF44
		CF61	P30.59	
G		CF62	P30.61	
	P30.60	CF63	P30.62	SF45
		CF64	P30.63	
H		CF65	P30.65	
	P30.64	CF66	P30.66	SF46
		CF67	P30.67	

Table 6-14. – Logic Blocks E, F, G & H

6.30.6 Logic Block E

P30.52 - Logic Block E Functions

The Boolean function of Logic Block E is selectable by means of the value entered into parameter P30.52.

Permitted values:

1 = Three Input AND
2 = Three Input NAND
3 = Three Input OR
4 = Three Input NOR
5 = Three Input XOR
6 = Three Input XNOR
7 to 12 = Two-Input versions of 1 to 6.

3-input Boolean functions use Control Flags 56, 57 and 58 as inputs.

2-input Boolean functions use Control Flags 56 and 57 as inputs. Status Flag 43 is the output.

P30.53 - Control Flag 56 - Logic Block E Input 1
P30.54 - Control Flag 57 - Logic Block E Input 2
P30.55 - Control Flag 58 - Logic Block E Input 3

These flags provide inputs to Logic Block E.

6.30.7 Logic Block F

P30.56 - Logic Block F Functions

The description of this parameter is as for parameter P30.52 in Logic Block E.

Logic Block F is identical to Logic Block E except that Control Flags 59, 60 and 61 are used as inputs and Status Flag 44 is the output.

P30.57 to P30.59 - Control Flags 59 to 61

These Control Flags operate on Logic Block F exactly as CF56 to CF58 operate on Logic Block E:

Control Flag 59 - Logic Block F Input 1.
Control Flag 60 - Logic Block F Input 2.
Control Flag 61 - Logic Block F Input 3.

6.30.8 Logic Block G

P30.60 - Logic Block G Functions

The description of this parameter is as for parameter P30.52 in Logic Block E.

Logic Block G is identical to Logic Block E except that Control Flags 62, 63 and 64 are used as inputs and Status Flag 45 is the output.

P30.61 to P30.63 - Control Flags 62 to 64

These Control Flags operate on Logic Block G exactly as CF56 to CF58 operate on Logic Block E:

Control Flag 62 - Logic Block G Input 1.
Control Flag 63 - Logic Block G Input 2.
Control Flag 64 - Logic Block G Input 3.

6.30.9 Logic Block H

P30.64 - Logic Block H Functions

The description of this parameter is as for parameter P30.52 in Logic Block E.

Logic Block H is identical to Logic Block E except that Control Flags 65, 66 and 67 are used as inputs and Status Flag 46 is the output.

P30.65 to P30.67 - Control Flags 65 to 67

These Control Flags operate on Logic Block H exactly as CF56 to CF58 operate on Logic Block E:

Control Flag 65 - Logic Block H Input 1.
Control Flag 66 - Logic Block H Input 2.
Control Flag 67 - Logic Block H Input 3.

6.31 MENU 31 - STATUS FLAG GENERATOR SETTINGS

(Refer to Control Block Diagram Sheet 12).

Menu 31 gives access to the parameters required to configure the Status Flag Generator. This generates 4 status flags (SF70 to SF73) in the form of a binary word. It may be configured to count up or down, automatically or manually, continuous cycle or single sequence. These status flags can be patched to the Fixed Position Menu, to achieve a position sequencer function, if required, or can be used elsewhere around the entire drive software.

The reset position for the sequencer is programmable, as are the number of points, 1 to 16. The times at each point are in the range 0.0 to 3200.0 seconds, in steps of 0.1 second.

Control inputs comprise Control Flags 97 to 100.

P31.00 - Status Flag Generator Mode

Permitted values: 0 = Stopped.
The pattern issued is given by P31.01.

1 = Manual Trigger Only.
The states are incremented / decremented by the control flags described above. The timing parameters are not applicable.

2 = Auto Cycle Up.
The generator remains at each state for a duration given by the associated parameters (P31.03 to P31.18). The state is then incremented to the next state higher in the sequence.

3 = Auto Cycle Down.
The generator remains at each state for a duration given by the associated parameters (P31.03 to P31.18). The state is then decremented to the next state lower in the sequence.

4 = Auto Cycle Single Sequence Up.
The generator remains at each state for a duration given by the associated parameters (P31.03 to P31.18). The state is then incremented to the next state higher in the sequence. The sequencer will stop when it reaches the last state in the sequence.

5 = Auto Cycle Single Sequence Down.
The generator remains at each state for a duration given by the associated parameters (P31.03 to P31.18). The state is then decremented to the next state lower in the sequence. The sequencer will stop when it reaches the last state in the sequence.

P31.01 - Sequence Start Point

This is the start and reset value of the sequencer.

Allowed values are: 0 to 15.

P31.02 - Sequence Length

This defines the number of states the sequencer will pass through before returning to the start state.

The sequence pattern runs from Sequence Start State to (Sequence Start State + Sequence Length - 1). i.e. counting upwards from Sequence Start State, the number of states are defined as the Sequence Length. This number is wrapped back into the range 0 to 15.

Example 1 If start state = 0, Mode = UP, and Sequence Length = 4, then the states are
0, 1, 2, 3, 0, 1, 2, 3, 0, 1, etc.

Example 2 If start state = 2, Mode = DOWN, and Sequence Length = 6, then the states are
2, 7, 6, 5, 4, 3, 2, 7, 6, 5, etc.

P31.03 to P31.18 - Sequence Times

The sequencer will remain at each state for the duration given by the associated parameter.

P31.03 = Time at state 0.

P31.04 = Time at state 1.

etc. to P31.18 = Time at State 15.

Allowed range: 0.0 seconds to 3200.0 seconds.

Status Flag Generator Outputs

Four outputs comprising:

Status Flag Generator Output 0 (Status Flag 70).
Status Flag Generator Output 1 (Status Flag 71).
Status Flag Generator Output 2 (Status Flag 72).
Status Flag Generator Output 3 (Status Flag 73).

These form a binary code (Output 0 is the least significant bit) that describes the state.

P31.19 - Control Flag 97 - Status Flag Generator Freeze

When set, CF97 halts the generator at the present state. The internal timer is halted.

P31.20 - Control Flag 98 - Status Flag Generator Up

When set, CF98 increments the sequencer to the next state.

P31.21 - Control Flag 99 - Status Flag Generator Down

When set, CF99 decrements the sequencer to the previous state.

P31.22 - Control Flag 100 - Status Flag Generator Reset

When set, CF100 resets the status flag generator to the start state, given by P31.01.

6.32 MENU 32 - SERIAL LINK SETTINGS

See Section 8 for details.

6.33 CONTROL FLAGS AND STATUS FLAGS

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

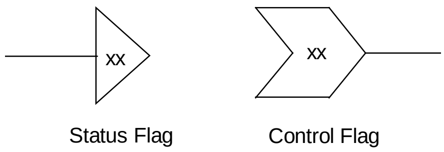


Figure 6-35. – Status & Control Flag Representations

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 drive'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 Diagram, e.g. <0> = cleared, <1.002> = DIGIN 2 etc. See "Rules for use" below for explanation.

The control flags have parameters that allow the user to "patch" them to other parts of the drive 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. A complete listing of control flags/parameter numbers is given at 5.4.75.

2. In the control flag Menus 33 and 34, where all the flags are grouped together for easy location, e.g. the Start flag (CF1) is also P33.01, see 6.34.

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. Each CF symbol actually has the "Local" menu parameter number printed next to it.

2. Refer to Table 6-15 and edit a value into the control flag parameter, this value will determine what the flag is connected to.

NOTE: The value has the form N.xxx where N is the type of source and xxx is the source identifier.

Source Parameter Value	Selected Source
0.000	Fixed 0 (cleared)
0.001 or 1.000	Fixed 1(set)
1.001... 1.006	Digital Input 1 ... Digital 6
1.014	INTERLOCK
1.100 ... 1.163	Extended digital input 0 to 63 (CAN1)
1.200... 1.263	Extended digital inputs 0 to 63 (CAN2)
2.000... 2.111	Status Flag 0 Status Flag 111
3.000... 3.015	RS485 Control Word 0, bit 0... RS485 Control Word 0 bit 15
3.100... 3.115	RS485 Control Word 1, bit 0... RS485 Control Word 1, bit 15
4.000... 4.015	RS232 Control Word 0, bit 0... RS232 Control Word 0 bit 15
4.100... 4.115	RS232 Control Word 1, bit 0... RS232 Control Word 1 bit 15
5.000... 5.015	FBC Word 1, bit 0... FBC Word 1, bit 15
5.016... 5.031	FBC1 Control Word 1, bit 0... FBC1 Control Word 1, bit 15
5.100... 5.115	* Fieldbus Control Word 1, bit 0... * Fieldbus Control Word 1, bit 15
5.200... 5.215	* Fieldbus Control Word 2, bit 0... * Fieldbus Control Word 2, bit 15
5.300... 5.315	Ethernet Channel 1 Control Word 1, bit 0... Ethernet Channel 1 Control Word 1, bit 15
5.316... 5.331	Ethernet Channel 1 Control Word 2, bit 0... Ethernet Channel 1 Control Word 2, bit 15
5.332... 5.347	Ethernet Channel 2 Control Word 1, bit 0... Ethernet Channel 2 Control Word 1, bit 15
5.348... 5.363	Ethernet Channel 2 Control Word 2, bit 0... Ethernet Channel 2 Control Word 2, bit 15
6.000 ... 6.031	Application Flag 0... Application Flag 31
7.000 ...7.031	CAN Control bit 0... CAN Control bit 31
7.032...7.063	CAN2 Control bit 0... CAN2 Control bit 31

Table 6-15. – Control Flag Source Selection

NOTES:

1 These flags are used for Fieldbus option boards, FIP, PROFIBUS and MicroPEC™, as only one of the boards can be fitted at any time.

2 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:

P4.04 = 1.002, then Control Flag 1 will be connected to digital input 2

or if

P4.04 = -1.002, then Control Flag 1 will be connected to the INV of digital input 2.

6.34 MENU 33 - CONTROL FLAGS 0 TO 99 CONNECTION SETTINGS MENU 34 - CONTROL FLAGS 100 TO 127 CONNECTION SETTINGS

Menus 33 and 34 give an alternative way to access the parameters required to configure and monitor the Control Flags.

For ease of access the control flags are grouped in Menus 33 and 34 so that Menu 33 contains CF1 to CF99 and Menu 34 contains CF100 to CF127. If the number of a control flag is known, its source parameter can easily be accessed by typing P33.xx or P34.xx where xx is the CF number, e.g. for:

CF1 parameter, enter P33.01.

CF9 parameter, enter P33.09.

CF116 parameter, enter P34.16 (subtract 100 from the CF number).

Examples of Connecting Flags

Two examples of the connection of control and status flags are shown below. The "local" menu numbers are given in brackets i.e. (P4.04) is the START Control Flag.

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 that might be made to the logic blocks:

6.35 MENU 35 - MISCELLANEOUS FEATURES SETTINGS

Menu 35 gives access to the parameters required to configure the following miscellaneous functions:

PWM Switching frequency.
Keypad Removal and default Keypad display.
Edits Review Enable.
RS232 Serial Link Baud rate and protocol.
Printer Settings.

6.35.1 PWM Switching Frequency

P35.00 - PWM Switching Frequency

The pulse width modulation (PWM) frequency of the drive output can be changed to suit local requirements. Increasing the PWM frequency will reduce the audible noise from the motor and increase the pitch. Increasing the PWM frequency also increases the amount of heat dissipated from the drive.

Allowed values (from Keypad):	1.25kHz.
	2.5kHz.
	5.0kHz.
	7.5kHz.

The default setting for this parameter is 1.25kHz. This value should be satisfactory for most installations except for the following conditions. The 1.25kHz value is the default for VVVF control and 2.5kHz is the default for Vector control. When on a DELTA System 5kHz is the maximum value.

NOTE: **At PWM switching frequencies higher than the default setting, it may be necessary to reduce the current rating of the drive, particularly when operated in high ambient temperatures.**

6.35.2 Allow Drive Data Manager™ (Keypad) Removal

P35.01 - Allow Keypad Removal

Configures the drive to enable Keypad removal, if the drive is not in Keypad control.

Permitted values:	0 = Disabled.
	1 = Enabled.

6.35.3 Set-up Review Mode

P35.03 - Set-up Review Mode

A list of parameters that have been changed from the factory default settings is maintained by the drive. Enabling the Set-up Review function causes the drive to display this list (P35.03 remains displayed). The up and down arrow keys can then be used to step through the complete list.

To revert to normal parameter display mode, use the up/down keys to display P35.03 again and then change its value to 0.

Allowed values:	0 = Disabled.
	1 = Enabled.

6.35.4 Auto-lock Action

P35.04 - Auto-lock Action

With auto-locking enabled, the parameters are locked automatically if no editing activity is detected for a period of five minutes.

Allowed values:	0 = Auto-locking OFF.
	1 = Auto-locking ON, Engineer parameters only.
	2 = Auto-locking ON, all parameters.

6.35.5 Printing

A printer can be connected to MV3000e to print out the drive records. The drive can be configured for printing either by using the Drive Data Manager™ (Keypad) or by using a suitable Personal Computer (PC) connected to the RS485 terminals on the I/O panel. The printer is connected to the RS232 connector on the front panel of the unit, in place of the Keypad.

Printer Specification

To work with MV3000e drives a printer must conform to the following specification:

Carriage width	42 characters
Print rate in the range	0.5 to 10 lines per second
Communications	RS232 serial port
Data format	8 bits, no parity
Buffer size	1 line
Baud rate	9600 to 38400 baud

The printer cable should be terminated in a 9-way D-type plug with connections as shown in Figure 8-1 .

Using the Drive Data Manager™ (Keypad) to Configure the Drive for Printing

The Drive Data Manager™ (Keypad) is used to configure the drive (see Section 2). It is then removed and the printer cable is connected to the Keypad port. The drive begins transmitting printer data approximately 10 seconds after the Keypad has been removed.

a) Follow the procedure below to configure the drive for printing.

b) Power up the printer and then remove the Keypad as described in Section 2.2.6.

c) Connect the printer cable to the Keypad port.

Using a PC to configure the Drive for Printing

For this method the printer is connected to the Drive Data Manager™ (RS232) port and the PC uses the RS485 serial link to configure the drive. To communicate with the drive, use a software package such as Drive Coach, available from **GE Power Conversion**.

A 4-way screened cable is required to connect between the PC RS485 connector and the drive connector TB4B/1-4, as shown in the Wiring Diagram in relevant manual. Connect the screen to TB4B/5.

a) Connect the printer to the Drive Data Manager™ port and power up the printer.

b) Connect the PC to the drive RS485 port.

c) Using the appropriate software package, configure the drive for printing as described below.

Configuring the Drive for Printing

To configure the drive for printing:

a) Set P35.06 - (RS232 Protocol) to `Printer' (Option 5).

b) Set P35.08 - (Printer lines per second) to the required speed.

c) Set P35.05 - (Serial link baud rate) to the baud rate setting of the printer.

d) Set P35.07 to the required print option.

On completion of the printout P35.07 automatically reverts to Option 0 (Print nothing) if the option selected was in the range 1 to 4. Print Option 5 remains valid until the operator changes it.

To terminate a printout in progress: Set parameter P35.07 to 0 and press ↵.

P35.05 - RS232 Serial Link Baud Rate

Sets the required value (in kBaud).

Allowed values: 9.6, 19.2 and 38.4 kBaud.

P35.06 - RS232 Serial Link Message Protocol

Values are:
0 = No Protocol.
1 = GEM 80 ESP.
2 = MODBUS™ RTU.
3 = MODBUS™ ASCII.
4 = Keypad ESP.
5 = Printer.

P35.07 - Printer Options

Determines which data is output to the printer.

Allowed values are:

0 = No Print Out.

1 = Print all parameters.

2 = Print all parameters which have been changed from the factory default settings.

3 = Print the parameters defined in the ESP user page 1. See Table 8-4 "Configuring the User-defined Pages" for information on how to configure the ESP user pages.

4 = Print the History log. This can only occur when the History log is frozen (i.e. the drive must be tripped). The History log will not start to run until the printout is completed. This allows the drive to be restarted while the History log is being printed.

5 = Print the History log automatically when the drive trips. This setting is intended for use with auto-reset trips, so that a log of History logs for previous trips is maintained.

6 = Print CANopen EDS Body.

7 = Print DeviceNet EDS Body.

8 = Print Allen Bradley special DeviceNet EDS Body.

P35.08 - Printer Lines/second

This parameter controls the rate at which data is sent to a printer. The default value (Option 2) is suitable for a typical serial dot matrix printer. The print speed can be increased if a different type of printer is in use or the print data is being sent direct to a computer terminal.

Allowed values:	1 =	0.5 lines /second.
	2 =	0.7 lines /second.
	3 =	1.0 lines /second.
	4 =	2.0 lines /second.
	5 =	5.0 lines /second.
	6 =	10.0 lines /second.

Trip Avoidance

The timed Overcurrent function trips the drive if the accumulated product of overload current (i.e. current above the drive Full Load Current indicated in P99.05) and time is equivalent to overload current of the drive for a period of 60 seconds. When P99.02 set to 0 the overload current is set at 1.5 x FLC and when P99.02 is set to 1 the overload current is set to 1.1 x FLC. P9.10 monitors the remaining percentage overload.

For example (for a drive with P99.02 set to 0):

1.5 x FLC for 60 seconds, or, 1.25 x FLC for 120 seconds.

The possibility of a timed Overcurrent trip can be reduced by enabling timed Overcurrent avoidance (P35.09). When the overload remaining value reaches 10% (e.g. [for a drive with P99.02 set to 0] after 1.5 x FLC for 54 seconds), the acceleration or speed is reduced, to allow the drive to recover from the accumulated overload.

P35.09 - Drive Overload Avoidance Enable

Allowed values:	0 = Disabled.
	1 = Enabled.

P35.10 - Over Temperature Avoidance Enable

The internal temperature of the drive is measured continuously and if the normal limits are exceeded the drive will generate a Warning and will ultimately trip. The drive can be programmed to take action to avoid tripping due to excessive internal temperature, by setting P35.10 to `enabled'.

When over temperature avoidance is enabled, the drive reduces the current limit setting when the Warning temperature level is reached. This reduces the output current, allowing the drive temperature to reduce. When the temperature is below the `Warning' level the normal current limit setting is restored. The drive over temperature trip is not disabled by this function, and the drive will still trip if the temperature limit is exceeded.

Allowed values:	0 = Disabled.
	1 = Enabled.

P35.12 - AC Loss Ride-through

If this parameter is enabled, the drive can maintain the DC link volts during short dips in the mains supply. Using kinetic energy in the load to re-generate the DC link voltage does this. The motor may decelerate very quickly in these conditions and may override programmed ramp rates. Refer also to P35.13.

Allowed values:	0 = Disabled.
	1 = Enabled.

P35.13 - Nominal Mains Voltage

This parameter must be set accurately if the AC Loss Ride-Through function (P35.12/P46.00) is required.

Allowed range:	300 V to 800V.

P35.11 - Expansion Bus Device

Various Communication Boards are available from **GE Power Conversion** e.g. FIP, PROFIBUS Ethernet. These are detailed in separate manuals. This parameter P35.11 indicates which Communication Board is fitted.

Allowed values: 0 = Non fitted.
1 = 1Mbit/s FIP.
2 = 2.5Mbit/s FIP.
3 = Fieldbus Coupler.

P35.14 - Maximum Ambient Temperature

This parameter displays the maximum ambient temperature.

Allowed values: 35˚C to 50˚C.

P35.15 - Fan Type

This parameter displays the fan type fitted.

Allowed values: 0 – Standard.
1 – Large.

Only DELTA drives will allow other than the standard fan type to be selected.

P35.16 - Drive Continuous Current Rating

This parameter displays the drive continuous current rating as a function of:

P35.00 - PWM Switching Frequency.
P35.13 - Nominal Input Voltage.
P35.14 - Maximum Ambient Temperature (35˚C to 50˚C, default 40˚C).
P35.15 - Fan Type (default 0 - standard).
P99.01 - Control Method.
P99.02 - Overload Setting.

When the drive's output bridge switching devices are below a 'hot' threshold, P35.16 will display the rated nominal current in Amps. When above this threshold, the P35.16 value may show a reduction depending upon the selection of the above influencing parameters. The drive internally determines the threshold as a function of the output bridge design parameters. The maximum current available is the value of P99.05 multiplied by the overload factor. Thus for a cold output bridge, the drive rated current is available. When the output bridge exceeds the 'hot' threshold, the maximum current is determined by the particular set of operating conditions specified by the above parameters.

P35.17 - Advanced Temperature Monitoring

This feature is only available if the MV3000e hardware has been programmed with the necessary data power bridge data. When enabled this feature allows a complex mathematical algorithm to be run which computes the switching device temperatures, from the prevailing power bride conditions, and the measured heatsink temperatures. The results are displayed in P45.25 - P45.27.

P35.18 - Action on Sharing Error

All versions of MV3000e AC Drives that are MVDELTA based have had the ability to make the MVDELTA modules share their currents in proportion to the total drive current. However this can only be achieved up to a point, for example if one of the phases of the MVDELTA modules remains unconnected then the current in that phase remains at zero.

P35.18- 'Active Sharing Error Detection' has been included to improve this situation. If the MV3000e is unable to force multiple MV DELTAs to share in proportion, and the current levels are high enough for this to present a potential problem for the remaining MVDELTA modules then the drive will issue a warning or a trip, indicating the phase sharing failure.

	Warning Number	Trip Number
U-Phase Sharing Error	139	207
V-Phase Sharing Error	140	208
W-Phase Sharing Error	141	209

Table 6-16. – Sharing Error Warning & Trip Numbers

Allowed values: 0 = No action.
1 = Warning.
2 = Trip (default).

It is recommended that this parameter be left at its default value 2 (trip). This parameter is included as a debug aid. If an application suffers a Sharing Error Trip, then P35.18 can be temporarily set to 1, so that the MV3000e can be run, and the source of the fault e.g. DELTA wiring, can be identified. P35.18 should be returned to 2 upon correction of the fault. To continuously run the MV3000e with P35.18 at a value other than 2 will potentially overstress the other DELTA modules, if a mis-sharing situation exists.

6.35.6 Enhanced Active Sharing

P35.19 - Active Sharing Disable

This parameter allows Active Sharing to be disabled altogether. It does not disable Active Sharing detection, which, in general, will need to be disabled separately via parameter P35.18.

P35.20 - PWM Sharing Threshold

This parameter is used to specify the number of consecutive PWM periods containing sharing required for a first level sharing error condition.

P35.21 - 100ms Sharing Threshold

This parameter is used to specify the number of 100ms periods that must have a level 1 sharing error before sharing error detection is triggered. This will filter out spurious noise events causing spurious sharing error detection. It will still retain the ability to detect a non-functional DELTA module.

P35.22 - Number of 100ms Sharings

This parameter is used to view the degree of sharing taking place. If level 1 sharing errors are not taking place, this will remain at zero.

P35.23 - Sharing Event Duration

The sharing event duration can be adjusted using this parameter.

Allowed values:	0 = 0.4µs
	1 = 0.8µs
	2 = 1.2µs
	3 = 1.6µs
	4 = 2.0µs
	5 = 2.4µs
	6 = 2.8µs
	7 = 3.2µs
	8 = 3.6µs
	9 = 4.0µs
	10 = 4.4µs
	11 = 4.8µs
	12 = 5.2µs
	13 = 5.6µs
	14 = 6.0µs
	15 = 6.4µs

6.35.7 PWM Synchronisation Parameters.

P35.30 - PWM Synchronisation Offset
P35.31 - Synchronisation

These parameters are fully described in Section 6.20.1.4.

6.36 MENU 36 - POSITION CONTROL SETTINGS (VECTOR WITH ENCODER ONLY)

(Refer to Control Block Diagram Sheet 10).

Some applications require the controller to maintain an accurate indication of the position of a turntable or other apparatus. The position control feature uses the speed feedback encoder, to provide an accurate position feedback, which can be used as a reference source to control the drive output.

Since the incremental encoder only provides a simple pulse count from which to derive the position, the Z-pulse of the encoder is used to establish the zero position of the motor during each full rotation, also it may be necessary in some applications to use limit switches to indicate absolute start and finish positions. The process of establishing the reference positions of the apparatus is known as 'datumizing'.

The output of position control is an error signal determined by the difference between the position reference and the actual position. This error signal can then be used as a reference source for the speed control or torque control loops or as a speed trim or trim reference. A `Speed profiler' is used to `shape' the reference signal, to give accurate control of the speed at which a set position is approached.

Setting the reference source to `Position Control' enables position control.

The drive's own internal position control variables are in units of encoder pulses. The encoder emits 4 pulses per encoder line (one on each encoder line edge). Thus a 1024 line encoder gives 4096 encoder pulses per revolution.

P36.01 - Encoder Line Count Divider

This parameter is used to scale the encoder output to a user defined range. It determines the number of encoder pulses for each bit added to the position variable. A 1024 line encoder has 4096 pulses per revolution. If P36.01 is set to 2 then the position variables have a range of 4096 / 2 = 2048 bits per shaft revolution.

Allowed values: 1 to 32.

6.36.1 Configuring the Drive for Position Control

The first stage in setting up the drive for Position Control is to set up the Speed Loop. Set up the Maximum Speeds, P5.15 and P5.17, correctly for the application, i.e. calculate the maximum motor speeds from the maximum position speeds required, and any gearbox ratios etc. applicable. Then set up the Speed Loop PID gains, P14.00 to P14.02, and Ramp Rates, P6.00 to P6.03. It is very useful to have the drive in Speed Control (P5.01 = 1) to do this initial set up.

When Position Control is active, the Position Shaper will take care of the `slowing down' as the drive approaches the set position. Therefore, P6.02 and P6.03 (the Deceleration Rates) should be set to high values, so that they have no effect when Position Control is active. However, the Acceleration Rates, P6.00 and P6.01 have to be set up at this stage to achieve the required acceleration profile as the drive leaves one set position to go to another. P6.00 and P6.01 will need to be set to suitable values.

a) Set up the Position Control Range, Maximum / Minimum Position, Control Flags, Position Shaper Range etc.

Next, start to commission the Position Control parameters:

b) Set up the required Position Control Mode (P36.00).

c) Set up the position limit switches (Control Flags 86 and 87) if applicable. See Section 6.34.

d) Set up the Maximum Position (P36.02 and P36.03) to the required values.

e) Set up the Minimum Position (P36.04 and P36.05) to the required values.

f) Set up the Position Shaper Range (P36.10 and P36.11). This is the range (in encoder pulses) over which the shaper is active. Also, set up the required Position Shaper profile in Parameters P36.12 to P36.31, if the default profile is not suitable.

g) Set the reference source (P5.01) to `Position Control' (Option16).

NOTE: It is suggested that an encoder with 2500 lines per revolution be chosen, as this is taken as 4 x 2500 = 10,000 pulses per revolution for position control purposes, and it is easier to perform mathematics for position control calculations e.g. 1/2 a revolution = 5000 pulses etc. The encoder should also have a 'Z' pulse.

P36.00 - Position Control Mode

P36.00 is used to select the position control mode as follows:

1 = Finite Mode.

Only position values between minimum and maximum positions are allowed. When position feedback reaches minimum or maximum, clamping occurs, and Position Valid (Status Flag 64) is cleared.

2 = Bi-directional Turntable Mode.

Position values in the range 0 to maximum position are allowed. When position feedback exceeds maximum position, it is `wrapped' back, by subtracting the position range (maximum position). This may be used on a machine that has cyclic operation, i.e. a turntable. Positioning will occur in either direction. The drive will take the shortest route to the position reference.

3 = Uni-directional Turntable Mode.

As mode 2, except that positioning will only occur in the forward direction of rotation. i.e. if a position change of -10 degrees is requested, the drive will rotate by +350 degrees. Note that the position monitor tolerance (P36.54 / P36.55 - see 6.34.12) is applicable in this mode. Negative rotations of values less that the monitor tolerance are permitted, to prevent a small position overshoot resulting in a complete rotation.

For the drive to act upon the output of the Position Controller, the drive must be configured such that Position Control is the reference source to one of the following:

Main Speed Reference

Set the active speed reference control source, P5.01 to P5.04, to 16. The Position Controller is now the main speed reference of the drive.

Trim Reference

Set the Trim Reference source, P19.00/P19.01 to 13. The total speed reference is then a combination of the Position Controller output and another speed reference.

Speed Trim

Set the Speed Trim source P24.00 to 16. This allows the Position Controller output to be added directly to the speed demand, after the ramps have been imposed on the main speed reference.

Torque ReferenceError! Bookmark not defined.

Set the Torque Reference source, P15.04 = 16. This makes motor torque a function of the position error.

P36.02 - Maximum Position Low
P36.03 - Maximum Position High

These two parameters determine the maximum value of the position variable.

Allowed values: -9999 to +9999 (pulses).

The Maximum Position set by these parameters is determined as follows:

Maximum Position = (P36.03 x 10,000) + P36.02.

P36.04 - Minimum Position Low
P36.05 - Minimum Position High

These two parameters determine the minimum value of the position variable.

Allowed values: -9999 to +9999 (pulses).

The Minimum Position set by these parameters is determined as follows:

Minimum Position = (P36.05 x 10,000) + P36.04.

P36.06 - Zero Position Tolerance Low
P36.07 - Zero Position Tolerance High

These two parameters determine the 0% position of the position variable used by the Position Reference Sources (P37.00, P37.01 and P37.02). The 100 % position is determined to be either the Maximum Position (P36.02/P36.03) or the Minimum Position (P36.04/P36.05) depending on which is furthest from the 0% position.

Allowed values: -9999 to +9999 (pulses).

The 0% Position Tolerance set by these parameters is determined as follows:

0% Position Tolerance = (P36.07 x 10,000) + P36.06.

Many position control parameters are implemented as double parameters, split into a low parameter and a high parameter. These parameters can be concatenated to give the full position control variable. i.e.

(full parameter) = (high parameter) x 10000 + (low parameter).

Each can be in the range ±9999; hence the full parameter range can be ±99999999.

There are two ways of representing any value, i.e.

12345678 = (1234 x 10000) + 5678 = (1235 x 10000) – 4322.

The drive will accept either format for inputs, but always produces its output such that the high and low parts of a variable have the same sign.

The internal position control variables have an additional internal limit of $\pm 2^{30}$-1. Care should be taken that this limit is not exceeded, e.g. by setting a position control parameter, such that:

Parameter high = 9876.

Parameter low = 5432.

Pulses/bit = 32.

Then: (internal format) = (9876 x 10000 + 5432) x 32 >> 230-1.

If this occurs, the internal format is clamped. If position feedback exceeds this limit, Position Valid (Status Flag 64) is cleared.

The mode of operation of position control is defined by P36.00.

6.36.2 Position Shaper, or Speed Profiler

It is very often necessary to have the drive approach its set position according to some speed profile, where the speed is a function of the position error, so that as the drive approaches position, the speed is reduced. The Speed Profiler provides this facility. This is simply a look-up table, the index of which is Position Error, and the output of which is a speed demand.

The X co-ordinates of the speed profile represent percentage (in 0.01% steps) of P36.10 (Position Shaper Range Low) and P36.11 (Position Shaper Range High), unless P36.10 = P36.11 = 0, when (max - min) position is used for the position shaper range, i.e. of the total position range.

This system allows the position profiler to be active only over a predefined position range, which is not affected by the total position range.

The Y co-ordinates of the speed profile are speed demand (in 0.01% top speed) to the speed controller. The drive performs linear interpolation between adjacent X co-ordinates to obtain the required speed demand.

The drive will go at the speed associated with the maximum X co-ordinate, for position errors outside the range specified by the range of the profiled table.

The drive sorts the X values into numerical order. Hence, the customer may enter them in the drive in any order, except that the Xn and Yn values must correspond to each other.

The parameters are different for positive and negative position errors as follows:

X1, Y1 to X5, Y5 for positive position error.

-X1, -Y1 to -X5, -Y5 for negative position error.

The default values are set to give a square root approach function (the Yn values) which exists over 100 % (the Xn values) of 100,000 encoder pulses.

P36.10 - Position Shaper Range Low
P36.11 - Position Shaper Range High

These two parameters define the travel over which the position shaper is active.

Allowed values are:	P36.10: 0 pulses to 9999 pulses.
	P36.11: 0x10k pulses to 9999x10k pulses.

The position shaper range = P36.10 + P36.11.

P36.12 - Position Shaper -X1
P36.13 - Position Shaper -Y1

These parameters define the first pair of position and speed co-ordinates of the shaper speed profile for the reverse direction of movement.

Allowed values are:	P36.12 = -100.00 (minimum) to 0.00 (maximum) (% of position travel).
	P36.13 = -100.00 (minimum) to 0.00 (maximum) (% top speed).

Similarly for co-ordinate pairs 2 to 5 (P36.14 to P36.21) as next.

P36.14 - Position Shaper -X2
P36.15 - Position Shaper -Y2
P36.16 - Position Shaper -X3
P36.17 - Position Shaper -Y3
P36.18 - Position Shaper -X4
P36.19 - Position Shaper -Y4
P36.20 - Position Shaper -X5
P36.21 - Position Shaper -Y5

These parameters define the positions and speeds for co-ordinate pairs 2 to 5 for the reverse direction.

P36.22 - Position Shaper X1
P36.23 - Position Shaper Y1

These parameters define the first pair of position and speed co-ordinates of the shaper speed profile for the forward direction of movement.

Allowed values are: P36.22 = 100.00 (maximum) to 0.00 (minimum) (% of position travel).

P36.23 = 100.00 (maximum) to 0.00 (minimum) (% Top Speed).

Similarly for co-ordinate pairs 2 to 5 (P36.24 to P36.31) as next.

P36.24 - Position Shaper X2
P36.25 - Position Shaper Y2
P36.26 - Position Shaper X3
P36.27 - Position Shaper Y3
P36.28 - Position Shaper X4
P36.29 - Position Shaper Y4
P36.30 - Position Shaper X5
P36.31 - Position Shaper Y5

These parameters define the positions and speeds for co-ordinate pairs 2 to 5 for the forward direction.

6.36.3 Datumizing

Status Flag 64 (Position Valid) indicates to the drive that the internal position feedback and the physical position of the drive are in agreement. Status Flag 64 must be Hi before position control can be used as a reference source.

Status Flag 64 is set to 0 on power up, disabling position control as a reference source. This can be over-ridden by a rising edge on Control Flag 80 (Force Position Valid) but this should only be done if it is known that the machine has not moved since power-down.

To re-establish agreement between the position of the machinery and the internal position indication of the drive, the drive will perform an automatic datumizing routine, this is invoked by a rising edge on Control Flag 83 (Perform Datum Movement). A datumizing sequence (or mode) to suit most applications can be selected from the eleven datumizing sequences available in P36.34. Some of these sequences require limit switches to be installed and connected to Control Flags 86 (P36.08 - Position High Limit) and 87 (P36.09 - Position Low Limit).

When the datum movement sequencer is invoked, Status Flag 64 (Position Valid) is cleared Lo, and Status Flag 65 (Datum Movement in Progress) is set Hi. The Speed Reference issued to the rest of the drive then comes from the datum movement sequencer.

Upon reaching the correct datum position, the position feedback is set to the preset datum position, given by P36.32 - Datum Position Low, and P36.33 - Datum Position High. The Control Flag Datum Movement in Progress is cleared Lo, and Position Valid is set Hi - see Figure 6-36.

P36.32 - Datum Position Offset Low
P36.33 - Datum Position Offset High

These two parameters together contain an offset value to which the internal position feedback is set when the datumizing position is reached. This may be used, for example, after a "next Z" datum movement, to offset the 'Z' pulse position to leave the mechanics exactly where you want it, as opposed to where the 'Z' pulse is.

Allowed values: -9999 to +9999 (pulses).

The offset value set by these parameters is determined as follows:

Datum Position Offset = (P36.33 x 10,000) + P36.32

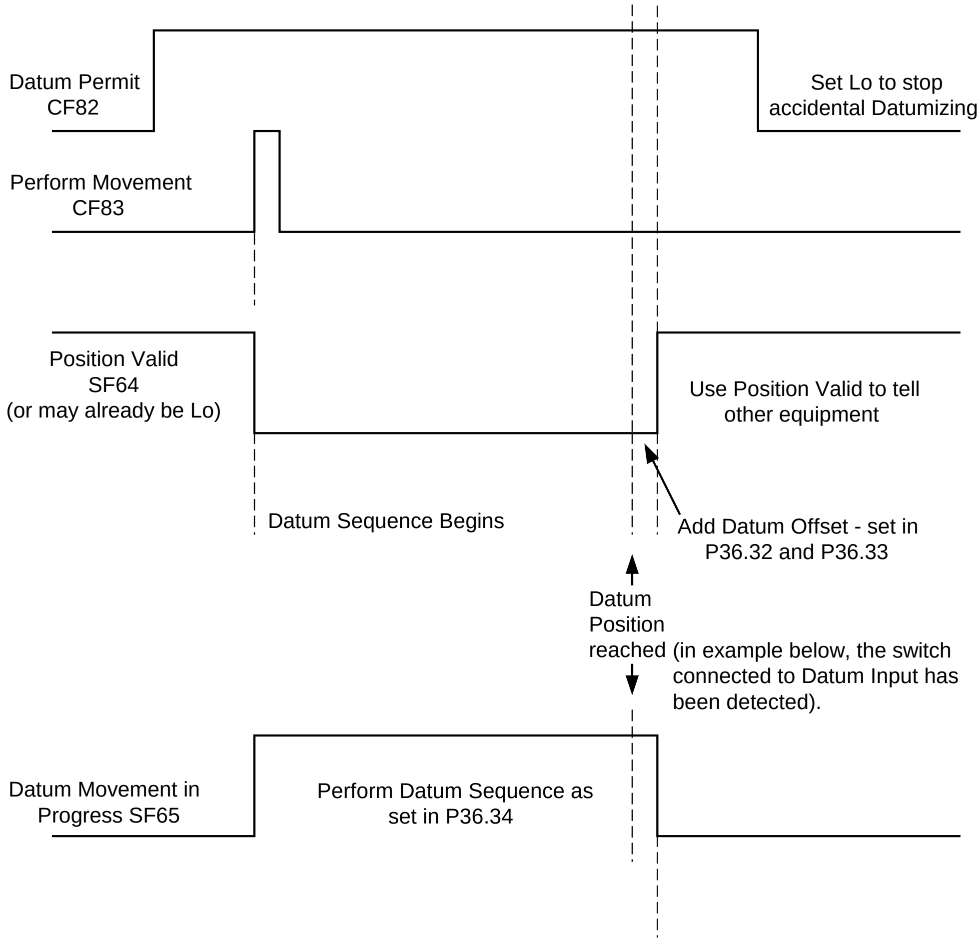


Figure 6-36. – Control Flags – Datum Movement

P36.35 - Datum Speed 1
P36.36 - Datum Speed 2
P36.37 - Datum Speed 3

These three parameters set the speed of datum movement during the datumization sequences defined by P36.34.

Allowed values: 0.00 % to 100.00 % (of top speed).

P36.34 - Datum Sequence

The parameter datumizing sequences are as follows. In all cases, the datum offsets set in P36.32 and P36.33 are executed at the end of the movements described below so that the next datum positions can be met.

1. The drive goes at Minus Datum Speed 1 (P36.35) until Low Limit (Control Flag 87) is high. It then goes at Plus Datum Speed 2 (P36.36) until Datum Approach (Control Flag 84) is high. It then goes at Plus Datum Speed 3 (P36.37) until a falling edge on Datum Input (Control Flag 85) is detected. Finally, it goes at Plus Datum Speed 3 until the encoder Z pulse is detected - see Figure 6-37 and Figure 6-38.

2. The drive goes at Plus Datum Speed 1 (P36.35) until High Limit (Control Flag 86) is high. It then goes at Minus Datum Speed 2 (P36.36) until Datum Approach (Control Flag 84) is high. It then goes at Minus Datum Speed 3 (P36.37) until a falling edge on Datum Input (Control Flag 85) is detected. Finally, it goes at Minus Datum Speed 3 until the encoder Z pulse is detected.

3. The drive goes at Minus Datum Speed 1 (P36.35) until Low Limit (Control Flag 87) is high. It then goes at Plus Datum Speed 2 (P36.36) until Datum Approach (Control Flag 84) is high. It then goes at Minus Datum Speed 3 (P36.37) until a falling edge on Datum Input (Control Flag 85) is detected. Finally, it goes at Minus Datum Speed 3 until the encoder Z-pulse is detected.

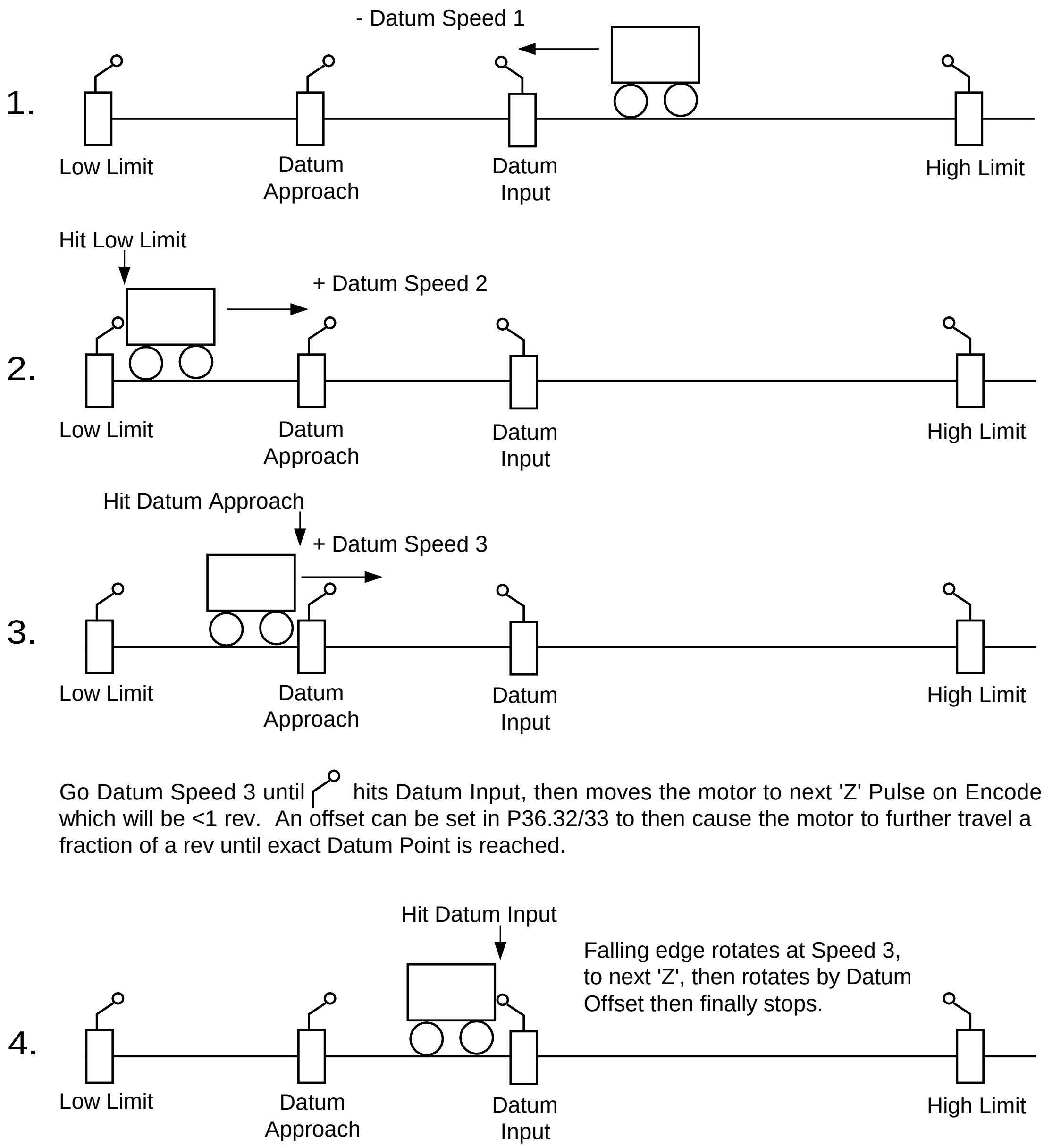


Figure 6-37. – Example of Datum Movement Sequence

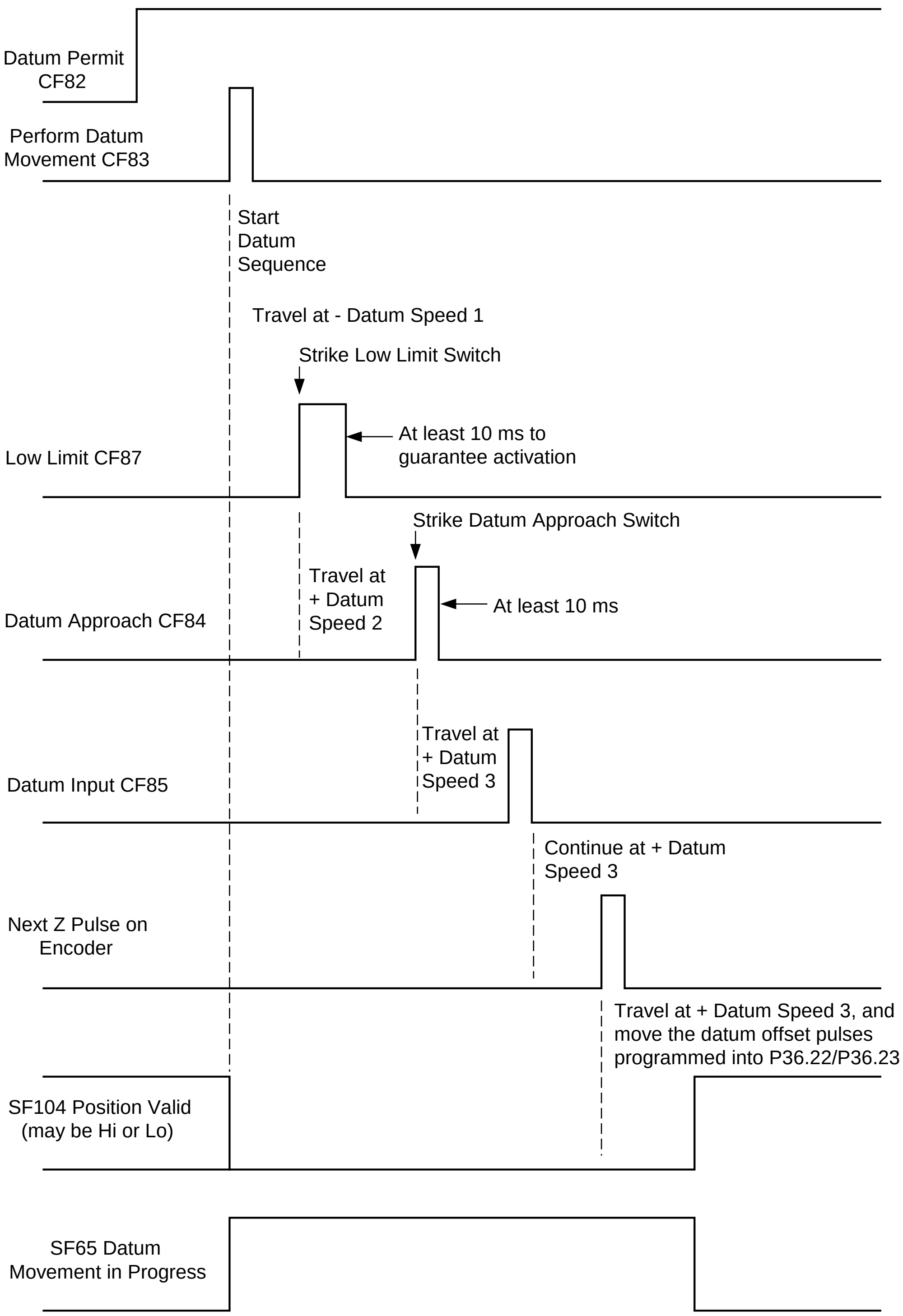


Figure 6-38. – Control Flag Logic Diagram for Datum Sequence

4. The drive goes at Plus Datum Speed 1 (P36.35) until High Limit (Control Flag 86) is high. It then goes at Minus Datum Speed 2 (P36.36) until Datum Approach (Control Flag 84) is high. It then goes at Plus Datum Speed 3 (P36.37) until a falling edge on Datum Input (Control Flag 85) is detected. Finally, it goes at Plus Datum Speed 3 until the encoder Z-pulse is detected.

5 - 8. These are identical to 1 to 4, except that datumizing occurs on the falling edge of Datum Input (Control Flag 85) - no encoder Z pulse is required. This will be less accurate than using a Z pulse.

9. The drive goes at Plus Datum Speed 3 (P36.37) until the encoder Z-pulse is detected. This is then the datum point. No limit switches are required.

10. The drive goes at Minus Datum Speed 3 (P36.37) until the encoder Z-pulse is detected. This is then the datum point. No limit switches are required.

11. Provided that Datum Permit (Control Flag 82) is set, then a rising edge on Datum Input (Control Flag 85) will force the current position to be regarded as the new datum position.

Notes on datumizing

All limit switches must be active for at least 10 ms, in order to guarantee that the software detects the switches.

The falling edge of the Datum Input (Control Flag 85) must occur at least 10 ms before the encoder Z pulse, to guarantee correct datumizing.

There is a maximum datumizing speed, such that the maximum number of encoder pulses received in 20 ms is limited to 30,000. If this speed is exceeded whilst datumizing, then the drive will trip on Datumize Fail (trip code 70).

The value of Position Feedback contained in P38.02 and P38.03 is stored at power-down, and recovered at power-up, to maintain internal storage of position feedback. This should only be used if it is possible to guarantee that the machine being controlled is not moved during power down.

6.36.4 Uni-directional Approach Bias

In some applications, it will be required to ensure that the drive approaches the set position from a fixed direction, whether the position is greater or less than the preceding position set point. This may be required to take out the effects of backlash in a system. The position control function can be configured to provide `uni-directional approach'.

Control Flag 90 (P36.46 - Enable Uni-directional Approach) enables the function. The drive will then go through the position set point + Approach Bias (set in P36.44/P36.45) before going to the position set point. This means that approach from one direction will result in an overshoot, before turning around to approach from the desired direction. This will ensure approach from the direction defined by P36.44/P36.45 (Approach bias) only.

P36.44 - Approach Bias Low
P36.45 - Approach Bias High

Allowed values: -9999 to 9999 (pulses).

The Approach Bias set by these parameters is determined as follows:

Approach Bias = (P36.45 x 10,000) + P36.44.

NOTE: The tolerance defined in the position monitor below is active in the determination of approach bias point. Therefore, if approach bias is positive, the drive will go through the position (approach bias - tolerance), before going to set point. Therefore, tolerance should not be set greater than approach bias, as it makes no sense to do so.

6.36.5 Position Incher

(Refer to Control Block Diagram Sheet 10)

A `Position Jog', or `Position Incher' feature is added immediately after the position reference arbitration (see Block Diagram). This is enabled by setting Control Flag 89 (P36.51 --'Enable Inching') high. Control Flags 95 (P36.52 - Inch Up) and 96 (P36.53 - Inch Down) will then increment / decrement the position reference by the values given in the appropriate parameters, (P36.47 / P36.48 - Inch Up Step, and P36.49 / P36.50 - Inch Down Step). The position reference before inching is the last value of position feedback when Status Flag 67 (At Position) was high.

P36.47 - Incher Step Up Low
P36.48 - Incher Step Up High

These two parameters determine the size of the Incher Step Up incremental step used by the position incher.

Allowed values: -9999 to +9999 (pulses).

The incremental step set by these parameters is determined as follows:

Incremental Step = (P36.48 x 10,000) + P36.47.

P36.49 - Incher Step Down Low
P36.50 - Incher Step Down High

These two parameters determine the size of the Incher Step Down decrement step used by the position incher.

Allowed values: -9999 to +9999 (pulses).

The decrement step set by these parameters is determined as follows:

Decrement Step = (P36.50 x 10,000) + P36.49.

6.36.6 Position Monitor

Four status flags are used to indicate information about position:

Status Flag 66 (Either Limit).

Status Flag 67 (At Position).

Status Flag 68 (Above Position).

Status Flag 69 (Below Position).

Status Flag 66 (Either Limit) is set if either the High Limit switch connected to CF86 or the Low Limit switch connected to CF87 is set.

Status Flag 67 (At Position) is set if the magnitude of Position Error is less than the Position Monitor Tolerance (set in P36.54 and P36.55), and the drive is at zero speed (Status Flag 11), and Position Valid (SF64) is set.

Status Flag 69 (Below Position) is set if the Position Error is greater than the tolerance band, and Position Valid is set.

Status Flag 68 (Above Position) is set if the Position Error is less than the -(tolerance band), and Position Valid is set.

P36.54 - Position Monitor Tolerance Low
P36.55 - Position Monitor Tolerance High

These two parameters determine the width of the tolerance band in which Status Flag 67 (At Position) is set or the overshoot tolerance in uni-directional turntable mode.

Allowed values: 0 to 9999 (pulses).

The Position Monitor Tolerance set by these parameters is determined as follows:

Position Monitor Tolerance = (P36.55 x 10,000) + P36.54.

6.36.7 Position Control Flags

P36.08 Control Flag 86 - Set High Limit
P36.09 Control Flag 87 - Set Low Limit
P36.38 Control Flag 80 - Force Position Valid
P36.39 Control Flag 81 - Force Position Invalid
P36.40 Control Flag 82 - Datum Move Permit
P36.41 Control Flag 83 - Perform Datum Movement
P36.42 Control Flag 84 - Datum Approach
P36.43 Control Flag 85 - Datum Input
P36.46 Control Flag 90 - Enable Uni-directional Approach
P36.51 Control Flag 89 - Enable Inching
P36.52 Control Flag 95 - Inching Up
P36.53 Control Flag 96 - Inching Down

See Section 6.33 for information on Control Flag programming.

6.37 MENU 37 - POSITION REFERENCE SETTINGS

(Refer to Control Block Diagram Sheet 10).

Menu 37 gives access to the parameters required to configure the fixed position menu function.

The fixed position menu allows up to 16 predefined positions to be selected using a 4-bit control word contained in Control Flags 91 to 94. The 16 pre-defined positions are set in parameter pairs P37.06 to P37.37. The 4-bit control word is decoded as shown in Table 6-17.

Fixed Position Ref Select 3 (Control Flag 94)	Fixed Position Ref Select 2 (Control Flag 93)	Fixed Position Ref Select 1 (Control Flag 92)	Fixed Position Ref Select 0 (Control Flag 91)	Position Selected
0	0	0	0	0
0	0	0	1	1
..	..	..	..	..
1	1	1	0	14
1	1	1	1	15

Table 6-17. – Position Control Word

NOTE: Use the Status Flag generator (Menu 31) to automatically generate a binary sequence with programmable times.

To enable Fixed Position Menu the Position Reference Source (P37.00 or P37.01) must be set to 1.

P37.06 - Fixed Position Reference #0 Low
P37.07 - Fixed Position Reference #0 High

These two parameters contain the value of the pre-set Fixed Position Reference #0.

Allowed values: -9999 to +9999 (pulses).

The Fixed Position Reference set by these parameters is determined as follows:

Fixed Position Reference #0 = (P37.07 x 10,000) + P37.06.

Similarly:

P37.08 to P37.37 - Fixed Position References #1 to #15 Low and High

These parameter pairs contain the high and low values of pre-set positions #1 to #15 (as P37.06 and P37.07).

Position Reference Teacher

In order to ease the programming of these fixed positions, a Position Teacher is incorporated. Using the position incher, for example, allows the required position to be approached. The value of position feedback can then be copied to the required element of the fixed position table, using the teacher.

P37.04 - Position to Learn

This parameter is set to the required target in the Fixed Position Table (0 to 15, as previously described).

Allowed values: 0 to 15.

A rising edge on Control Flag 101 (P37.05 - Learn Position Now) then copies the present value of position feedback into the selected target, provided that Status Flag 64 (Position Valid) is set.

Position Reference Sources

Two primary position reference sources and a Backup position control reference sources can be defined, as described next. The primary reference is selected using Control Flag 88 (P37.03).

P37.00 - Position Reference Source 1
P37.01 - Position Reference Source 2

These parameters are used to select the source of the position control reference. Position reference Source 1 is selected when Control Flag 88 is set to 0. Position reference 2 is selected when Control Flag 88 is set to 1.

Allowed values are:

1 = The output from the Fixed Position Menu	
2 = Analogue Reference 1	(Percent - see Note 1 below)
3 = Analogue Reference 2	(Percent - see Note 1 below)
4 = Fixed 0%	(Not used)
5 = Fixed 0%	(Not used)
6 = RS485 Double Word	(See Note 2 below)
7 = RS232 Double Word	(See Note 2 below)
8 = RS485 Ref 1	(0.01% - see Note 1 below)
9 = RS485 Ref 2	(0.01% - see Note 1 below)
10 = RS232 Ref 1	(0.01% - see Note 1 below)
11 = RS232 Ref 2	(0.01% - see Note 1 below)
12 = PID Controller	(0.01% - see Note 1 below)
13 = Motorised Potentiometer	(0.01% - see Note 1 below)
14 = Pointer 16	
15 = Double Pointer	(Pointer 16 = Low, Pointer 17 = High)

NOTES:

1 Position Feedback & Reference in percent are defined as follows: P36.06 - 0% Position Low and P36.07 - 0% Position High make up the position which is called 0% position. The 0% position, in conjunction with the furthest away from it, (either P36.02 / P36.03 Maximum Position, or P36.04 / P36.05 Minimum Position), define the 100% position range. It is this range that is used for the percentage positions defined above.
For example:
P36.06 (0% Position low) = 5000
P36.07 (0% Position High) = 7 [0% position is at 75,000]
P36.02 (Maximum Position Low) = 0
P36.03 (Maximum Position High) = 10 [Max Position = 100,000]
P36.04 (Minimum Position Low) = 0
P36.05 (Minimum Position High) = 0[Min Position = 0]
As Minimum position is further away from 0% than Maximum position (i.e. Min-0% is greater than Max-0%), then minimum position is at -100%. This means that maximum position is at +33.33%.

2 Serial Link Double Word references are in the data format defined in P36.06/P36.07 (Section 0), where Ref 1 = low part, and Ref 2 = high part.

P37.02 - Position Reference Backup

This source is active when the primary reference source (P37.00 or P37.01) is invalid, e.g. serial link not present.

Allowed values: 0 = No backup.
1 to 15 = As P37.00/P37.01.

P37.03 - Control Flag 88 - Position Reference 1/2 Selection
P37.05 - Control Flag 101 - Position Learn Now
P37.38 to P37.41 - Control Flags 91 to 94 - Position Reference Select 0 to 3

See Section 6.33 for information on Control Flag programming.

6.38 MENU 38 - POSITION CONTROL MONITOR

(Refer to Control Block Diagram Sheet 10).

A number of read only parameters are provided to allow the values of the position control variables to be viewed. These are as follows:

6.38.1 Position Monitoring Parameters

P38.00 - Position Reference Low
P38.01 - Position Reference High

These read-only parameters together contain the value of the selected position reference.

Range: -9999 to +9999 (pulses).

Position Reference = (P38.01 x 10k) + P38.00.

P38.02 - Position Feedback Low
P38.03 - Position Feedback High

These read-only parameters together contain the value of the position feedback.

Range: -9999 to +9999 (pulses).

Position Feedback = (P38.03 x 10k) + P38.02.

P38.04 - Position Error Low
P38.05 - Position Error High

These read-only parameters together contain the value of the position error.

Range: -9999 to +9999 (pulses).

Position Error = (P38.05 x 10k) + P38.04.

6.38.2 Position Reference

P38.06 - Position Reference

This parameter contains the position reference expressed as a percentage of the position range defined in parameters P36.02/P36.03 and P36.04/P36.05.

Range: -100.00% to +100.00% (of position range).

6.38.3 Position Feedback

P38.07 - Position Feedback

This parameter contains the position feedback expressed as a percentage of the position range defined in parameters P36.02/P36.03 and P36.04/P36.05.

Range: -100.00% to +100.00% (of position range).

6.38.4 Position Error

P38.08 - Position Error

This parameter contains the position error expressed as a percentage of the position range defined in parameters P36.02/P36.03 and P36.04/P36.05.

Range: -100.00% to +100.00% (of position range).

6.38.5 Position Status Flags

P38.09 - Position Status Flags

P38.09 contains a 16-bit word corresponding to the state of Position Status Flags SF64 to SF79, as shown in Figure 6-39.

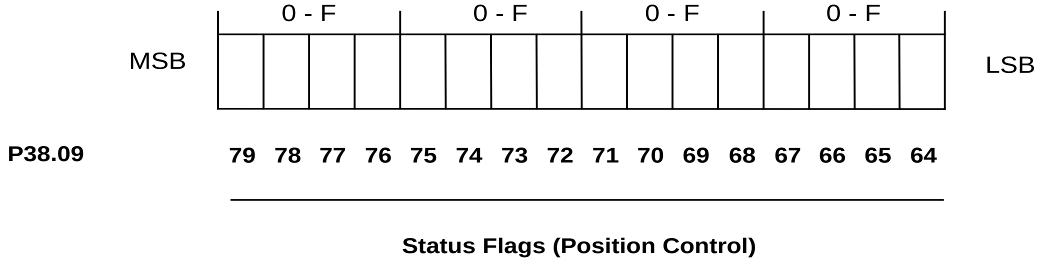


Figure 6-39. – Monitoring Status Flags (Position Control)

The word is displayed as a 4-digit hexadecimal number in the range:

0000h to FFFFh.

The status is also displayed in binary, i.e. typically:

0000 0000 0000 0000b.

6.38.6 Position Control Flags

P38.10 - Position Control Flags 0
P38.11 - Position Control Flags 1

Parameters P38.10 and P38.11 each contain a 16-bit word corresponding to the state of Control Flags CF80 to CF95 (Word 0) and CF96 to CF111 (Word 1), as shown in Figure 6-40.

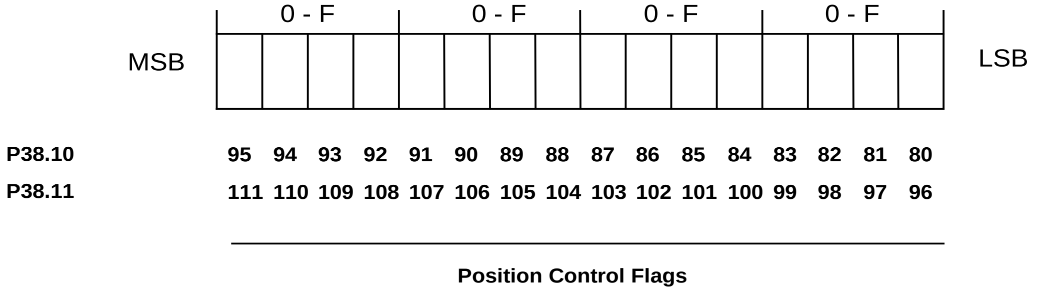


Figure 6-40. – Monitoring Position Control Flags

Each word is displayed as a 4-digit hexadecimal number in the range:

0000h to FFFFh.

The status is also displayed in binary, i.e. typically:

0000 0000 0000 0000b.

6.38.7 Position Control Output

P38.12 - Position Control Output

This read-only parameter monitors the position controller output as a percentage of top speed.

Range of values: -100% to +100% of Top Speed).

6.39 MENU 39 - USER CONFIGURABLE MENU (MENU 1) SETTINGS

Menu 39 is used to configure Menu 1, the user defined menu. Up to 31 parameters can be configured in Menu 1 and these are defined in parameters P39.00 to P39.30.

Example: To allocate P5.00 (speed reference) to Menu 1 parameter P1.00:

Set P39.00 = 5.00.

6.39.1 User Menu Configuration

Parameters P39.00 to P39.30 - User Menu Configuration

Allowed values: 0.00 to 99.99 (Any valid parameter number).

6.40 MENU 40 - SUMMING NODES SETTINGS

Menu 40 gives access to parameters required to configure four Summing Nodes A, B, C and D. Each summing node can add two parameters, selected by the user and each having its own scale, to produce Summing Node Outputs.

These Summing Node Outputs are available as parameters that can be used, for example, in Comparator Blocks and are also available for use as inputs to various reference sources as shown at the Control Block Diagram.

The parameters used for configuring Summing Nodes are shown in Table 6-18.

Summing Nodes	Input 1	Input 2	Scale 1	Scale 2	Output	Mode
Summing Node A	P40.00	P40.01	P40.02	P40.03	P40.04	P40.20
Summing Node B	P40.05	P40.06	P40.07	P40.08	P40.09	P40.21
Summing Node C	P40.10	P40.11	P40.12	P40.13	P40.14	P40.22
Summing Node D	P40.15	P40.16	P40.17	P40.18	P40.19	P40.23
Summing Node E	P40.24	P40.25	P40.26	P40.27	P40.28	P40.44
Summing Node F	P40.29	P40.30	P40.31	P40.32	P40.33	P40.45
Summing Node G	P40.34	P40.35	P40.36	P40.37	P40.38	P40.46
Summing Node H	P40.39	P40.40	P40.41	P40.42	P40.43	P40.47
Defaults	P9.01	P9.01	+100.00	+100.00	--	1

Table 6-18. – Summing Node Configuration

Consider Summing Node A:

The value in P40.00 is the parameter number for input 1. Similarly, P40.01 is the parameter number for input 2. Each of the parameters is then scaled, such that the value in P40.02 or P40.03 represents +100.00 %. The two results are then added, and the final result placed in P40.04. This is shown as follows:

$$P40.04 = \frac{[P40.00]*100.00}{P40.02} + \frac{[P40.01]*100.00}{P40.03}$$

The output, P40.04, is clamped to the range ±100.00 %.

6.40.1 Summing Nodes A to H

Parameters P40.00 to P40.04 - Summing Node A
Parameters P40.05 to P40.09 - Summing Node B
Parameters P40.10 to P40.14 - Summing Node C
Parameters P40.15 to P40.19 - Summing Node D
Parameters P40.24 to P40.28 - Summing Node E
Parameters P40.29 to P40.33 - Summing Node F
Parameters P40.34 to P40.38 - Summing Node G
Parameters P40.39 to P40.43 - Summing Node H

For each of the eight summing nodes the equivalent parameters are identical.

Referring to Table 6-18:

Allowed values for the Input 1 and Input 2 parameters:

1.00 to 99.99 (any parameter number).

Allowed values for the Scale 1 and Scale 2 parameters:

-300.00 to +300.00.

Range of values for the Output parameters:

-100.00 to +100.00.

6.40.2 Summing Nodes A to H Modes

Parameters P40.20 - Sum Node A Mode
Parameters P40.21 - Sum Node B Mode
Parameters P40.22 - Sum Node C Mode
Parameters P40.23 - Sum Node D Mode
Parameters P40.44 - Sum Node E Mode
Parameters P40.45 - Sum Node F Mode
Parameters P40.46 - Sum Node G Mode
Parameters P40.47 - Sum Node H Mode

Each of the summing nodes of Menu 40, Parameters P40.20 to P40.23 and P40.44 to P40.47, can now perform in one of four modes: Addition, Subtraction, Multiplication and Division.

Allowed values: 1 to 4.

The summing node modes are defined as follows:

Mode 1: Addition:

$$Sum.node.output = \left(\left(\frac{Sum.node.I\ /\ P.1}{Sum.node.scale.1} \right) + \left(\frac{Sum.node.I\ /\ P.2}{Sum.node.scale.2} \right) \right) \times 100.00\%$$

Mode 2: Subtraction

$$Sum.node.output = \left(\left(\frac{Sum.node.I\ /\ P.1}{Sum.node.scale.1} \right) - \left(\frac{Sum.node.I\ /\ P.2}{Sum.node.scale.2} \right) \right) \times 100.00\%$$

Mode 3: Multiplication

$$Sum.node.output = \left(\left(\frac{Sum.node.I\ /\ P.1}{Sum.node.scale.1} \right) \times \left(\frac{Sum.node.I\ /\ P.2}{Sum.node.scale.2} \right) \right) \times 100.00\%$$

Mode 4: Division

$$Sum.node.output = \frac{\left(\frac{Sum.node.I\ /\ P.1}{Sum.node.scale.1} \right)}{\left(\frac{Sum.node.I\ /\ P.2}{Sum.node.scale.2} \right)} \times 100.00\%$$

6.40.3 Square Roots

Two square root functions are provided to calculate the square root of the parameter pointed to by the inputs.

P40.48 - Square Root A Input

Allowed values: 1.00 to 99.99 (any parameter number).

P40.49 – Square Root of Input A

This output is scaled such that an input value of 100.00% (represented internally as 10,000) will produce a value of 100.00%. Thus an input value of 10.00% will generate an output value of 31.62%. This is equivalent to taking the square root of 0.1 to produce a value of 0.3162.

If the input scaling is not 0.01%, taking 10,000 as being equivalent to unity will perform the square root. For example, the square root of 100.0 will be 316.2

If the input is negative the result will be the negated value of the square root of the absolute value of eh input. For example, an output value of -31.62% will result from an input value of -10.00%.

P40.50 - Square Root B Input

Allowed values: 1.00 to 99.99 (any parameter number).

P40.51 - Square Root of Input B

The value in this parameter is calculated by the same method as for parameter P40.49.

6.40.4 Comparator Function Blocks U, V, W and X

Four comparator blocks are provided to allow the comparison of parameters against other parameters or against fixed values.

Comparator	Input 1	Input 2	Fixed Ref	Hysteresis	Mode	Output	Status Flag
U	P40.52	P40.53	P40.54	P40.55	P40.56	P40.57	SF132
V	P40.58	P40.59	P40.60	P40.61	P40.62	P40.63	SF133
W	P40.64	P40.65	P40.66	P40.67	P40.68	P40.69	SF134
X	P40.70	P40.71	P40.72	P40.73	P40.74	P40.75	SF135

Table 6-19. –Comparator Function Block Configuration

P40.52 - Comparator U Input 1
P40.58 - Comparator V Input 1
P40.64 - Comparator W Input 1
P40.70 - Comparator X Input 1

Allowed values: 1.00 to 99.99 (any parameter number).

P40.53 - Comparator U Input 2
P40.59 - Comparator V Input 2
P40.65 - Comparator W Input 2
P40.71 - Comparator X Input 2

The default of this parameter is to point to the Fixed Reference parameter for this comparator,

Allowed values: 1.00 to 99.99 (any parameter number).

P40.54 - Comparator U Fixed Reference
P40.60 - Comparator V Fixed Reference
P40.66 - Comparator W Fixed Reference
P40.72 - Comparator X Fixed Reference

This parameter holds a fixed value that can be used as a comparator threshold. The scaling and units of this parameter mimic the parameter pointed to by input 1.

Allowed values: same as the input parameter pointer set by Input 1.

P40.55 - Comparator U Hysteresis
P40.61 - Comparator V Hysteresis
P40.67 - Comparator W Hysteresis
P40.73 - Comparator X Hysteresis

This parameter holds a fixed value that is used as the comparator hysteresis. The scaling and units of this parameter mimic the parameter pointed to by input 1.

Allowed values: same as the input parameter pointer set by Input 1.

P40.56 - Comparator U Mode
P40.62 - Comparator V Mode
P40.68 - Comparator W Mode
P40.74 - Comparator X Mode

The output from the comparator and the comparator state, as a status flag, are determined by the setting of this parameter.

Allowed values: 1 = ‘Input 1 = Input 2’
2 = ‘Input 1 ≠ Input 2’
3 = ‘Input 1 > Input 2’
4 = ‘Input 1 ≤ Input 2’
5 = ‘Input 1 < Input 2’
6 = ‘Input 1 ≥ Input 2’

P40.56 - Comparator U Output
P40.62 - Comparator V Output
P40.68 - Comparator W Output
P40.74 - Comparator X Output

The output is selected from either of the two input values according to the following table.

Comparison is performed using the internal binary representation of the inputs being compared. The user is responsible for ensuring that the scaling of the two inputs are the same.

Comparator Mode	Output Parameter	Status Flag
Input 1 = Input 2	Input 1 when TRUE Else Input 2 i.e. equivalent to Input 2	‘On’ when TRUE Else ‘Off’’
Input 1 ≠ Input 2	Input 1 when TRUE Else Input 2 i.e. equivalent to Input 1	‘On’ when TRUE Else ‘Off’
Input 1 > Input 2	Input 1 when TRUE Else Input 2	‘On’ when TRUE Else ‘Off’
Input 1 ≤ Input 2	Input 1 when TRUE Else Input 2	‘On’ when TRUE Else ‘Off’
Input 1 < Input 2	Input 1 when TRUE Else Input 2	‘On’ when TRUE Else ‘Off’
Input 1 ≥ Input 2	Input 1 when TRUE Else Input 2	‘On’ when TRUE Else ‘Off’

Table 6-20. – Comparator Output

6.40.5 Analogue Switches A, B, C and D

Four analogue switches are provided. Each switch is identical in operation.

Analogue Switch	Input 1	Input 2	Fixed Ref. 1	Fixed Ref 2	Switch State	Output
A	P40.76	P40.77	P40.78	P40.79	P40.80: CF140	P40.81
B	P40.82	P40.83	P40.84	P40.85	P40.86: CF141	P40.87
C	P40.88	P40.89	P40.90	P40.91	P40.92: CF142	P40.93
D	P40.94	P40.95	P40.96	P40.97	P40.98: CF143	P40.99

Table 6-21. – Analogue Switches Configuration

P40.76 - Switch A Input 1
P40.82 - Switch B Input 1
P40.88 - Switch C Input 1
P40.94 - Switch D Input 1

Allowed values: 1.00 to 99.99 (any parameter number).

The default value of this parameter is to point to the Fixed Reference 1.

P40.77 - Switch A Input 2
P40.83 - Switch B Input 2
P40.89 - Switch C Input 2
P40.95 - Switch D Input 2

Allowed values: 1.00 to 99.99 (any parameter number).

The default value of this parameter is to point to the Fixed Reference 2.

P40.78 - Fixed Reference A1
P40.84 - Fixed Reference B1
P40.90 - Fixed Reference C1
P40.96 - Fixed Reference D1

This parameter holds a fixed value that can be used to provide a fixed input. The scaling and units of this parameter do not depend on any other parameter.

P40.79 - Fixed Reference A2
P40.85 - Fixed Reference B2
P40.91 - Fixed Reference C2
P40.97 - Fixed Reference D2

This parameter holds a fixed value that can be used to provide a fixed input. The scaling and units of this parameter depends on the parameter pointed to by the Input 1 parameter.

If Input 1 points to the Fixed Reference 1 then the scaling and units of this parameter are as for the Fixed Reference 1.

Thus, if it is required to switch between two fixed values and theses values are the Fixed References 1 and 2 parameters the scaling and units are the same. If it is required to have one variable input and one fixed input ensure that Input 1 pointer is set to select the variable value. In this way the fixed input assumes the same scale and units as the variable value.

P40.80 - Control Flag 140 - Switch A State
P40.86 - Control Flag 141 - Switch B State
P40.92 - Control Flag 142 - Switch C State
P40.98 - Control Flag 143 - Switch D State

When the value of the Control Flag is zero, Input 1 is selected otherwise Input 2 is selected.

P40.81 - Switch A Output
P40.87 - Switch B Output
P40.93 - Switch C Output
P40.99 - Switch D Output

This parameter contains the values of the selected input.

The user is responsible for ensuring that the scaling of the two inputs are the same.

6.41 MENU 41 - PROGRAMMABLE STATUS WORD SETTINGS

Menu 41 gives access to parameters required to configure the Programmable Status Words.

When a serial link (or Fieldbus or Ethernet Communications) is used, it is sometimes desirable to select which of the drive's various Control and Status Flags are monitored via the serial links. The Control and Status Flags are present in Menu 11, but these might not be in a suitable form for use.

Selected flags may therefore be copied into two 16-bit Programmable Status Words. Each bit position within each Status Word has a parameter associated with it. The sources of these bits are as the drive Control Flag Sources, so that any Digital Input, Serial Link Input, Status Flag etc. can be selected as a source for the Programmable Status Bit.

6.41.1 Status Word Inputs

P41.00 to P41.15 - Inputs to Status Word 0
P41.16 to P41.31 - Inputs to Status Word 1

These are formatted as follows:

P41.00: Programmable Status Word 0.0
P41.01: Programmable Status Word 0.1

P41.15: Programmable Status Word 0.15

P41.16: Programmable Status Word 1.0
P41.17: Programmable Status Word 1.1

P41.31: Programmable Status Word 1.15

Allowed values: As given in Table 6-15.

6.41.2 Status Word Outputs

P41.32 - Status Word 0 Output
P41.33 - Status Word 1 Output

Each parameter contains a 16-bit Programmable Status Word.

This is displayed in hexadecimal format, with allowed values:

0000h to FFFFh.

The output is also displayed in binary, with allowed values:

0000 0000 0000 0000b.

To

1111 1111 1111 1111b.

6.42 MENU 42 - REFERENCE POINTERS - SOURCE SETTINGS

The pointers are set up by the parameters in Menu 42.

Reference Pointers are included in all of the drive reference tables. These Pointers allow a reference source to come from any of the drive's internal parameters. Control Block Diagram 11 indicates which pointers are available for the various reference sources.

Each pointer can generate a reference value, scaled by a Pointer Scale value:

$$Pointer\ Value = \frac{Value\ of\ Parameter\ Pointed\ at}{Pointer\ Scale} * 100.00$$

This enables features such as a Fieldbus to be used to reference the drive as required.

The pointers defined are shown in Table 6-22.

6.42.1 Pointers Source

P42.00 to P42.38 - Pointers 1 to 20 Source

These parameters contain the user-selected source parameters pointed at by the reference pointers.

Allowed values: 1.00 to 99.99 (any parameter number).

P42.40 to P42.52 - Pointers 21 to 27 Source

These parameters contain the user-selected source parameters, for SFE Mode, pointed at by the reference pointers.

Allowed values: 1.00 to 99.99 (any parameter number).

P42.54 - Pointer 28 Source

This parameter contains the user-selected source parameter pointed at by the reference pointer for drive Dynamic Braking.

Allowed values: 1.00 to 99.99.

P42.56 to P42.74 - Pointers 29 to 38 Source

These parameters contain further user-selected source parameters, for SFE Mode, pointed at by the reference pointers.

Allowed values: 1.00 to 99.99 (any parameter number).

6.42.2 Pointers Scale

P42.01 to P42.39 - Pointers 1 to 20 Scale

These parameters contain the user-defined scales for the relevant pointers.

Allowed values: -300.00 to +300.00.

P42.41 to P42.53 - Pointers 21 to 27 Scale

These parameters contain the user-defined scales, for the SFE Mode, for the relevant pointers.

Allowed values: -300.00 to +300.00.

P42.55 - Pointer 28 Scale

This parameter contains the user-defined scale for Pointer 28 used for drive Dynamic Braking.

Allowed values: -30 000 to +30 000.

P42.57 to P42.75 - Pointers 29 to 38 Scale

These parameters contain further user-defined scales, for the SFE Mode, for the relevant pointers.

Allowed values: -300.00 to +300.00.

Table 6-22. – Reference Pointers

Pointer Number	Used For	Option Number	Pointer Setup Parameters
1	Speed Reference	Option 21 for P5.01 to P5.05	P42.00 - Source P42.01 - Scale
2	Speed Reference	Option 21 for P5.01 to P5.05	P42.02 - Source P42.03 - Scale
3	Reference Sequencer	Option 20 for P17.03 to P17.07	P42.04 - Source P42.05 - Scale
4	PID Setpoint	Option 14 for P16.00	P42.06 - Source P42.07 - Scale
5	PID Feedback	Option 12 for P16.01	P42.08 - Source P42.09 - Scale
6	Trim Reference	Option 16 for P19.00 & P19.01	P42.10 - Source P42.11 - Scale
7	Speed Trim	Option 21 for P24.00	P42.12 - Source P42.13 - Scale
8	Torque Reference	Option 21 for P15.04	P42.14 - Source P42.15 - Scale
9	Torque Limits	Option 17 for P8.08 & P8.09	P42.16 - Source P42.17 - Scale
10	Torque Limits	Option 18 for P8.08 & P8.09	P42.18 - Source P42.19 - Scale
11	Temperature Compensation	Option 13 for P12.08	P42.20 - Source P42.21 - Scale
12	Flux Limit	Option 17 for P12.24	P42.22 - Source P42.23 - Scale
13	Current Limit	Option 17 for P3.06	P42.24 - Source P42.25 - Scale
14	Scalar Current Reference	Option 17 for P3.18 & P3.19	P42.26 - Source P42.27 - Scale
15	Scalar Current Reference	Option 18 for P3.18 & P3.19	P42.28 - Source P42.29 - Scale
16	Position Reference	Options 14 & 15 for P37.00 to P37.02	P42.30 - Source P42.31 - Scale
17	Position Reference	Option 15 for P37.00 to P37.02	P42.32 - Source P42.33 - Scale
18	Tacho Feedback	Option 10 for P13.14	P42.34 - Source P42.35 - Scale
19	Variable Volts Boost	Option 11 for P3.25	P42.36 - Source P42.37 - Scale
20	Reference Shaper	Pointer 20 is the only input source	P42.38 - Source P42.39 - Scale
21	SFE Vdc Reference	Option 19 for P53.00	P42.40 - Source P42.41 - Scale
22	SFE Active Current Reference	Option 17 for P53.04	P42.42 - Source P42.43 - Scale

Table 6-22. – Reference Pointers

Pointer Number	Used For	Option Number	Pointer Setup Parameters
23	SFE Active Current Negative Limit	Option 17 for P53.08	P42.44 - Source P42.45 - Scale
24	SFE Active Current Positive Limit	Option 17 for P53.06	P42.46 - Source P42.47 - Scale
25	SFE Reactive Current Reference	Option 17 for P53.10	P42.48 - Source P42.49 - Scale
26	SFE Reactive Current Positive Limit	Option 17 for P53.12	P42.50 - Source P42.51 - Scale
27	SFE Reactive Current Negative Limit	Option 17 for P53.14	P42.52 - Source P42.53 - Scale
28	Dynamic Braking Reference	Option 21 for P23.14	P42.54 - Source P42.55 - Scale
29	PPID Set Point	Option 19 for P54.20	P42.56 - Source P42.57- Scale
30	PPID Feedback	Option 2 for P54.21	P42.58 - Source P42.59- Scale
31	Feedforward	Option 19 for P54.31	P42.60 - Source P42.61- Scale
32	Positive Limit	Option 19 for P54.33	P42.62 - Source P42.63- Scale
33	Negative Limit	Option 19 for P54.34	P42.64 - Source P42.65- Scale
34	QPID Set Point	Option 19 for P54.40	P42.66 - Source P42.67- Scale
35	QPID Feedback	Option 2 for P54.41	P42.68 - Source P42.69- Scale
36	Feedforward	Option 19 for P54.51	P42.70 - Source P42.71- Scale
37	Positive Limit	Option 19 for P54.53	P42.72 - Source P42.73- Scale
38	Negative Limit	Option 19 for P54.54	P42.74 - Source P42.75- Scale

6.43 MENU 43 - LOAD FAULT DETECTION WINDOW SETTINGS

Menu 43 contains parameters required to configure the Load Fault Detection facility.

This facility detects a fault when the load (defined either as current or torque) falls outside specified limits. To prevent spurious load fault detection during momentary overloads, the motor is allowed to operate outside the limits for a specified time.

The envelope of operation is defined by specifying maximum and minimum loads at three speeds in the forward direction and three in the reverse direction. This envelope is illustrated in Figure 6-41.

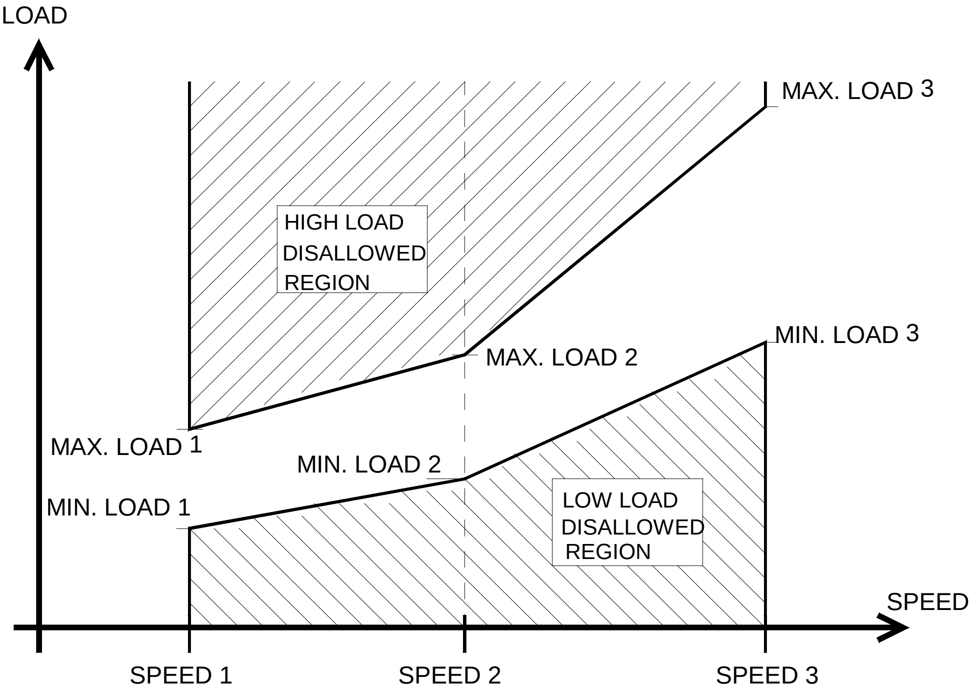


Figure 6-41. – Load Fault Limits

P43.00 - Load Fault Action

Defines the action to be taken by a drive when a load fault is detected.

Allowed values: 0 = No action, although Status Flags SF60 (High) or SF61 (Low) are active.
1 = Warning (No. 128 Load Fault - High, No. 129 Load Fault - Low).
2 = Trip (No. 64 Load Fault - High, No. 65 Load Fault - Low).

P43.01 - Load Fault Input

Selects whether Drive Current (monitored in P9.06) or Torque Demand (P9.04) are to be used as the load input.

Allowed Values: 1 = Current.
2 = Torque.

P43.02 - Load Fault Time

Defines the period of time, in seconds, during which the drive may operate outside the load fault envelope before action is taken.

Allowed values: 1 to 100 seconds.

P43.03 - Load Fault Forward Speed 1
P43.06 - Load Fault Forward Speed 2
P43.09 - Load Fault Forward Speed 3

Defines the three forward speeds, as a % of top speed, for specified maximum and minimum loads.

Allowed values: 1.00% to 100.00%.

P43.04 - Load Fault Forward Maximum Load 1
P43.07 - Load Fault Forward Maximum Load 2
P43.10 - Load Fault Forward Maximum Load 3

Defines values of forward maximum load for the three specified forward speeds.

Allowed values: 1.00% to 300.00%.

P43.05 - Load Fault Forward Minimum Load 1
P43.08 - Load Fault Forward Minimum Load 2
P43.11 - Load Fault Forward Minimum Load 3

Defines values of forward minimum load for the three specified forward speeds.

Allowed values: 1.00% to 300.00%.

P43.12 - Load Fault Reverse Speed 1
P43.15 - Load Fault Reverse Speed 2
P43.18 - Load Fault Reverse Speed 3

Defines the three reverse speeds, as a % of top speed, for specified maximum and minimum loads.

Allowed values: 1.00% to 100.00%.

P43.13 - Load Fault Reverse Maximum Load 1
P43.16 - Load Fault Reverse Maximum Load 2
P43.19 - Load Fault Reverse Maximum Load 3

Defines values of reverse maximum load for the three specified reverse speeds.

Allowed values: 1.00% to 300.00%.

P43.14 - Load Fault Reverse Minimum Load 1
P43.17 - Load Fault Reverse Minimum Load 2
P43.20 - Load Fault Reverse Minimum Load 3

Defines values of reverse minimum load for the three specified reverse speeds.

Allowed values: 1.00% to 300.00%.

6.44 MENU 44 - REFERENCE SHAPER SETTINGS

(Refer to Control Block Diagram Sheet 12).

Menu 44 gives access to the parameters required to configure the Reference Shaper. The Reference Shaper allows a programmable non-linear gain to be imposed on any of the drive's signals. The output from this function can then be used (via the Pointer mechanism) to provide any of the drive's references.

The Reference Shaper derives its input via Pointer 20.

The shape of the function is defined by entering ten X-Y points, typically as shown in Figure 6-42. Linear interpolation is then used to calculate the output for any given input. If the input exceeds the region for which the shape is defined, the output is clamped at the maximum or minimum defined value.

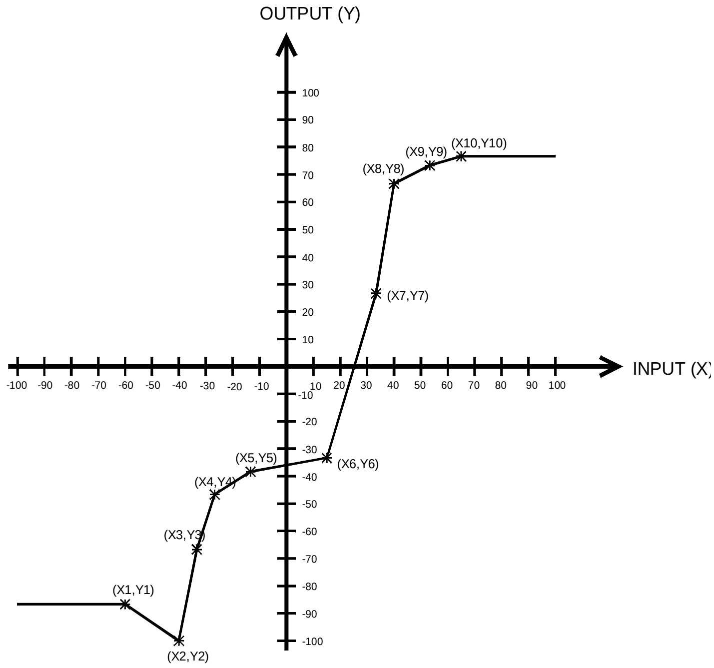


Figure 6-42. – Typical Gain Characteristic

NOTE: If X1 to X10 are not in ascending order, the drive will first sort them. All X values MUST be different from each other, if any two are the same, the Reference Shaper will give an unpredictable output.

The parameters associated with the Reference Shaper gain characteristic are:

For X co-ordinates		**For Y co-ordinates**	
P44.00	X1	P44.01	Y1
P44.02	X2	P44.03	Y2
P44.04	X3	P44.05	Y3
P44.06	X4	P44.07	Y4
P44.08	X5	P44.09	Y5
P44.10	X6	P44.11	Y6
P44.12	X7	P44.13	Y7
P44.14	X8	P44.15	Y8
P44.16	X9	P44.17	Y9
P44.18	X10	P44.19	Y10

P44.00 to P44.18 - Reference Shaper X1 to X10
P44.01 to P44.19 - Reference Shaper Y1 to Y10

These parameters set the co-ordinates of the required gain characteristic.

Allowed values: -100.00% to +100.00%.

Reference Shaper Input

The shaper input uses the Pointer mechanism described in Section 6.42. The input source is set by Pointer 20 (P42.38), which is scaled by P42.39.

P44.20 - Reference Shaper Output

This read-only parameter is the output of the Reference Shaper. It is used to provide the reference for other features via the Pointer mechanism.

Allowed range: -100.00% to +100.00%.

6.45 MENU 45 - TEMPERATURE

Menu 45 is used to individually show all the temperatures in a drive. Menu 11 shows the temperatures in a 'compressed' form i.e. only the hottest one for each bridge, not all three phases.

In addition to the 'standard' level of over and under temperature protection of the output bridge switching devices provided in Menu 45 an extra level of over temperature protection has been implemented. The standard over temperature protection is based on how hot the output bridge heat sinks are. If they exceed a pre-defined temperature, the drive trips on over temperature.

The extra level of over temperature protection, referred to as 'Advanced Temperature Protection' is based upon a detailed thermal model of a drive's particular configuration of output bridge heat sink and switching devices. The Advanced Temperature Protection predicts how hot the actual silicon switching devices become for the load current being delivered through the devices. If the silicon reaches the maximum allowed silicon temperature, the drive trips on over temperature.

The Advanced Temperature Protection acts in addition to the standard over temperature protection. However, for the advanced over temperature protection to work, the characteristics of the particular drive's output bridge heat sink and switching devices must be present in the product ID record held in EEPROM - see Menu 90.

NOTE: In certain cases, (e.g. such as when upgrading earlier drive software versions, or after replacing drive electronics), the data within the Product ID record may be incomplete. In these cases Advanced Temperature Protection will be disabled.

P45.00, P45.01, P45.02 - Output U1, V1, W1 IGBT Temperatures
P45.07, P45.08, P45.09 - Output U2, V2, W2 IGBT Temperatures
P45.10, P45.11, P45.12 - Output U3, V3, W3 IGBT Temperatures
P45.13, P45.14, P45.15 - Output U4, V4, W4 IGBT Temperatures
P45.16, P45.17, P45.18 - Output U5, V5, W5 IGBT Temperatures
P45.19, P45.20, P45.21 - Output U6, V6, W6 IGBT Temperatures

Allowed range: -40˚C to 150˚C.

P45.03 and P45.04 - Rectifier 1 and Rectifier 2 Temperatures

Allowed range: -40˚C to 150˚C.

P45.05 and P45.06 - DB1 and DB2 Temperatures

Allowed range: -40˚C to 150˚C.

P45.22 - Temperature Warn/Trip Type

There could be many causes of an Over-temperature trip which results in the single Over-temperature trip code 6 (see Table 9-3). Examination of P45.22 and the following parameter will show the type of trip, the device causing the trip and the temperature at the trip. This information is latched until the trip cause is removed and a trip reset has been performed.

Because the separate under temperature trip (code 26 - see Table 9-3) can also result from more than one cause, the under temperature trip is also latched into P45.22 to P45.24. The first occurrence of either of the over or under temperature trip is latched.

Parameters P45.22 to P45.24 are also used to display the cause of an over or under temperature warning. In the case where there is more than one warning cause, the last detected warning is displayed. The details of the warning are not latched and P45.24 will show the actual warning temperature. As soon as the warning condition clears, the parameter display reverts to the default. Latched trip details over-ride any warning information.

Allowed values for four temperature states are:

0 = None	: No temperature trips or warnings active
1 = Over Temperature	: A heat sink over temperature situation exists
2 = Under Temperature	: A heat sink under temperature situation exists
3 = Rate of Temperature Rise	: A heat sink is rising too fast - check the fans
4 = Junction Temperature	: A silicon device over temperature situation exists

6.45.1 P45.23 - Temperature Warn/Trip Cause

Values for the possible cause of temperature trip are:

0 = None	: No temperature trips or warnings active
1 = Rect 1	: Input Rectifier Bridge Number 1
2 = Rect 2	: Input Rectifier Bridge Number 2
3 = O/P U1	: U Phase Output Bridge Number 1
4 = O/P V1	: V Phase Output Bridge Number 1
5 = O/P W1	: W Phase Output Bridge Number 1
6 = DB 1	: Dynamic Brake Number 1
7 = O/P U2	: U Phase Output Bridge Number 2 (DELTAs only)
8 = O/P V2	: V Phase Output Bridge Number 2 (DELTAs only)
9 = O/P W2	: W Phase Output Bridge Number 2 (DELTAs only)
10 = O/P U3	: U Phase Output Bridge Number 3 (DELTAs only)
11 = O/P V3	: V Phase Output Bridge Number 3 (DELTAs only)
12 = O/P W3	: W Phase Output Bridge Number 3 (DELTAs only)
13 = DB 2	: Dynamic Brake Number 2
14 = O/P U4	: U Phase Output Bridge Number 4 (DELTAs only)
15 = O/P V4	: V Phase Output Bridge Number 4 (DELTAs only)
16 = O/P W4	: W Phase Output Bridge Number 4 (DELTAs only)
17 = O/P U5	: U Phase Output Bridge Number 5 (DELTAs only)
18 = O/P V5	: V Phase Output Bridge Number 5 (DELTAs only)
19 = O/P W5	: W Phase Output Bridge Number 5 (DELTAs only)
20 = O/P U6	: U Phase Output Bridge Number 6 (DELTAs only)
21 = O/P V6	: V Phase Output Bridge Number 6 (DELTAs only)
22 = O/P W6	: W Phase Output Bridge Number 6 (DELTAs only)
23 = ELECTRONICS	: Drive Electronics

P45.24 - Temperature at Warn/Trip

P45.24 displays the temperature of the warning or the temperature when the trip occurred. It displays 'Uncollated' if no warning or trip situation exists or if the trip is due to incomplete Product ID information.

Allowed range: -40˚C to 150˚C

P45.25-P45.27

P45.25 and P45.26 are the temperatures of the hottest IGBT, and the hottest free wheel diode respectively. The temperature is displayed, as a percentage of the maximum permissible in percent degree C. P45.27 is simply the greater of P45.25 and P45.26; it is displayed for convenience so that it is easy identify which is the limiting device.

In general the free wheel diode will be hotter when the transistor bridge is in regeneration (power flow is into the DC link) and the IGBT will be hotter when the transistor bridge is in the motoring condition (power flow is out of the DC Link).

6.46 MENU 46 - AC LOSS RIDETHROUGH (VECTOR CONTROL ONLY

Early versions of MV3000e Firmware[3] supported AC Loss Ridethrough in VVVF mode. This no longer applies; this feature can now only be used in Vector Control Modes.

6.46.1 Introduction to AC Loss Ridethrough

AC Loss Ridethrough is a feature, whereby, in the event of the ac mains loss, or dip, the drive attempts to maintain its DC Link voltage via regeneration from the motor (and load) inertia.

This means that the feature is only suitable for high inertia loads and if used in applications where the load inertia is low it cannot be guaranteed to work.

6.46.2 AC Loss Ridethrough Invocation Mode

Setting either parameter P35.12 or parameter P46.00 - ‘AC Loss Ridethrough’ to ‘enabled’, enables Ridethrough.

The drive monitors the DC link voltage and invokes ac loss ridethrough when either:

- The DC link falls below a predefined ridethrough invocation level, and/or the rate of fall of DC link is greater that a predefined amount.
- Direct measurement of loss of the ac mains supply using a Mains Voltage Monitor (MVM).

Either of these indicates that the mains supply has been lost, and the drive enters the ridethrough mode. The drive will invoke ac loss ridethrough via a falling DC Link voltage even if MVM mode is selected, if the DC Link condition occurs earlier. The drive will use the MVM invocation if P46.00 (P35.12) = 2 and if the MVM unit is actually fitted.

The drive then attempts to control the DC Link voltage, by regenerating (a small amount) from the load inertia. Involved in this DC Link voltage control is a PI loop.

[3] For firmware versions V11.83 and earlier, this feature had a particular firmware architecture and could not be guaranteed to work, especially under conditions of high drive load prior to the loss of the mains supply.
For firmware versions V11.84 and later the MV3000e firmware has been modified to give improved ac loss ridethrough performance.
From V11.84 and above (until further notice) ridethrough operation in VVVF mode is disallowed.
When upgrading to V11.84 the drive will force parameter edits to be lost due to the change in default values for ridethrough operation. Customer edits may be retained by saving/storing edits to/from the keypad or Drive Coach. Edits should NOT be saved/restored to the drive internal backup set.

P46.00 - AC Loss Ridethrough

Allowed values: 1 = Enabled from Vdc
2 = Enabled from MVM

P46.00	MVM Unit Present	MVM Unit Absent
1 = Enabled from Vdc	Ridethrough invoked by falling DC Link only	Ridethrough invoked by falling DC Link only
2 = Enabled from MVM	Ridethrough invoked by falling DC Link, or falling mains voltage, whichever is earlier	Ridethrough invoked by falling DC Link only

Table 6-23. – AC Loss Ridethrough Invocation

6.46.3 Mains Voltage Monitor Unit (MVM)[4]

The input circuit of the drive contains some capacitance. Due to this capacitance, when ridethrough mode is tested, say, by opening an isolator on the drive input, the mains supply signal may be slow in decaying. A small (approximately 10kW 3-phase load may need to be applied on the drive side of the isolator to ensure that the MVM registers the ac loss quickly.

On an air-cooled drive the fans and fan transformers may be sufficient to provide this load.

In real site situations, where ridethrough is invoked by a mains dip, other common loads on the mains supply will provide the load to ensure that the loss of mains is registered.

6.46.4 AC Loss Ridethrough Set Up

P46.01 - Nominal Mains Voltage

This parameter is used by the ac loss ridethrough to set various voltages to internally configure the feature. It is a repeat of parameter P12.02, changing the value in P46.00 will also change it in P12.02.

Allowed values: 300 to 900V.

P46.02 - Mains Voltage Scaling

This parameter is used to allow for an instrumentation transformer to feed the Mains Voltage Monitor unit. It can also be used for calibration of residual errors in the mains amplitude measurement.

Allowed values: 10.0 to 1000.0%.

P46.03 - Measured Mains Voltage

This parameter is only valid if an MVM unit is fitted. It displays the measured rms mains voltage.

P46.04 - Measured Mains Amplitude

This parameter is only valid if an MVM unit is fitted. It displays the measured mains voltage as a percentage of the value set in parameter P46.01.

P46.05 – Ridethrough Threshold

This parameter is used to set (as a percentage of the value in P46.01) the mains voltage at which the loss of the mains is determined and ridethrough is invoked.

Setting this parameter's value too high will result in erroneous invocation of ridethrough.

Allowed values: 0.00 to 100.00%.

[4] On rectifier fed DELTA based MV3000e drives that are required to be in motor control mode, when an MVM unit is fitted then the default control mode will be SFE mode, (i.e. P99.01 = 4) by default. This will need to be returned to option 2 (Vector Control).

P46.06 – Mains Filter Bandwidth

The mains voltage is filtered at this bandwidth in the drive firmware. This parameter should be set as high as possible unless a very corrupt mains supply results in erroneous ridethrough invocation.

Setting this parameter too low will result in very slow detection of mains loss.

Allowed values: 0 = 100Hz.
1 = 200Hz.
2 = 400Hz.
3 = 800Hz.

P46.07 - Ridethrough Active

This is a read only parameter and can be viewed to identify when the drive is in ridethrough. It can, if required, be put into the History Record to facilitate fault finding in ridethrough mode.

P46.08 - Mains Loss Action

When ridethrough is invoked by loss of the mains supply, then the drive will issue a warning indicating loss of mains. If the warning is not wanted, this parameter can be set to produce no warning.

Allowed values: 0 = Ignore.
1 = Warn only.

P46.20 - Vdc Controller Bandwidth

This parameter is used to set the bandwidth of the DC Link controller when ridethrough is invoked.

Allowed values: 0 to 200rads/s.

6.46.5 DC Link Controller – Calculation of Gains

The drive will automatically calculate the correct P and I gains for the ridethrough DC Link controller. The value of these gains depend on:

DC Link capacitance.
Drive current and voltage ratings.
Motor power rating.
Number of DELTA modules fitted.

It is possible to manually adjust the P and I gain terms. For instance, if there is extra DC Link capacitance present, of which the firmware is unaware, and unsatisfactory DC Link control occurs then the P and I gain terms can be manually adjusted.

It is recommended that the automatic calculation be employed.

P46.21 - Vdc Controller Gains - Auto-manual

To manually adjust the DC Link controller gains this parameter must be set = 1.

Allowed values: 0 = Automatic Adjust.
1 = Manual Adjust.

P46.22 - DC Link Controller Kp

This parameter is the proportional gain of the DC Link controller when the drive is in ridethrough.

Its value is automatically calculated when parameter P42.21 = 0.

P46.23 - DC Link Controller Ki

This parameter is the integral gain of the DC Link controller when the drive is in ridethrough.

Its value is automatically calculated when parameter P42.21 = 0.

6.47 MENU 47 - SECOND LOGIC MENU

(Refer to Control Block Diagram Sheets 13 and 15).

Menu 47 gives access to the parameters required to configure the twelve General Purpose Logic Blocks I to T and a special purpose Brake Logic Block.

Four identical logic blocks, I to L, each contain the following functions:

Comparator:	This allows any variable to be compared to a fixed threshold.
Delay :	Allows the output of the comparator block to have its rising edge delayed.
Selectable Boolean Function:	Allows the delay output to be combined with two other digital signals (Control Flags).

Each of the logic block functions outputs to a Status Flag, and the inputs come from the previous function and Control Flags.

Each of the four logic blocks are identified by the letters I to L and the parameters, Control Flags and Status Flags for each logic block are described in the following sections:

A second group of eight logic blocks, M to T, are described in Section 0.

NOTE: Each of the logic blocks is scanned once every 10 ms. If the blocks are interconnected (by patching the output Status Flags of one logic block to the input Control Flags of another), this will take an additional scan to take effect.

6.47.1 Logic Block I

P47.00 - Comparator I Input

This parameter can point the comparator input at any drive parameter.

Allowed values: 1.00 to 99.99 (any parameter number).

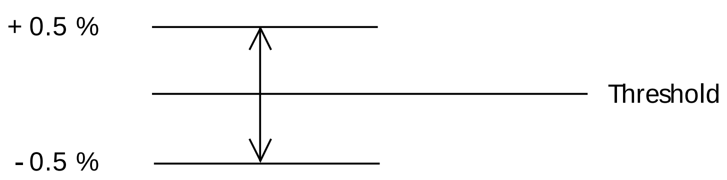
The output from Comparator I can be selected as an input to P47.04 and is echoed in Status Flag 112.

P47.01 - Comparator I Threshold

A fixed value whose range changes to match that of the parameter that is chosen as the comparator input.

P47.02 - Comparator I Hysteresis

A fixed value whose range changes depending on the parameter chosen as the comparator input. The Hysteresis is a % value, producing a band of Hysteresis on either side of the threshold e.g. for a 1% hysteresis you would get Comparator Output SF17 set when Comparator input = Threshold setting ± 0.5%.



P47.03 - Comparator I Mode

The comparator produces a high output under the following conditions, when selected by P47.03.

Allowed values: 1 = Input = Threshold.
2 = Input ≠ Threshold.
3 = Input > Threshold (signed).
4 = Input ≤ Threshold (signed).
5 = Input < Threshold (signed).
6 = Input ≥ Threshold (signed).
7 to 10 = As 3 to 6 but the absolute value is used.

P47.04 - Delay I Input Source

Selects the input to the Delay I module.

Allowed values: 1 = Comparator.
2 = Control Flag 144 (P47.07).

P47.05 - Delay I Time

The output from Delay I is used as an input to the configurable Logic Block I (P47.06) and is echoed in Status Flag 113.

Allowed values: 0.0secs to 600.0secs.

P47.06 - Logic Block I Functions

The Boolean function of Logic Block I is selectable by the value entered into P47.06.

Permitted values: 1 = Three Input AND.
2 = Three Input NAND.
3 = Three Input OR.
4 = Three Input NOR.
5 = Three Input XOR.
6 = Three Input XNOR.
7 to 12 = Two Input versions of 1 to 6.

3-input Boolean functions use the outputs from Delay I (P47.05), and Control Flags 145 (P47.08) and 146 (P47.09) as inputs.

2-input Boolean functions use Control Flags 144 and 145 as inputs. The output is Status Flag 114.

P47.07 - Control Flag 144 - Delay I Input

When selected by P47.04, applies a rising edge to the Delay I module input.

P47.08 - Control Flag 145 - Logic Block I Input 1
P47.09 - Control Flag 146 - Logic Block I Input 2

These control flags provide inputs to Logic Block I.

6.47.2 Logic Block J

P47.10 to P47.16 - Logic Block J Functions

The description of these parameters is as for parameters P47.00 to P47.06 in Logic Block I.

Logic Block J is identical to Logic Block I except that Control Flags 147 to 149 are inputs and Status Flags 115 to 117 are outputs.

P47.17 to P47.19 - Control Flags 147 to 149

These Control Flags operate on Logic Block J exactly as CF144 to CF146 operate on Logic Block I:

Control Flag 147 - Delay J Input.
Control Flag 148 - Logic Block J Input 1.
Control Flag 149 - Logic Block J Input 2

6.47.3 Logic Block K

P47.20 to P47.26 - Logic Block K Functions

The description of these parameters is as for parameters P47.00 to P47.06 in Logic Block I.

Logic Block K is identical to Logic Block I except that Control Flags 150 to 152 are inputs and Status Flags 118 to 120 are outputs.

P47.27 to P47.29 - Control Flags 150 to 152

These Control Flags operate on Logic Block K exactly as CF144 to CF146 operate on Logic Block I:

Control Flag 150 - Delay K Input.
Control Flag 151 - Logic Block K Input 1.
Control Flag 152 - Logic Block K Input 2.

6.47.4 Logic Block L

P47.30 to P47.36 - Logic Block K Functions

The description of these parameters is as for parameters P47.00 to P47.06 in Logic Block I.

Logic Block L is identical to Logic Block I except that Control Flags 153 to 155 are inputs and Status Flags 121 to 123 are outputs.

P47.37 to P47.39 - Control Flags 153 to 155

These Control Flags operate on Logic Block L exactly as CF144 to CF146 operate on Logic Block I:

Control Flag 153 - Delay L Input.
Control Flag 154 - Logic Block L Input 1.
Control Flag 155 - Logic Block L Input 2.

6.47.5 Logic Blocks M, N, O, P, Q, R, S and T

There are eight logic blocks, each of which comprises a selectable 4-input Boolean function. The inputs to these Boolean functions are four Control Flags and the outputs are to Status Flags. There are five parameters for each logic block.

Logic Block	Function	Control Flag	Parameter	Status Flag
M	P47.40	CF156	P47.41	SF124
		CF157	P47.42	
		CF158	P47.43	
		Cf159	P47.44	
N	P47.45	CF160	P47.46	SF125
		CF161	P47.47	
		CF162	P47.48	
		CF163	P47.49	
O	P47.50	CF164	P47.51	SF126
		CF165	P47.52	
		CF166	P47.53	
		CF167	P47.54	
P	P47.55	CF168	P47.56	SF127
		CF169	P47.57	
		CF170	P47.58	
		CF171	P47.59	
Q	P47.60	CF172	P47.61	SF128
		CF173	P47.62	
		CF174	P47.63	
		CF175	P47.64	
R	P47.65	CF176	P47.66	SF129
		CF177	P47.67	
		CF178	P47.68	
		CF179	P47.69	
S	P47.70	CF180	P47.71	SF130
		CF181	P47.72	
		CF182	P47.73	
		CF183	P47.74	
T	P47.75	CF184	P47.76	SF131
		CF185	P47.77	
		CF186	P47.78	
		CF187	P47.79	

Table 6-24. – Logic Blocks M, N, O, P, Q, R, S & T

6.47.6 Logic Block M

P47.40 - Logic Block M Functions

The Boolean function of Logic Block M is selectable by means of the value entered into parameter P47.40.

Allowed values:
1 = AND.
2 = NAND.
3 = OR.
4 = NOR.
5 = XOR.
6 = XNOR.

Two and three input logic functions can be realised by setting the unused inputs to high (1.000) or low (0.000) depending on the function type. For AND functions set the unused inputs high. For OR and XOR functions set the unused inputs low.

Status Flag 124 is the output.

P47.41 - Control Flag 156 - Logic Block M Input 1
P47.42 - Control Flag 157 - Logic Block M Input 2
P47.43 - Control Flag 158 - Logic Block M Input 3
P47.44 - Control Flag 159 - Logic Block M Input 4

These flags provide inputs to Logic Block M.

6.47.7 Logic Block N

P47.45 - Logic Block N Functions

The Boolean function of Logic Block N is selectable by means of the value entered into parameter P47.45.

Allowed values:
1 = AND.
2 = NAND.
3 = OR.
4 = NOR.
5 = XOR.
6 = XNOR.

Two and three input logic functions can be realised by setting the unused inputs to high (1.000) or low (0.000) depending on the function type. For AND functions set the unused inputs high. For OR and XOR functions set the unused inputs low.

Status Flag 125 is the output.

P47.46 - Control Flag 160 - Logic Block N Input 1
P47.47 - Control Flag 161 - Logic Block N Input 2
P47.48 - Control Flag 162 - Logic Block N Input 3
P47.49 - Control Flag 163 - Logic Block N Input 4

These flags provide inputs to Logic Block N.

6.47.8 Logic Block O

P47.50 - Logic Block O Functions

The Boolean function of Logic Block O is selectable by means of the value entered into parameter P47.50.

Allowed values:
1 = AND.
2 = NAND.
3 = OR.
4 = NOR.
5 = XOR.
6 = XNOR.

Two and three input logic functions can be realised by setting the unused inputs to high (1.000) or low (0.000) depending on the function type. For AND functions set the unused inputs high. For OR and XOR functions set the unused inputs low.

Status Flag 126 is the output.

P47.51 - Control Flag 164 - Logic Block O Input 1
P47.52 - Control Flag 165 - Logic Block O Input 2
P47.53 - Control Flag 166 - Logic Block O Input 3
P47.54 - Control Flag 167 - Logic Block O Input 4

These flags provide inputs to Logic Block O.

6.47.9 Logic Block P

P47.55 - Logic Block P Functions

The Boolean function of Logic Block P is selectable by means of the value entered into parameter P47.55.

Allowed values:	1 = AND.
	2 = NAND.
	3 = OR.
	4 = NOR.
	5 = XOR.
	6 = XNOR.

Two and three input logic functions can be realised by setting the unused inputs to high (1.000) or low (0.000) depending on the function type. For AND functions set the unused inputs high. For OR and XOR functions set the unused inputs low.

Status Flag 127 is the output.

P47.56 - Control Flag 168 - Logic Block P Input 1
P47.57 - Control Flag 169 - Logic Block P Input 2
P47.58 - Control Flag 170 - Logic Block P Input 3
P47.59 - Control Flag 171 - Logic Block P Input 4

These flags provide inputs to Logic Block P.

6.47.10 Logic Block Q

P47.60 - Logic Block Q Functions

The Boolean function of Logic Block Q is selectable by means of the value entered into parameter P47.60.

Allowed values:	1 = AND.
	2 = NAND.
	3 = OR.
	4 = NOR.
	5 = XOR.
	6 = XNOR.

Two and three input logic functions can be realised by setting the unused inputs to high (1.000) or low (0.000) depending on the function type. For AND functions set the unused inputs high. For OR and XOR functions set the unused inputs low.

Status Flag 128 is the output.

P47.61 - Control Flag 172 - Logic Block Q Input 1
P47.62 - Control Flag 173 - Logic Block Q Input 2
P47.63 - Control Flag 174 - Logic Block Q Input 3
P47.64 - Control Flag 175 - Logic Block Q Input 4

These flags provide inputs to Logic Block Q.

6.47.11 Logic Block R

P47.65 - Logic Block R Functions

The Boolean function of Logic Block R is selectable by means of the value entered into parameter P47.65.

Allowed values:
1 = AND.
2 = NAND.
3 = OR.
4 = NOR.
5 = XOR.
6 = XNOR.

Two and three input logic functions can be realised by setting the unused inputs to high (1.000) or low (0.000) depending on the function type. For AND functions set the unused inputs high. For OR and XOR functions set the unused inputs low.

Status Flag 129 is the output.

P47.66 - Control Flag 176 - Logic Block R Input 1
P47.67 - Control Flag 177 - Logic Block R Input 2
P47.68 - Control Flag 178 - Logic Block R Input 3
P47.69 - Control Flag 179 - Logic Block R Input 4

These flags provide inputs to Logic Block R.

6.47.12 Logic Block S

P47.70 - Logic Block S Functions

The Boolean function of Logic Block S is selectable by means of the value entered into parameter P47.70.

Allowed values:
1 = AND.
2 = NAND.
3 = OR.
4 = NOR.
5 = XOR.
6 = XNOR.

Two and three input logic functions can be realised by setting the unused inputs to high (1.000) or low (0.000) depending on the function type. For AND functions set the unused inputs high. For OR and XOR functions set the unused inputs low.

Status Flag 130 is the output.

P47.71 - Control Flag 180 - Logic Block S Input 1
P47.72 - Control Flag 181 - Logic Block S Input 2
P47.73 - Control Flag 182 - Logic Block S Input 3
P47.74 - Control Flag 183 - Logic Block S Input 4

These flags provide inputs to Logic Block S.

6.47.13 Logic Block T

P47.75 - Logic Block T Functions

The Boolean function of Logic Block T is selectable by means of the value entered into parameter P47.75.

Allowed values:
1 = AND.
2 = NAND.
3 = OR.
4 = NOR.
5 = XOR.
6 = XNOR.

Two and three input logic functions can be realised by setting the unused inputs to high (1.000) or low (0.000) depending on the function type. For AND functions set the unused inputs high. For OR and XOR functions set the unused inputs low.

Status Flag 131 is the output.

P47.76 - Control Flag 184 - Logic Block T Input 1
P47.77 - Control Flag 185 - Logic Block T Input 2
P47.78 - Control Flag 186 - Logic Block T Input 3
P47.79 - Control Flag 187 - Logic Block T Input 4

These flags provide inputs to Logic Block T.

6.47.14 Special Brake Logic Function

This brake control is for operational purposes only and must form part of the functional safety of the system. If application of the brakes is required for the functional safety of the system, then there must be a means of applying the brakes (and keeping them applied) independently of the MV3000e

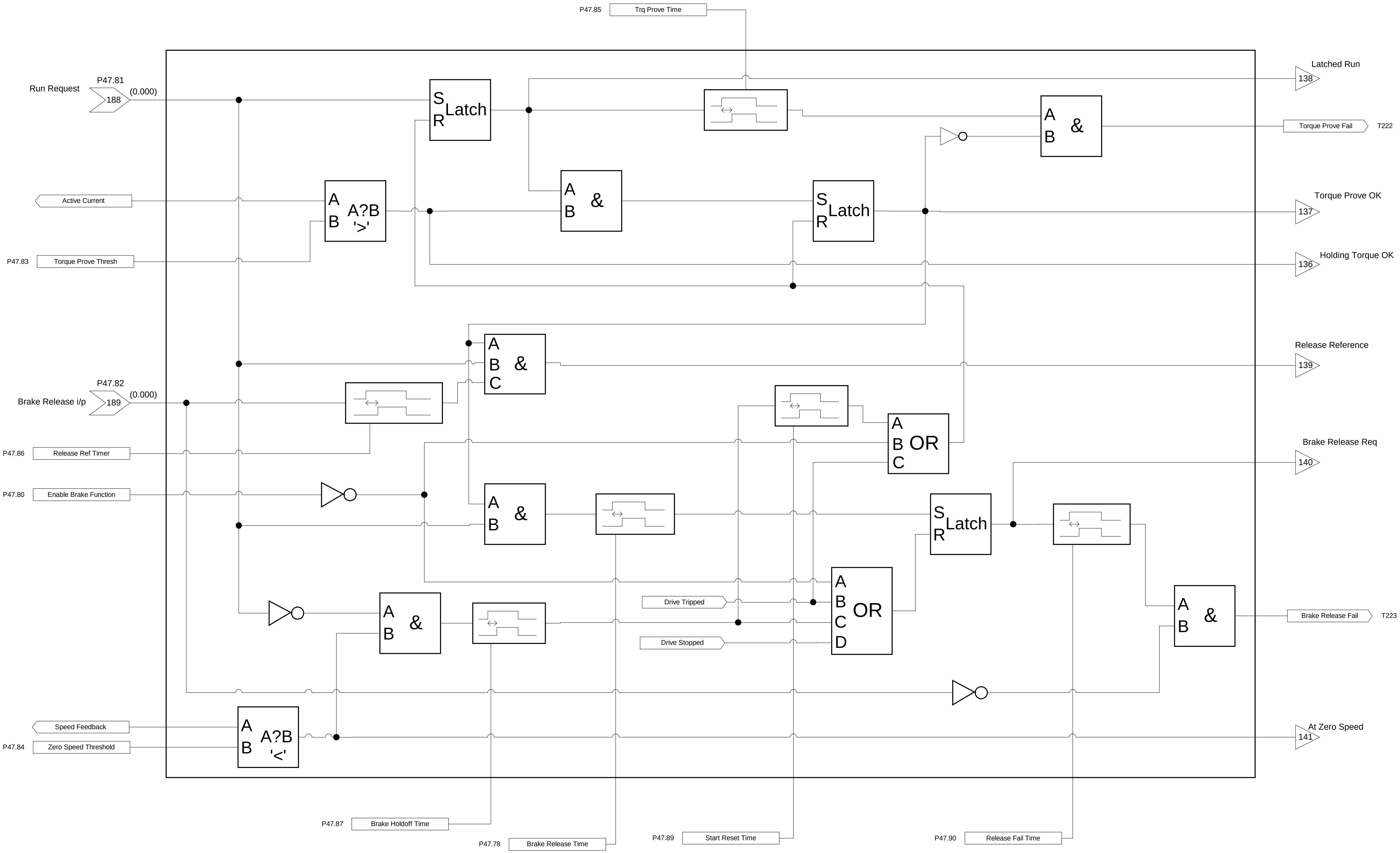


Figure 6-43. – Brake Function Internal Logic

6.47.15 Brake Function Sequence of Operation

With reference to Figure 6-43, the following brake release sequence is supported.

- The drive is assumed to have completed its power up sequence and to have no trips present.

- The drive is stopped and the brake is on.

- A run request is required at the Run Request Control Flag (CF188). Using general-purpose logic this can be derived from raise/lower digital inputs, from throttle contacts, or by analogue speed reference greater than a minimum value.

- The run request is latched and the Latched Run status flag (SF138) may be connected to the start/stop control flags to initiate a motor start.

- Torque Prove OK (SF137) will be at 0 until the drive can prove it can generate sufficient torque to support the load when the brake is released. The torque is proved by selecting a torque proving speed, default of 10%, at a reduced torque limit, default of 15%.

- With the brake still on the drive is now running with 10% speed reference and 15% torque limit. The Active Current is monitored; if it becomes greater than the Torque Prove Threshold (default of 15%) before the Torque Prove Timeout timer (default of 5s) has elapsed, the latched Torque Prove OK status flag (SF137) becomes true[5].

- If Torque Prove OK does not set before the Torque Prove Timeout has elapsed the drive will trip on Torque Prove Fail (Trip Code 222).

- When Torque Prove OK is true for the Brake Release Time (default of 1s) the latched Brake Release Request status flag (SF140) becomes true. This flag is to be connected to the digital output used to release/apply the brake.

  Once the Torque Prove OK flag goes true, the drive should be commanded to apply zero speed reference at the normal torque limit (default of 100%) until the brake is released. This is achieved by connecting the negated value of the Release Reference status flag (SF139) to parameter P5.10, i.e. P5.10 = -2.139.

  Parameter P5.04 - 'Speed Reference Source 4' needs to be set to one of the fixed zero references.

  The torque limit will switch to the normal value contained in parameter P8.00 as a consequence of the change of state of the Torque Prove OK status flag.

- If the brake is not released before the Brake Release Timer has expired the Brake Release Fail trip occurs and the drive trips.

  For a monitored brake, the Brake Release Input control flag (CF189) is connected to the digital input used to indicate status of the brake.

  For an unmonitored brake the control flag is set = 2.140, the Brake Release Request status flag.

[5] The Torque Prove OK Status Flag is used to select the torque proving limit value (P8.07). It is also intended that it be used to select the Torque Prove Speed Reference (typically P5.09). In both cases the inverted state for the Torque Prove OK status flag is required, i.e. specify a value of –2.137 for P5.09 and P8.07.
P5.03 - 'Reference Source 3' needs to be set to point at a fixed reference of 10%. P8.02 - 'Positive Torque Limit 2' will normally be set to 15% assuming that its associated scale, P8.10, is at 100%.

- If the brake stays released longer than the Release Reference Timer, and the Run Request and Torque Prove OK are both still true, the Release Reference status flag (SF139) goes true.

  This status flag is used to select the normal speed reference by connection it parameter P5.08 - 'Reference 2 Selector' and setting P5.02 - 'Speed Reference 2 Source' to be the normal reference source.

- At this point the drive is running with full torque and the normal active speed reference as chosen by the user.

- Zero speed demand will cause the motor to decelerate towards zero speed. When the speed feedback (P9.01) is less than the zero speed comparator threshold the At Zero Speed status flag (SF141) goes true.

  If the Run Request is derived from having a non-zero speed demand, the Run Request will be false (zero).

  if both of these conditions remain, (i.e. zero demand and at zero speed) for longer than the Brake Holdoff Time, the brake will be applied.

- When the Brake Holdoff Time expires and the Start Reset Timer has elapsed the brake logic will be reset, i.e. requiring the Torque Prove and Brake Release sequence to be repeated before allowing normal speed control.

  if the Latched Run status flag is used to start/stop the drive, the drive will be stopped.

If a drive trip occurs;

Or

The motor speed has been below the zero speed threshold for longer than the Brake Holdoff Time AND Run Request is false

Or

The Brake Function is disabled

Then

- The Brake Release Request status flag (SF140) is set to zero by holding the brake release latch in reset.
- The Torque Prove OK (SF137) and Latched Run (SF138) status flags are held at zero by holding the run latch and torque prove latch in reset.
- As a consequence of the change of state of the Torque Prove OK status flag the Release Reference status flag (SF139) also goes to zero.

6.47.16 Brake Function Parameters

P47.80 - Enable Brake Function

The brake logic function is held in reset until enabled by this parameter. Status flags 138 to 141 are held at their logic zero state until the brake logic function is enabled.

P47.81 - Control Flag 188 - Run Request

This parameter is required to be connected to the appropriate run signal. This run signal can, typically, be derived from asking for a speed greater than zero.

P47.82 - Control Flag 189 - Brake Release Input

This parameter is either connected to the digital input used to monitor the state of the brake, or, it is connected to the Brake Release Request status flag if brake monitoring is not available.

P47.83 - Torque Prove Threshold

This parameter is set to the value of the Active Current (% of motor full load current) at which the Holding Torque OK status flag (SF137) goes true.

At this threshold the Torque Prove OK status flag is normally latched and the brake release sequence continues.

P47.84 - Zero Speed Threshold

This parameter is set to the value of speed feedback (% of Top Speed) below which the At Zero Speed status flag goes true.

P47.85 - Torque Prove Time

From the application of a Run Request the torque must achieve the Torque Prove Threshold within the time set in this parameter, otherwise, the drive will trip on Torque Prove Fail.

Allowed values: 0.0 to 600.0s.

P47.86 - Release Reference Time

This parameter is set to the time to wait after the Brake Release Input goes true before allowing normal speed demand.

While this timer is active it is usual to apply a zero speed reference with a full torque limit.

P47.87 - Brake Holdoff Time

This parameter is set to the time to wait at zero speed before the brake is applied. In the case of a crane this allows the operator to stop and then stop the hoist within this time without the brake being applied.

Allowed values: 0.0 to 600.0s.

P47.88 - Brake Release Time

This parameter is set to the time to wait after proving the torque capability before allowing the normal speed reference to be applied. During this time zero speed reference is applied while the brake is released. Thus at the moment the brake is released there should be a smooth transition from zero speed to demanded speed.

Allowed values: 0.0 to 600.0s.

P47.89 - Start Reset Time

This parameter is set to the time to wait after the Brake Holdoff time expires before the Brake Logic Function block resets the Latched Run and Torque Prove OK status flags.

Allowed values: 0.0 to 600.0s.

P47.90 - Release Fail Time

From the Brake Release Request going true, if the Brake release Input does not occur within the time set in this parameter the drive will trip on Brake Release Fail (Trip Code 223).

NOTE: If the Brake Release Input goes false after this time, and the Brake Release Request is still true the trip occurs.

Allowed values: 0.0 to 600.0s.

P47.91 - Preset Parameters

This parameter is used to pre-configure other drive parameters to values typical for brake applications. Be aware that the previous values of these parameters will be overwritten.

The process is initiated by selecting a value of 1. It only possible to select 1 if the Brake Function is enabled, i.e. P47.80 = 1. The action has to be confirmed before the command is executed. After execution the parameter value returns to zero.

The following drive parameters are changed.

Par No.	Description	New Value
P47.81 to P47.90	Brake Logic Parameters	Default
P5.01	Speed Reference 1 Source	Default
P5.02	Speed Reference 2 Source	Default
P5.03	Speed Reference 3 Source	22 = Pointer 2
P5.04	Speed Reference 4 Source	13 = Fixed Reference 0%
P5.07	CF4: Reference1 Selector	2.139 - Release Reference Status Flag
P5.08	CF5: Reference 2 Selector	2.139 - Release Reference Status Flag
P5.09	CF6: Reference 3 Selector	-2.137 - NOT Torque Prove OK Status Flag
P5.10	CF7: Reference 4 Selector	-2139 - NOT Release Reference Status Flag
P8.00	Torque Limit (Also positive torque limit 1)	Default
P8.02	Positive Torque Limit 2	15.00%
P8.07	CF21: Torque Limit Selection	-2.137 - NOT Torque Prove OK Status Flag
P8.08	Positive Torque Limit Scale Source 1	Default
P8.10	Positive Torque Limit Scale Source 2	Default
P21.15	Fixed Reference #15	10.00%
P42.02	Pointer 2 Source	P21.15
P42.03	Pointer 2 scale	100.00%

Table 6-25. – Brake Logic Preset Parameters

6.48 MENU 50 - BASIC SFE SET-UP MENU

Menu 50 is used for the Basic SFE Set-up facility. This mode is only visible when SFE mode has been selected via P99.01.

P50.00 - DC Link Voltage Reference

This is the reference value for the DC link voltage controller. The SFE will attempt to maintain this value of DC link voltage at all times, unless 'active current limits' are reached. See parameters P50.03 and P50.04.

By default, P50.00 can be edited directly to change the DC link reference voltage. However, P53.00 can be edited such that the DC link reference voltage can be adjusted indirectly. If P53.00 is edited such that P50.00 is no longer the source of DC link voltage reference, P50.00 becomes a monitoring point for DC link voltage reference. The limits of P50.00 are applied to that indirect reference.

If the alternative DC link voltage feedback is selected via P53.02 and the SFE subsequently undergoes a power-up reset, the minimum permissible DC link voltage reference will reduce to 200V. Returning P53.02 to be a standard DC link feedback and performing a further power-up reset will reset the minimum DC link voltage reference to the level given at 5.4.45.

P50.01 - Line Choke Inductance

This parameter is set to the inductance, per phase, of the line choke. Value is to be entered in µH units. See also P52.13.

P50.02 - DC Fed Drives Rating

This parameter allows the SFE to calculate the correct DC link controller gains.

Value to enter is

$$\frac{\sum nominal\ current\ rating\ of\ all\ Machine\ Bridges\,(A)}{nominal\ current\ rating\ of\ SFE\,(A)} \times 100\%$$

P50.03 and P50.04 - Active Current Positive and Negative Limits

These parameters allow the active current sourced to, or drawn from the mains to be limited. Note that if the ac current becomes clamped by either limit, the DC link voltage cannot be maintained at its reference value. The values entered are a percentage of the nominal current rating of the SFE, given in P99.05.

By default, P50.03 and P50.04 can be edited directly to change the active current limits. However, P53.06 and P53.08 can be edited such that the active current limits can be adjusted indirectly. When not configured as the source of the active current limits, P50.03 and P50.04 become monitoring points for the active current limits.

P50.05, P50.06, P50.07 and P50.08 - Control Flags

Control Flags are listed at Table 5-2. Four Control Flags, from the complete set, are used with the SFE product as parameters P50.05 to P50.08, described as follows:

P50.05	CF0	Normal Stop
P50.06	CF1	Start
P50.07	CF25	Output Enable/Run
P50.08	CF116	Keypad/Remote.

P50.09 - Nominal Mains Supply

This parameter is the same as parameter P12.02 – Menu 12 is not available in SFE Mode.

The parameter is required to be set to the nominal mains supply voltage (Vrms) as various thresholds are expressed as a percentage of this value.

Allowed values: 300 to 900V.

6.49 MENU 51 - BASIC SFE MONITORING MENU

Menu 51 is used for the SFE Monitoring facility. This mode is only visible when SFE mode has been selected via P99.01.

P51.00 - DC Link Voltage

Parameter P51.00 indicates the DC link voltage.

P51.01 and P51.02 - Mains Current Feedback

These parameters indicate the ac rms line current drawn from the mains supply via the SFE:

P51.01	indicates the current in amps
P51.02	indicates the current as a percentage of the SFE nominal current rating, as indicated in P99.05.

P51.03 - Mains Frequency

The SFE is phase insensitive and will operate with any phase rotation, provided that there is consistency of phasing within the various elements of the SFE. However, the SFE does indicate the rotation of phases that it has detected.

If the mains frequency displayed in P51.03 is positive, the SFE has detected a positive phase sequence (A-B-C, or R-S-T sequence).

If the mains frequency displayed in P51.03 is negative, the SFE has detected a negative phase sequence (C-B-A, or T-S-R sequence).

P51.04 - Measured Mains Voltage

Parameter P51.04 indicates the ac rms line-to-line voltage of the mains supply.

P51.05 - PWM Volts

Parameter P51.05 indicates the voltage, in volts rms, at the PWM terminals of the inverter.

P51.06 - Power from Mains

Parameter 51.06 indicates the power flow from the mains to the SFE.

P51.07 - Feedforward Power Demand

Parameter P51.07 indicates the kW demanded from load power feedforward.

P51.08 - DC Link Current

Parameter P51.08 indicates the approximate DC link current supplied by the SFE.

P51.09 - DC Link Controller Current Demand

Parameter P51.09 indicates the active current demanded from the DC link controller.

P51.10 - Feedforward Current Demand

Parameter P51.10 indicates the active current demanded from load power feedforward.

P51.11 and P51.12 - Active Current Demand

Parameters P51.11 and P51.12 indicate the total active current demanded from load power feedforward in units of percentage and Amps respectively.

P51.13 and P51.14 - Active Current

Parameters P51.13 and P51.14 indicate the active current in phase with the mains voltage in units of percentage and Amps respectively.

P51.15 and P51.16 - Reactive Current Demand

Parameters P51.15 and P51.16 indicate the total reactive current demanded from load power feedforward in units of percentage and Amps respectively.

P51.17 and P51.18 - Reactive Current

Parameters P51.17 and P51.18 indicate the reactive current in quadrature with the mains voltage in units of percentage and Amps respectively.

P51.19 - SFE Overload Remaining

Parameter P51.19 indicates the percentage of total overload capacity remaining to be monitored. Its units are percentage of (1.5 x drive Full Load Current) for 60 seconds.

P51.20 - Measured PTC Resistance

Parameter P51.20 indicates the value of resistance that the drive has determined between TB5/1 and TB5/3.

P51.21 - Vq Mains

This is the calculated Vq component of the mains network voltage

P51.22 - Vd Mains

This is the calculated Vd component of the mains network voltage

P51.23 - Mains Amplitude

This is the calculated Vrms mains network voltage

6.50 MENU 52 - ADVANCED SFE SET-UP MENU

Menu 52 is used for the Advanced SFE Set-up facility. This mode is only visible when SFE mode has been selected via P99.01.

P52.00, P52.01, P52.02 and P52.03 - DC Link Voltage Controller Gains

P52.01 allows the Kp and Ki terms of the DC link controller to be calculated automatically, or entered manually.

The automatic calculation is dependent upon P52.00 (DC link controller bandwidth), P50.02 (DC Fed Drives rating) and P50.00 (DC link voltage reference) in addition to information retrieved from serial EEPROMs contained within the SFE. When calculated automatically, the Kp and Ki gains are displayed in P52.02 and P52.03. It is recommended that the maximum value of DC link bandwidth is 1/4 the current loop bandwidth, as set via P52.04.

Alternatively, setting P52.01 to 1 allows manual adjustment to Kp and Ki by editing P52.02 and P52.03 respectively.

P52.04 - Current Bandwidth

The current loop PI controllers have their Kp and Ki gain terms automatically calculated based on this parameter. Value to be entered in radians/second. It is recommended that this value is always set to a minimum of 4 times the DC link controller bandwidth. See parameters P52.00, P52.01, P52.02, P52.03 and P50.02.

P52.05, P52.06 and P52.07 - Reactive Current Reference and Limits

If required, a reactive current reference can be requested and limited via the values in these three parameters. By default, these parameters are the sources of these references. Alternatively, these values can be controlled indirectly by editing P53.10, P53.12 and P53.14. When not configured as the source of the reactive current demand and limits, these parameters become monitoring points for the reactive current demand and limits.

P52.08 and P52.11 - Mains Frequency Trip Limits

These parameters adjust the mains frequency trip limits. A trip code 93, mains frequency trip, will be generated for a mains frequency detected outside of these limits.

P52.09 and P52.10 - Mains Frequency Warning Limits

These parameters adjust the mains frequency warning limits. A warning code 133, mains frequency warning, will be generated for a mains frequency detected outside of these limits.

P52.13 - Supply Inductance Compensation

If there is significant inductance in the supply cabling between the incoming mains point of common coupling and the SFE mains voltage monitor input terminals, the current drawn by the SFE will have a load-dependent phasing error. This error can be compensated by entering the value of the supply cable inductance, in µH, into P52.13.

P52.12 and P52.14 - Supply Transformer Compensation

It is possible to connect the input terminals to the Mains Voltage Monitor unit to a mains supply that is separated from the SFE input terminals via a transformer. Any fixed phasing errors introduced by the transformer may be removed by adjusting P52.12. Adjusting P52.14 will compensate for the turns ratio of the transformer. See also P52.13 for supply cable inductance compensation.

P52.15 and P52.16 - DC Link Hall Effect Device

If P53.03, the DC link load power feedforward source, is set mode 1 or 2, the value of the turns ratio of the DC link Hall effect device is to be entered into P52.15, and the value of the burden resistor used is to be entered into P52.16.

P52.17 - DC Link Pre-charge Threshold

This parameter sets the DC link voltage above which the SFE will attempt to energise the line contactor and de-energise the pre-charge circuit. By default it is set to its minimum value that is equal to the under voltage trip level of the SFE. It is possible to raise the pre-charge threshold voltage above this value if the application requires it.

If the alternative DC Link feedback has been selected via P53.02, there are two effects on P52.17. Firstly, P52.17 will simultaneously adjust both the pre-charge level and the under voltage trip threshold. Secondly, if a power up reset is performed after P53.02 has been set, the minimum allowable value of P52.17 will reduce to 100V.

P52.18 - Active Current Offset

This parameter allows the user to tune out any offsets in the active current feedback, P51.13.

P52.19 - Choke PTC Trip Resistance

This parameter is the value of choke PTC resistance to be determined as the trip level, i.e. above this value the choke is too hot; there is ±0.1kΩ hysteresis on this value.

Allowed range: 0.10kΩ to 10.00kΩ.

P52.20 - Action on Choke PTC Loss

This parameter specifies the action to be taken by the drive when the measured PTC resistance is above the trip value, i.e. when P51.20 > P52.19.

Options are:
0 = No action (default).
1 = Warning - drive issues a PTC Warning (No. 137).
2 = Trip issues a PTC Trip (No. 98).

P52.21 - Frequency Timer

A trip is generated when the mains supply frequency is outside of the limits specified by parameters P52.09 and P52.10 for longer than the time set in this parameter. Setting a negative value disables the trip.

Allowed values: -1.00 to 1.00s.

P52.22 - Minimum Amplitude

This parameter is used to set a minimum threshold for the mains amplitude under which the drive, after the time set in parameter P52.24, will trip.

Allowed values: -0.00 to 100.00% (of the nominal mains voltage).

P52.23 - Maximum Amplitude

This parameter is used to set a maximum threshold for the mains amplitude. Above this threshold the drive, after the time set in parameter P52.24, will trip.

Allowed values: -100.00 to 120.00% (of the nominal mains voltage).

P52.24 - Amplitude Timer

A trip is generated when the mains supply amplitude is outside of the limits specified by parameters P52.22 and P52.23 for longer than the time set in this parameter. Setting a negative value disables the trip.

Allowed values: -1.00 to 10.00s.

6.50.1 Application Specific Parameters

Parameters P52.30 to P52.63 are application specific parameters and their use is not described in this manual.

6.51 MENU 53 - SFE REFERENCE SETUP MENU

Menu 53 is used with the SFE Reference Setup facility. This mode is only visible when SFE mode has been selected via P99.01.

P53.00, P53.04, P53.06, P53.08, P53.10, P53.12 and P53.14 - DC Link Voltage and Current Control Reference Source Selection

These parameters allow the sources of the DC link voltage and current demand references to be chosen. Reference Source 1 is the default for each. When an alternative reference source is selected, the parameter listed as Reference Source 1 becomes a read-only monitor and will display the (scaled) value passed from the chosen reference. Also, this scaled reference will be clamped to the limits of the monitor parameter. Note that none of these references are "keypad" references, and therefore keypad removal is not affected by the selection of the reference. Selection details are in Table 6-26.

Ref Src	DC Link Voltage Reference	Active Current Demand Reference	Active Current Demand Pos Limit Reference	Active Current Demand Neg Limit Reference	Reactive Current Demand Reference	Reactive Current Demand Pos Limit Reference	Reactive Current Demand Neg Limit Reference
	Selected by P53.00	Selected by P53.04	Selected by P53.06	Selected by P53.08	Selected by P53.10	Selected by P53.12	Selected by P53.14
1	P50.00	DC Link Control	P50.03	P50.04	P52.05	P52.06	P52.07
2	Analogue Ref 1	Analogue Ref 1	Analogue Ref 1	Analogue Ref 1	Analogue Ref 1	Analogue Ref 1	Analogue Ref 1
3	Analogue Ref 2	Analogue Ref 2	Analogue Ref 2	Analogue Ref 2	Analogue Ref 2	Analogue Ref 2	Analogue Ref 2
4	RS485 ref 1	RS485 ref 1	RS485 ref 1	RS485 ref 1	RS485 ref 1	RS485 ref 1	RS485 ref 1
5	RS485 ref 2	RS485 ref 2	RS485 ref 2	RS485 ref 2	RS485 ref 2	RS485 ref 2	RS485 ref 2
6	RS232 ref 1	RS232 ref 1	RS232 ref 1	RS232 ref 1	RS232 ref 1	RS232 ref 1	RS232 ref 1
7	RS232 ref 2	RS232 ref 2	RS232 ref 2	RS232 ref 2	RS232 ref 2	RS232 ref 2	RS232 ref 2
8	PID Controller	PID Controller	PID Controller	PID Controller	PID Controller	PID Controller	PID Controller
9	Reference sequencer	Reference sequencer	Reference sequencer	Reference sequencer	Reference sequencer	Reference sequencer	Reference sequencer
10	Fixed ref menu	Fixed ref menu	Fixed ref menu	Fixed ref menu	Fixed ref menu	Fixed ref menu	Fixed ref menu
11	Motorised pot	Motorised pot	Motorised pot	Motorised pot	Motorised pot	Motorised pot	Motorised pot
12	Trim reference	Trim reference	Trim reference	Trim reference	Trim reference	Trim reference	Trim reference
13	Fixed 0%	Fixed 0%	Fixed 0%	Fixed 0%	Fixed 0%	Fixed 0%	Fixed 0%
14	Fixed 0%	Fixed 0%	Fixed 0%	Fixed 0%	Fixed 0%	Fixed 0%	Fixed 0%
15	Summing node A	Summing node A	Summing node A	Summing node A	Summing node A	Summing node A	Summing node A
16	Summing node B	Summing node B	Summing node B	Summing node B	Summing node B	Summing node B	Summing node B
17	Summing node C	Pointer 22	Pointer 24	Pointer 23	Pointer 25	Pointer 26	Pointer 27
18	Summing node D	N/A	N/A	N/A	N/A	N/A	N/A
19	Pointer 21	N/A	N/A	N/A	N/A	N/A	N/A

Table 6-26. – DC Link Voltage & Current Control Reference Source Selection

P53.01, P53.05, P53.07, P53.09, P53.11, P53.13 and P53.15 - DC Link Voltage and Current Control Reference Scaling

These parameters allow all non-default references to be scaled. When the default source is selected, its scaling parameter becomes read-only and displays 100.0%.

Allowed range: -300.0% to +300.0%.

P53.16 - Action on SFE Reference Loss

This parameter allows selection of action to be taken when there is an SFE reference loss.

Options are:
0 = no action.
1 = warning (Warning Code 105).
2 = trip (Trip Code 2).

P53.02 - Alternative DC Link Feedback

The MV3000e SFE MicroCubicles™ contain hardware that allows the DC link feedback to come from two possible sources. If required, P53.02 can be set to use the alternative DC link feedback signal. When the alternative DC link voltage feedback is selected, the pre-charge level, the under voltage level and the DC Link voltage reference have a wider range of adjustment. See parameters P50.00 and P52.17.

P53.03 - DC Link Load Power Feedforward Configuration

The primary function of the MV3000e SFE is to maintain the voltage at its DC terminals. To achieve this, it compares the voltage at its DC terminals with its reference and produces a demand for ac mains current if there is any error. This DC Link voltage correction is achieved with a 'built-in' PI Controller. The voltage controller has a programmable, but finite, bandwidth and therefore any change in the power requirements of the equipment connected to the DC terminals will cause a disturbance in the DC Link voltage.

It is possible to reduce the disturbance at the DC terminals of the SFE by using a load power feedforward technique. Such a technique provides the SFE with a signal, which represents the instantaneous power requirements of the load, and the SFE will use this to pre-empt its demand for ac mains current. This dramatically speeds up the dynamic response of the system. Therefore, the DC link power dynamic limits of the SFE will be increased with the use of a load power feedforward method. Refer to **GE Power Conversion** for more details about dynamic limits for the MV3000e SFE product used in a variety of applications, with and without load power feedforward.

The MV3000e Firmware supports four options for Load Power Feedforward or alternatively the SFE can operate without Load Power Feedforward.

Load Power Feedforward Modes

The MV3000e SFE supports two modes of load power feedforward signal. Both modes use the analogue input channel hardware, but the source and scaling of the two modes is very different. Table 6-27 lists the modes.

P53.03: Load Power Feedforward Source	Feedforward Mode	Analogue Input Channel	General Recommendation for application types
0	None	None	AEM systems with the sum of Machine Bridge ratings >3 x SFE rating
1	DC link current sensor	1	AEM systems with the sum of Machine Bridge ratings ≤3 x SFE rating, or where non- MV3000 DC fed equipment is used
2		2	
3*	Fast load power signal from DC fed MV3000s	1	AEM drives, or other AEM systems with the sum of Machine Bridge ratings ≤ SFE rating
4*		2	

Table 6-27. – Load Power Feedforward Modes

NOTE: * The Fast Load power signals MUST be screened with each end of the cable connected to the drive chassis as shown in Figure 1 in the T2002EN Getting Started Manual.

DC Link Current Sensor Mode

For values of P53.03 of 1 or 2, the DC link current sensor mode uses a Hall effect device and burden resistor as shown in Figure 6-44. This is the preferred mode for systems where non- MV3000e equipment is connected to the SFE DC terminals, or systems where the sum of the ratings of the MV3000e products connected to the DC terminals of the SFE is greater than the rating of the SFE itself. Refer to **GE Power Conversion** for additional details about DC link stability when using this method.

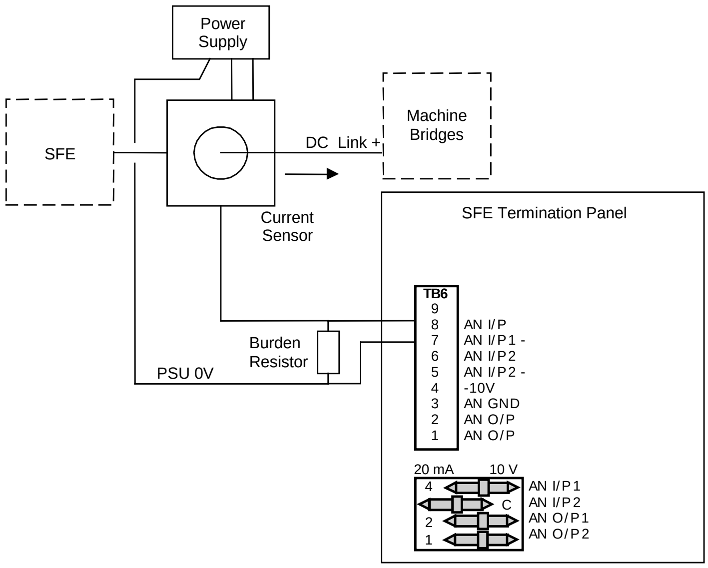


Figure 6-44. – DC Link Current Sensor Mode

SFE Software Configuration for DC Link Current Sensor Mode

Set P53.03 to 1 (analogue input channel 1) or 2 (analogue input channel 2).
Set P52.15 to the value of the turns ratio of the Hall effect sensor.
Set P52.16 to the value of the burden resistor, in ohms.
Set P50.02 to the value 0%.

Ensure that P52.00, DC link controller bandwidth, is less than the value in Table 6-28.

Set the dipswitch for the analogue input to its 10 V position.

Optionally configure the analogue input parameters P7.00 - P7.03 (analogue input channel 1) or P7.04 - P7.07 (analogue input channel 2) to derive further references from the analogue input. The scaling of the analogue input is:

$$Analogue\ input(V) = \frac{DC\ Link\ current\ \ from\ SFE\ (A)}{Current\ sensor\ turns\ ratio} \times Burden\ resistor\ (ohms)$$

True ratio of DC Fed rating to AEM rating	P50.02, parameter value to be entered	Maximum value of P52.00, DC Link Controller Bandwidth
≤ 1 (100%)	0%	180 rad/s
≤ 2 (200%)	0%	100 rad/s
≤ 3 (300%)	0%	50 rad/s
> 3 (300%)	not recommended	not recommended

Table 6-28. – DC Link Controller Bandwidth

Fast Power Output

When the SFE has been configured to expect a load power feedforward signal, with P53.03 set to a value of 3 or 4, all Machine Bridges which are connected to the DC link should be configured by the user to provide a fast power output signal. In this mode, an analogue signal is passed from each MV3000e Machine Bridge to the SFE. This signal is proportional to the instantaneous power being consumed by the MV3000e Machine Bridge. This is the preferred mode for systems where the Machine Bridge equipment is entirely MV3000e, and where the Machine bridge rating is no greater than the SFE rating.

For multiple machine bridges, parallel the load power feedforward signal at TB6 to each machine bridge.

The SFE and Machine Bridge software configurations for a Fast Load Power Mode are now described.

SFE Software Configuration for Fast Load Power Mode

Set P53.03 to 3 (analogue input channel 1) or 4 (analogue input channel 2).
Set the dipswitch for the analogue input to its 20mA position.

Optionally configure the analogue input parameters P7.00 - P7.03 (analogue input channel 1) or P7.04 - P7.07 (analogue input channel 2) to derive further references from the analogue input. The scaling of the analogue input is:

$$\textit{Analogue input (A)} = \frac{0.6 \times \textit{Load power required from SFE (W)}}{\textit{Vdc(V)} \times \textit{SFE nominal current rating (A)}} \times 20mA$$

Machine Bridge Software Configuration for Fast Load Power Mode

Set P7.18 (analogue output channel 1) or P7.23 (analogue output channel 2) to the value 5, fast load power output mode.

Set P7.20 (analogue output channel 1) or P7.25 (analogue output channel 2) to the current rating, in amps, of the SFE.

Set the dipswitch for the analogue output channel to its 20mA position.

P53.17 - Frequency Method

This parameter allows the user to select between Zero Crossing Detection[6] (ZCD) and Phase Locked Loop (PLL) methods of measuring mains network frequency.

The PLL method allows the Network Bridge to monitor mains network voltage at a much higher update method than the ZCD method. This parameter must be set to 1, PLL method, for the drive to be able to ride through a dip event.

Allowed values: 0 = ZCD, Zero Crossing Detection.

1 = PLL, Phase Locked Loop.

P53.18 - Mains Filter Bandwidth

A second order low-pass filter is applied to the measured mains network phase voltages before the calculation of the active and reactive components of the mains network voltage.

The parameter selects the value of the filter cut-off frequency used. Increasing the cut-off frequency reduces the time taken to detect changes in mains network amplitude at the cost of reducing noise immunity. The default setting is 200Hz, but a setting of 800Hz is recommended for Network Loss Ridethrough applications.

Allowed values:
0 = 100Hz.
1 = 200Hz.
2 = 400Hz.
3 = 800Hz.

[6] ZCD is the only method used in early versions of firmware, V11.02 and earlier.

P53.19 - Mains Loss Action

The setting of this parameter determines the drive's behaviour when mains loss is detected.

Allowed values: 0 = Ignore.
1 = Warn Only.
2 = Warn and Trip.

P53.20 - Ridethrough Threshold

When the mains network voltage falls below this threshold the PPL mains network frequency tracker cannot be guaranteed and is inhibited. The mains network frequency and phase are then generated synthetically, based on the last measured value, until the mains network amplitude is at or above the threshold again.

Allowed values: 0.00 to 100.00%.

P53.21 - Regen Power Limit Source

This parameter can be used to set the source of parameter P52.54 'Regen Power Limit'. The scale is set by P53.22.

The value of P52.54 is equal to the value of the parameter selected by P53.21 multiplied by the scale P53.22.

Allowed values: 1 = P52.54
2 = Analogue Ref 1
3 = Analogue Ref 2
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 0 %
14 = Fixed 0 %
15 = Sum Node A
16 = Sum Node B

P53.22 - Regen Power Limit Scale

This parameter is used to scale the Regen Power Source selected by parameter P53.21.

Allowed values: -300.0 to 300.0%.

6.52 MENU 54 – MAINS MONITOR MENU

The drive firmware will detect the presence of a Mains Voltage Monitor (MVM) unit and activate this menu. If an MVM is not fitted the menu is hidden and code associated with menu will not execute.

P54.00 - Mains Voltage Monitor Mode

If parameter P99.01 - 'Control Structure' is set to 4 = SFE Mode then this parameter automatically sets to SFE mode.

If P99.01 is set to any other value then this parameter automatically sets to Disabled and the SFE mode selection is not available.

Over voltage trip avoidance may still be selected by setting this parameter = 1.

Allowed values: 0 = SFE Mode.
1 = Over Voltage Trip Avoidance.
2 = Disabled.

SFE Mode

When in SFE Mode the Mains Voltage Monitor is used for mains synchronisation.

Over Voltage Trip Avoidance Mode

When in over voltage trip avoidance mode this parameter is used to indicate that the MVM is being used for the purposes of discriminating between a DC Link over voltage condition being caused by elevated mains supply voltage or by motor regeneration.

In this mode the calculation of active and reactive power is disabled.

As the supply amplitude measurement does not require synchronisation with the mains, the Mains Sync Loss trip is suppressed in this mode. However, because the mains input may be missing the mains synch loss warning is retained. This warning can be disabled by the setting parameter P54.14 - Mains Loss Action

Disabled

The option to disable the MVM is provided for those drives that are fitted with an MVM but the MVM is not connected to the mains. This prevents trips from the absence of a mains supply.

P54.01 - Mains Filter Bandwidth

A second order low-pass filter is applied to the measured mains network phase voltages before the calculation of the active and reactive components of the mains network voltage.

The parameter selects the value of the filter cut-off frequency used. Increasing the cut-off frequency reduces the time taken to detect changes in mains network amplitude at the cost of reducing noise immunity. The default setting is 200Hz, but a setting of 800Hz is recommended for Network Loss Ridethrough applications.

Allowed values: 0 = 100Hz.
1 = 200Hz.
2 = 400Hz.
3 = 800Hz.

P54.02 - Auto Restart Factor

By monitoring both the AC supply and the DC Link voltages, it is possible to distinguish between a supply induced over voltage and a motor/load derived (e.g. regeneration of power through the machine bridge beyond the braking capacity connected to the DC Link) over voltage.

The auto-restart mechanisms and suppression of over voltage trips are invoked if,

$$Vdc < P54.02 \times Supply\_Amplitude .$$

Otherwise over voltage trips occur in the normal way.

Allowed values: 0.90 to 1.15.

If this parameter is set = 0.9 the auto-restart process is not invoked.

If this parameter is set > 1.04 auto-restart is invoked.

The auto-recovery software will only function when both the AC supply and DC Link transients exist simultaneously. Otherwise, a DC Link transient without an AC supply transient will be assumed to be a motor/load derived over voltage and the drive will be tripped in the normal way.

P54.03 - Vq Mains

This parameter displays the calculated Vq component of the mains supply voltage.

P54.04 - Vd Mains

This parameter displays the calculated Vd component of the mains supply voltage.

P54.05 - Vrms Mains

This parameter displays the calculated Vrms of the mains supply voltage.

P54.06 – Mains Frequency

This parameter displays the measured mains supply frequency.

P54.07 - DC Link Voltage

This parameter displays the DC Link voltage. It is a copy of parameter P11.03 and is I this menu for convenience.

When the DC Link voltage at the SMPS falls to a low level, the DC Link voltage measurement will not be representative of the actual DC Link voltage.

- This will result in the DDM (keypad) indicating the value as “uncollated”.
- This data will also show within Drive Coach as “uncollated” but will be represented in the Drive Coach History as the value 0.
- The serial communication links (e.g. Ethernet, RS485) shows a value of 8000h (32768).
- Customers may need to verify that their interface protocol can operate with this value.

NOTE: **Software versions earlier than:**

00S122	**MV3000e Firmware**	**Rev. 20.00**
00S122-3020	**MV3000e Firmware**	**Rev. 12.21**
00S122-3030	**MV3000e DSP Firmware**	**Rev. 2.17**

May show this value as 0 on the DDM (keypad), Drive Coach and serial links.

WARNING
• **This voltage measurement is for indication only and must not be used as verification that the voltage has reduced to a safe level.**

P54.13 - Frequency Method

This parameter allows the user to select between Zero Crossing Detection[7] (ZCD) and Phase Locked Loop (PLL) methods of measuring mains network frequency.

The PLL method allows the Network Bridge to monitor mains network voltage at a much higher update method than the ZCD method. This parameter must be set to 1, PLL method, for the drive to be able to ride through a dip event.

Allowed values: 0 = ZCD, Zero Crossing Detection.
1 = PLL, Phase Locked Loop.

P54.14 - Mains Loss Action

This parameter automatically sets to the 'Warn and Trip' option if parameter P99.01 - 'Control Structure' is changed to SFE mode.

When P99.01 is changed from SFE Mode the parameter automatically sets to the 'Warn Only' option and the 'Warn and Trip' option is no longer available.

Setting this parameter to the 'Warn Only option suppresses the generation of the trip associated with the fault event. Setting the parameter to the 'ignore' option suppresses the generation of the trip or warning associated with the fault event.

P54.15 - Ridethrough Threshold

When the mains network voltage falls below this threshold the PPL mains network frequency tracker cannot be guaranteed and is inhibited. The mains network frequency and phase are then generated synthetically, based on the last measured value, until the mains network amplitude is at or above the threshold again.

Allowed values: 0.00 to 100.00%.

P54.16 - Mains Amplitude

This parameter displays the mains amplitude as a percentage of the nominal mains voltage set in parameter P50.09.

P54.17 - Nominal Mains Supply

This parameter is the same as parameter P12.02 – Menu 12 is not available in SFE Mode.

The parameter is required to be set to the nominal mains supply voltage (Vrms) as various thresholds are expressed as a percentage of this value.

Allowed values: 300 to 900V.

6.53 MENU 55 - MACHINE BRIDGE CONTROL MENU

Menu 55 is an application specific menu and its use is not described in this manual.

[7] ZCD is the only method used in early versions of firmware, V11.02 and earlier.

6.54 MENU 56 – AC VOLTAGE CONTROL MENU

6.54.1 Network Voltage Control

It is possible to control the magnitude of the network voltage by adjusting the steady state reactive current demand. The following parameters are those that should be configured to achieve this function.

P56.00 - Network Voltage Reference

This parameter sets the network voltage reference level.

Allowed values: 300 to 900Vrms.

P56.01 - Network Voltage Feedback - Filtered

This parameter displays the filtered and measured, network voltage as a percentage of the nominal network voltage set in parameter P50.09.

P56.02 - Network Voltage Controller Droop Resistance

In order to add a droop characteristic, a droop resistance can be set. This is scaled as a line impedance and adjusts the line to line network voltage reference in proportion to the active current demand that the controller creates.

Allowed values: 0.0 to 300.0mΩ.

P56.03 - Network Voltage Controller Drooped Reference

This is the controller reference, minus the droop adjustment, that the network voltage controller uses as its input. It is expressed as a percentage of the nominal network voltage set in P50.09.

P56.04 - Network Voltage Controller Proportional Gain Kp

The network voltage controller is a PI controller. This parameter is used to set the proportional gain of the controller.

Allowed values: 0.000 to 10.000%Id/%Vac nominal.

P56.05 - Network Voltage Controller Integral Gain Ki

The network voltage controller is a PI controller. This parameter is used to set the integral gain of the controller.

Allowed values: 0 to 5000%Id/%Vac nominal/s.

P56.06 - Network Voltage Controller Unclamped Id Demand

This is the current demand that is passed to the modulation depth controller/limiter. Nominally, the ac voltage controller produces it, but it can alternatively be configured to come from any source selected via parameter P56.12. If P56.12 is set to the value 56.00 the ac voltage controller function is enabled.

6.54.2 Avoiding Over Modulation

A positive reactive current will increase the modulation depth of the network bridge, i.e. it will increase the ac voltage produce at the PWM terminals of the inverter.

When this voltage is excessive, as a proportion of the prevailing DC Link voltage, the inverter produces a non-sinusoidal voltage and the harmonics supplied to the network will increase.

This can be avoided by using the PI controller that reduces the reactive current demand if the modulation depth becomes too high.

P56.07 - Modulation Depth Limit

Below the modulation depth set in this parameter, the modulation depth controller is inactive. Above this set modulation depth, the controller uses this value as a control reference and limits the reactive current demand accordingly.

P56.08 - Modulation Depth

This parameter displays the instantaneous modulation depth that is used as feedback to the modulation depth controller. It is a filtered version of the instantaneous modulation depth seen by the network bridge.

P56.09 - Modulation Depth Controller Proportional Gain Kp

This parameter is used to set the proportional gain of the modulation depth controller.

Allowed values: 0.000 to 0.500%Id/% modulation depth.

P56.10 - Modulation Depth Controller Integral Gain Ki

This parameter is used to set the integral gain of the modulation depth controller.

Allowed values: 0 to 2000%Id/% modulation depth/s.

P56.11 - Modulation Depth Controller Clamped Id Demand

This is the limited reactive current demand. In order to activate the network voltage controller the ‘alternative current reference’ P52.36 must point to this parameter bt setting P52.56 = P56.11.

P56.12 - Unclamped Id Demand Source

This pointer allows the source of P56.06 to be selected. If the pointer is set to any value between P56.00 and P56.99 (i.e. anywhere in Menu 56) then the source of P56.06 will be the ac voltage controller. Alternatively P56.12 can be set to point to anywhere within the parameter set.

6.55 MENU 91 – FAST ANALOGUE MENU

This menu is an advanced manufacturer’s commissioning/fault finding menu and, is generally, not available to the user. If required a fast analogue module must be installed after which this menu will be visible. The fast analogue module and an interface box are designed for connection to a high performance oscilloscope.

The use of this feature also requires knowledge of the MV3000e internal variables and their internal scales to be able to set up the parameters to be viewed. It can then be used as an advanced fault finding aid on difficult applications.

P91.00 - Fast Analogue Output 1 Global
P91.05 - Fast Analogue Output 2 Global
P91.10 - Fast Analogue Output 3 Global
P91.15 - Fast Analogue Output 4 Global

These parameters are set to the MV3000e’s internal global variable reference that it is the signal required to be displayed/recorded on an oscilloscope.

Allowed values: 0 to 9999.

P91.01 - Fast Analogue Output 1 Scale
P91.06 - Fast Analogue Output 2 Scale
P91.11 - Fast Analogue Output 3 Scale
P91.16 - Fast Analogue Output 4 Scale

These parameters are the scaling factors for the output global variables above.

Allowed values: -3276 to 3276bits/V.

6.56 MENU 98 - MENU ENABLE SELECTION SETTINGS

Menu 98 is used to activate Menus 1 to 89.

P98.01 to P98.46 - Menus 1 to 46 Enable

Allowed values: 0 = Menu invisible.
1 = Menu visible.

Example:

To make Menu 3 accessible to the operator, set P98.03 to 1.

P98.50 - Menu 50 (SFE Basic Set-up) Enable
P98.51 - Menu 51 (SFE Monitor) Enable
P98.52 - Menu 52 (SFE Adv Set-up) Enable
P98.53 - Menu 53 (SFE Ref Set-up) Enable

Allowed values: 0 = Menu invisible.
1 = Menu visible.

P98.58 - Menu 58 (Extended I/O 2) Enable

This parameter is only available if the 2nd CAN Port Module is fitted.

Allowed values: 0 = Menu invisible.
1 = Menu visible.

P98.59 to P98.63 - Menus 59 to 63 Enable

Allowed values: 0 = Menu invisible.
1 = Menu visible.

P98.65 - Menu 65 (CDC CAN 2 Port) Enable

This parameter is only available if a 2nd CAN Port Module is fitted.

Allowed values: 0 = Menu invisible.
1 = Menu visible.

P98.66 - Menu 66 (CAN 2 CANopen) Enable

This parameter is only available if a 2nd CAN Port Module is fitted.

Allowed values: 0 = Menu invisible.
1 = Menu visible.

P98.67 - Menu 67 (CAN 2 DeviceNet) Enable

This parameter is only available if a 2nd CAN Port Module is fitted.

Allowed values: 0 = Menu invisible.
1 = Menu visible.

P98.70, P98.71 and P98.72 - Menus 70, 71 and 72

(Application Code Developer) Enable.

These parameters are only available for use with the Application Code Developer.

P98.74 - Menu 74 (PROFIBUS) Enable

This parameter is only available if a PROFIBUS Board type MVC3007-4002 is fitted.

Allowed values: 0 = Menu invisible.
1 = Menu visible.

P98.75 - Menu 75 (PROFIBUS) Enable

This parameter is only available if a PROFIBUS Board is fitted.

Allowed values: 0 = Menu invisible.
1 = Menu visible.

P98.78 - Menu 78 (MicroPEC™) Enable

This parameter is only available if a MicroPEC™ Module is used

Allowed values: 0 = Menu invisible.
1 = Menu visible.

P98.80 to P98.89 - Menus 80 to 89 Enable

These parameters are available only if an optional Communications Board (e.g. FIP, Ethernet) is fitted.

Allowed values: 0 = Menu invisible.
1 = Menu visible.

P98.90 - Menu 90 (GE Power Conversion Service Use) Enable

This parameter is to enable Menu 90, which is the **GE Power Conversion** service menu for access only by **GE Power Conversion** staff for service purposes.

P98.98 and P98.99 - Menus 98 and 99 Enable

These parameters are always set to 1 (Enable).

6.57 MENU 99 - CONFIGURATION SETTINGS

Menu 99 gives access to the parameters required to configure and monitor various basic drive parameters as follows:

System Hardware Configuration
Control Structure
Drive Duty Type
Firmware version - read only
Controller Serial number
Security code
Text Language
Set-up, storage and retrieval
Software downloader
Template upload

6.57.1 DELTA Drives

P99.00 - Number of DELTAs

This read-only parameter indicates the number of DELTA modules (output bridges) fitted.

Range of values: 0 to 6.

For all basic drive modules in MicroCubicle™ format, P99.00 has no meaning and is set at 0, from which it cannot be adjusted.

6.57.2 Control Structure

P99.01 - Control Structure

Allowed values:
0 = No Motor Control.
1 = Frequency Control.
2 = Vector Control.
3 = Scalar Control.
4 = SFE Mode.

When switching from a non-SFE Mode to SFE Mode, various adjustments will be made to the Parameter Set as follows:

- Menu 1 will change to a default Parameter Set suitable for SFE.
- Digital output 3 will change to 'Vdc at reference', Status Flag 100.
- The minimum permissible PWM frequency will be raised to 2.5 kHz.
- The history channel settings will change.

6.57.3 Overload Duty

P99.02 - Overload Duty

MV3000e drives are dual rated, i.e. they can operate with either 110% overload or 150% overload ratings. The value set in P99.02 selects the drive Full Load Current for the chosen rating as follows:

0 = (Disabled) 150% overload - for industrial plant applications.
1 = (Enabled) 110% overload - typically for fans and pumps.

The duty type selected effects the continuous current rating, the current limit range and other current-dependent parameters.

When this parameter is changed the CDC re-starts and the keypad will lose connection for a short time.

6.57.4 Alternative Voltage Grades

P99.11 - Alternative Drive Voltage Grades

Some drives have two possible options. These drives have a different nominal current rating for each of their voltage ratings. The voltage and current ratings are stated on the drive label. Where applicable, this parameter switches the drive into its alternative grade option. This will in turn adjust the value of P99.05 - Drive Nominal Current.

Allowed values: 0 = Standard Voltage Grade.
1 = Alternative Voltage Grade.

6.57.5 Firmware Type

P99.03 - Firmware Type

This read-only parameter contains a number indicating the Type of firmware in use.

E.g. 6 = MV3000e series drives.

P99.04 - Firmware Revision Number

This read-only parameter indicates the revision status of the drive's firmware.

The number takes the form X.YY.

6.57.6 Drive Nominal Current

P99.05 - Drive Nominal Current

This a read-only parameter, containing the manufacturer's rated current for the drive.

Values are as the drive current ratings: 58A to 6000A.

6.57.7 Drive Security Passwords and IDs

There are two passwords that can be entered to allow an authorised operator or engineer to change parameter values - see Figure 6-45. The passwords are numbers set and stored in P99.07 (Operator Security Code) and P99.08 (Engineer Security Code). P99.06 is the "key". When a password is entered in P99.06 it is compared with P99.07 and P99.08 - if they match, one relevant access level is achieved.

When editing is completed the parameters are locked by entering a value, other than the operator or engineer codes (password), in P99.06. Also refer to Parameter P35.04 for an Auto-locking feature.

Sometimes the passwords for Operator and Engineer Security Access levels may be forgotten or mislaid and it is then not possible to edit parameters within a drive. Use of the Master Password will allow users to open the Engineer Security level. When Engineer access is available the original passwords can be re-acquired - see Note in Figure 6-45.

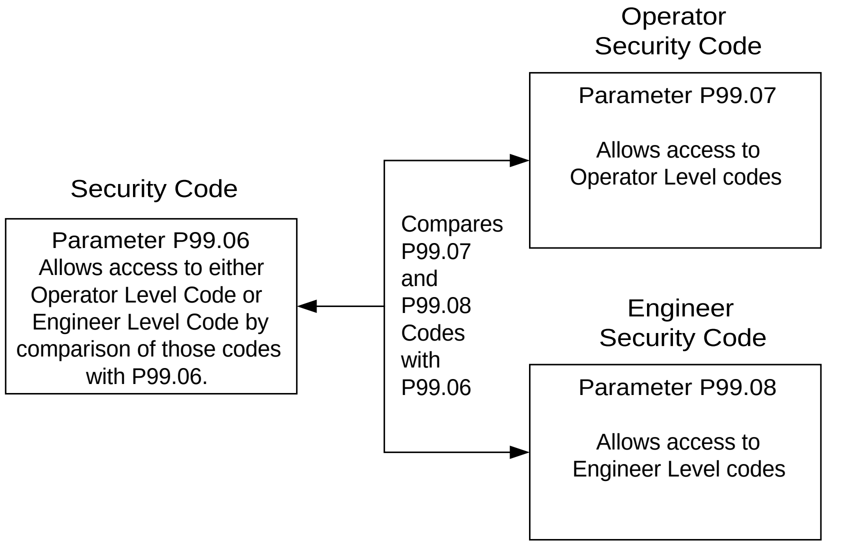
P99.06 - Security Code

This is where the "key" is entered into the "lock". The combination must match either P99.07 or P99.08 to "open" the relevant access level.

Allowed values: 0 to 9999.

P99.07 - Operator Security Code

Contains the value that must be entered in P99.06 to allow access to the `operator' parameters. This value cannot be read or adjusted unless the operator access is unlocked.



Note:
If Master Password Code 3511 is entered for P99.06 then Engineer Access is available and parameters at P99.07 and P99.08 can either be viewed or changed.

Figure 6-45. – Drive Security Codes

P99.08 - Engineer Security Code

Contains the value that must be entered in P99.06 to allow access to `engineer' parameters. This parameter cannot be read or adjusted unless the engineer access is unlocked.

P99.09 – Manufacturer Security Code

Contains the value that must be entered in P99.06 to allow access by the drive manufacturer's personnel. This parameter cannot be read or adjusted unless manufacturer's access is unlocked.

P99.13 - Drive Security ID 1
P99.14 - Drive Security ID 2

These parameters prevent the parameter-set intended for one drive from being loaded, via a serial link, into an incorrect drive. This is achieved by requiring P99.13 and P99.14 to have identical values before a parameter-set can be loaded.

P99.13 can only be edited via the Keypad, not via a serial link.

P99.14 can be edited via Keypad or serial link.

Allowed values: 0 to 30,000.

Application Example for Achieving Drive File Security Using Drive Coach

a) Set P99.13 to a security number of your choice e.g. 3008.

b) The drive will trip on "drive ID violation" - this is OK, it simply means that P99.13 does not match P99.14.

c) Set P99.14 to the same as P99.13.

d) Reset the trip.

e) Now do a parameter upload to Drive Coach, the values of P99.13/14 will be saved.

f) When the file is sent to another drive, Drive Coach will notice that the security IDs in the drive and the file do not match and will warn you.

g) If the download is carried out anyway then the drive will trip out on "drive ID violation" again.

6.57.8 User Text Language

P99.10 - User Text Language

Allowed values: 1 = English.
2 = French.
3 = Portuguese.
4 = German.

6.57.9 Firmware Downloader

P99.12 - Firmware Downloader

This parameter is used when it is required to update the drive firmware. Instructions for updating drive firmware are included with the firmware release documentation.

Allowed values: 0 = Not Enabled.
1 = Enable Download.

6.57.10 Upload Template

The MV3000e pc programming package (Drive Coach) uses "template files" to allow fast data transfer to and from the drive. These template files are uploaded from a drive when the programmer is first used.

The following parameter (P99.15) allows the generation of customised template files for each drive application.

P99.15 - Upload Template

This is a three-digit number that is only used by Drive Coach. It is used to determine the filename for the template to be created.

The individual drive types and sizes have a pre-determined template number which Drive Coach looks at e.g. Template 21 is an MV3071A4A1.

The only advantage, as a user, to changing the number is that the templates that are stored by the pc would be more easily identifiable, for example the template number for a 71 A MV3000e is 21. However, as a user you could write P99.15 to 371, for example, and it would have more sense on the PC. Re-numbering the template would still not prevent files from being placed in the wrong drives.

See P99.13 and P99.14 for "protecting" firmware uploads.

Allowed values: 1 to 999.

NOTE: Values in the range 1 to 199 should not be used as they refer to the default template files for different sizes of MV3000e drives.

6.57.11 Backup Parameters

P99.16 - Backup Parameters

This parameter allows the user to:

- Save the current Parameter Set (excluding the history record and any read-only parameters) as the Backup Parameter Set, or to the Keypad (perhaps to load into another drive).
- Restore the Backup Parameter Set to the main Parameter Set manually. This is automatically done at power up if the parameters stored at power down are found to be invalid.

If this occurs, a Status Flag (SF110 - Backup Parameter Set in use) will be set until the next power up, to indicate that there is a system problem. No trip will be generated, and the History Record will not be restored. Other read-only parameters (e.g. kWh) will also have lost their stored value. However, the drive will operate correctly according to the stored backup Parameter Set.

This feature can also be used to save a known working drive Set-up, before undertaking experimental changes. The known working Set-up can then be restored with a single parameter change.

In addition to the primary non-volatile storage each drive has two other parameter storage locations. The first location is a backup storage internal to the drive; the 'Internal Store'. The second location is keypad storage for transferring parameters from one drive to another; the 'Keypad Store'. P99.16 controls this parameter storage mechanism and Figure 6-46 shows an overview.

Allowed values:

0 = No Action.
The Backup Parameter Set remains as currently stored.

1 = Save.
The current drive Parameter Set becomes the Backup Parameter Set. This excludes any read-only parameters. Once the parameters have been saved, P99.16 returns to a value of 0.

2 = Recall.
The Backup Parameter Set (if valid) is copied to the current drive Parameter Set. This excludes any read-only Parameters. Once the parameters have been restored, P99.16 returns to a value of 0. If no valid Backup Parameter Set exists, P99.16 will return to zero without changing the current parameter settings.

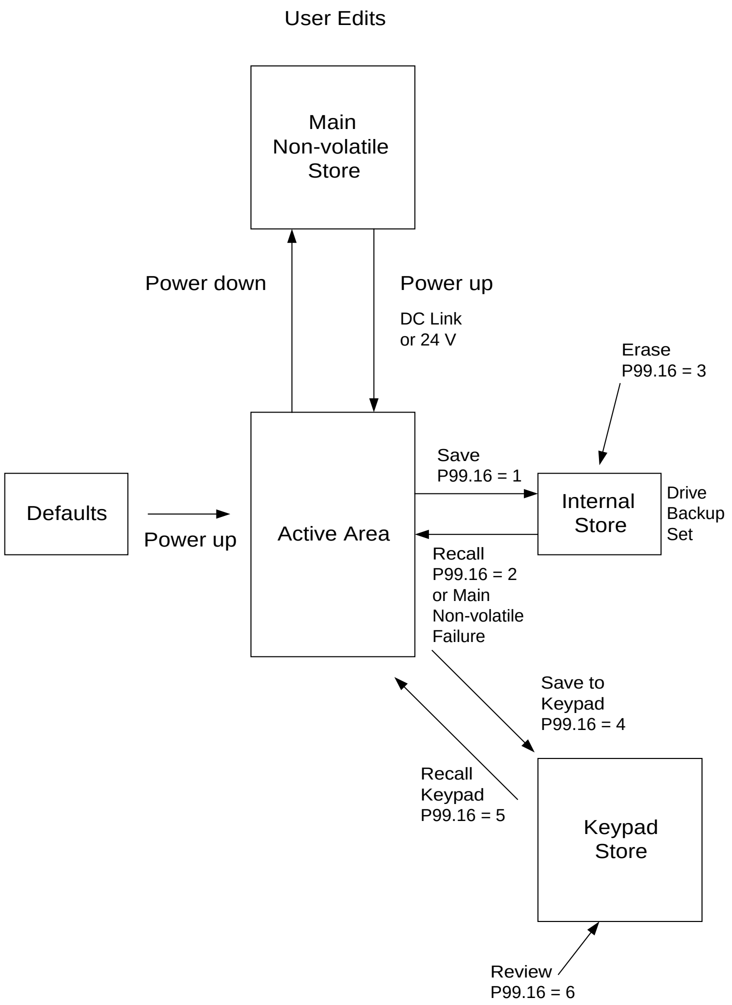


Figure 6-46. – Overview of Parameter Backup Storage

3 = Erase.
The Backup Parameter Set is erased and normal behaviour is restored in the event of an invalid stored Parameter Set at power up.

4 = Save to Keypad.
The current drive Parameter Set is copied to the Keypad. This includes the firmware revision number but excludes any read-only parameters. Once the parameters have been saved, P99.16 returns to a value of 0.

5 = Recall Keypad.
The Parameter Set stored in the Keypad is copied to the current drive Parameter Set, but only if the firmware revision status is compatible. When recalling to a different drive size, parameters related to drive size are not copied. Once the parameters have been recalled, P99.16 returns to a value of 0. If no valid Keypad Parameter Set exists, P99.16 will return to zero without changing the current parameter settings.

6 = Check Keypad Data.
Shows Parameter Set compatibility data, i.e. why a Parameter Set stored in the Keypad may not recall.

Press the Navigation arrows to check the whole of the data.

Recalling a Parameter Set from the Drive Data Manager™ (Keypad)

Recalling a Parameter Set from one drive to another is a very powerful and useful feature. However, care must be taken to ensure that an incorrect Parameter Set in the target drive does not result from copying the Parameter Set from an inappropriately configured drive, particularly from a drive of different rating from the source drive.

If the firmware revision status of the saved Parameter Set is compatible with the target drive, then the Parameter Set will be restored.

If the saved Parameter Set is from a drive of the same size (voltage and current rating) as the target drive, then ALL of the customer parameters (except for read-only parameters) will be copied from the Drive Data Manager™.

If the saved Parameter Set is from a drive of a different size (voltage or current rating) from the target drive, then parameters dependent upon the size of drive will NOT be copied from the Drive Data Manager™ to the target drive. Parameters that fall into this category are listed at Table 6-17.

It is recommended that parameters are not transferred between drives of different sizes fitted with MV3000e MicroCubicle™ and DELTA AC Drives Firmware Versions 1.00 and 2.00.

Refer to Section 9 for the consequences of changing pcbs and/or DELTAs and the operation of P10.35 to ensure that the Product Identity Record is not lost during service visits.

Parameter Number	Description	Parameter Number	Description
P2.00	Motor Base Frequency	P12.17	No Load Current @ 50% V
P2.01	Motor Base Voltage	P12.18	No Load Current @ 60% V
P2.02	Motor Full Load Current	P12.19	No Load Current @ 70% V
P2.03	Motor Nominal Power	P12.20	No Load Current @ 80% V
P2.04	Motor Nominal Speed	P12.21	No Load Current @ 90% V
P2.05	Motor Full Load Power Factor	P12.22	Leakage Voltage
P2.06	Number of Motor Poles	P23.00	DB Resistor Value
P3.13	Motor Stator Resistance - VVVF	P23.01	DB Resistor Average Power
P3.14	Motor Stator Inductance - VVVF	P23.02	DB Resistor Maximum Power
P3.15	Motor Magnetising Resistance - VVVF	P23.04	DB Voltage Threshold
P4.12	Motor Regeneration Power Limit	P23.05	Motor Regenerative Power Limit
P6.17	Trip Avoidance Threshold	P35.00	PWM Switching Frequency
P12.00	Motor No Load Current	P50.00	DC Link Voltage Reference
P12.02	Nominal Mains Supply Volts	P50.01	Line Choke Inductance
P12.10	Measured Rotor Resistance	P50.03	Active Current Positive Limit
P12.11	Stator Resistance	P50.04	Active Current Negative Limit
P12.12	Stator Inductance	P52.17	DC Link Pre-Charge Threshold
P12.13	Magnetising Resistance	P53.02	Alternative DC Link Feedback
P12.14	Magnetising Inductance	P99.05	Drive Nominal Current
P12.15	Rotor Resistance	P99.15	Upload Template
P12.16	Rotor Inductance	P99.16	Backup Parameters

Table 6-29. – Parameters which will NOT be copied from the Drive Data Manager™ when attempting a transfer between drives of different sizes

6.57.12 Restore Defaults

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.**

Record the settings in "Edit Review Mode", i.e. set P35.03 = 1.

P99.17 - Restore Defaults

This parameter allows the restoration of factory default settings to the active parameter set or all of the parameter sets.

Allowed values: 0 = Normal.
1 = Default Current.
2 = Default All Parameter Sets.

6.57.13 Multiple Parameter Sets

The MV3000e drive can store up to 3 parameter sets, allowing one drive to be used with 3 different motors.

P99.20 - Active Parameter Set

This parameter displays the current active parameter set being used by the drive.

P99.21 - Parameter Set Select

This parameter is used to select the active parameter set when under keypad or simple Fieldbus control. When the drive is in the 'stopped' state this parameter determines how the active parameter set is selected.

Value	Action
0	The parameter set is selected by examining the values of the P-Set select Control Flags. Note: Control cannot be changed to this method until the drive is stopped.
1	Parameter Set 1 is activated
2	Parameter Set 2 is activated
3	Parameter Set 3 is activated

Table 6-30. – P99.21 Parameter Set Select

All three parameter sets are held within the drive at all times and are retained when the drive is powered off.

When changing the active parameter set the data for the new parameter set is retrieved from non-volatile memory into the drive's active parameter set. The drive behaves as if the parameters had been individually edited one after the other. As such, the drive may go through a re-boot as a result of changes in some parameter values, for example P99.02 - 'Overload Duty'.

In order to prevent a potential oscillation between parameter sets the value of P99.21 is copied to all three parameters sets' non-volatile storage before changing to the new parameter set.

The drive is inhibited from starting until the new parameter set has been fully copied and made ready.

P99.22 – CF190: Parameter Set Select
P99.23 – CF191: Alternative Parameter Set Select

These control flags are used to select the active parameter set in response to a change in a digital input, status bit or some other control flag source.

When the parameter select is by control flag source (P99.21 = 0), the active parameter set is determined by reference to the following table.

CF190	CF191	Action
0	Do not care	Use Parameter Set 1
1	0	Use Parameter Set 2
1	1	Use Parameter Set 3

Table 6-31. –Control Flag State for Parameter Set Select

In order to prevent a potential oscillation between parameter sets the values of these parameters are copied to all three parameters sets' non-volatile storage rather than just the active parameter set's values.

P99.24 - Copy Parameter Set

This parameter is used to copy the active parameter set into the selected parameter set. This is useful when creating a second parameter set that contains most of the edits in the active parameter set.

7. CONTROL BLOCK DIAGRAMS

7.1 INTRODUCTION

The Control Block Diagrams for the MV3000e drive are included in this section. These diagrams graphically represent most of the drive's parameters. They are designed to show the inter-relationship of the drive functions and features and form a set of sheets that will allow the user to completely design customised application solutions.

The Control Block Diagrams are arranged in three groups. One group shows the functional relationship for the Machine Control Mode of operation. Another group shows the functional relationship for the Sinusoidal Front End (SFE) Mains Control Mode of operation. A third group shows the Proportional DB mode of operations. A Control System Overview, showing the relationship between the modes of operation, is shown at Sheet 1 of the Control Block Diagrams. Sheet 1 can be used as a reference sheet for the complete set of 19 sheets.

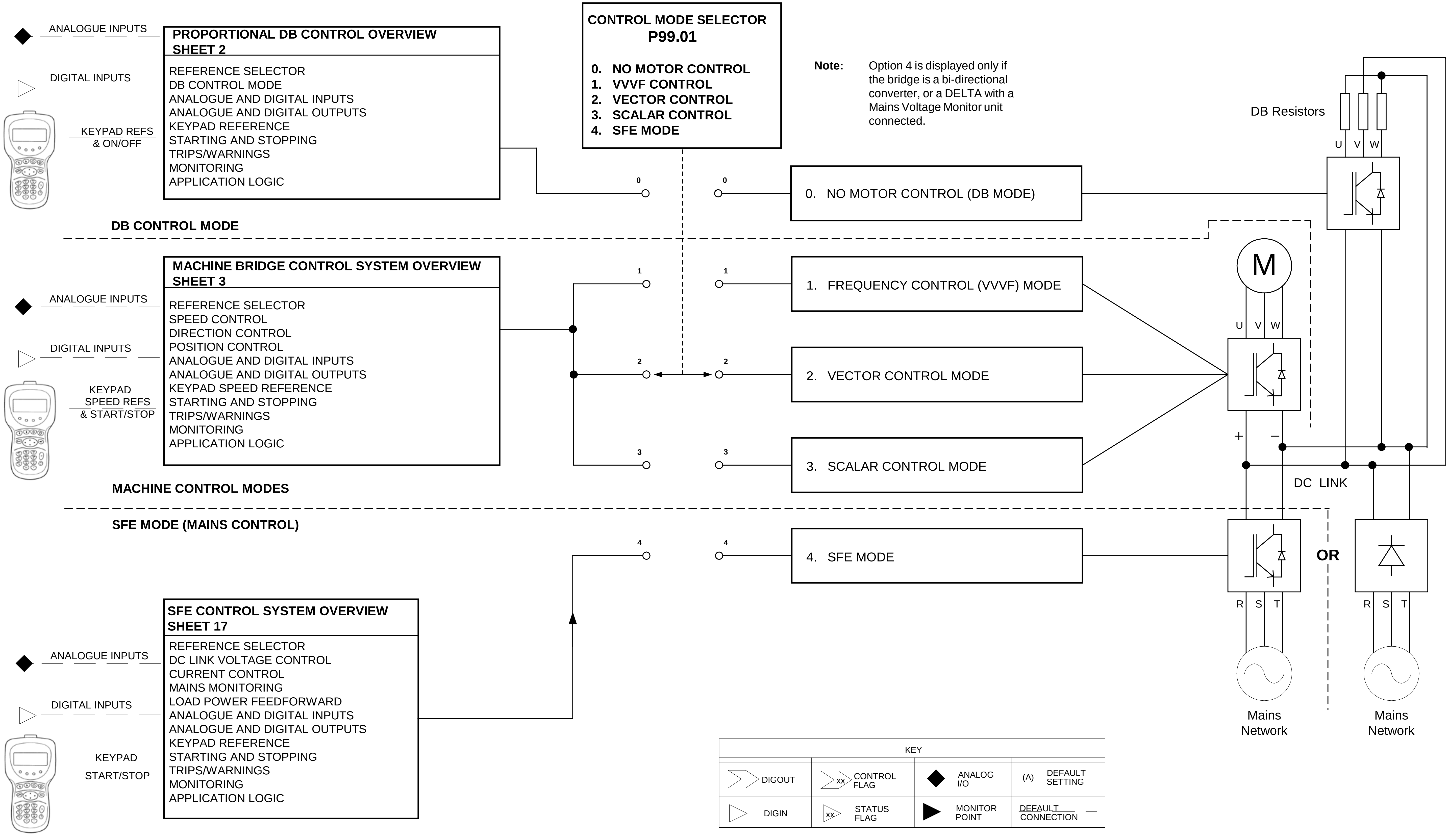
The diagrams are summarised in Table 7-1 with an indication of their use.

Functions within a drive 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. Over Speed. 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 at a key that is featured on each of the diagram pages.

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 & Special Monitoring Functions	✓	✓	✓
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	Scalar Control			✓
17	SFE Control System Overview		✓	
18	SFE Vector Control, Part 1		✓	
19	SFE Vector Control, Part 2		✓	

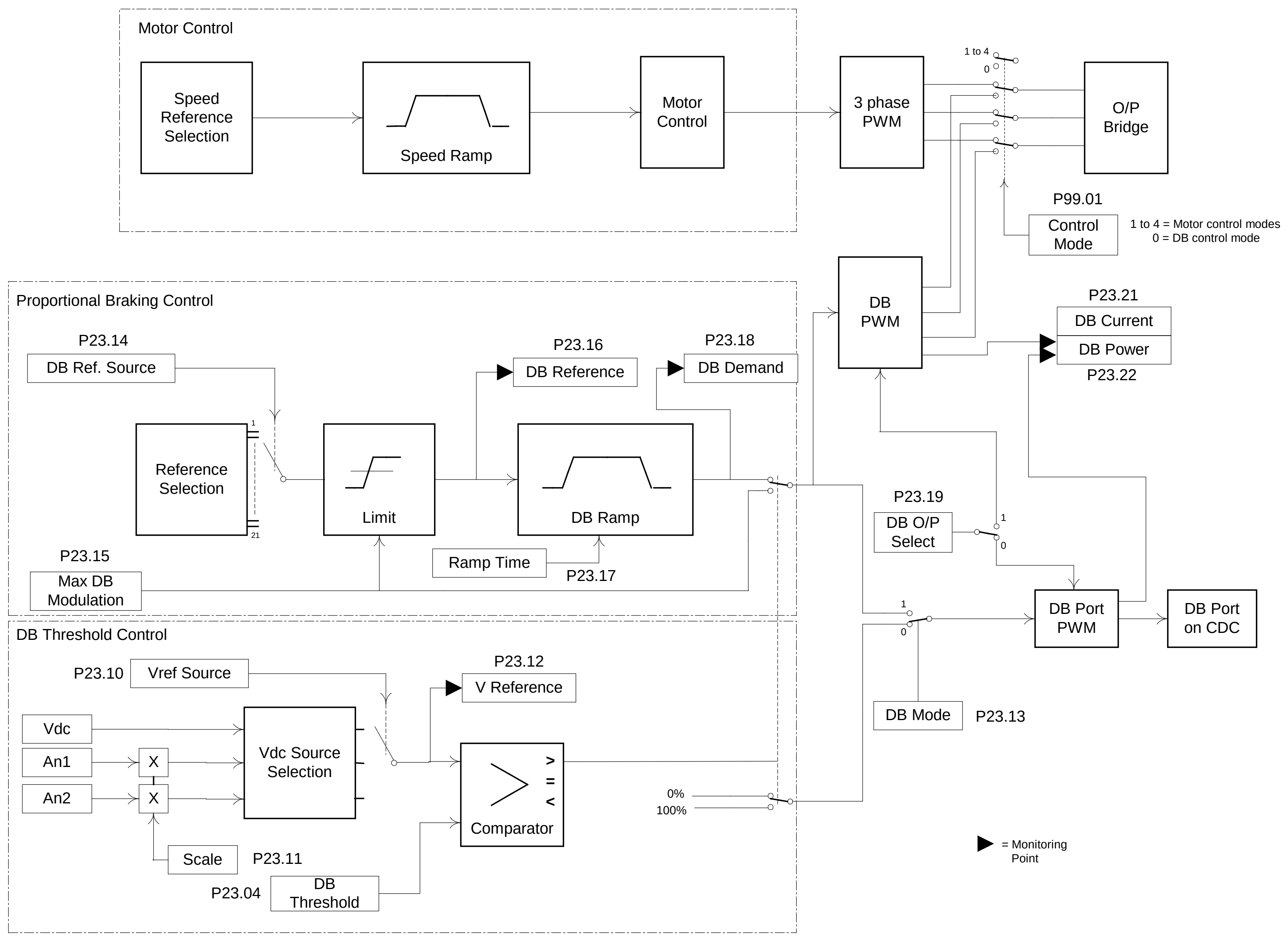
Table 7-1. – Summary of Control Block Diagrams & their use

Control System Overview

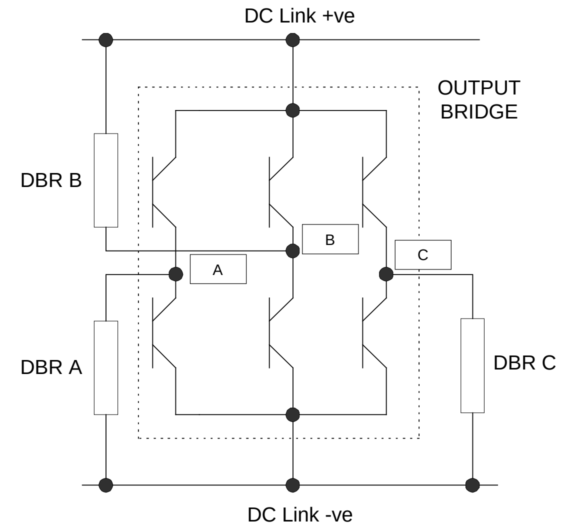


Sheet 1

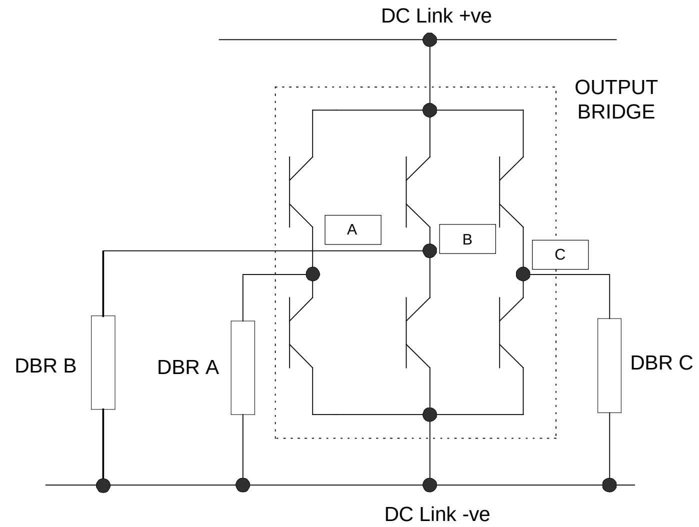
PROPORTIONAL DB CONTROL



MENU 23

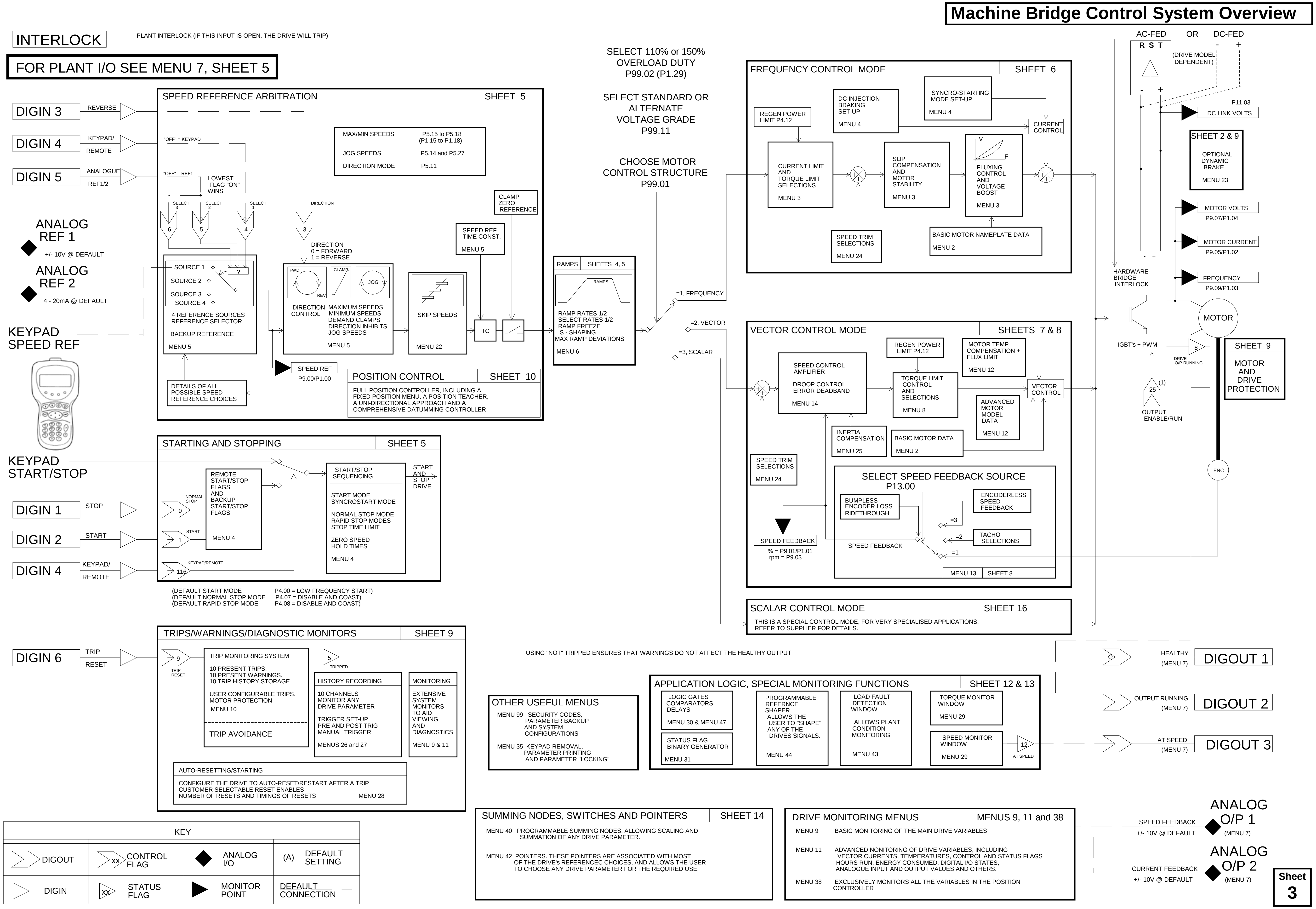


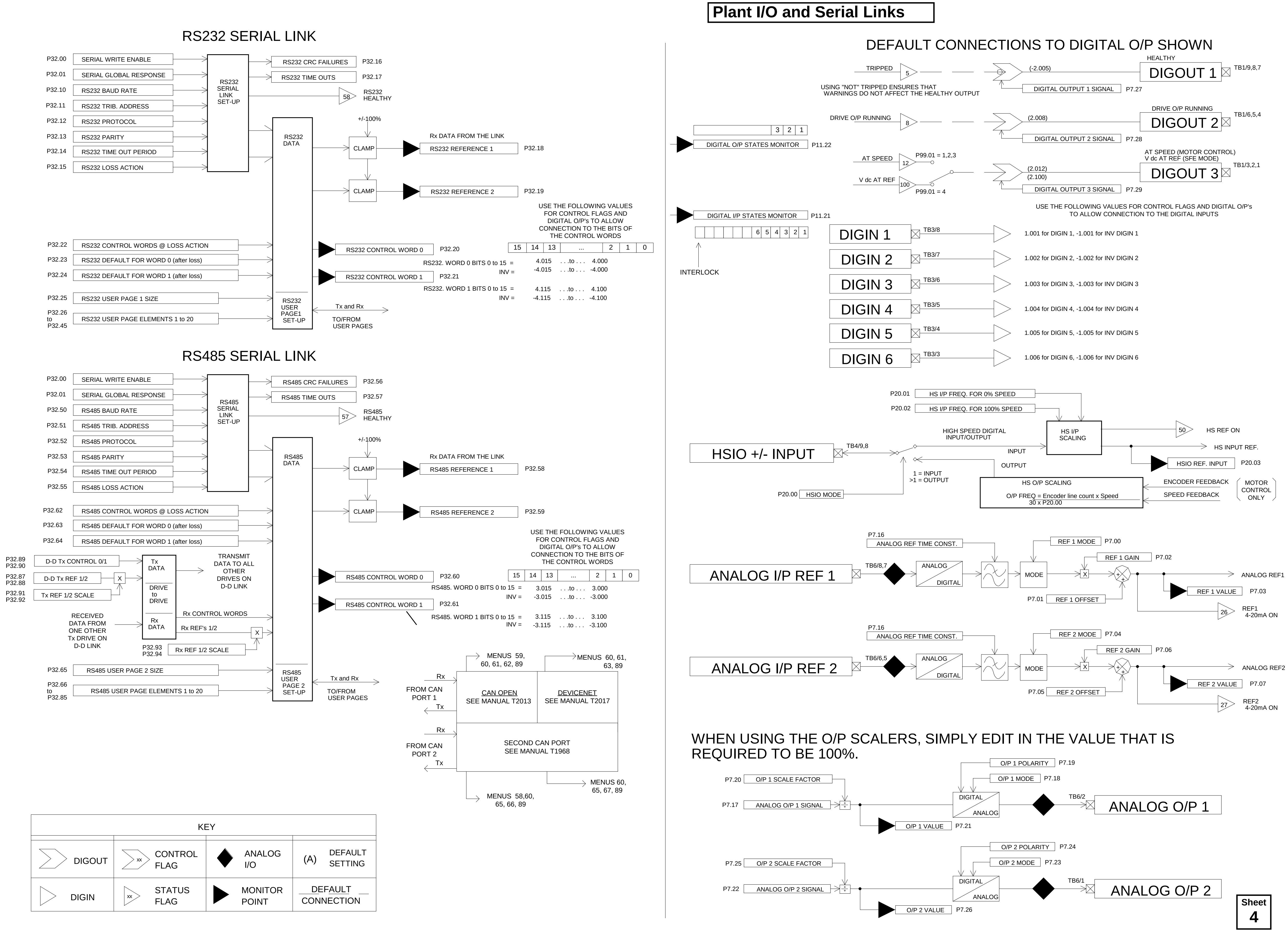
Output Bridge Connections
For Proportional DB Control



Output Bridge Connections
For Threshold DB Control

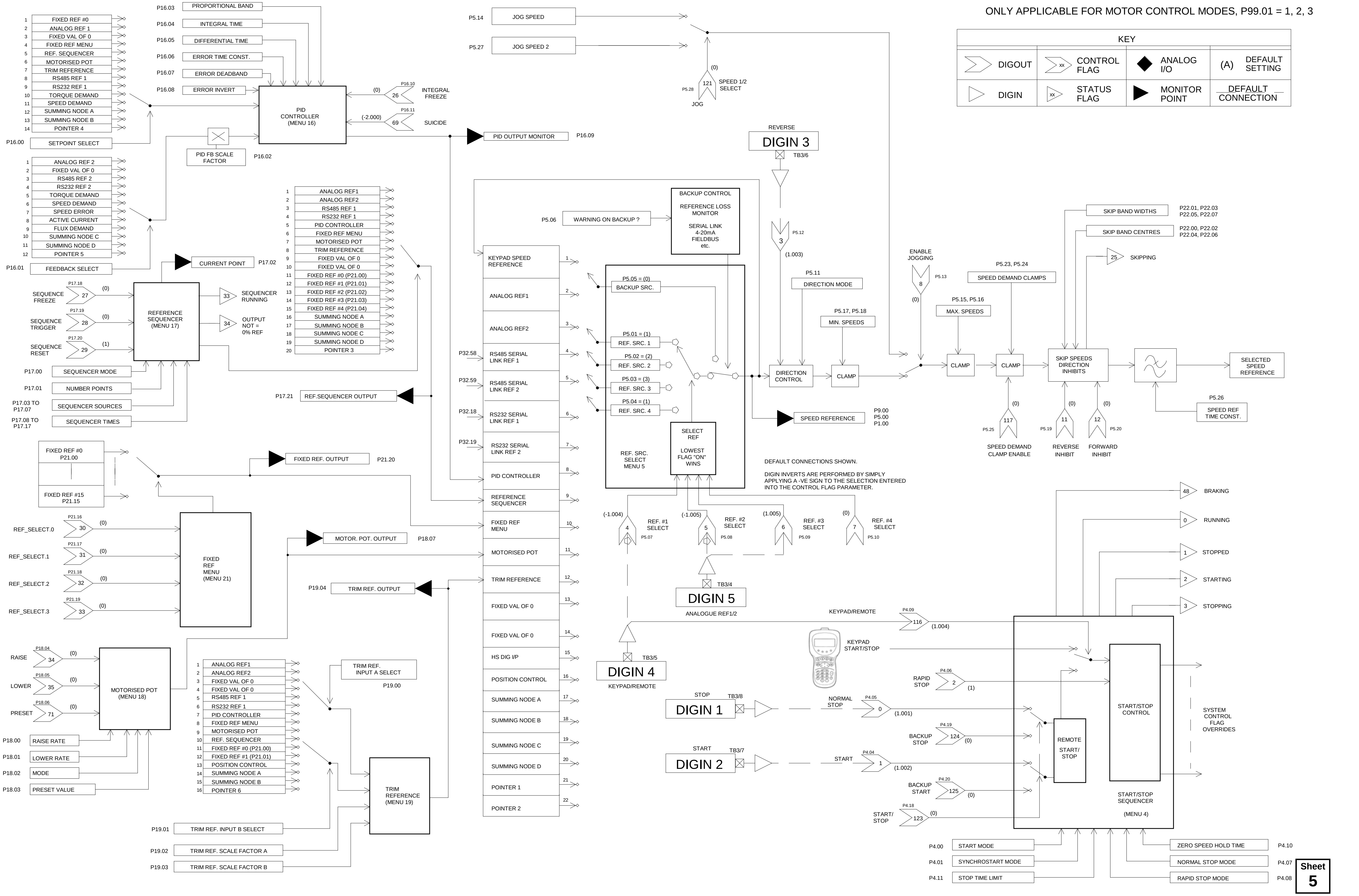
Sheet 2


Machine Bridge Control System Overview
INTERLOCK
PLANT INTERLOCK (IF THIS INPUT IS OPEN, THE DRIVE WILL TRIP)
FOR PLANT I/O SEE MENU 7, SHEET 5
SELECT 110% or 150% OVERLOAD DUTY P99.02 (P1.29)
SELECT STANDARD OR ALTERNATE VOLTAGE GRADE P99.11
CHOOSE MOTOR CONTROL STRUCTURE P99.01
SPEED REFERENCE ARBITRATION SHEET 5
DIGIN 3 REVERSE
DIGIN 4 KEYPAD/ REMOTE
DIGIN 5 ANALOGUE REF1/2
ANALOG REF 1 +/- 10V @ DEFAULT
ANALOG REF 2 4 - 20mA @ DEFAULT
KEYPAD SPEED REF
MAX/MIN SPEEDS P5.15 to P5.18 (P1.15 to P1.18)
JOG SPEEDS P5.14 and P5.27
DIRECTION MODE P5.11
4 REFERENCE SOURCES REFERENCE SELECTOR
BACKUP REFERENCE
MENU 5
DIRECTION CONTROL
MAXIMUM SPEEDS DEMAND CLAMPS DIRECTION INHIBITS JOG SPEEDS
SKIP SPEEDS MENU 22
SPEED REF TIME CONST. MENU 5
CLAMP ZERO REFERENCE
SPEED REF P9.00/P1.00
DETAILS OF ALL POSSIBLE SPEED REFERENCE CHOICES
POSITION CONTROL SHEET 10
FULL POSITION CONTROLLER, INCLUDING A FIXED POSITION MENU, A POSITION TEACHER, A UNI-DIRECTIONAL APPROACH AND A COMPREHENSIVE DATUMMING CONTROLLER
RAMPS SHEETS 4, 5
RAMP RATES 1/2
SELECT RATES 1/2
RAMP FREEZE
S - SHAPING
MAX RAMP DEVIATIONS
MENU 6
=1, FREQUENCY
=2, VECTOR
=3, SCALAR
FREQUENCY CONTROL MODE SHEET 6
REGEN POWER LIMIT P4.12
DC INJECTION BRAKING SET-UP MENU 4
SYNCRO-STARTING MODE SET-UP MENU 4
CURRENT CONTROL
CURRENT LIMIT AND TORQUE LIMIT SELECTIONS MENU 3
SLIP COMPENSATION AND MOTOR STABILITY MENU 3
FLUXING CONTROL AND VOLTAGE BOOST MENU 3
SPEED TRIM SELECTIONS MENU 24
BASIC MOTOR NAMEPLATE DATA MENU 2
AC-FED R S T OR DC-FED (DRIVE MODEL DEPENDENT)
P11.03 DC LINK VOLTS
SHEET 2 & 9 OPTIONAL DYNAMIC BRAKE MENU 23
MOTOR VOLTS P9.07/P1.04
MOTOR CURRENT P9.05/P1.02
FREQUENCY P9.09/P1.03
HARDWARE BRIDGE INTERLOCK
IGBT's + PWM
MOTOR
DRIVE O/P RUNNING
OUTPUT ENABLE/RUN
SHEET 9 MOTOR AND DRIVE PROTECTION
ENC
VECTOR CONTROL MODE SHEETS 7 & 8
SPEED CONTROL AMPLIFIER
DROOP CONTROL ERROR DEADBAND MENU 14
REGEN POWER LIMIT P4.12
TORQUE LIMIT CONTROL AND SELECTIONS MENU 8
MOTOR TEMP. COMPENSATION + FLUX LIMIT MENU 12
VECTOR CONTROL
ADVANCED MOTOR MODEL DATA MENU 12
INERTIA COMPENSATION MENU 25
BASIC MOTOR DATA MENU 2
SPEED TRIM SELECTIONS MENU 24
SELECT SPEED FEEDBACK SOURCE P13.00
BUMPLESS ENCODER LOSS RIDETHROUGH
ENCODERLESS SPEED FEEDBACK
TACHO SELECTIONS
SPEED FEEDBACK
% = P9.01/P1.01 rpm = P9.03
MENU 13 SHEET 8
SCALAR CONTROL MODE SHEET 16
THIS IS A SPECIAL CONTROL MODE, FOR VERY SPECIALISED APPLICATIONS. REFER TO SUPPLIER FOR DETAILS.
STARTING AND STOPPING SHEET 5
KEYPAD START/STOP
DIGIN 1 STOP
DIGIN 2 START
DIGIN 4 KEYPAD/ REMOTE
REMOTE START/STOP FLAGS AND BACKUP START/STOP FLAGS MENU 4
START/STOP SEQUENCING
START MODE SYNCROSTART MODE
NORMAL STOP MODE RAPID STOP MODES STOP TIME LIMIT
ZERO SPEED HOLD TIMES
MENU 4
START AND STOP DRIVE
(DEFAULT START MODE P4.00 = LOW FREQUENCY START)
(DEFAULT NORMAL STOP MODE P4.07 = DISABLE AND COAST)
(DEFAULT RAPID STOP MODE P4.08 = DISABLE AND COAST)
TRIPS/WARNINGS/DIAGNOSTIC MONITORS SHEET 9
DIGIN 6 TRIP RESET
TRIP MONITORING SYSTEM
10 PRESENT TRIPS. 10 PRESENT WARNINGS. 10 TRIP HISTORY STORAGE.
USER CONFIGURABLE TRIPS. MOTOR PROTECTION MENU 10
TRIP AVOIDANCE
HISTORY RECORDING
10 CHANNELS MONITOR ANY DRIVE PARAMETER
TRIGGER SET-UP PRE AND POST TRIG MANUAL TRIGGER
MENUS 26 and 27
MONITORING
EXTENSIVE SYSTEM MONITORS TO AID VIEWING AND DIAGNOSTICS
MENU 9 & 11
AUTO-RESETTING/STARTING
CONFIGURE THE DRIVE 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
OUTPUT RUNNING (MENU 7) DIGOUT 2
AT SPEED (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 12 & 13
LOGIC GATES COMPARATORS DELAYS MENU 30 & MENU 47
STATUS FLAG BINARY GENERATOR MENU 31
PROGRAMMABLE REFERNCE SHAPER ALLOWS THE USER TO "SHAPE" ANY OF THE DRIVES SIGNALS. MENU 44
LOAD FAULT DETECTION WINDOW ALLOWS PLANT CONDITION MONITORING MENU 43
TORQUE MONITOR WINDOW MENU 29
SPEED MONITOR WINDOW MENU 29
SUMMING NODES, SWITCHES AND POINTERS SHEET 14
MENU 40 PROGRAMMABLE SUMMING NODES, ALLOWING SCALING AND SUMMATION OF ANY DRIVE PARAMETER.
MENU 42 POINTERS. THESE POINTERS ARE ASSOCIATED WITH MOST OF THE DRIVE's REFERENCEC CHOICES, AND ALLOWS THE USER TO CHOOSE ANY DRIVE PARAMETER FOR THE REQUIRED USE.
DRIVE MONITORING MENUS MENUS 9, 11 and 38
MENU 9 BASIC MONITORING OF THE MAIN DRIVE VARIABLES
MENU 11 ADVANCED NONITORING OF DRIVE VARIABLES, INCLUDING VECTOR CURRENTS, TEMPERATURES, CONTROL AND STATUS FLAGS HOURS RUN, ENERGY CONSUMED, DIGITAL I/O STATES, ANALOGUE INPUT AND OUTPUT VALUES AND OTHERS.
MENU 38 EXCLUSIVELY MONITORS ALL THE VARIABLES IN THE POSITION CONTROLLER
SPEED FEEDBACK +/- 10V @ DEFAULT ANALOG O/P 1 (MENU 7)
CURRENT FEEDBACK +/- 10V @ DEFAULT ANALOG O/P 2 (MENU 7)
KEY
DIGOUT
CONTROL FLAG
ANALOG I/O
(A) DEFAULT SETTING
DIGIN
STATUS FLAG
MONITOR POINT
DEFAULT CONNECTION
Sheet 3


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
RS232 DATA
+/-100%
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
RS485 DATA
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)
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
TRANSMIT DATA TO ALL OTHER DRIVES ON D-D LINK
RECEIVED DATA FROM ONE OTHER Tx DRIVE ON D-D LINK
Rx DATA
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
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
MENUS 59, 60, 61, 62, 89
MENUS 60, 61, 63, 89
FROM CAN PORT 1
CAN OPEN SEE MANUAL T2013
DEVICENET SEE MANUAL T2017
FROM CAN PORT 2
SECOND CAN PORT SEE MANUAL T1968
MENUS 58,60, 65, 66, 89
MENUS 60, 65, 67, 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
USING "NOT" TRIPPED ENSURES THAT WARNINGS DO NOT AFFECT THE HEALTHY OUTPUT
(-2.005) HEALTHY DIGOUT 1 TB1/9,8,7
DIGITAL OUTPUT 1 SIGNAL P7.27
DRIVE O/P RUNNING 8
(2.008) DRIVE O/P RUNNING DIGOUT 2 TB1/6,5,4
DIGITAL OUTPUT 2 SIGNAL P7.28
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
DIGITAL I/P STATES MONITOR P11.21
INTERLOCK
USE THE FOLLOWING VALUES FOR CONTROL FLAGS AND DIGITAL O/P's TO ALLOW CONNECTION TO THE DIGITAL INPUTS
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

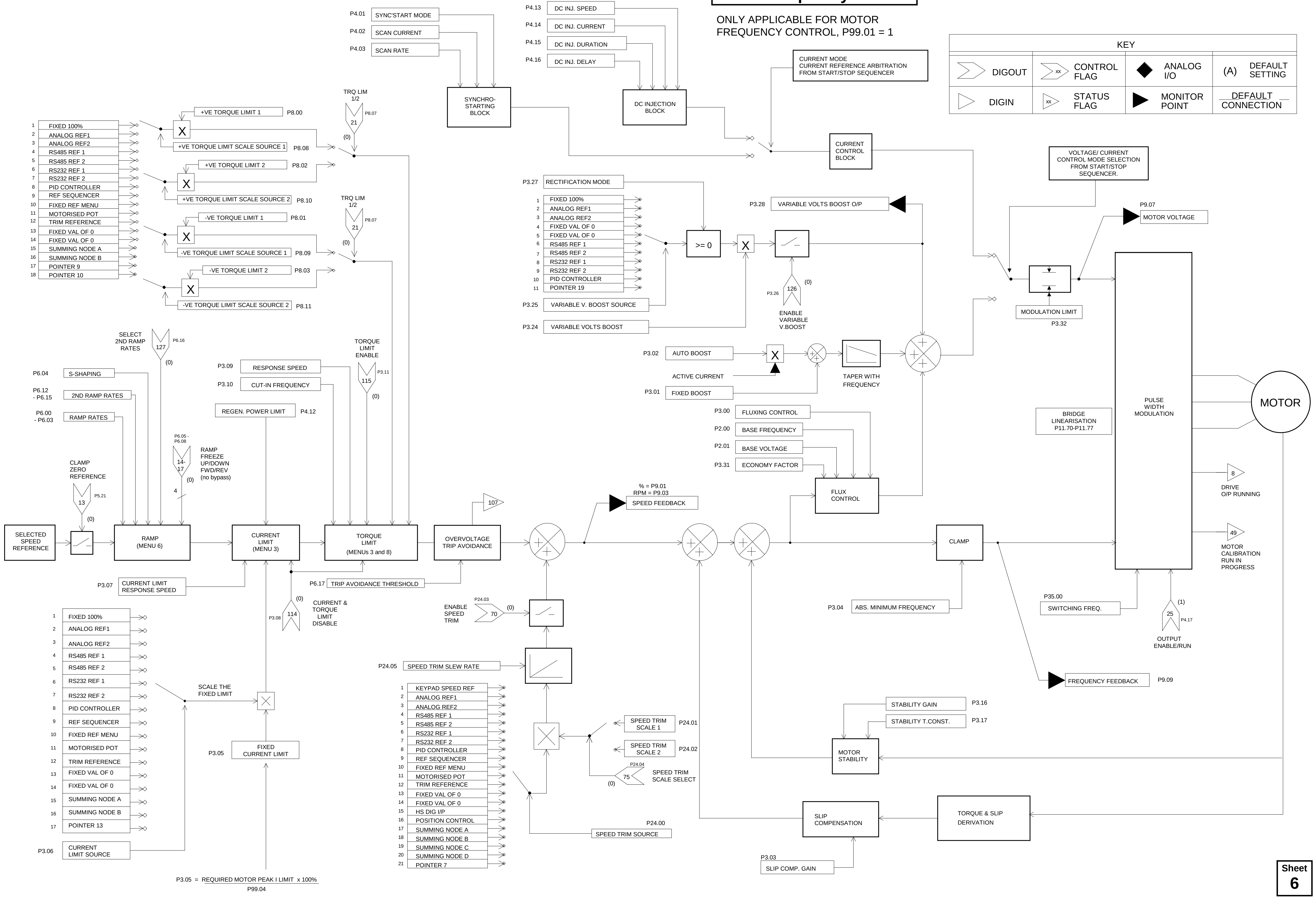
Reference Arbitration and Starting/Stopping

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



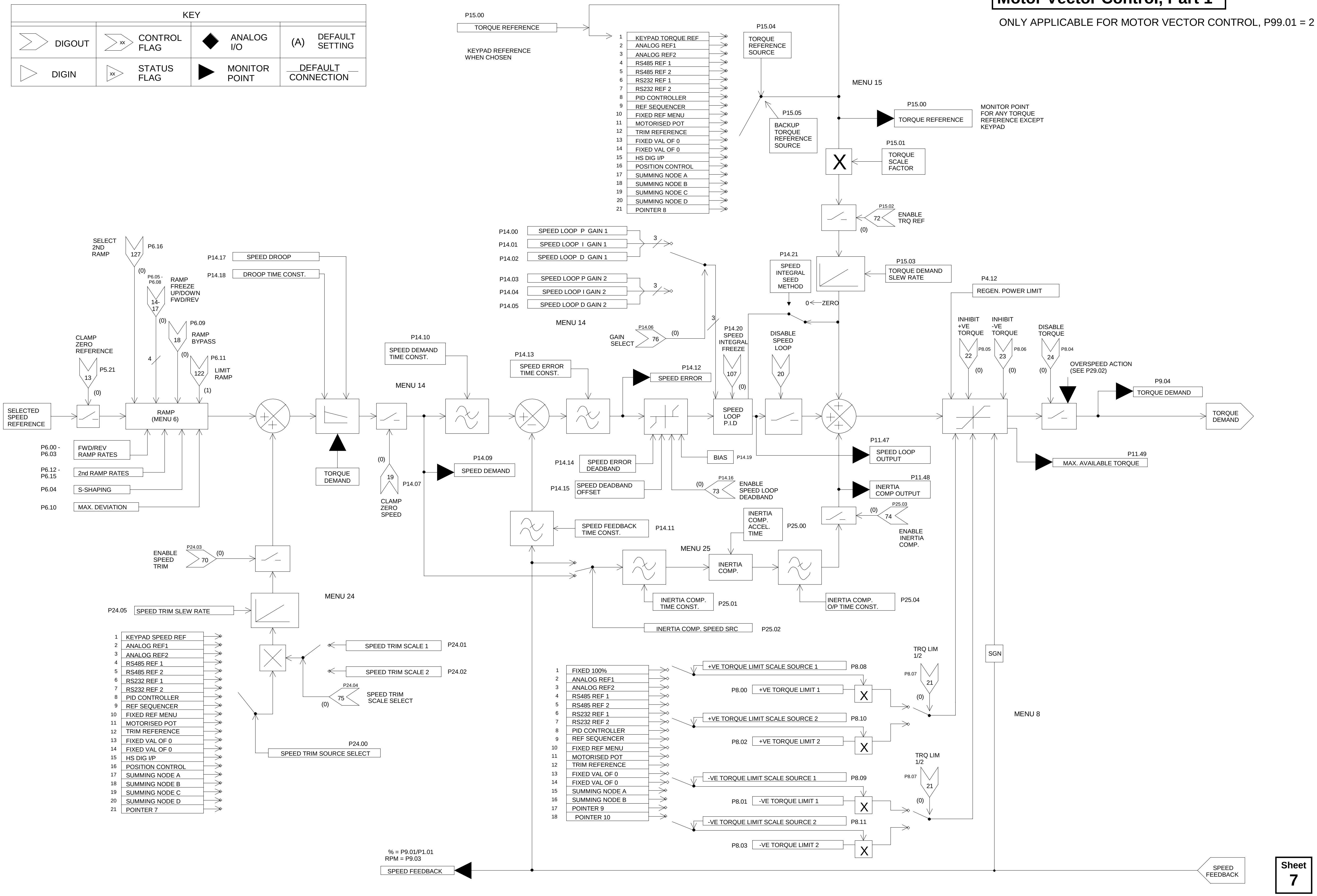
Motor Frequency Control

ONLY APPLICABLE FOR MOTOR FREQUENCY CONTROL, P99.01 = 1



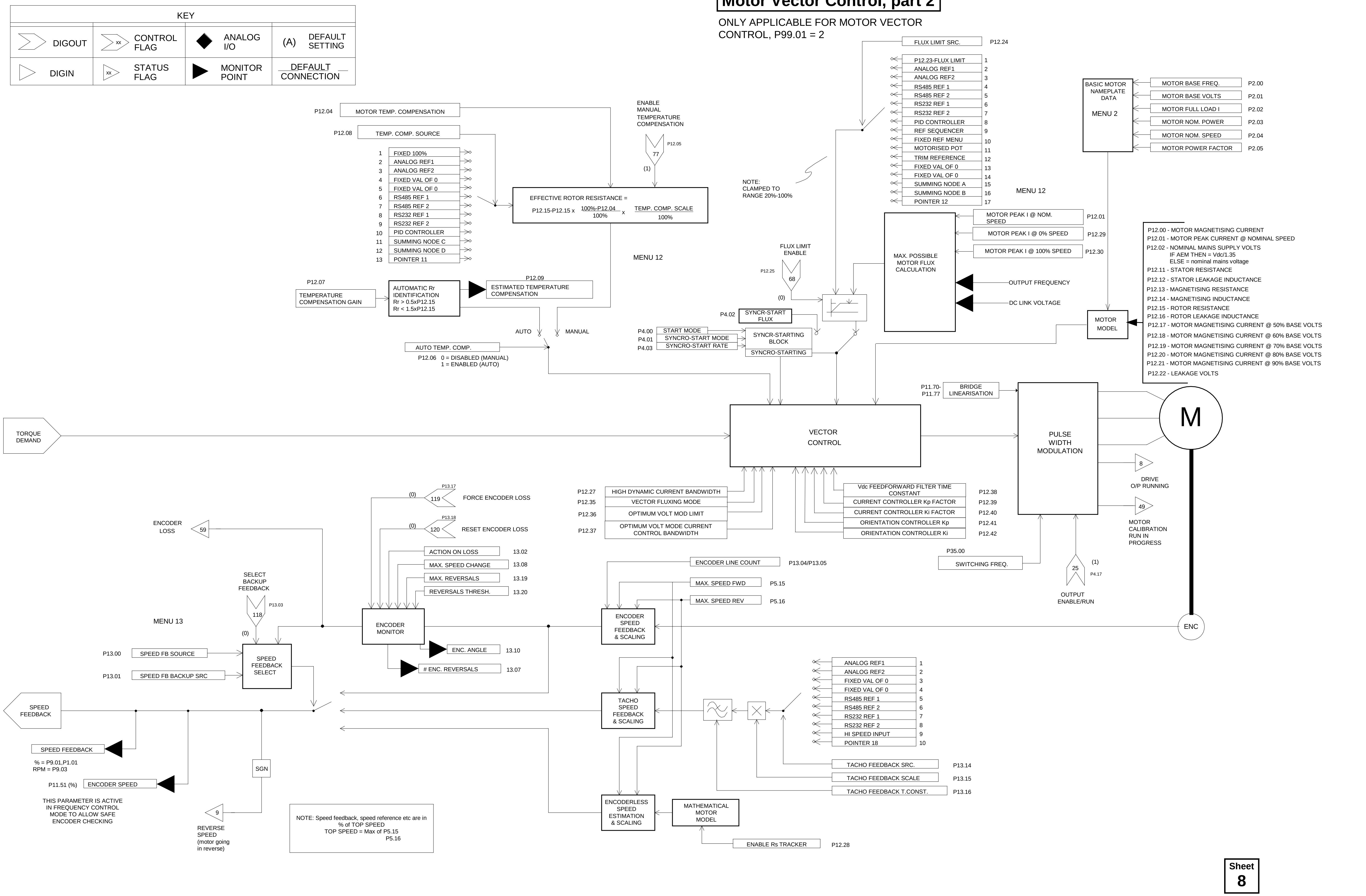
Motor Vector Control, Part 1

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

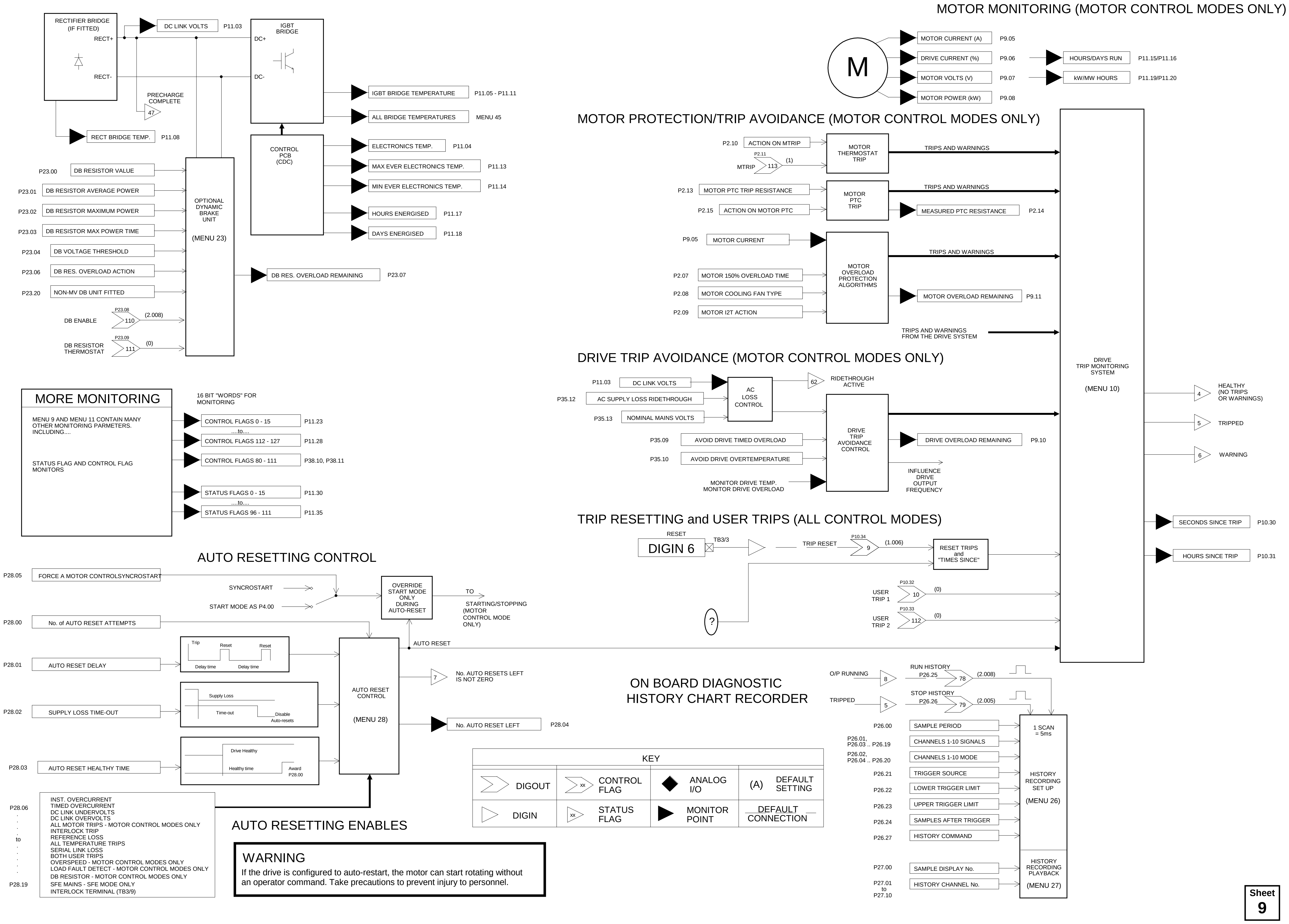


Motor Vector Control, part 2

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



Trips/Warnings and Diagnostic Monitoring



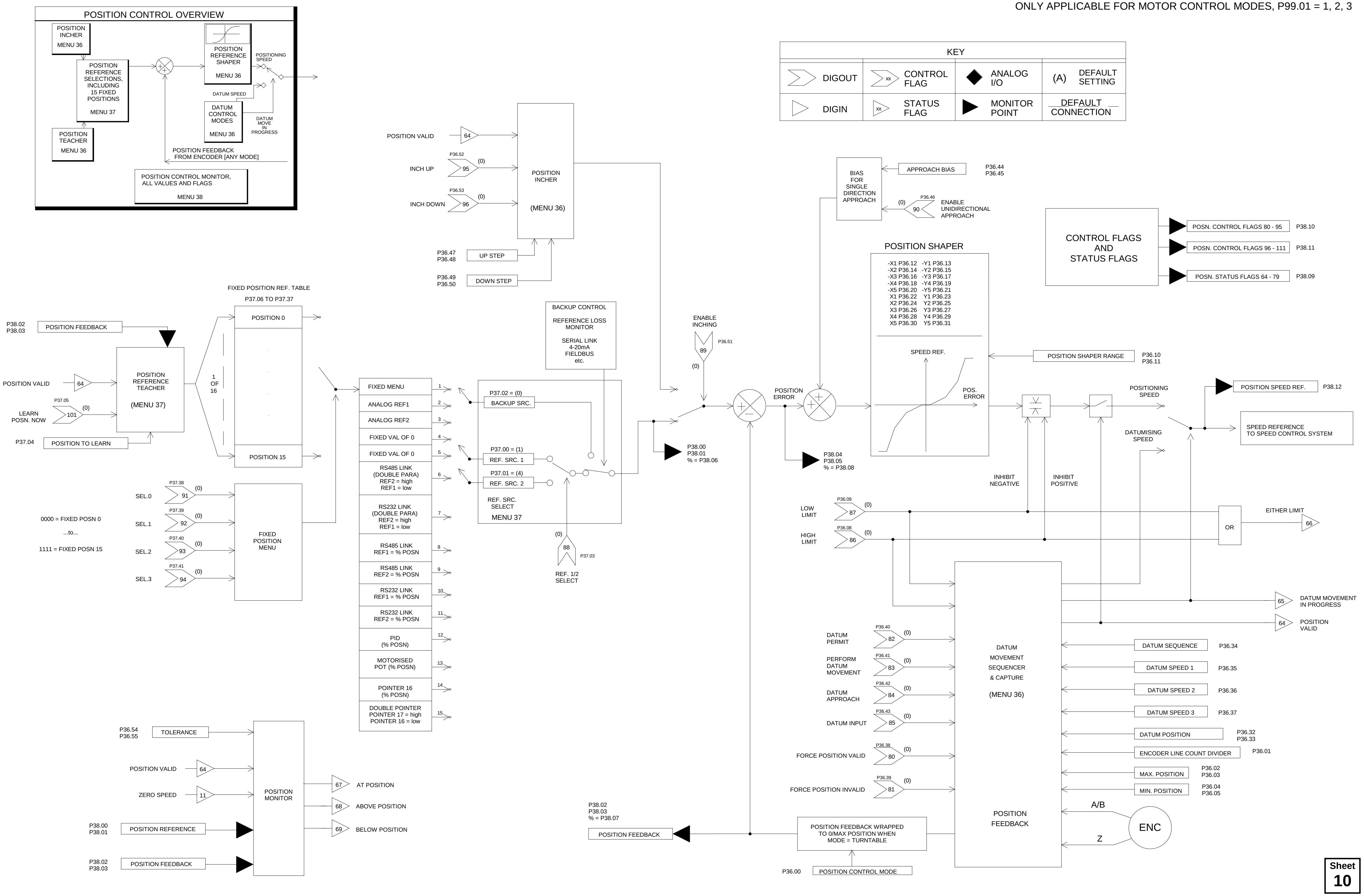
WARNING

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

Sheet
9

Motor Position Controller

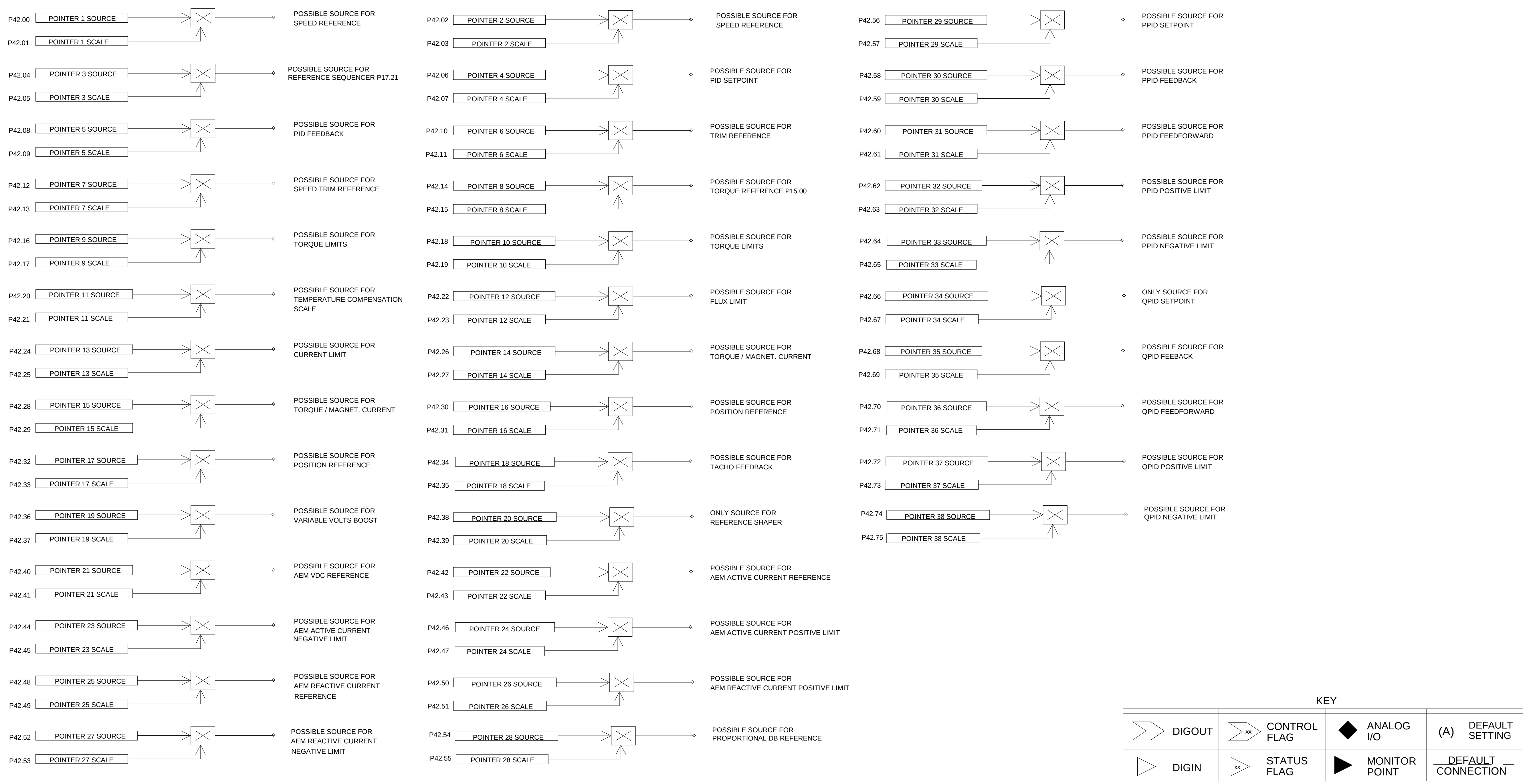
ONLY APPLICABLE FOR MOTOR CONTROL MODES, P99.01 = 1, 2, 3



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.

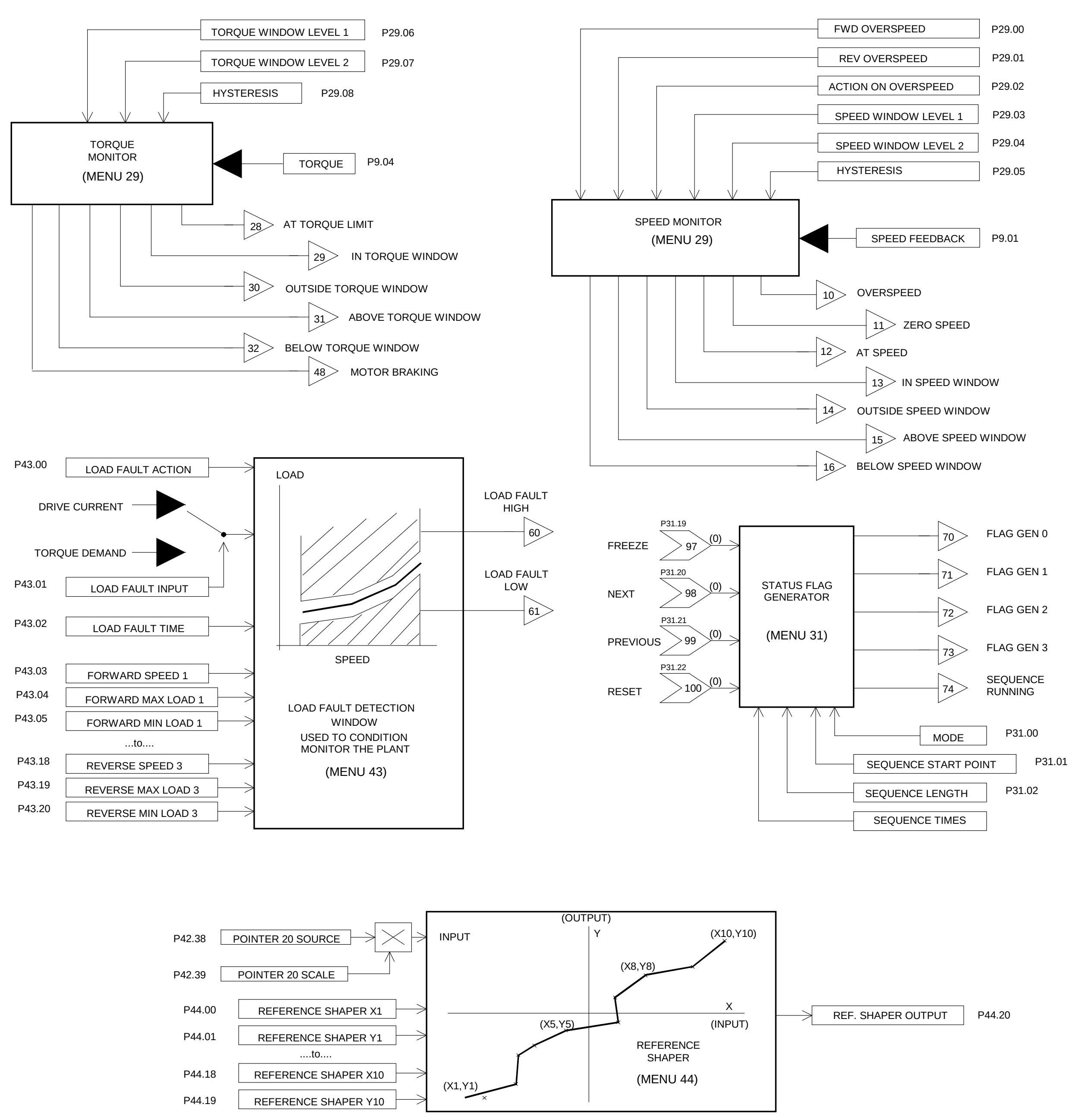


Sheet 11

AVID CONTROLS

Special Monitoring Functions

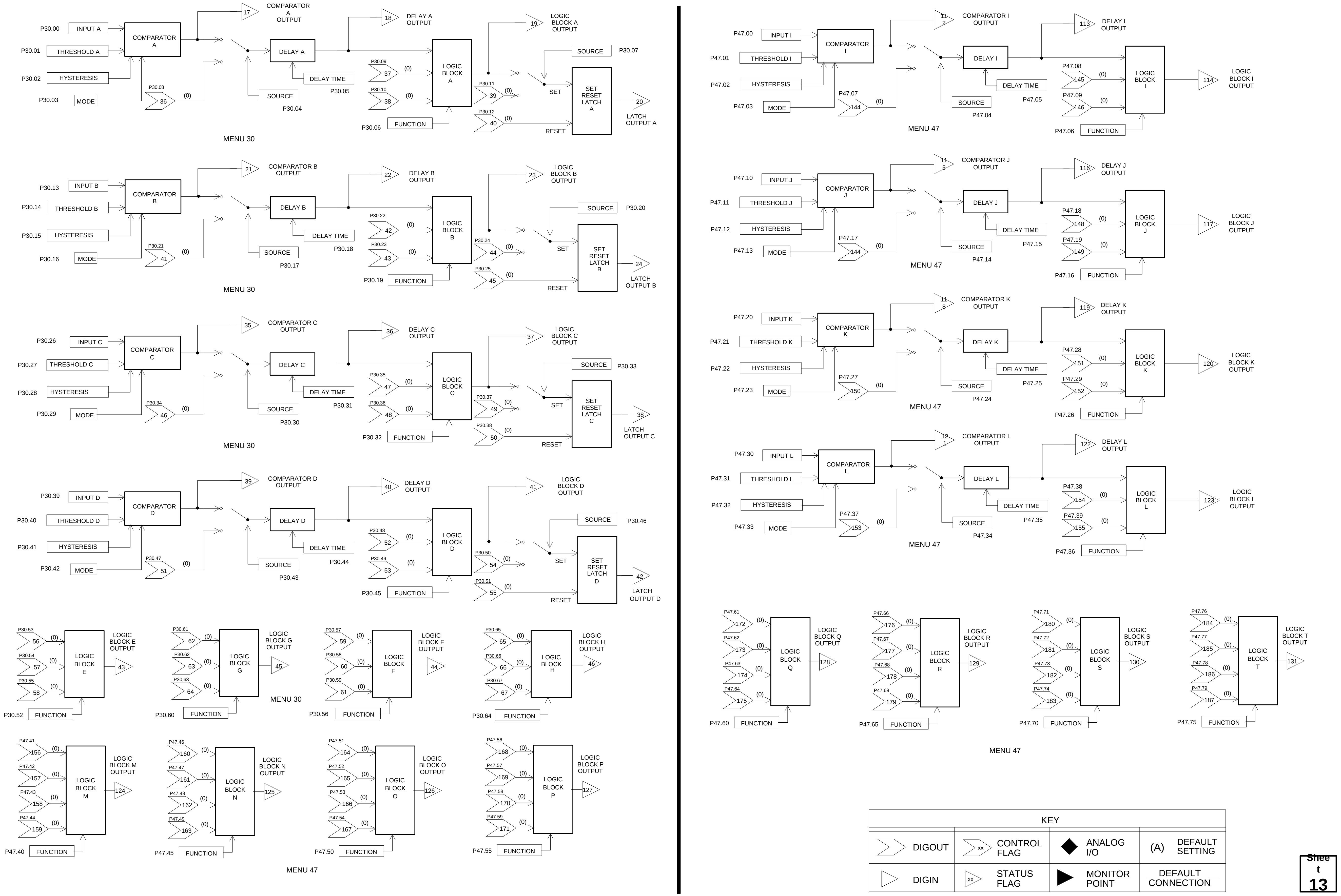
APPLICATION MONITORS AND SPECIAL FUNCTIONS, MOTOR CONTROL MODES ONLY



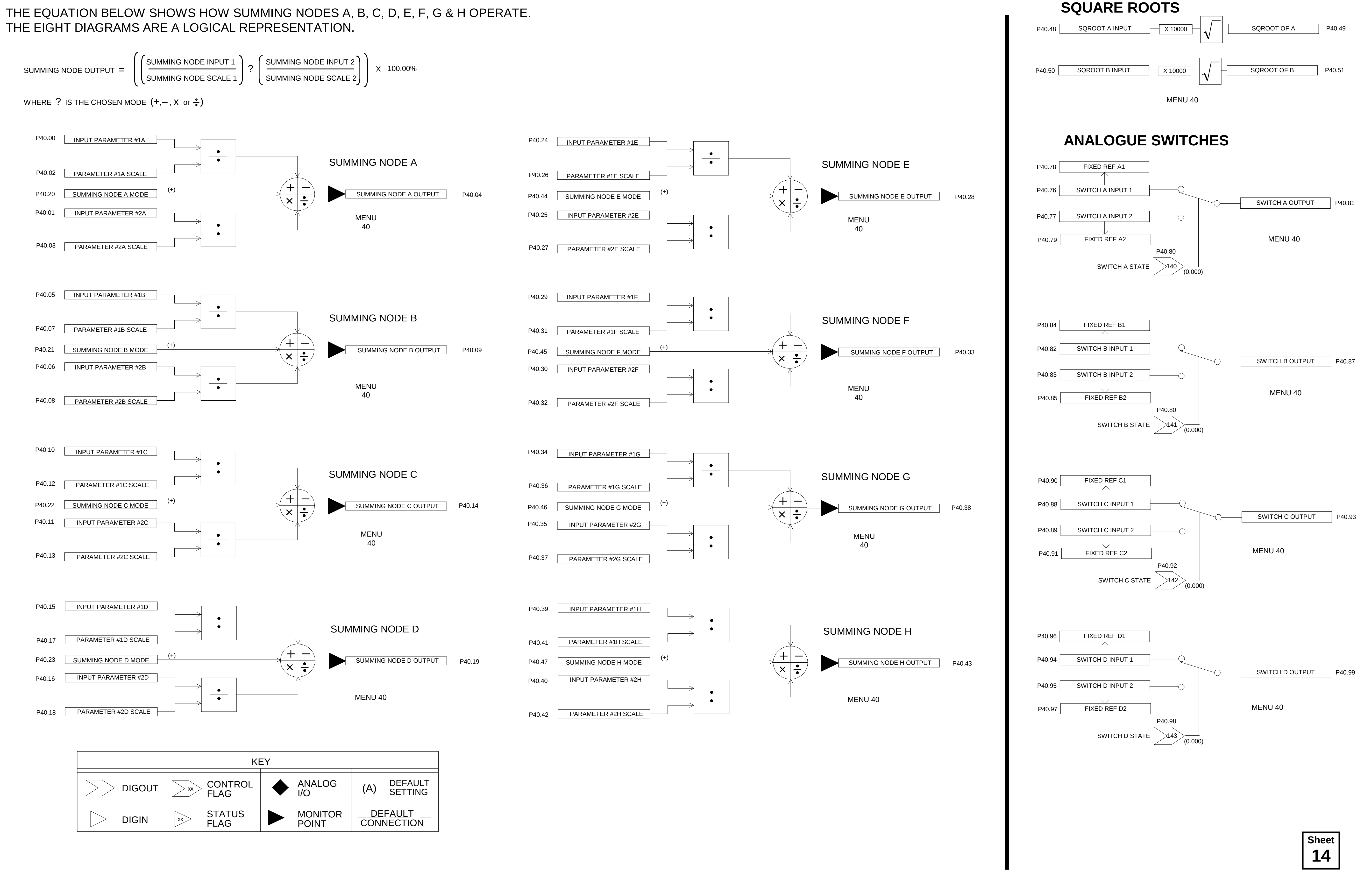
KEY							
	DIGOUT	xx	CONTROL FLAG		ANALOG I/O	(A)	DEFAULT SETTING
	DIGIN	xx	STATUS FLAG		MONITOR POINT		DEFAULT CONNECTION

Sheet 12

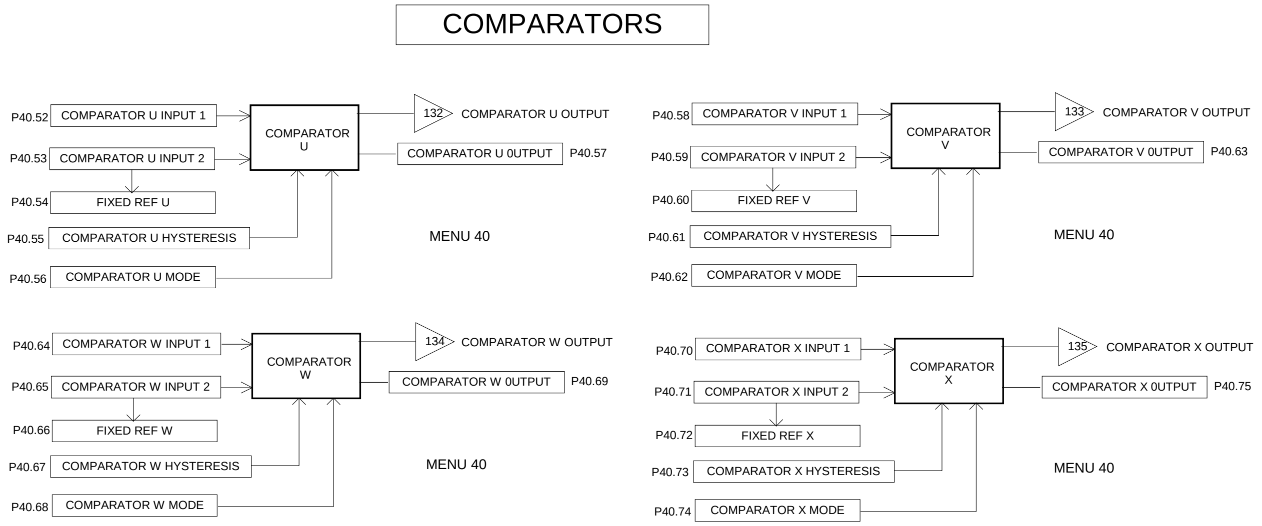
Application Logic - General Purpose Logic Blocks

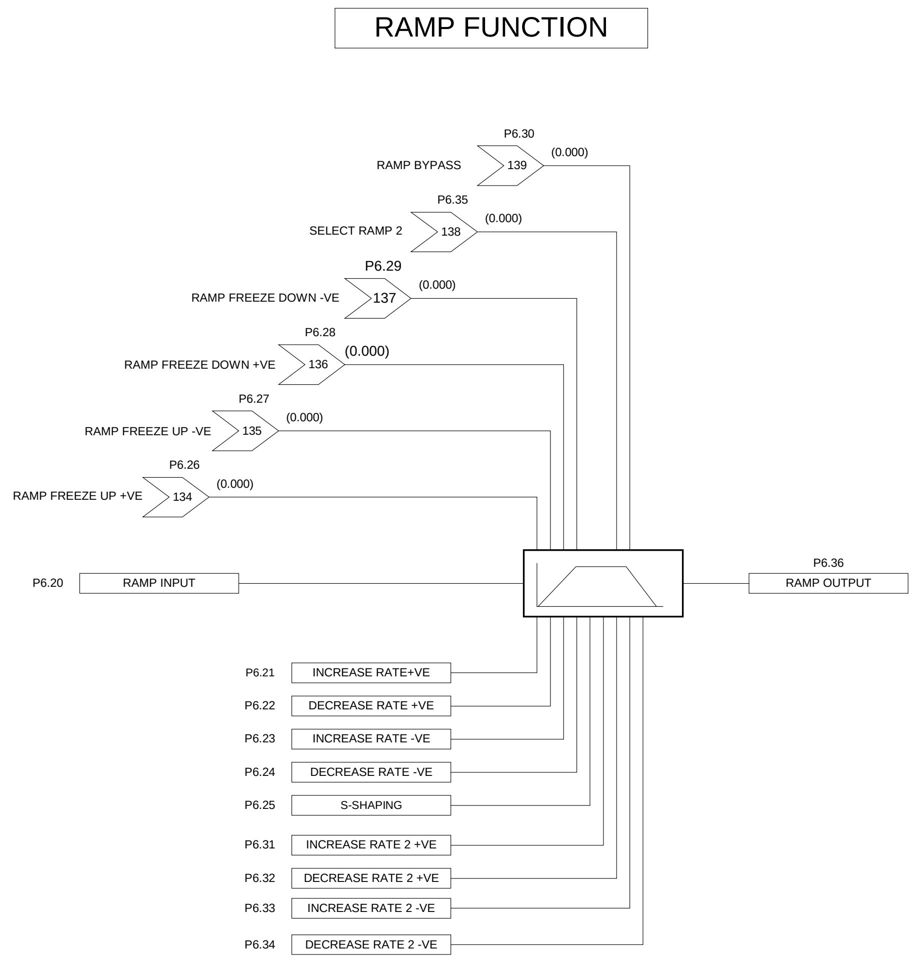


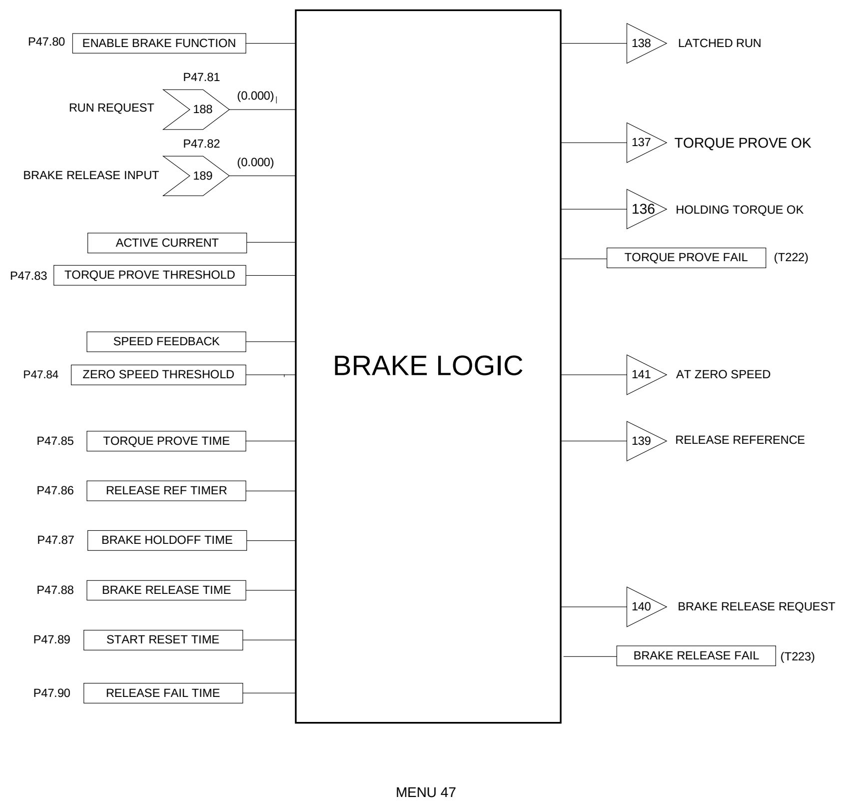
Summing Nodes, Analogue Switches and Square Roots

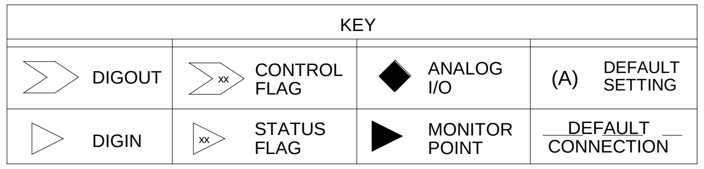


Comparators, Ramp Function & Brake Logic





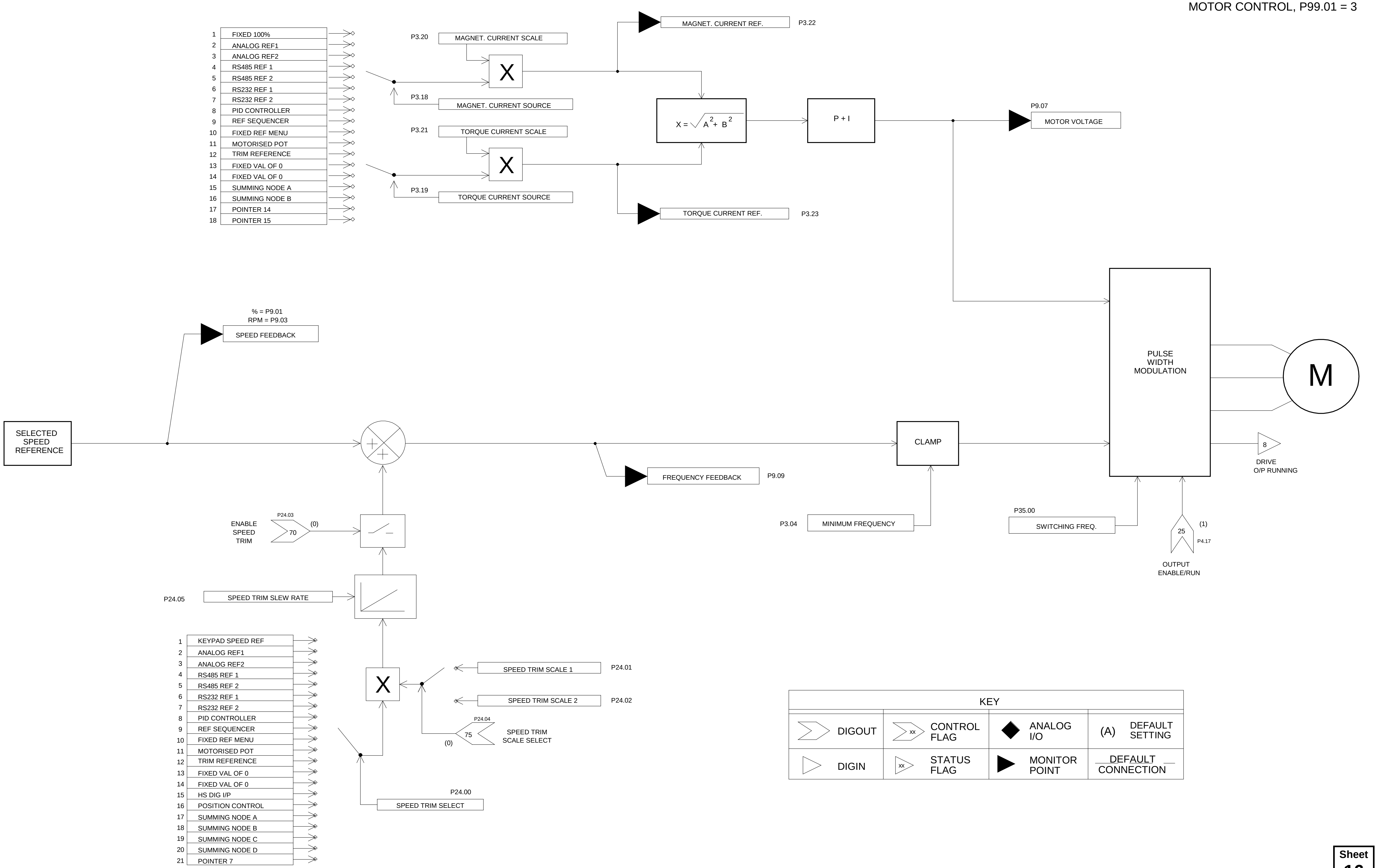




Sheet
15

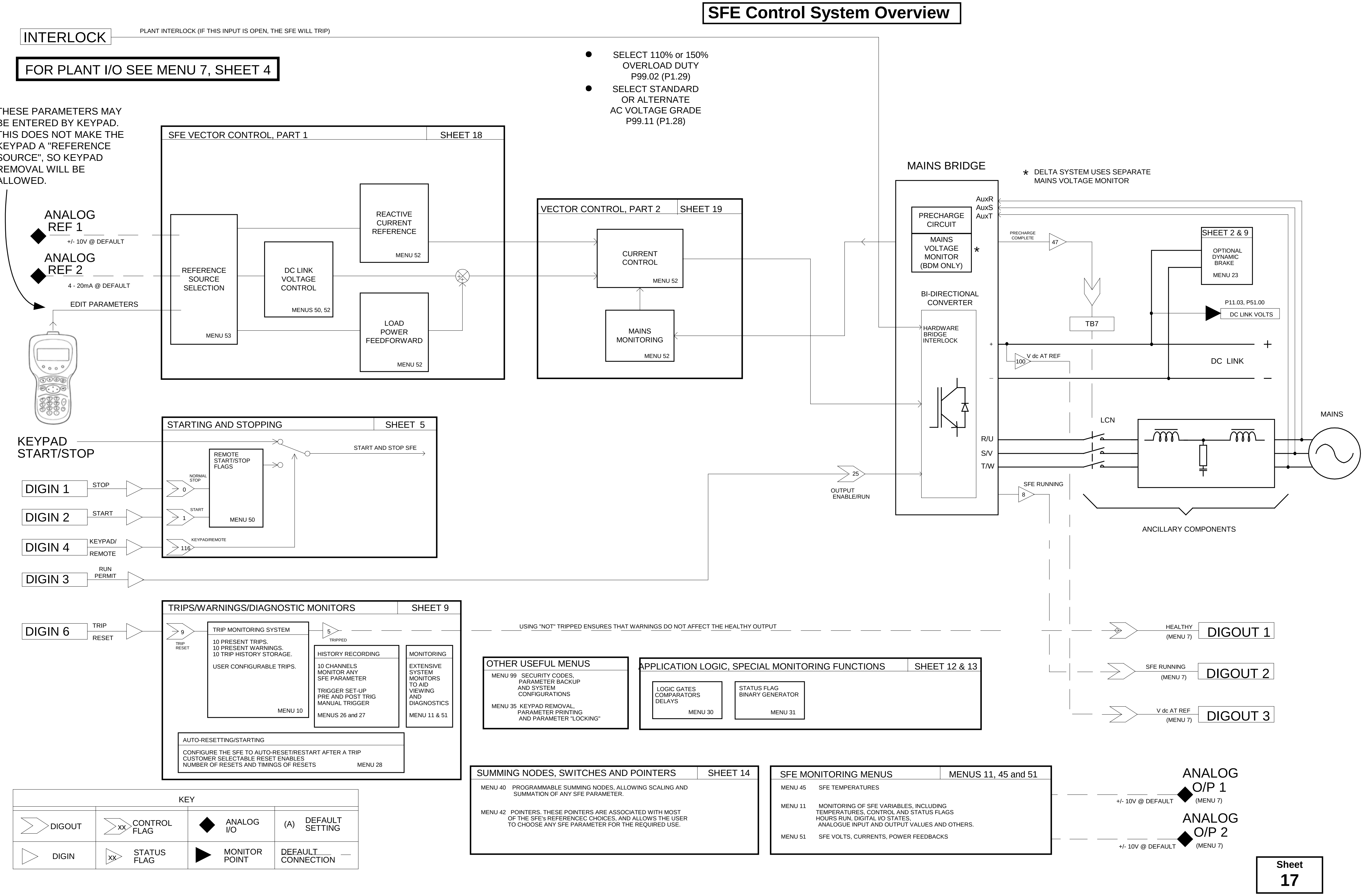
Scalar Control

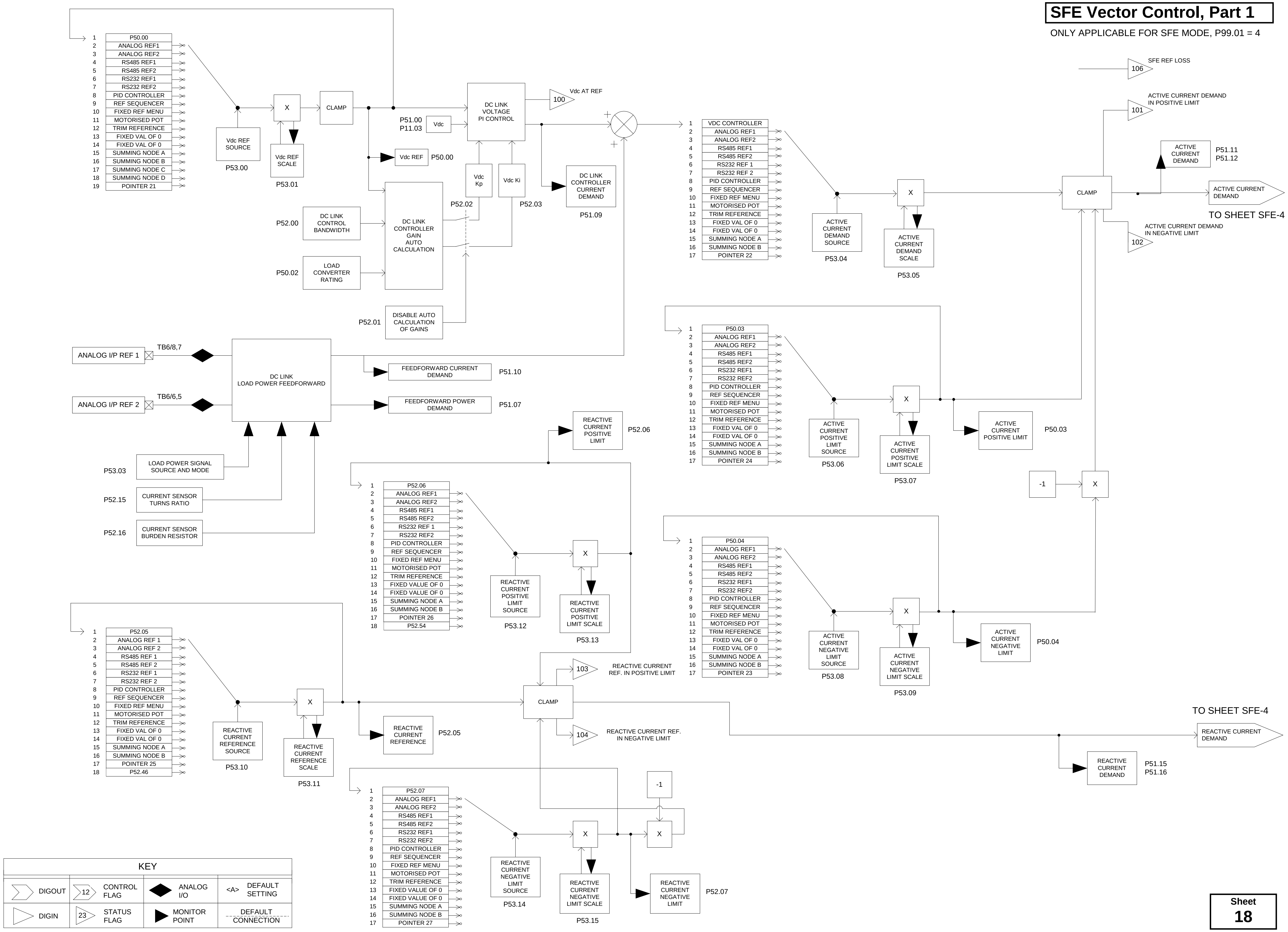
ONLY APPLICABLE FOR SCALAR MOTOR CONTROL, P99.01 = 3

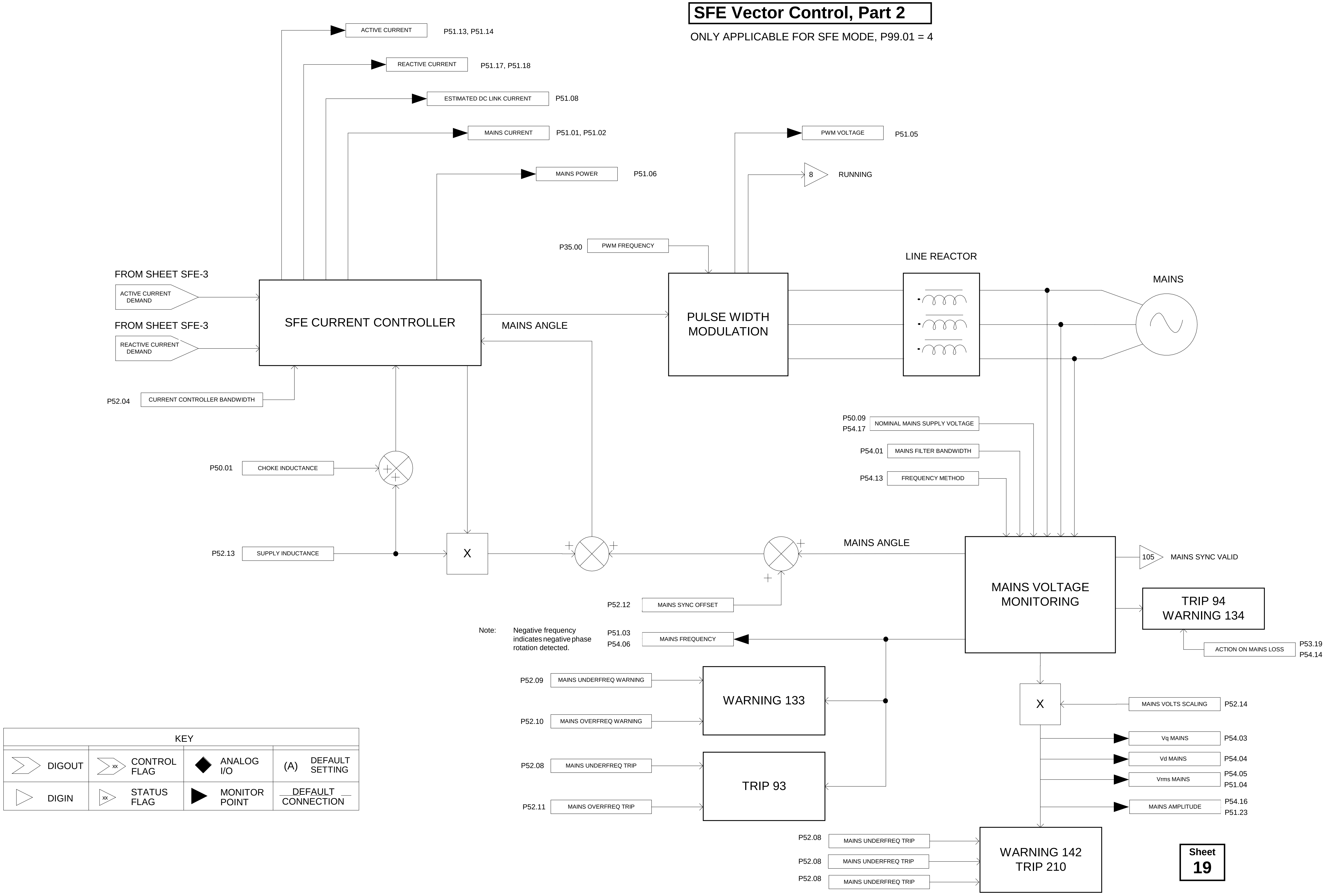


KEY			
DIGOUT	CONTROL FLAG	ANALOG I/O	(A) DEFAULT SETTING
DIGIN	STATUS FLAG	MONITOR POINT	DEFAULT CONNECTION

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 4
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.
SFE VECTOR CONTROL, PART 1
SHEET 18
ANALOG REF 1
+/- 10V @ DEFAULT
ANALOG REF 2
4 - 20mA @ DEFAULT
EDIT PARAMETERS
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 19
CURRENT CONTROL
MENU 52
MAINS MONITORING
MENU 52
MAINS BRIDGE
* DELTA SYSTEM USES SEPARATE MAINS VOLTAGE MONITOR
AuxR
AuxS
AuxT
PRECHARGE CIRCUIT
MAINS VOLTAGE MONITOR (BDM ONLY)
PRECHARGE COMPLETE
47
SHEET 2 & 9
OPTIONAL DYNAMIC BRAKE
MENU 23
BI-DIRECTIONAL CONVERTER
HARDWARE BRIDGE INTERLOCK
TB7
P11.03, P51.00
DC LINK VOLTS
V dc AT REF
100
DC LINK
LCN
MAINS
R/U
S/V
T/W
SFE RUNNING
8
25
OUTPUT ENABLE/RUN
ANCILLARY COMPONENTS
KEYPAD START/STOP
STARTING AND STOPPING
SHEET 5
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 9
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
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 12 & 13
LOGIC GATES COMPARATORS DELAYS
MENU 30
STATUS FLAG BINARY GENERATOR
MENU 31
SFE RUNNING
(MENU 7)
DIGOUT 2
V dc AT REF
(MENU 7)
DIGOUT 3
SUMMING NODES, SWITCHES AND POINTERS
SHEET 14
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
CONTROL FLAG
ANALOG I/O
(A) DEFAULT SETTING
DIGIN
STATUS FLAG
MONITOR POINT
DEFAULT CONNECTION
Sheet
17


SFE Vector Control, Part 1
ONLY APPLICABLE FOR SFE MODE, P99.01 = 4
SFE REF LOSS
ACTIVE CURRENT DEMAND IN POSITIVE LIMIT
ACTIVE CURRENT DEMAND IN NEGATIVE LIMIT
ACTIVE CURRENT DEMAND
TO SHEET SFE-4
P51.11
P51.12
Vdc AT REF
DC LINK VOLTAGE PI CONTROL
CLAMP
Vdc REF SOURCE
P53.00
Vdc REF SCALE
P53.01
P51.00
P11.03
Vdc REF
P50.00
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
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
ACTIVE CURRENT DEMAND SOURCE
P53.04
ACTIVE CURRENT DEMAND SCALE
P53.05
ACTIVE CURRENT POSITIVE LIMIT SOURCE
P53.06
ACTIVE CURRENT POSITIVE LIMIT SCALE
P53.07
ACTIVE CURRENT POSITIVE LIMIT
P50.03
ACTIVE CURRENT NEGATIVE LIMIT SOURCE
P53.08
ACTIVE CURRENT NEGATIVE LIMIT SCALE
P53.09
ACTIVE CURRENT NEGATIVE LIMIT
P50.04
REACTIVE CURRENT POSITIVE LIMIT
P52.06
REACTIVE CURRENT POSITIVE LIMIT SOURCE
P53.12
REACTIVE CURRENT POSITIVE LIMIT SCALE
P53.13
REACTIVE CURRENT REFERENCE SOURCE
P53.10
REACTIVE CURRENT REFERENCE SCALE
P53.11
REACTIVE CURRENT REFERENCE
P52.05
REACTIVE CURRENT REF. IN POSITIVE LIMIT
REACTIVE CURRENT REF. IN NEGATIVE LIMIT
REACTIVE CURRENT DEMAND
REACTIVE CURRENT DEMAND
P51.15
P51.16
REACTIVE CURRENT NEGATIVE LIMIT SOURCE
P53.14
REACTIVE CURRENT NEGATIVE LIMIT SCALE
P53.15
REACTIVE CURRENT NEGATIVE LIMIT
P52.07
KEY
DIGOUT
CONTROL FLAG
ANALOG I/O
DEFAULT SETTING
DIGIN
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
P52.12
MAINS SYNC OFFSET
TRIP 94
WARNING 134
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
WARNING 133
P52.10
MAINS OVERFREQ WARNING
X
MAINS VOLTS SCALING
P52.14
Vq MAINS
P54.03
Vd MAINS
P54.04
Vrms MAINS
P54.05
P51.04
P52.08
MAINS UNDERFREQ TRIP
TRIP 93
P52.11
MAINS OVERFREQ TRIP
MAINS AMPLITUDE
P54.16
P51.23
P52.08
MAINS UNDERFREQ TRIP
P52.08
MAINS UNDERFREQ TRIP
P52.08
MAINS UNDERFREQ TRIP
WARNING 142
TRIP 210
Sheet
19
KEY
DIGOUT
CONTROL FLAG
ANALOG I/O
(A)
DEFAULT SETTING
DIGIN
STATUS FLAG
MONITOR POINT
DEFAULT CONNECTION

8. SERIAL COMMUNICATIONS

8.1 INTRODUCTION

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 MV3000e has two serial communications ports, a RS232 port that is shared with the Drive Data Manager™ (Keypad), and a RS485 port. Each port can receive and transmit messages either in GEM 80 ESP, MODBUS™ RTU or MODBUS™ ASCII message protocols.

The two ports are controlled independently of each other, with each port being configured using its own set of drive parameters. Both serial ports may be used to read from or write to the drive parameters. The RS232 port can be used to update/read parameters every 100ms. The RS485 port can be used to update/read parameters every 10ms.

8.1.1 RS232 Port and the Keypad

If the RS232 port is re-configured to communicate to another device, removing the Keypad allows it to change to that mode. The Keypad is automatically detected when re-connected.

8.1.2 Access Authority

Updating any of the user parameters is only allowed if the communications device attempting to read or write to the parameter has access authority. Both serial links have an engineer status with regard to updating/accessing drive parameters. All drive attributes apply down the serial link, i.e. a “Stop to Edit” parameter can only be edited when the drive is stopped.

8.1.3 Parameter Numbers

The Serial Links are configured and programmed using parameter Menu 32.

8.2 RS232 SERIAL LINK

8.2.1 Introduction

See Section 8.4 for worked examples.

The RS232 Serial Link is connected through the 9-way D-type Keypad socket SK5 on the front panel of the MV3000e drive unit. This connector is not available for RS232 communications if the Keypad is fitted. The RS232 port can operate at up to 38,400 Baud.

Terminal	Signal Name	Signal on PC com port	Comments
1	NC	DCD	Not connected
2	RS232 TX	RX	
3	RS232 RX	TX	
4	NC	DTR	Not connected
5	0 V	GND	
6	8 V	DSR	8 V output from drive
7 and 8		RTS/CTS	Connected together
9	PWM ON		Indicates drive is active
Body	EARTH	CHASSIS	Screen connection

Table 8-1. – RS232 Connections

8.2.2 RS232 Outline Protocol Specification

Baud Rates	:	9.6, 19.2 & 38.4 kBaud
Protocols	:	MODBUS™ RTU – 8 bit data format
	:	MODBUS™ ASCII – 7 and 8 bit data format
	:	GEM80 ESP – 8 bit data format
Update period	:	100ms

8.2.3 RS232 Connection Details

Figure 8-1 shows the method of connecting a RS232 serial link.

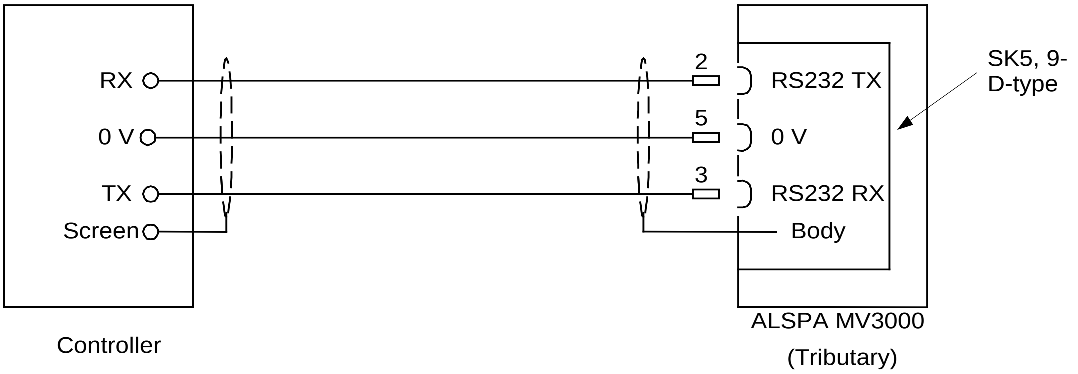


Figure 8-1. – RS232 Connections

NOTE: **The RS232 serial link connections are not isolated. The cable shield must be connected to the back shell of the D-type connector. This back shell is connected to safety ground internally. For shield connections at the controller, see controller manual. The cable length is 3 m (10 ft) maximum.**

8.2.4 RS232 Serial Port Configuration

To configure MV3000e for GEM 80 ESP communications using the RS232 port, the following parameters must be configured using the Keypad. When the Keypad is removed, socket SK5 functions as the RS232 port. When RS232 communication is no longer required and the Keypad is plugged into SK5, the port automatically re-configures as the Keypad port.

P32.00 - Serial Links Write Enable

The value set determines whether the drive parameters can be written to via the serial links, this affects both the RS232 and the RS485 serial links.

Allowed values are: 0 = Disable – Serial links can monitor only.
1 = Enable – Allows Read and Write access, so serial links can both monitor and edit parameters.

P32.01 - Global Response

This parameter affects both RS232 and RS485 links.

Allowed values: 0 = Disabled (reject broadcast messages).
1 = Enabled (accept broadcast messages).

NOTES:

1 Broadcast messages not specifically intended for MV3000e will produce unpredictable effects.
2 This parameter should be set to 0 (default state) unless it can be guaranteed that ALL broadcast messages produced by the system are intended for MV3000e drives.

P32.10 - RS232 Baud Rate

Sets the required value (in kBaud).

Allowed values are: 4= 9.6 kBaud.
5= 19.2 kBaud.
6= 38.4 kBaud.

P32.11 - RS232 Address

Set the required tributary number.

Allowed values are: 0 to 255.

NOTES:

1 For GEM 80 ESP systems the address must be in the range 0 to 14 inclusive (15 is used for broadcast messages).
2 For MODBUS™ ASCII and MODBUS™ RTU the address must be in the range 1 to 255 inclusive (0 is used for broadcast messages). The PLC system may have address number limitations.

P32.12 - RS232 Protocol

Allowed values:

0 = No protocol
1 = GEM80 ESP
2 = MODBUS™ RTU
3 = MODBUS™ ASCII
4 = Keypad ESP
5 = Printer (see 6.35.5 for further information on printing).

(Note that 7 bit data format is not supported by MODBUS RTU or GEM80 ESP)

P32.13 - RS232 Link Parity

Set the value to match the controlling device.

Allowed values are:

1 = 8 bit data, no parity
2 = 8 bit data, even parity
3 = 8 bit data, odd parity
4 = 7 bit data, even parity
5 = 7 bit data, odd parity
6 = 7 bit data, parity reset
7 = 7 bit data, parity set

(Note that 7 bit data format is not supported by MODBUS RTU or GEM80 ESP)

8.2.5 Loss of RS232 Serial Link

P32.14 - RS232 Timeout

When used with a programmable controller operating in free running mode the timeout period should be set to a value greater than the scan time of the programmable controller. If a timeout occurs, the RS232 link becomes unhealthy as a control or reference source. The link is restored to healthy when the next valid message is received.

If communications are non-repetitive set the value to 0. This sets the timeout detection period to infinity and disables the serial link as a control or reference source.

Allowed values, in seconds, are: 0.0s = No timeout detection.
0.1s to 99.9s.

P32.15 - Action on RS232 Timeout

This parameter determines the action taken by the drive in the event of a RS232 serial link timeout.

Allowed values:	0 = No action. 1 = Issue Warning. 2 = Trip.

P32.22 - RS232 Control Words at Loss

This parameter determines the state of the RS232 control word on detection of a timeout. The control word could be controlling start/stop, for example.

Allowed values are:	0 = Remain at previous state.
	1 = Go to default states.

The default states for the RS232 control words are set in P32.23 and P32.24.

P32.23 - RS232 Default for Control Word 0
P32.24 - RS232 Default for Control Word 1

Allowed values (hex):	0000h to FFFFh.

The Keypad also displays these values in binary, i.e.

0000 0000 0000 0000b

to

1111 1111 1111 1111b

See Section 8.4.2 for more information on control words.

P32.16 - RS232 CRC Failures Count

This read only parameter indicates the number errors detected by the cyclic redundancy check on messages received.

Permitted range:	0 to 9999.

P32.17 - RS232 Timeouts Count

This read-only parameter indicates the number of serial link timeouts that have occurred. P32.14 must be set to a value greater than 0 for timeouts to occur.

Permitted range:	0 to 9999.

8.3 RS485 SERIAL LINK

8.3.1 Introduction

See 8.4 for worked examples.

The RS485 serial link is connected to terminal block TB4 on the I/O panel, behind the front door of the drive unit. Cable entry is via the control cable entry point at the bottom of the unit.

The RS485 port can operate up to 38.4kB using half-duplex communications, i.e. reception is ignored while transmitting. This allows 2-wire RS485 links to be used if required.

Table 8-2 shows the function and connection details of RS485 signals.

Terminal	Name	Function	Remarks
1	TX+	RS485 +ve Transmit Line	
2	TX–	RS485 –ve Transmit Line	Must be shielded
3	RX+	RS485 +ve Receive Line	
4	RX–	RS485 –ve Receive Line	
5	GND	Screen Ground	Connected to safety ground internally

Table 8-2. –RS485 Connections at TB4

8.3.2 RS485 Outline Protocol Specification

Baud Rates : 1.2, 2.4, 4.8, 9.6, 19.2 & 38.4 kBaud
Protocols : MODBUS™ RTU – 8 bit data format
: MODBUS™ ASCII – 7 and 8 bit data format
: GEM80 ESP – 8 bit data format
Update period : 10ms

8.3.3 RS485 Connection Details

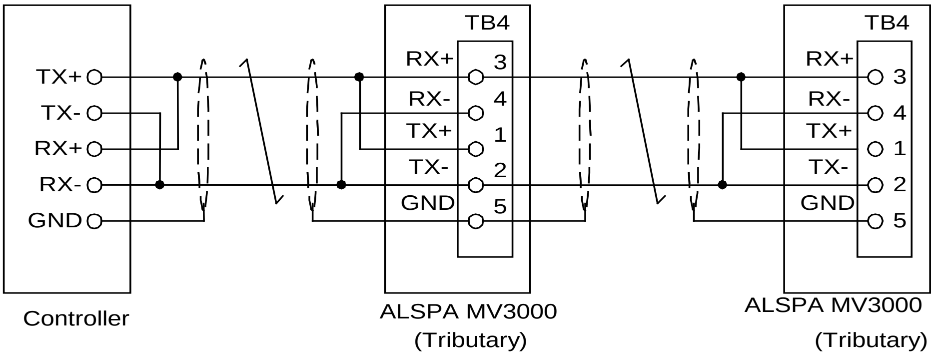


Figure 8-2. – RS485 2 Wire Multi-drop Connections

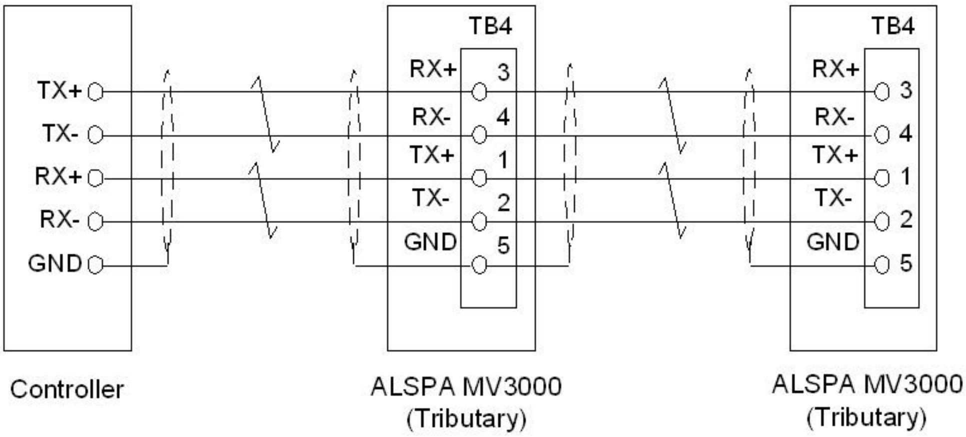


Figure 8-3. – RS485 4 Wire Multi-drop Connections

Figure 8-2 shows the method of connecting a RS485 2-wire multi-drop serial link and Figure 8-3 shows the method of connecting a RS485 4-wire multi-drop serial link.

NOTE: **The serial link connections are not isolated. The cable screens must be connected to TB4 pin 5, which is connected to safety ground internally. For screen connections at the controller, see the controller manual.**

8.3.4 RS485 Serial Port Configuration

To configure the drive for ESP communications using the RS485 port, P32.00 must be edited to enable read and write access, then the following parameters must be set:

P32.00 - Serial Links Write Enable

The value set determines whether the drive parameters can be written to via the serial links, this affects both the RS232 and the RS485 serial links.

Allowed values are:	0 = Disable – Serial links can monitor only. 1 = Enable – Allows Read and Write access, so serial links can both monitor and edit parameters.

P32.01 - Global Response

This parameter affects both RS232 and RS485 links.

Allowed values:	0 = Disabled (reject broadcast messages). 1 = Enabled (accept broadcast messages).

NOTES: 1 Broadcast messages not specifically intended for MV3000e will produce unpredictable effects.
2 This parameter should be set to 0 (default state) unless it can be guaranteed that ALL broadcast messages produced by the system are intended for MV3000e drives.

P32.50 - RS485 Baud Rate

Set the required value (in kBaud).

Allowed values are:	1.2, 2.4, 4.8, 9.6, 19.2 and 38.4.

P32.51 - RS485 Address

Set the required tributary number.

Allowed values are:	0 to 255.

NOTES: 1 For GEM 80 ESP systems the address must be in the range 0 to 14 inclusive (15 is used for broadcast messages).
2 For MODBUS™ ASCII and MODBUS™ RTU the address must be in the range 1 to 255 inclusive. (0 is used for broadcast messages). There may be other limitations due to characteristics of the external master PLC.

P32.52 - RS485 Protocol

Sets the protocol for RS485 serial link messages.

Allowed values:

0 = No Protocol
1 = GEM 80 ESP
2 = MODBUS™ RTU
3 = MODBUS™ ASCII
4 = Drive to Drive1
5 = RSVP2

$\}$ (Note that 7 bit data format is not supported by MODBUS RTU or GEM80 ESP)

NOTES: 1 When Drive-to-Drive Link (Option 4) is selected, the drive automatically sets the RS485 Baud Rate (P32.50) to 19.2 kBaud. The Timeout Period (P32.54), Timeout Action (P32.55) and Control Words Upon Timeout (P32.62) parameters all operate as for any other protocol.
2 Option 5 allows communication with FIP via an DI100 unit.

8.3.5 Loss of RS485 Serial Link

P32.54 - RS485 Timeout

When used with a programmable controller operating in free running mode the timeout period should be set to a value greater than the scan time of the Programmable Controller. If a timeout occurs, the RS485 link becomes unhealthy as a control or reference source. The link is restored to healthy when the next valid message is received.

Set the value to 0 if communications are non-repetitive. This sets the timeout detection period to infinity and disables the serial link as a control or reference source.

Allowed values are:	0 = No timeout detection.
	0.1 to 99.9 seconds.

P32.55 - RS485 Loss Action

This parameter determines the action taken by the drive in the event of a RS485 serial link timeout.

Allowed values:	0 = No action.
	1 = Warning.
	2 = Trip.

P32.62 - RS485 Control Words at Loss

This parameter determines the state of the RS485 control words on detection of a timeout. The control words could be controlling start/stop, for example.

Allowed values are:	0 = Remain at previous states.
	1 = Go to RS485 Default states.

The Default states for the RS485 control words are set in P32.63 and P32.64.

P32.63 - RS485 Default for Control Word 0
P32.64 - RS485 Default for Control Word 1

Allowed values (hex): 0000h to FFFFh.

The values are also displayed by the Keypad in binary.
See Section 8.4.2 for more information on Control Words.

P32.56 - RS485 CRC Failures Count

This read only parameter indicates the number of errors detected by the cyclic redundancy check on messages received by the RS485 serial link.

Allowed values: 0 to 9999 Failures.

P32.57 - RS485 Timeouts Count

This read only parameter indicates the number of RS485 serial link timeouts that have occurred. P32.54 must be set to a value greater than 0 for timeouts to occur.

Allowed values: 0 to 9999 Timeouts.

8.3.6 RS485 Link Parity

P32.53 - RS485 Link Parity

Set the value to match the controlling device.

Allowed values are:

1 = 8 bit data, no parity
2 = 8 bit data, even parity
3 = 8 bit data, odd parity
4 = 7 bit data, even parity
5 = 7 bit data, odd parity
6 = 7 bit data, reset parity
7 = 7 bit data, set parity

(Note that 7 bit data format is not supported by MODBUS RTU or GEM80 ESP)

8.3.7 Accept Broadcast Messages

P32.01 - Accept Broadcast Messages

Allowed values: 0 = Disabled (reject broadcast messages).
1 = Enabled (accept broadcast messages).

NOTE: Broadcast messages not specifically intended for MV3000e drives will produce unpredictable effects. This parameter should therefore be set to 0 unless it can be guaranteed that ALL broadcast messages produced by the system are intended for MV3000e drives.

8.4 USING SERIAL LINKS TO CONTROL AND MONITOR THE DRIVE

The RS232 and RS485 serial ports may be used to provide the principal or the Backup speed/torque reference and control reference for the drive.

8.4.1 Speed and Torque References

To select a serial link as the principal speed or torque reference source, edit one or more of the P5.01 to P5.04 described at 6.5.1 (speed), and P15.04 described at 6.15 (torque). Note that torque reference is for vector control only.

For example:

a) To select RS485 Link Ref 2 as the source for Principal Speed Reference 3, edit P5.03 = Option 5.

b) To select Principal Speed Reference 3 as the drive speed reference set Control Flag 6 = 1.

In the event of a serial link failure, P5.05 - Backup Reference Source - will determine the source for backup speed reference and P15.05 for the backup torque reference.

P32.18 - RS232 Speed Reference 1
P32.19 - RS232 Speed Reference 2
P32.58 - RS485 Speed Reference 1
P32.59 - RS485 Speed Reference 2

These parameters may only be written to by the appropriate serial link. When selected, the current value becomes the speed reference for the drive.

Allowed values: –100% to +100% of Top Speed.

8.4.2 Control Words

Each serial link has two parameters for Control Flag entry. The 16 bits of each parameter can be written to control flags. These parameters are:

P32.20 - RS232 Control Word 0
P32.21 - RS232 Control Word 1
P32.60 - RS485 Control Word 0
P32.61 - RS485 Control Word 1

The control word is treated as 16-bit binary data and each bit of the control word can be allocated to a control flag by setting the control flag sources, P33.00 to P33.99 or P34.00 to P34.99. See 6.34.

Allowed values (hex): 0000h to FFFFh.

The allowed values are also displayed in binary by the Keypad:

0000 0000 0000 0000b
to
1111 1111 1111 1111b.

8.4.3 Monitoring the Drive Using the Serial Links

The drive can be monitored using the serial links to access the various read only monitoring parameters described at 4.14 and by reading the drive status flags.

The drive status flags can be viewed, via the serial links, by reading the parameters P11.30 to P11.33.

The resulting bit fields are allocated to status flags as shown next.

P11.30 - Drive Status Word 0 - Status Flags 0 to 15
P11.31 - Drive Status Word 1 - Status Flags 16 to 31
P11.32 - Drive Status Word 2 - Status Flags 32 to 47
P11.33 - Drive Status Word 3 - Status Flags 48 to 63

Each parameter contains a 16-bit Drive Status Word, displayed in hexadecimal format.

Allowed range: 0000h to FFFFh.

The words are also displayed in binary, in the range:

0000 0000 0000 0000b
to
1111 1111 1111 1111b.

Status Flags SF0, SF16, SF32 and SF48 are assigned to the least significant bit of their respective words.

Further information on status flags is given in Section 6.33.

8.4.4 History Logs

The History Log can be configured using either the serial links or the Keypad. The method of configuring the history log is described in Section 8.4.4.

To play back the history log:

a) Request which sample is to be read, by setting 0 to 99 at P27.00.

b) Read P26.00 to identify the sample period.

c) Read P27.01 to P27.10, the history data, as required.

To read the entire history log, repeat the above procedure, changing the value in P27.00 at each repetition.

NOTE: If P27.00 is changed by the RS485 serial link it will not change the sample set that is read by the RS232 serial link, or displayed by the Keypad, i.e. the values written to P27.00 by one device do not affect the values written to P27.00 by other devices.

8.5 DRIVE TO DRIVE PROTOCOL (RS485 ONLY)

This additional protocol allows the automatic transfer of parameters from one drive to another (or several others) for the purpose of slave operation without the need for a PLC master. This is shown graphically in Figure 8-4.

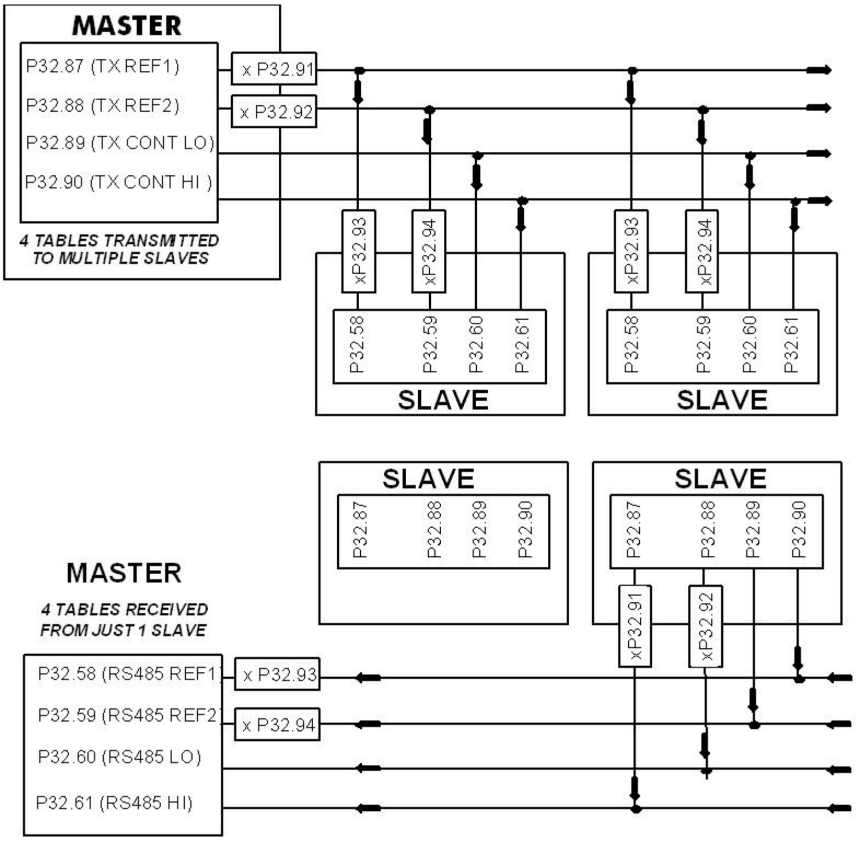


Figure 8-4. – Drive to Drive Link

P32.87 - Drive to Drive TX Reference 1
P32.88 - Drive to Drive TX Reference 2
P32.89 - Drive to Drive TX Control Word 0
P32.90 - Drive to Drive TX Control Word 1

These parameters control which of the drive parameters are transmitted to the slave drive(s). Each of these points to any of the drive parameters.

Allowed values: 0 to 99.99 (parameter number).

P32.91 - Drive to Drive TX Reference 1 Scale
P32.92 - Drive to Drive TX Reference 2 Scale

These parameters define the scale factors that are applied to the Reference 1 and Reference 2 values before they are transmitted to the slave(s).

Allowed values: –100.00 to +100.00.

P32.93 - Drive to Drive RX Reference 1 Scale
P32.94 - Drive to Drive RX Reference 2 Scale

These parameters define the scale factors that are applied to the REF1 and REF2 values after reception, before they are written to the drive parameter table (P32.87 and P32.88). The selection of the TX & RX scale factors should be made with care, bearing in mind that the maximum range of the REF1 & REF2 values (P32.87, 32.88) is ±10,000 (100.00 %).

Allowed values: –100.00 to +100.00.

8.5.1 Application Example - Torque Slave Helper Drives

The master drive, DRIVE 1, is the main speed control drive on a conveyor system. In addition to this drive, there are two helper drives, DRIVE 2 & DRIVE 3, whose torque is required to track that of DRIVE 1 with scaling factors of 75% & 90% respectively. Also, to confirm that there is no slipping, the speed of DRIVE 3 is to be fed back to DRIVE 1 for monitoring by a PC Based SCADA package connected to the RS232 Link of DRIVE 1.

Connections:

The TX+/- terminals of DRIVE 1 should be connected to RX+/- terminals of DRIVE 2 & DRIVE 3.

The TX+/- terminals of DRIVE 3 should be connected to RX +/- terminals of DRIVE 1.

The TX +/- terminals of DRIVE 2 are not connected.

DRIVE 1 Parameters:

P32.52	:	RS485 Protocol = 4, Drive to Drive Link
P32.87	:	Drive to Drive TX Reference 1 = P9.04, Torque Demand
P32.88 to P32.90	:	Drive to Drive TX Reference 2, Control Word 0, Control Word 1 = 0, No Parameter (Zero will be transmitted)
P32.91	:	Drive to Drive TX Reference 1 Scale = 1.00

DRIVE 2 Parameters:

P32.52	:	RS485 Protocol = 4, Drive to Drive Link
P32.93	:	Drive to Drive RX Reference 1 Scale = 0.75, i.e. 75%
P33.20	:	Control Flag 20 (Disable Speed Loop) = 1, i.e. disabled
P15.04	:	Torque Reference Source = 4 (RS485 Link Ref 1)
P15.01	:	Torque Reference Scale Factor = 100.0%
P32.87	:	Drive to Drive TX Reference 1 = P9.01, Speed Feedback

With this Set-up, DRIVEs 2 & 3 will track the torque of DRIVE 1. Also, the speed of DRIVE 3 may be monitored in P32.58 of DRIVE 1. Note that RUN/STOP commands may also have been passed via the Control Word 0 and Control Word 1 parameters.

8.6 GEM 80 ESP PROTOCOL

The MV3000e is addressed as a tributary port when processing ESP messages. The drive may have a system address number between 0 and 14 inclusive. Global messages (messages with address = 15) will only be processed if P32.01 is set to 1.

A full description of the ESP protocol message structure, CRC generation and inclusion can be found in the GEM 80 Serial Communications Manual available from **GE Power Conversion**.

The drive parameters are accessed in pre-defined groups (referred to as pages), each page containing a group of related parameters. A complete list of the pre-defined parameter pages is shown in Table 8-3. Page 1 is the user-defined parameter page; the method of accessing this page is described in Section 8.7.

Table 8-3. – ESP Parameter Pages

Page Number	Parameter Numbers											
1	ESP User-defined Page 1											
2	2.00 2.12	2.01 2.13	2.02 2.14	2.03 2.15	2.04	2.05	2.06	2.07	2.08	2.09	2.10	2.11
3	3.00 3.12 3.24	3.01 3.13 3.25	3.02 3.14 3.26	3.03 3.15 3.27	3.04 3.16 3.28	3.05 3.17 3.29	3.06 3.18	3.07 3.19	3.08 3.20	3.09 3.21	3.10 3.22	3.11 3.23
4	4.00 4.12	4.01 4.13	4.02 4.14	4.03 4.15	4.04 4.16	4.05 4.17	4.06 4.18	4.07 4.19	4.08 4.20	4.09 3.30	4.10 3.31	4.11
5	5.00 5.12 5.24	5.01 5.13 5.25	5.02 5.14 5.26	5.03 5.15 5.27	5.04 5.16 5.28	5.05 5.17	5.06 5.18	5.07 5.19	5.08 5.20	5.09 5.21	5.10 5.22	5.11 5.23
6	6.00 6.12	6.01 6.13	6.02 6.14	6.03 6.15	6.04 6.16	6.05	6.06	6.07	6.08	6.09	6.10	6.11
7	7.00	7.01	7.02	7.03	7.04	7.05	7.06	7.07	7.16			
8	7.17 7.29	7.18	7.19	7.20	7.21	7.22	7.23	7.24	7.25	7.26	7.27	7.28
9	8.00	8.01	8.02	8.03	8.04	8.05	8.06	8.07	8.08	8.09	8.10	8.11
10	9.00	9.01	9.02	9.03	9.04	9.05	9.06	9.07	9.08	9.09	9.10	9.11
11	10.00 10.12 10.24	10.01 10.13 10.25	10.02 10.14 10.26	10.03 10.15 10.27	10.04 10.16 10.28	10.05 10.17 10.29	10.06 10.18	10.07 10.19	10.08 10.20	10.09 10.21	10.10 10.22	10.11 10.23
12	10.30	10.31	10.32	10.33	10.34	41.32	41.33					
13	11.00 11.12	11.01 11.13	11.02 11.14	11.03 11.15	11.04 11.16	11.05 11.17	11.06 11.18	11.07 11.19	11.08 11.20	11.09	11.10	11.11
14	11.21 11.33 11.50	11.22 11.34 11.51	11.23 11.35	11.24 11.36	11.25 11.37	11.26 11.40	11.27 11.41	11.28 11.45	11.29 11.46	11.30 11.47	11.31 11.48	11.32 11.49
15	12.00 12.12 12.24	12.01 12.13 12.25	12.02 12.14 12.26	12.03 12.15 12.27	12.04 12.16 12.28	12.05 12.17	12.06 12.18	12.07 12.19	12.08 12.20	12.09 12.21	12.10 12.22	12.11 12.23
16	13.00 13.12	13.01 13.13	13.02 13.14	13.03 13.15	13.04 13.16	13.05 13.17	13.06 13.18	13.07 13.19	13.08 13.20	13.09	13.10	13.11
17	14.00 14.12	14.01 14.13	14.02 14.14	14.03 14.15	14.04 14.16	14.05 14.17	14.06 14.18	14.07 14.19	14.08	14.09	14.10	14.11
18	15.00	15.01	15.02	15.03	15.04	15.05						
19	16.00	16.01	16.02	16.03	16.04	16.05	16.06	16.07	16.08	16.09	16.10	16.11
20	17.00 17.12	17.01 17.13	17.02 17.14	17.03 17.15	17.04 17.16	17.05 17.17	17.06 17.18	17.07 17.19	17.08 17.20	17.09 17.21	17.10	17.11
21	18.00 19.04	18.01 20.00	18.02 20.01	18.03 20.02	18.04 20.03	18.05	18.06	1807	19.00	19.01	19.02	19.03
22	21.00 21.12	21.01 21.13	21.02 21.14	21.03 21.15	21.04 21.16	21.05 21.17	21.06 21.18	21.07 21.19	21.08 21.20	21.09	21.10	21.11
23	22.00	22.01	22.02	22.03	22.04	22.05	22.06	22.07				

Table 8-3. – ESP Parameter Pages

Page Number	Parameter Numbers											
24	23.00	23.01	23.02	23.03	23.04	23.05	23.06	23.07	23.08	23.09		
25	24.00	24.01	24.02	24.03	24.04	24.05	25.00	25.01	25.02	25.03	25.04	
26	26.00	26.01	26.02	26.03	26.04	26.05	26.06	26.07	26.08	26.09	26.10	26.11
	26.12	26.13	26.14	26.15	26.16	26.17	26.18	26.19	26.20	26.21	26.22	26.23
	26.24	26.25	26.26	26.27	26.28	26.29						
27	27.00	27.01	27.02	27.03	27.04	27.05	27.06	27.07	27.08	27.09	27.10	27.11
	27.12											
28	28.00	28.01	28.02	28.03	28.04	28.05	28.06	28.07	28.08	28.09	28.10	28.11
	28.12	28.13	28.14	28.15	28.16	28.17	28.18	28.19				
29	29.00	29.01	29.02	29.03	29.04	29.05	29.06	29.07	29.08	29.09		
30	30.00	30.01	30.02	30.03	30.04	30.05	30.06	30.07	30.08	30.09	30.10	30.11
	30.12	30.13	30.14	30.15	30.16	30.17	30.18	30.19	30.20	30.21	30.22	30.23
	30.24	30.25										
31	30.26	30.27	30.28	30.29	30.30	30.31	30.32	30.33	30.34	30.35	30.36	30.37
	30.38	30.39	30.40	30.41	30.42	30.43	30.44	30.45	30.46	30.47	30.48	30.49
	30.50	30.51										
32	30.52	30.53	30.54	30.55	30.56	30.57	30.58	30.59	30.60	30.61	30.62	30.63
	30.64	30.65	30.66	30.67								
33	31.00	31.01	31.02	31.03	31.04	31.05	31.06	31.07	31.08	31.09	31.10	31.11
	31.12	31.13	31.14	31.15	31.16	31.17	31.18	31.19	31.20	31.21	31.22	
34	32.00	32.01	32.10	32.11	32.12	32.13	32.14	32.15	32.16	32.17	32.18	32.19
	32.20	32.21	32.22	32.23	32.24							
35	32.25	32.26	32.27	32.28	32.29	32.30	32.31	32.32	32.33	32.34	32.35	32.36
	32.37	32.38	32.39	32.40	32.41	32.42	32.43	32.44	32.45			
36	32.50	32.51	32.52	32.53	32.54	32.55	32.56	32.57	32.58	32.59	32.60	32.61
	32.62	32.63	32.64									
37	32.65	32.66	32.67	32.68	32.69	32.70	32.71	32.72	32.73	32.74	32.75	32.76
	32.77	32.78	32.79	32.80	32.81	32.82	32.83	32.84	32.85			
38	32.87	32.88	32.89	32.90	32.91	32.92	32.93	32.94				
39	33.00	33.01	33.02	33.03	33.04	33.05	33.06	33.07	33.08	33.09	33.10	33.11
	33.12	33.13	33.14	33.15	33.16	33.17	33.18	33.19	33.20	33.21	33.22	33.23
	33.24	33.25	33.26	33.27								
40	33.28	33.29	33.30	33.31	33.32	33.33	33.34	33.35	33.36	33.37	33.38	33.39
	33.40	33.41	33.42	33.43	33.44	33.45	33.46	33.47	33.48	33.49	33.50	33.51
	33.52	33.53	33.54									
41	33.55	33.56	33.57	33.58	33.59	33.60	33.61	33.62	33.63	33.64	33.65	33.66
	33.67	33.68	33.69	33.70	33.71	33.72	33.73	33.74	33.75	33.76	33.77	33.78
	33.79											
42	33.80	33.81	33.82	33.83	33.84	33.85	33.86	33.87	33.88	33.89	33.90	33.91
	33.92	33.93	33.94	33.95	33.96	33.97	33.98	33.99				
43	34.00	34.01	34.02	34.03	34.04	34.05	34.06	34.07	34.08	34.09	34.10	34.11
	34.12	34.13	34.14	34.15	34.16	34.17	34.18	34.19	34.20	34.21	34.22	34.23
	34.24	34.25	34.26	34.27								
44	35.00	35.01	35.02	35.03	35.04	35.05	35.06	35.07	35.08	35.09	35.10	35.11
	35.12	35.13	26.30	26.31								
45	36.00	36.01	36.02	36.03	36.04	36.05	36.06	36.07	36.08	36.09		
46	36.10	36.11	36.12	36.13	36.14	36.15	36.16	36.17	36.18	36.19	36.20	36.21
	36.22	36.23	36.24	36.25	36.26	36.27	36.28	36.29	36.30	36.31		
47	36.32	36.33	36.34	36.35	36.36	36.37	36.38	36.39	36.40	36.41	36.42	36.43
	36.44	36.45	36.46	36.47	36.48	36.49	36.50	36.51	36.52	36.53	36.54	36.55
48	37.00	37.01	37.02	37.03	37.04	37.05	37.38	37.39	37.40	37.41		
49	37.06	37.07	37.08	37.09	37.10	37.11	37.12	37.13	37.14	37.15	37.26	37.17
	37.18	37.19	37.20	37.21								
50	37.22	37.23	37.24	37.25	37.26	37.27	37.28	37.29	37.30	37.31	37.32	37.33
	37.34	37.35	37.36	37.37								

Table 8-3. – ESP Parameter Pages

Page Number	Parameter Numbers											
51	38.00 38.12	38.01	38.02	38.03	38.04	38.05	38.06	38.07	38.08	38.09	38.10	38.11
52	39.00 39.12	39.01 39.13	39.02 39.14	39.03 39.15	39.04 39.16	39.05 39.17	39.06 39.18	39.07 39.19	39.08	39.09	39.10	39.11
53	39.20	39.21	39.22	39.23	39.24	39.25	39.26	39.27	39.28	39.29	39.30	
54	98.01 98.13 98.25	98.02 98.14 98.26	98.03 98.15 98.27	98.04 98.16 98.28	98.05 98.17 98.29	98.06 98.18	98.07 98.19	98.08 98.20	98.09 98.21	98.10 98.22	98.11 98.23	98.12 98.24
55	98.30 98.42	98.31 98.43	98.32 98.44	98.33 98.50	98.34 98.51	98.35 98.52	98.36 98.53	98.37 98.80	98.38 98.83	98.39 98.84	98.40 98.85	98.41 98.89
56	99.00 99.13	99.01 99.14	99.02 99.16	99.03 99.17	99.04	99.05	99.06	99.07	99.08	99.09	99.10	99.12
57	40.00 40.12	40.01 40.13	40.02 40.14	40.03 40.15	40.04 40.16	40.05 40.17	40.06 40.18	40.07 40.19	40.08 40.20	40.09 40.21	40.10 40.22	40.11 40.23
58	41.00 41.12	41.01 41.13	41.02 41.14	41.03 41.15	41.04	41.05	41.06	41.07	41.08	41.09	41.10	41.11
59	41.16 41.28	41.17 41.29	41.18 41.30	41.19 41.31	41.20	41.21	41.22	41.23	41.24	41.25	41.26	41.27
60	42.00 42.12	42.01 42.13	42.02 42.14	42.03 42.15	42.04 42.16	42.05 42.17	42.06	42.07	42.08	42.09	42.10	42.11
61	42.18 42.30	42.19 42.31	42.20 42.32	42.21 42.33	42.22 42.34	42.23 42.35	42.24 42.36	42.25 42.37	42.26 42.38	42.27 42.39	42.28	42.29
62	ESP User-defined Page 2											
63	43.00 43.12	43.01 43.13	43.02 43.14	43.03 43.15	43.04 43.16	43.05 43.17	43.06 43.18	43.07 43.19	43.08 43.20	43.09	43.10	43.11
64	44.00 44.12	44.01 44.13	44.02 44.14	44.03 44.15	44.04 44.16	44.05 44.17	44.06 44.18	44.07 44.19	44.08 44.20	44.09	44.10	44.11
65	42.40 42.52	42.41 42.53	42.42	42.43	42.44	42.45	42.46	42.47	42.48	42.49	42.50	42.51
66	50.00 51.03 51.15	50.01 51.04 51.16	50.02 51.05 51.17	50.03 51.06 51.18	50.04 51.07	50.05 51.08	50.06 51.09	50.07 51.10	50.08 51.11	51.00 51.12	51.01 51.13	51.02 51.14
67	52.00 52.12	52.01 52.13	52.02 52.14	52.03 52.15	52.04 52.16	52.05 52.17	52.06 52.18	52.07	52.08	52.09	52.10	52.11
68	53.00 53.12	53.01 53.13	53.02 53.14	53.03 53.15	53.04 53.16	53.05	53.06	53.07	53.08	53.09	53.10	53.11

8.6.1 Writing Data to the MV3000e

GEM 80 programmable controllers use the K tables to store data to be transmitted over the serial links. The addresses of the K tables used depend on the serial port used and the type of controller. The GEM 80 controller technical manual should therefore be consulted for detailed information on how to configure a GEM 80 controller.

When used with MV3000e the data passed to the K tables for transmission must be set as follows:

1st K table	Drive parameter page number to write to.
2nd K table	Drive parameter page to read from. See 8.6.2.
3rd K table	Value to be written to first item of MV3000e parameter page.
4th K table	Value to be written to second item of parameter page.
5th K table	etc.....

NOTES:

1 Do not transfer data to the MV3000e until all the data relating to the page is correct, since all the parameters in the specified page will be overwritten by the data in the K-tables.

2 If there is a valid page number in the 2nd K table, the parameter values in that page will be transferred to the GEM 80 J tables. To prevent a transfer to J tables a zero should be placed in the 2nd K table.

8.6.2 Reading Data from the MV3000e

To read data from the MV3000e, place the required page number in the 2nd K table and transfer the K tables to the MV3000e. The MV3000e then copies the values of the parameters listed in the specified page to the GEM 80 J tables. On receipt, the contents of the J tables will be as follows:

1st J table	Error word associated with the last message transaction, See Section 8.7.9.
2nd J table	Page number being read, confirmed here.
3rd J table	Value contained in first item on parameter page.
4th J table	Value contained in second item on parameter page.
5th J table	etc.....

NOTE: If a read operation is required without changing any MV3000e parameters, a zero must be placed in the 1st K table.

8.7 USER-DEFINED ESP PAGES

Generally the ESP parameter pages have fixed contents. To increase flexibility, the user can define the contents of two pages and these two pages can be accessed from either the RS232 or the RS485 serial links. The user-defined pages are referred to as User Pages 1 and 2.

8.7.1 ESP User-Defined Page 1

The number of parameters that are accessed on user-defined page 1 is specified by the contents of parameter P32.25, and the contents of the page are defined by parameters P32.26 to P32.45.

8.7.2 User Page 1 Size

P32.25 - User Page 1 Size

Defines the number of parameters contained in user-defined page 1.

Allowed values: 1 to 20.

8.7.3 User Page 1, Parameters 1 to 20

P32.26 to P32.45 - User Page 1, Parameters 1 to 20

These parameters specify the contents of the user-defined page 1.

Allowed values: Any valid parameter number in the range 1.00 to 99.99, simply drop the “P” suffix.

8.7.4 ESP User-Defined Page 2

The number of parameters that are accessed on user-defined page 2 is specified by the contents of parameter P32.65, and the contents of the page are defined by P32.66 to P32.85.

8.7.5 User Page 2 Size

P32.65 - User Page 2 Size

Defines the number of Parameters contained in the user-defined page 2.

Allowed values: 1 to 20.

8.7.6 User Page 2, Parameters 1 to 20

P32.66 to P32.85 - User Page 2, Parameters 1 to 20

These parameters specify the contents of the user-defined page 2.

Allowed values: Any valid parameter number in the range 1.00 to 99.99, simply drop the "P" suffix.

8.7.7 Configuring User-Defined Pages from the Drive Data Manager^{TM} (Keypad)

To configure user-defined pages:

Navigate to Menu 32. Set the user-defined page 1 and page 2 parameters as shown in Table 8-4.

Parameter		Contents
User Page 1	**User Page 2**	
P32.25	P32.65	Number of items to be included in user page (20 maximum)
P32.26	P32.66	First Page 1 or Page 2 parameter number
P32.27	P32.67	Second Page 1 or Page 2 parameter number
etc....	etc....	etc....

Table 8-4. – Configuring the User-defined Pages

NOTE: **If read and write parameters are mixed within the same page and the page is written to the MV3000e, the read-only parameters are not overwritten and bit 10 of the error word ("Access Error") is set (see Section 8.7.9). The drive continues to function correctly.**

8.7.8 Configuring a User Defined Page from GEM 80

For example, Table 8-5 shows configuring the User Page 1:

K table	To value	Why
1st	35	Write to ESP page 35
2nd	–	Don't care what is read
3rd	1 to 20	To set P32.25
4th	1.00 to 99.99	To set P32.26 with which drive parameters to place in the user page
etc.	etc.	

Table 8-5. – Configuring User Page 1

NOTE: **The message length set in the P-tables of the GEM 80 specifies the amount of data sent to the drive. The expected length of a reply message is also specified in the P-tables. When communicating with the MV3000e using a fixed message length, the MV3000e will accept the amount of data required by the intended page. Any further message data is ignored.**

If the message length contains less data than is required by the page, the number of data words received gives the number of parameters updated.

The reply sent back by the MV3000e is `n' data words where `n' is the number of parameters listed in the specified reply page. The GEM 80 ignores the whole message if this is greater than the expected reply length. If the reply message is shorter than the expected length of reply the GEM 80 updates only those J-table locations that have received an associated data word.

8.7.9 GEM80 ESP Error Messages

The 1st data word of the reply is an error word generated during the parameter read/write cycle of the message and is placed in the 1st J table. Particular errors are indicated by individual bits within the word, as shown in Table 8-6.

Bit	Error
0	"Write" page number too large
1	"Read" page number too large
2	Data sent, page length too short
3	Attempting to alter "Stop to Edit" parameter with drive running
4	CRC failure occurred
5	Message structure incorrect
6	Data sent, page length too long
7	Attempt to write out-of-range data to parameter
8	Serial link "Read" access not enabled (P32.00 = 0)
9	Trying to access non-existent parameter
10	Access error
11 to 15	Not defined

Table 8-6. – Error Messages

8.7.10 Error Handling

If the GEM 80 receives a message that is corrupted or no message arrives before the GEM 80 timeout period occurs it asks for re-transmission of the last reply by sending an ENQ ADDR message to the source of the message failure.

The first time the MV3000e receives a valid ENQ ADDR message it re-transmits the last reply message. If the next message received is ENQ ADDR the MV3000e responds with an NAK, a negative acknowledgement message. From then on each successive ENQ ADDR is responded to by a NAK reply until a valid data transfer message is received by the MV3000e.

If the MV3000e receives a correctly addressed message that has an incorrect CRC word attached, processing of that message is reset and the CRC count associated with the serial port is incremented.

8.8 RSVP PROTOCOL

The RSVP protocol is used for communication with D100 (WorldFIP to Serial Link Gateway) and is available only on the RS485 serial link. This protocol is similar to GEM80 ESP but allows faster communications to the drive from the D100. The RSVP protocol is selected by setting P32.52 to Option 5.

8.9 MODBUS™ RTU

The MV3000e can communicate using MODBUS™ RTU message protocol via the system link and/or the slow serial link. The MV3000e is configured to operate as a slave address, with an address range of 1-255. Broadcast messages i.e. functions intended for address 0 are ignored, this allows the MV3000e to be included in existing communications systems where broadcast messages may already be in use.

The MODBUS™ functions supported by the MV3000e allow reading of n-parameters, writing of n-parameters, writing a single parameter and a loop-back communications test. These correspond to the function numbers as shown in Table 8-7 to Table 8-16.

MODBUS™ Function Number (decimal)	MODBUS™ Function Name	MV3000 Application
03	Read Multiple Holding Registers	Read from Multiple Drive Parameters
04	Read Multiple Input Registers	Read from Multiple Drive Parameters
06	Preset Single Holding Register	Write to Single Drive Parameter
16	Preset Multiple Holding Registers	Write to Multiple Drive Parameters
08 Sub-function 00	Loop-back Diagnostic Test	Loop-back Diagnostic Test

Table 8-7. – MODBUS Functions

NOTE: For Modicon PLCs the Input Registers are from 30 000. The drive treats all parameters, subject to their attributes, as Holding Registers, for example P0.00 ≡ 40 000, P1.00 ≡ 40 100.

Drive MODBUS Address	Function Code	Number of 1st drive parameter to read		Total number of parameters to read		CRC word	
	03 or 04	High byte	Low byte	High byte	Low byte	High byte	Low byte

Table 8-8. – Read Multiple Drive Parameters

Drive MODBUS Address	Function Code	Data Length (2 bytes)	Register Word 1 Data		:	Register Word N Data		CRC word	
	03 or 04		High byte	Low byte	:	High byte	Low byte	High byte	Low byte

Table 8-9. – Drive Response

Drive Address	Function Code	Drive parameter to write		Value to write		CRC word	
	06	High byte	Low byte	High byte	Low byte	High byte	Low byte

Table 8-10. – Write to a Single Drive Parameter

Drive Address	Function Code	Drive parameter written to		Value written		CRC word	
	06	High byte	Low byte	High byte	Low byte	High byte	Low byte

Table 8-11. – Drive Response

Drive Address	Function Code	Number of 1st drive parameter to write		Number of parameters to write		No. of bytes	Value to write to 1st parameter		Value to write to Nth parameter		CRC word	
	16 (Dec)	H byte	L byte	H byte	L byte		H byte	L byte	H byte	L byte	H byte	L byte

Table 8-12. – Request to Write Multiple Parameters

Drive Address	Function Code	Number of 1st parameter written to		Number of parameters written		CRC word	
	16	High byte	Low byte	High byte	Low byte	High byte	Low byte

Table 8-13. – Response to Mulitple Parameter Write

Drive Address	Function No.	Sub-function number 0000		Data		CRC word	
	08	High byte	Low byte	High byte	Low byte	High byte	Low byte

Table 8-14. – Diagnostic Loopback Request

Drive Address	Function Code	Sub-function number 0000		Data		CRC word	
	08	High byte	Low byte	High byte	Low byte	High byte	Low byte

Table 8-15. – Loopback Test Request

Drive Address	Function Code	Error Code	CRC word	
		01	High byte	Low byte

Table 8-16. – Exception Message

The MODBUS™ protocol is designed and described around data exchange between PLCs. When used on a MV3000e the term "word" becomes synonymous with drive parameter. Hence, a MODBUS™ message intending to access word 110 is interpreted by the MV3000e as a requirement to access drive parameter P1.10. The start of an RTU frame is assumed to be the first character received after a gap in communications of at least 3.5 character intervals, i.e. the time taken for 3.5 characters to be transmitted, taking into account baud rate, data word length, stop bits and parity selection.

For transfers of 8 bit data, 1 start bit, 1 stop bit and no parity, a character is transferred approximately every 1 ms. Hence a 3.5 character gap equates to no characters being sent for approximately 3.5 ms.

The end of a message frame is also indicated by a 3.5 character gap. That is, the last character received before the communications gap occurred is assumed to be the last character of the message.

8.9.1 MODBUS™ RTU Error Messages

If the MV3000e receives messages requiring an unsupported function or an attempt to read/write more than 32 drive parameters, an exception message of error code 01, is sent back by the drive. If a correctly addressed message is received with an incorrect CRC word, the MV3000e flushes the message frame and increments the CRC count.

8.10 MODBUS™ ASCII

The difference between MODBUS™ ASCII and MODBUS™ RTU lies only in the way the message is framed, how the error checksum is generated and then how the message content is represented. The start and end of the message are not time framed as with RTU, but marked by specific start and end characters. The error word included at the end of the message is generated using a Longitudinal Redundancy Check (LRC) rather than a CRC error word. Two ASCII characters represent each byte of the message frame.

These differences are shown at the following example:-

Example- Read Multiple Drive Parameters in MODBUS™ ASCII

See Table 8-17 to read contents of P3.00 from Address 1 request.

:	Drive address		Function number		Number of 1st drive parameters to read				Total number of parameters to read				LRC word		CR	LF
3A	30	31	30	33	30	31	32	43	30	30	30	31	43	45	OD	OA

Table 8-17. – Read Contents of P3.00 from address 1 Request

NOTE: P3.00 is read as 300 (= 012Ch).

8.11 GEM 80-16 AND GEM 80-10 N-BUS PROTOCOL

The N-bus protocol used by GEM 80-16 and GEM 80-10 can be used to communicate with MV3000e MODBUS™, provided the MV3000e is addressed as a non C50, C100 subscriber.

Although N-bus is generally compatible with the MODBUS™ protocol used by MV3000e there is a difference in the way N-Bus processes address information (MV3000e parameter numbers) in messages. MODBUS™ changes addressing mode with the message function (e.g. bit addressing for bit data word addressing for word data), whereas N-bus starts all word addresses on a 16-bit boundary. This means that MV3000e parameter numbers originating from GEM 80-16 will have a four bit offset when included in the message frame.

Therefore, when using MV3000e within a GEM 80-16 network a MV3000e parameter number should not be specified as a `word' data type (i.e. it should not have the `W' prefix when programmed from the GEM 80-16 system programmer).

9. DIAGNOSTICS

9.1 INTRODUCTION TO DIAGNOSTICS

This section includes details of the different diagnostic methods provided within the software for a drive.

9.2 LED FAULT INDICATORS

Illumination of the WARNING or flashing TRIPPED indicator and extinguishing of the HEALTHY/STANDBY indicator indicate a fault condition.

The four LED indicators on the Keypad are repeated on the Keypad Harbour and give a first indication of drive status. The Drive and Keypad indicators are shown at Section 2.

9.3 WARNINGS

If the WARNING indicator is lit a problem has occurred which is not sufficiently serious to trip the drive. 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. It is most important that all Warning codes are viewed to get a complete picture.

A full list of codes for WARNINGS is shown in Table 9-2.

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).

9.4 TRIPS

If the TRIPPED indicator is flashing, a serious fault has occurred which has caused the drive to shut down. The drive may be faulty, but usually the drive has tripped in response to a problem on the plant, and the drive has protected the installation. 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. It is most important that all Trip codes are viewed to get a complete picture.

A full list of codes for TRIPS is shown in Table 9-3.

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

9.5 VIEWING WARNINGS AND TRIPS

Parameters in the drive report the trip or warning currently present, and other parameters hold a history of the last 10 trips. These parameters display codes and text that 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 1	Available parameters in Menu 10
P1.06 = FIRST WARNING	P10.00 - P10.09 = WARNINGS 1 to 10
P1.07 - P1.09 = FIRST 3 TRIPS	P10.10 - P10.19 = CURRENT TRIPS 1 to 10
	P10.20 - P10.29 = TRIP HISTORY 1 to 10

Table 9-1. – Viewing Warnings & Trips

Viewing using navigation keys

Navigate to one of the above parameters, either a Trip or a Warning and note the trip code and the trip text message – remember to view all, not just the first one.

Viewing using "help" key

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

b) The Keypad will display a diagnostic menu. Choose the relevant option.

c) See Sections 9.5.1 and 9.5.2 for what to do if a Trip or Warning occurs.

9.5.1 Action in the Event of a Warning

a) Press ? and select "2" – Display Warnings.

b) P10.00 will be displayed – note the first Warning! This is the problem that is causing the warning indication.

c) In turn, Display P10.01 to P10.09 and note any additional warnings. Any warnings in these locations will be for secondary problems and will help with diagnosis.

d) Refer to Table 9-2 and check the meaning of each warning. Take corrective action as necessary.

9.5.2 Action in the Event of a Trip

a) Press ? and select "2" – Display Trips.

b) P10.10 will be displayed – note the most recent Trip. This is the problem that has caused the trip indication. (For the default configuration, Trips 1/2 are located at P1.07/P1.08).

c) In turn, Display P10.11 to P10.19 and record any additional trips that may be present.

d) Refer to Table 9-3 and check the meaning of each fault code. Take corrective action as necessary.

e) See Section 9.5.3 for resetting trips.

9.5.3 Resetting Trips

From the Digital Inputs

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

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

From the Drive Data Manager™ (Keypad)

a) Press ? and select Option 3 (Attempt Trip Reset).

Table 9-2. – Warning Fault Codes

Fault Code	Warning Description	Possible reason why
100	Excess output current	Drive output current > drive continuous rating
101	Motor thermostat (MTRIP)	MTRIP input is low (P2.10 = 1)
102	Motor I^2T	Accumulated I^2T product of motor overload has reached Warning level (P2.09 = 2 or 3)
103	Motor PTC	PTC resistance increasing and approaching trip level
104	DB resistor	Resistor has 25% remaining power dissipation capability
105	Reference loss	Failure of selected drive reference
106	FBC1 loss	Cable fallen out. Not configured correctly, either on drive, or network master.
107	High temperature - see P45.22	A temperature high warning has occurred – *see* P45.22 for more details ∗
108	Low temperature - see P45.22	A temperature low warning has occurred – *see* P45.22 for more details ∗

Table 9-2. – Warning Fault Codes

Fault Code	Warning Description	Possible reason why
110	Backup reference loss	Failure of backup reference source
111	CAN2 Warnings	Refer to MV3000 Second CAN Port technical manual, T1968
112	RS232 loss	RS232 serial link has timed out (P32.15 = 1)
113	RS485 loss	RS485 serial link has timed out (P32.55 = 1)
114	Over speed	Motor operating above over speed level (P29.00/P29.01)
115	Encoder loss	Signal from encoder suggests fault
116	Fieldbus Loss	The Fieldbus communication link has failed
117 to 119	CAN2 Warnings	Refer to MV3000 second CAN Port technical manual, T1968
120 to 125	Internal software fault	Fault detected in operating software
127	Back-up parameter set in use	If main parameter set is corrupt at power up, the drive reverts to the back-up parameter set (if stored via P99.16). SF11 is set High, and warning 127 is active, to indicate Back-up set is being used.
128	Load fault – High	Fault due to excessive load
129	Load fault – Low	Fault due to inadequate load
130 to 132 & 135	CAN Warnings	Refer to MV3000 CANopen Fieldbus Facility Technical Manual T2013 – see 1.6.
133	SFE: Mains frequency outside limits	Set by P52.09 and P52.10
134	SFE: Synch Loss (P99.01?)	It has not been possible to synchronise the mains e.g. because of an auxiliary supply fault. If attempt made to run with this Warning displayed the SFE will trip on Trip Code 94.
136	SFE: LCN feedback missing/CF25 not been enabled	The unit will therefore not respond to a run request.
137	SFE: Choke ptc Warning	Resistance is greater than the threshold set in P52.19 and P52.20 is set to the value 1.
138	DB inactive (P99.01?)	P23.01 set to 1 (Proportional) P99.01 not set to 0 (No Motor Control)
139	U-phase sharing failure	The U-phases between all of the connected DELTA units are not sharing current equally. Faulty wiring. Unequal wiring impedances/lengths. Loose wiring terminals Faulty DELTA unit.
140	V phase sharing failure	As for 139 except for V phase
141	W phase sharing failure	As for 139, except for W phase.
142	Mains Amplitude Warning	SFE Mode: The measured mains voltage amplitude is outside of the limits set in P52.22 and P52.23 Motor Control Mode: The measured mains voltage amplitude is such that AC Loss Ridethrough has been invoked.
143	Ethernet Channel 1 Loss	Ethernet Channel 1 has not received the appropriate protocol message within the time-out specified, see MV3000e Ethernet Interface Technical Manual T2034 for full details
144	Ethernet Channel 2 Loss	As for 143 except for Ethernet Channel 2.
145 & 146	Reserved - Future Use	
147	Download in Progress	A parameter set is being downloaded to the drive

NOTE: Refer to Section 6.9 for details of the drive hardware.

9.5.4 Trip Fault Codes

These are shown in Table 9-3. There are four classes of trip:

A = Auto-resettable trip (see Menu 28).
R = Manually resettable trip (see Section 9.5.3).
S = System trip.
N = Non-resettable trip.

Table 9-3. – Trip Fault Codes

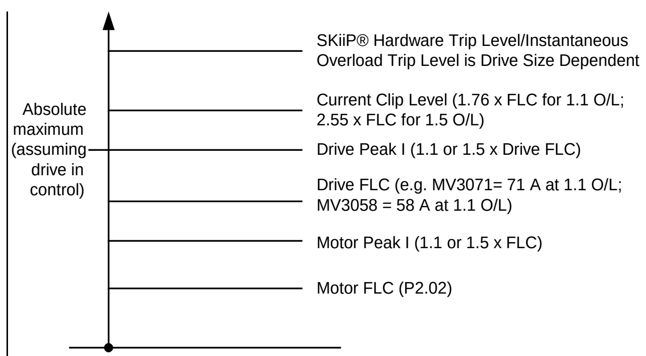
Fault Code	Name	Class	Description	Parameter No. to enable Auto-reset	What can cause a trip	Remarks
1	Interlock	A,R	Interlock Input at TB3/9 is low or open	P28.11	24 V not present on TB3/9. This is usually due to a plant E-stop or interlock being open	Check for open E-stops or interlocks outside the drive cubicle. Check that TB3 is not loose.
2	Reference Loss	A,R	No reference source can be found (either primary or backup)	P28.12	The drive receives references from analogue inputs, 4-20mA etc or Fieldbus link and the active reference has gone	Check more trip codes on Menu 10 by scrolling through. Extra trip codes will give clues to which reference has been lost.
3	DC Overvolts	A,R	DC Link Voltage exceeds the over voltage level: 780 V on a 380V-480VAC system 875V on a 525VAC system 1165V on a 690VAC system	P28.09	The DC Link volts monitored on P11.03 has risen; usually caused by the motor decelerating quickly and regenerating back into the drive. Check decelerating ramp rates are not too high or that any dynamic brake fitted is operating	If the decelerating ramp rate that stops the drive from tripping is too long, fit a DB. This is not a drive fault but an application error. Refer to Over/Under volts trip table in the appropriate product technical manual.
4	DC Undervolts	A,R	DC Link Voltage is less than the under voltage level: 400V on a 380V-480VAC system 450V on a 525VAC system 560V on a 690VAC system	P28.08		When a MicroCubicle™ CDC or a DELTA CDC is operating from 24 V auxiliaries the mains power is off and so the DC Link is not established.
5	Timed Over-current	A,R	Total I.T limit of the drive overload has been exceeded	P28.07		
6	Over-temperature -see P45.22 (pointed at by P10.10)	A,R	An Over-temperature trip has occurred – see P45.22 for more details	P28.13	Over temperature trips are generated by software in the CDC, by comparing temperature feedback to trip levels, or in the SKiiP® circuits in hardware, in case the software fails: - the temperature feedback is high - check Menu 45; - the drive ventilation is inhibited - check temperature, check air throughput against table in specification section of the appropriate product manual; - for liquid cooled products check that the coolant flow rates and volumes meet the specification in the product manual.	Refer to over temperature trips at Table 6-11. Menu 45 is dedicated to temperature feedback - some of the temperatures are also included at Menu 11. When a MicroCubicle is operating from 28V auxiliaries the SKiiP circuits are not powered up, which is where the trip originates, and the drive will show this trip.
7	Instantaneous Over-current	A,R	The drive output current has exceeded its maximum safe level – see diagram below for an indication of various trip levels. Note: When a Fault Code 7 occurs it is also likely that there will be a fault on any 8 to 13 U, V, W trip codes.	P28.06	The current feedback has exceeded the trip levels within the product: - motor faulty; - motor cable damage; - shock loads to system - however, the drive's internal current clipping ride-through function should stop this; - possible faulty transistors: - remove the motor cables, if the drive still trips then it is at fault internally; - for a DELTA system try exchanging the ribbons in the CDC and see if the trip 'moves'. If it does, the DELTA now reporting the trip is faulty. If it doesn't the CDC is faulty.	Refer to diagram under 'Description' for the various trip levels. When operating from 28V the drive will trip because the SKiiP circuits, within the product, are not powered. The exact list of trips will depend on the size of the drive powered by 28V.
				-		When operating from 24 V the drive will trip because the SKiiP® circuits, within the product, are not powered. The exact list of trips will depend on the size of the drive powered by 24 V.
8	Instantaneous Over-current on U-phase	A,R	U-phase transistor turned off by self-protection*	P28.06		

Table 9-3. – Trip Fault Codes

Fault Code	Name	Class	Description	Parameter No. to enable Auto-reset	What can cause a trip	Remarks
9	Hardware Over-temperature on U-phase	A,R	Over-temperature detected by U-phase output*	P28.13		
10	Instantaneous Over-current on V-phase	A,R	V-phase transistor turned off by self-protection*	P28.06		
11	Hardware Over-temperature on V-phase	A,R	Over-temperature detected by V-phase output*	P28.13		
12	Instantaneous Over-current on W-phase	A,R	W-phase transistor turned off by self-protection*	P28.06		
13	Hardware Over-temperature on W-phase	A,R	Over-temperature detected by W-phase output*	P28.13	The Over temperature Trips in Code 6 should react first. However, if the CDC is not functioning then the temperature may keep rising. The SKiiP® circuits have a hardwire temperature monitor for safety and these may trigger:- is the drive really hot - check Menus 11 and 45.- if YES check fans and ventilation requirements;- if NO then the drive may be at fault - e.g. change ribbon cables on DELTAs.	When operating from 24 V the drive will trip because the SKiiP® circuits, within the product, are not powered. The exact list of trips will depend on the size of the drive powered by 24 V.
14	Encoder Power Supply Fail	R	Encoder supply is internally supplied at 8 V then regulated down to the value set in P13.06 and 'I' limited, then if current flowing to the encoder is too high, trip here.	-	Check encoder cabling for damage – remove encoder connection at TB5 and try a reset to see if drive or cable is at fault – is encoder correct type? Refer to 'Encoder Selection' in appropriate product manual.	
15	Controller 15 V Fail	R	Internal supply voltage on the Control Board has failed. Failure of 15 V supply could result in: (a) no +15V for SKiiP which will result in any number of trips on the SKiiP module e.g. over temperature, over current.	-	Faulty CDC	
16	24 V Output Fail	R	The User +24 V output from the Control Electronics has failed, or been overloaded.	-	Disconnect User I/O terminals from the drive. See if 24 V recovers – check wiring if it does.	
17	Unidentified Power Interface Board	N.S	The drive cannot recognise the Power Interface (PIB) PCB, and therefore cannot run. It looks for an E^2PROM on the PIB.	-	E^2PROM failure on a MicroCubicle™ - the PIB is part of the CDC; On a DELTA system the PIB is within the controller's metal case.	
18	History Restore Fail	S	The Non-volatile History record cannot be recovered at power-up.	-	Can happen after a firmware upgrade and is OK. Is not critical if history record is not needed and therefore it can be ignored.	
19	New PCB	S	One of the printed circuit boards (pcb) in the drive has changed from when the drive was last switched off. Refer to Spares Manual supplied with new pcb.	-	Exchanging pcbs between drives Changing DELTA1; Changing DELTA pcbs. It is important that the correct spares procedures are followed.	
20	Parameter Edits Lost	S	The Non-volatile Parameter Edits cannot be recovered at power-up. All parameters have returned to their factory default values.	-	This trip is rare and is a warning. The DC Link on the drive may have been dragged down very quickly, preventing enough time for parameter storage on Power Off. Check for excessive DC Link Loads e.g. faulty DBs or DC Link schemes faulty.	
21	Motor Thermostat (MTRIP)	A,R	Motor thermostat has tripped. This trip can only occur if the thermostat is connected via a digital input to CF113 and P2.10 = 2. See Control Block Diagram Sheet 7	P28.10	CF113 is healthy when High, so n/c thermostats need to be inverted by placing a –ve sign in the edit.	Check motor fans and thermostat functionality.
22	Motor I^2T	A,R	The motor I^2T limit has been exceeded. This trip can only occur if P2.09 = 2.	P28.10	Is the motor free to rotate? Is the motor sized correctly for the load? Is P2.07 set correctly? Is P2.08 set correctly?	
23	RS232 Loss	A,R	RS232 serial link has timed out. This trip can only occur if P32.15 = 2.	P28.14	Check RS232 connections and wiring. Is the serial link manager plc OK? Check that the time-out period is set correctly.	
24	RS485 Loss	A,R	RS485 serial link has timed out. This trip can only occur if P32.55 = 2.	P28.14	Check RS485 connections and wiring. Is the serial link manager plc OK? Check that the time-out period is set correctly. Is P2.08 set correctly?	
25	Internal Reference Fail	R	Internal reference voltage has failed, CDC faulty	-	The CDC is faulty – replace.	
26	Under-temperature - see P45.22	A,R	An under-temperature trip has occurred – see P45.22 for more details	P28.13	Is the temperature actually low? *See* Menu 11 and 45 . If it is the drive cannot operate <0 °C. Temperature feedback comes from the SKiiP® Module. Check connections to the CDC.	

Table 9-3. – Trip Fault Codes

Fault Code	Name	Class	Description	Parameter No. to enable Auto-reset	What can cause a trip	Remarks
27	Keypad Loss/Removed	R	Keypad Communications have illegally halted. See Keypad removal at 2.2.5.	-	The Keypad has been removed when it was either in control (start/stop) or had reference control (Keypad ref).	
28	Current Imbalance	R	The 3 output phases are imbalanced in current This trip can only occur in VVVF mode (P99.01 = 1).	-	If the current is different by 20% in any 1 phase the drive trips. Disconnect motor cables and see if the trip remains - if YES then = drive; - if NO then = motor; Check motor. Check motor cables.	Check fans and ventilation. Check motor loads and cables - can disconnect motor cables and run drives to see if trip goes away - if it does the drive is not at fault.
29	Precharge failure	A,R	The Power Interface Board received no pre-charge contactor close signal. On a DELTA, check the rectifier wiring.	P28.08	24 V Precharge Acknowledge on PL12/9 has not been detected – wiring error or relay on DELTA Rectifier faulty or 24 V is down.	
30	Drive ID Violation	R	P99.13 is not equal to P99.14	-	Simple editing error. FIP or Fieldbus parameter set sent to wrong drive.	
31	DELTA 1 Over-current on U-phase	A,R	U-phase transistor on DELTA 1 turned off by self-protection.	P28.06	The Over current and Over temperature trips are operated by the SKiiP® Modules. Either the temperature or current is high (check Menus 11 and 45) or the SKiiP® Modules are faulty (move CDC ribbons for the DELTAs to see if the Trips move) or the controller is faulty. If the trips do not move with the DELTA ribbons and not the motor then it must be the controller. Checking if drive is faulty: 1. Remove motor cables from drive end; 2. 'Run' the drive in VVVF Mode and see if trips occur - if not drive is OK - if it does it may be controller or DELTA at fault. Checking if DELTA is faulty: 1. With the power OFF, move DELTA ribbons in the DELTA CDC; 2. Power ON and run the drive; 3. If the drive trips again and the trip has moved with the DELTA then the DELTA is at fault; If the drive trips on the same trip then the DELTA is OK but the CDC is at fault.	
32	DELTA 1 Over-temp on U-phase	A,R	Over-temperature detected on DELTA 1 U-phase.*	P28.13	See Fault Code 31 above.	
33	DELTA 1 Over-current on V-phase	A,R	V-phase transistor on DELTA 1 turned off by self-protection.	P28.06	See Fault Code 31 above.	
34	DELTA 1 Over-temp on V-phase	A,R	Over-temperature detected on DELTA 1 V-phase.*	P28.13	See Fault Code 31 above.	
35	DELTA 1 Over-current on W-phase	A,R	W-phase transistor on DELTA 1 turned off by self-protection	P28.06	See Fault Code 31 above.	
36	DELTA 1 Over-temp on W-phase	A,R	Over-temperature detected on DELTA 1 W-phase.*	P28.13	See Fault Code 31 above.	
37	DELTA 1 External trip	R	External trip detected on DELTA 1, TB1.	-	Only possible on Liquid Cooled DELTA (LCD) – this TB is used to detect fan failure on the LCD. See DC Link Overvoltage Trip 3. Could be faulty SMPS - exchange with another.	
38	DELTA 1 Over-voltage	A,R	DC Link over voltage detected on DELTA 1 – signal from the SMPS	P28.09		
39	DELTA 1 Enhanced DIB Trip	A,R	Reported if an enhanced trip from new Delta Interface Board (20X4381) is detected by an older controller.	P28.06	Controllers made after September 2005 show trip codes 240 to 249 instead.	
40	DELTA 2 Over-current on U-phase	A,R	U-phase transistor on DELTA 2 turned off by self-protection.	P28.06	Checks for Overcurrent on DELTA 2 are the same as those for DELTA 1 – refer to details at Fault Code 31.	
41	DELTA 2 Over-temp on U-phase	A,R	Over-temperature detected on DELTA 2 U-phase.*	P28.13	Checks for Overtemperature on DELTA 2 are the same as those for DELTA 1 – refer to details at Fault Code 31.	
42	DELTA 2 Over-current on V-phase	A,R	V-phase transistor on DELTA 2 turned off by self-protection.	P28.06	See Fault Code 40 above.	
43	DELTA 2 Over-temp on V-phase	A,R	Over-temperature detected on DELTA 2 V-phase.*	P28.13	See Fault Code 40 above.	
44	DELTA 2 Over-current on W-phase	A,R	W-phase transistor on DELTA 2 turned off by self-protection	P28.06	see Fault Code 40 above.	
45	DELTA 2 Over-temp on W-phase	A,R	Over-temperature detected on DELTA 2 W-phase.*	P28.13	see Fault Code 40 above.	

Table 9-3. – Trip Fault Codes

Fault Code	Name	Class	Description	Parameter No. to enable Auto-reset	What can cause a trip	Remarks
46	DELTA 2 External trip	R	External trip detected on DELTA 2, TB1.	-	See details for Fault Code 37.	
47	DELTA 2 Over-voltage	A,R	DC Link over voltage detected on DELTA 2.	P28.09		
48	DELTA 2 Over-current	A,R	Reported if an enhanced trip from new Delta Interface Board (20X4381) is detected by an older controller.	P28.06	Controllers made after September 2005 show trip codes 250 to 259 instead.	
49	DELTA 3 Over-current on U phase	A,R	U-phase transistor on DELTA 3 turned off by self-protection	P28.06	Checks for Overcurrent on DELTA 3 are the same as those for DELTA 1 - refer to details at Fault Code 31.	
50	DELTA 3 Over-temp on U-phase	A,R	Over-temperature detected on DELTA 3 U-phase.*	P28.13	Checks for Over temperature on DELTA 3 are the same as those for DELTA 1 - refer to details at Fault Code 31.	
51	DELTA 3 Over-current on V-phase	A,R	V-phase transistor on DELTA 3 turned off by self-protection.	P28.06	See Fault Code 49 above.	
52	DELTA 3 Over-temp on V-phase	A,R	Over-temperature detected on DELTA 3 V-phase.*	P28.13	See Fault Code 49 above.	
53	DELTA 3 Over-current on W-phase	A,R	W-phase transistor on DELTA 3 turned off by self-protection	P28.06	See Fault Code 49 above.	
54	DELTA 3 Over-temp on W-phase	A,R	Over-temperature detected on DELTA 3 W-phase.*	P28.13	See Fault Code 49 above.	
55	DELTA 3 External trip	R	External trip detected on DELTA 3, TB1.	-	See details for Fault Code 37.	
56	DELTA 3 Over-voltage	A,R	DC Link over voltage detected on DELTA 3.	P28.09		
57	Overspeed	A,R	The motor is operating above its set over speed level. This trip can only occur if P29.02 = 3.	P28.16	Speed feedback level in P9.01 is > over speed level in P29.00, P29.01. Is the encoder OK? Is the motor being overhauled? If in torque control, the motor may be running off due to mechanical failure of the load.	
58	Current Control Fault	R	Drive cannot control the motor current as required. Check the motor model, mains voltage, encoder connections and check for earth faults.	-	Value set in P12.02 is too high, or mains supply voltage is lower than thought. Poor motor model - do a CAL run. Encoder connections - mechanical and electrical are poor. Ensure the motor is off-load - the drive checks this at the beginning of the test. Motor parameters have been entered manually and are incorrect - do a CAL run.	Are the PID settings for Speed Amplifier OK? It may be unstable.
59	Motor Calibration Failure	R	Motor Calibration Test (P3.12 or 12.03 = 3) failed. Check the motor and encoder connections.	-		Motor must be off load.
60	Unsuitable Motor	R	The Motor Parameters entered do not describe a motor within the control capabilities of the drive.	-	The drive checks for three conditions to flag encoder loss: Maximum speed change (set in P13.02); Maximum reversals (set in P13.19); Reversible threshold (set in P13.20). Check encoder electrical and mechanical connections - ensure encoder cable has a continuous screen and is earthed at both ends.	
61	Encoder Loss	R	Encoder Signal has been lost, or cannot be relied upon. This trip can only occur if P13.02 = 3. See Control Block Diagram, Sheet 6.	-	The drive checks for three conditions to flag encoder loss: Maximum speed change (set in P13.02); Maximum reversals (set in P13.19); Reversible threshold (set in P13.20). Check encoder electrical and mechanical connections - ensure encoder cable has a continuous screen and is earthed at both ends.	
62	User Trip 1	A,R	Control Flag 10 = 1	P28.15	CF10 has been connected to something by the user – ensure that whatever it is connected to is healthy (i.e. producing a LO on CF10).	
63	Fieldbus Loss	R	The Fieldbus communication link has failed.	-	FIP, PROFIBUS, are Fieldbus communication links – the one in use has failed.	
64	Load Fault - High	A,R	The drive has detected a load fault due to excessive load.	P28.17	Menu 43 allows the drive to monitor the load – check mechanics for bearing failure or coupling breakages etc.	
65	Load Fault - Low	A,R	The drive has detected a load fault due to inadequate load.	P28.17		
66	Motor PTC trip	R	Excessive temperature detected by PTC on TB5, pin 1. See Menu 2.	P28.10	Is the motor stalled? Is the motor fan faulty? Is the motor PTC faulty? Is the PTC wiring and connectors OK?	

Table 9-3. – Trip Fault Codes

Fault Code	Name	Class	Description	Parameter No. to enable Auto-reset	What can cause a trip	Remarks
67	DB resistor trip	A,R	Drive estimates the DB resistor is too hot.	P28.18	Only possible for a MV DB. Drive bases estimation on information typed into P23.01 to P23.03.	
68	Unknown Drive Size	N.S	The software was unable to read the E^2 PROM on one, or more, of the pcbs.	-	E^2 PROMs exist on the SMPS, the DELTA PIBs and the DELTA DIBs.	
69	Configuration Trip	N.S	The drive is not correctly configured to operate in a DELTA system. DELTAs are not connected to the DELTA Controller correctly.	-	The DELTAs must be plugged in from DELTA 1 slot to DELTA 6 with no gaps; The DELTAs must all be the same type; The SMPS units on the DELTAs must all be the same type.	
70	Datumize Error	R	Datumizing (Position Control Only) encountered limit switches in the wrong order. See Position Control.	-	Ensure that the HI and LO position limit switches are wired and programmed correctly to CF87 and CF86. Datumizing speeds set in P36.35 to P36.37 are too high – see Datumizing 6.36.3.	
71	Speed Feedback Loss	R	Only applies to Speed Feedback Vector Control Mode (P99.01 = 2, and P13.00 = 1 & 2).	-	The selected speed feedback is no longer present, or backup has been selected, and it has not been programmed or connected.	
72	Over Frequency	R	Allowed output frequency has been exceeded. 250Hz at switching frequencies >= 2.5kHz 125Hz at switching frequency = 1.25kHz	-	Absolute limit to prevent IGBTs from being damaged.	
73	User Trip 2	A,R	Control Flag 112 = 1	P28.15	See User Trip 1 to Trip Code 62.	
74	DELTA 3 Over-current	A,R	Reported if an enhanced trip from new Delta Interface Board (20X4381) is detected by an older controller.	P28.06	Controllers made after September 2005 show trip codes 260 to 269 instead.	
75	DELTA 4 Over-current on U-phase	A,R	U-phase transistor on DELTA 4 turned off by self-protection	P28.06	Checks for Overcurrent on DELTA 4 are the same as those for DELTA 1 - refer to details at Fault Code 31.	
76	DELTA 4 Over-temp on U-phase	A,R	Over-temperature detected on DELTA 4 U-phase.*	P28.13	Checks for over temperature on DELTA 4 are the same as those for DELTA 1 - refer to details at Fault Code 31.	
77	DELTA 4 Over-current on V-phase	A,R	V-phase transistor on DELTA 4 turned off by self-protection.	P28.06	See Fault Code 75 above.	
78	DELTA 4 Over-temp on V-phase	A,R	Over-temperature detected on DELTA 4 V-phase.*	P28.13	See Fault Code 76 above.	
79	DELTA 4 Over-current on W-phase	A,R	W-phase transistor on DELTA 4 turned off by self-protection	P28.06	See Fault Code 75 above.	
80	DELTA 4 Over-temp on W-phase	A,R	Over-temperature detected on DELTA 4 W-phase.*	P28.13	see Fault Code 76 above.	
81	DELTA 4 External trip	R	External trip detected on DELTA 4, TB1.	-	See details for Fault Code 37.	
82	DELTA 4 Over-voltage	A,R	DC Link over voltage detected on DELTA 4.	P28.09		
83	DELTA 4 Over-current	A,R	Reported if an enhanced trip from new Delta Interface Board (20X4381) is detected by an older controller.	P28.06	Controllers made after September 2005 show trip codes 270 to 279 instead.	
84	DELTA 5 Over-current on U-phase	A,R	U-phase transistor on DELTA 5 turned off by self-protection	P28.06	Checks for Overcurrent on DELTA 5 are the same as those for DELTA 1 - refer to details at Fault Code 31.	
85	DELTA 5 Over-temp on U-phase	A,R	Over-temperature detected on DELTA 5 U-phase.*	P28.13	Checks for over temperature on DELTA 5 are the same as those for DELTA 1 - refer to details at Fault Code 31.	
86	DELTA 5 Over-current on V-phase	A,R	V-phase transistor on DELTA 5 turned off by self-protection.	P28.06	See Fault Code 84 above.	
87	DELTA 5 Over-temp on V-phase	A,R	Over-temperature detected on DELTA 5 V-phase.*	P28.13	See Fault Code 85 above.	
88	DELTA 5 Over-current on W-phase	A,R	W-phase transistor on DELTA 5 turned off by self-protection	P28.06	See Fault Code 84 above.	
89	DELTA 5 Over-temp on W-phase	A,R	Over-temperature detected on DELTA 5 W-phase*	P28.13	See Fault Code 85 above.	
90	DELTA 5 External trip	R	External trip detected on DELTA 5, TB1.	P25.19	See details for Fault Code 37.	
91	DELTA 5 Over-voltage	A,R	DC Link over voltage detected on DELTA 5.	P28.09		
92	DELTA 5 Over-current	A,R	Reported if an enhanced trip from new Delta Interface Board (20X4381) is detected by an older controller.	P28.06	Controllers made after September 2005 show trip codes 280 to 289 instead.	
93	SFE: Mains frequency detected outside of limits	A,R	Mains frequency has been detected outside of the limits set by P52.08 and P52.11	P28.19	The Mains Monitor Unit may not be connected correctly. The mains frequency may be varying.	
94	SFE: Synchronisation to mains has failed	A,R	Synchronisation to the mains has failed due to: a) permanent loss of mains signal, or b) temporary interruption of mains signal, or c) mains frequency has changed at a rate greater than 2%/s.	P28.19	The Mains Monitor Unit may not be connected at all, or connected correctly.	
95	SFE: Mains Voltage Monitor Loss	A,R	Mains Voltage Monitor Loss	P28.19	A ribbon cable may have become disconnected	
96	SFE: Auxiliary Phase Detection Loss	A,R	Auxiliary Phase Detection Loss	P28.19	There may be a missing phase on an Input Monitor or a mismatch of amplitude and phasing on the incoming phases.	
97	Pre-release Expiry	R	Pre-release Software time limit expired	-	A pre-release version of firmware has been left in the drive – update to latest version.	

Table 9-3. – Trip Fault Codes

Fault Code	Name	Class	Description	Parameter No. to enable Auto-reset	What can cause a trip	Remarks
98	SFE: Choke ptc trip	A,R	Choke PTC resistance is greater than the threshold set in P52.19 and P52.20 is set to the value 2.	P28.19	The SFE Choke is either very hot; Or its detector (PTC) has failed; Or its detector (PTC) is not wired correctly.	
99	Unknown trip			-		
100-	Reserved for Warning Codes			-	The controller has detected an error in the PWM Pattern. CDC is at fault. Check DB resistor wiring, or DB resistor, maybe DB Family. Check DB resistor wiring and resistor. The DB may be hot due to short circuit of cables or DB may be faulty. Checks for Overcurrent on DELTA 6 are the same as those for DELTA 1 - refer to details at Fault Code 31.	
149	See Warning Codes			-	The controller has detected an error in the PWM Pattern. CDC is at fault. Check DB resistor wiring, or DB resistor, maybe DB Family. Check DB resistor wiring and resistor. The DB may be hot due to short circuit of cables or DB may be faulty. Checks for Overcurrent on DELTA 6 are the same as those for DELTA 1 - refer to details at Fault Code 31. Checks for over temperature on DELTA 6 are the same as those for DELTA 1 - refer to details at Fault Code 31.	
150	PWM error	N.S	Error detected in Drive's PWM. Report to **GE Power Conversion**	-		
151	DB Trip	A,R	Over-current from DB unit – detected by the SKiiP® Modules.	P28.06		
152	DB hardware Over-temp trip	A,R	Over-temperature from DB unit – detected by the SKiiP® Modules.	P28.13		
153	DELTA 6 Over-current on U-phase	A,R	U-phase transistor on DELTA 6 turned off by self-protection	P28.06		
154	DELTA 6 Over-temp on U-phase	A,R	Over-temperature detected on DELTA 6 U-phase.*	P28.13		
155	DELTA 6 Over-current on V-phase	A,R	V-phase transistor on DELTA 6 turned off by self-protection.	P28.06	See Fault Code 153 above.	
156	DELTA 6 Over-temp on V-phase	A,R	Over-temperature detected on DELTA 6 V-phase.*	P28.13	See Fault Code 154 above.	
157	DELTA 6 Over-current on W-phase	A,R	W-phase transistor on DELTA 6 turned off by self-protection	P28.06	See Fault Code 153 above.	
158	DELTA 6 Over-temp on W-phase	A,R	Over-temperature detected on DELTA 6 W-phase.*	P28.13	See Fault Code 154 above.	
159	DELTA 6 External trip	R	External trip detected on DELTA 6, TB1.	-	See details for Fault Code 37.	
160	DELTA 6 Over-voltage	A,R	DC Link over voltage detected on DELTA 6.	P28.09		
161	DELTA 6 Over-current	A,R	Reported if an enhanced trip from new Delta Interface Board (20X4381) is detected by an older controller.	P28.06	Controllers made after September 2005 show trip codes 290 to 299 instead.	
162	DB 1 Over-current U	A,R	U-phase transistor on DB 1 turned off by self-protection.	P28.06	DELTA Bridges can be used as DBs by connecting them into the relevant connections or the CDC Controller; the trips are therefore generated in the same way as a normal DELTA, so refer to DELTA 1 Codes. However, over currents can be caused by faulty resistors, or resistor wiring, as there is no motor here – check wiring and resistors for damage. Move the ribbons from DB1 to DB2. See if the trip moves with the DB or the Controller.	
163	DB 1 Over-temp U	A,R	Over-temperature detected on DB 1 U-phase.	P28.13		
164	DB 1 Over-current V	A,R	V-phase transistor on DB 1 turned off by self-protection.	P28.06		
165	DB 1 Over-temp V	A,R	Over-temperature detected on DB 1 V-phase.	P28.13		
166	DB 1 Over-current W	A,R	W-phase transistor on DB 1 turned off by self-protection.	P28.06		
167	DB 1 Over-temp W	A,R	Over-temperature detected on DB 1 W-phase.	P28.13		
168	DB 1 External trip	R	External trip detected on DB 1, TB1.	-		
169	DB 1 Over-voltage	A,R	DC Link over voltage detected on DB 1.	P28.09		
170	DB 1 Over-current	A,R	Over-current detected on DB 1.	P28.06		
171	DB 2 Over-current U	A,R	U-phase transistor on DB 2 turned off by self-protection.	P28.06		
172	DB 2 Over-temp U	A,R	Over-temperature detected on DB 2 U-phase.	P28.13		
173	DB 2 Over-current V	A,R	V-phase transistor on DB 2 turned off by self-protection.	P28.06		
174	DB 2 Over-temp V	A,R	Over-temperature detected on DB 2 V-phase.	P28.13		
175	DB 2 Over-current W	A,R	W-phase transistor on DB 2 turned off by self-protection.	P28.06		
176	DB 2 Over-temp W	A,R	Over-temperature detected on DB 2 W-phase.	P28.13		
177	DB 2 External trip	R	External trip detected on DB 2, TB1.	-		
178	DB 2 Over-voltage	A,R	DC Link over voltage detected on DB 2.	P28.09		
179	DB 2 Over-current	A,R	Over-current detected on DB 2.	P28.06		

Table 9-3. – Trip Fault Codes

Fault Code	Name	Class	Description	Parameter No. to enable Auto-reset	What can cause a trip	Remarks
180	PIB FPGA config. Failure	N.S	Internal failure. Report to **GE Power Conversion**	-	Identity in E^2PROM on MicroCubicle™ SMPS is unrecognisable – faulty SMPS or corrupt E^2PROM or maybe loose ribbon connections between CDC and SMPS.	
181	Unidentified SMPS	N.S	System error as described. Check wiring.	-		
182	Unidentified DELTA 1	N.S	Identity information in DIB is unrecognisable.	-		
183	Unidentified SMPS 1	N.S	Identity information in DELTA SMPS is unrecognisable.	-		When a DELTA CDC is operating from 24 V auxiliaries the CDC is unable to read the E^2PROM on the DELTA DIB (DELTA Interface Board) so this trip will occur. The trip can be masked by CF108.
184	Incorrect DELTA 1	N.S	The complete DELTA is incorrect type	-	This means that the SMPS and the DELTA are not compatible. There may be a high voltage SMPS with a low voltage DELTA or vice versa – check correct SMPS type for DELTA.	When a DELTA CDC is operating from 24 V auxiliaries the CDC is unable to read the E^2PROM on the DELTA SMPS (Switched Mode Power Supply) so this trip will occur. The trip can be masked by CF108.
185	Unidentified DELTA 2	N.S	See 182.	-	See 182	When a DELTA CDC is operating from 24 V auxiliaries the CDC is unable to read the E^2PROM on the DELTA DIB (DELTA Interface Board) so this trip will occur.
186	Unidentified SMPS 2	N.S	See 183.	-		When a DELTA CDC is operating from 24 V auxiliaries the CDC is unable to read the E^2PROM on the DELTA SMPS (Switched Mode Power Supply).
187	Incorrect DELTA 2	N.S	See 184.	-		
188	Unidentified DELTA 3	N.S	See 182.	-		
189	Unidentified SMPS 3	N.S	See 183.	-		
190	Incorrect DELTA 3	N.S	See 184.	-		
191	Unidentified DELTA 4	N.S	See 182.	-		
192	Unidentified SMPS 4	N.S	See 183.	-		
193	Incorrect DELTA 4	N.S	See 184.	-		
194	Unidentified DELTA 5	N.S	See 182.	-		
195	Unidentified SMPS 5	N.S	See 183.	-		
196	Incorrect DELTA 5	N.S	See 184.	-		
197	Unidentified DELTA 6	N.S	See 182.	-		
198	Unidentified SMPS 6	N.S	See 183.	-		
199	Incorrect DELTA 6	N.S	See 184.	-		
200	CAN 1 Loss, see P61.43	R	CAN is not communicating correctly	-	Some possible causes of a trip are:CAN cable disconnected;No other active nodes on the CAN Network.Refer to T2013 CANopen Fieldbus Facility Technical Manual for more details.	
201	Unsuitable DB Load	N.R	Load too high (resistor value too low) on DB mode, on IGBT Bridge	-	When using a Power Bridge as a DB (P23.19 = 1) incorrect value of DB resistors will trigger this trip. Check resistor values; Check DB resistor wiring.	
202	DELTA Rectifier Thermostat Trip	A,R	Thermostat connections (PL12/3 and PL12/4) on DELTA Controller are open circuit.	P28.13	Missing or damaged wiring between DELTA Controller (PL12/3/4) and DELTA Rectifier (TB1/3/4).	
203	CAN 2 LOSS See P65.43	R	As Trip 200	-	As Trip 200	
204	Fieldbus Coupler 1 Loss	R	The Fieldbus communication associated with Menu 74 has failed	-	Cable fallen out Not configured correctly - either on drive or network master.	
205	Reserved			-		
206	Reserved			-		
207	U-Phase Sharing Failure	R	Imbalance between DELTA U-Phase Currents	-	The U- Phases between all of the connected DELTA units are not sharing current equally: Unequal wiring impedances/lengths Loose wiring terminals Faulty DELTA unit	
208	V-Phase Sharing Failure	R	Imbalance between DELTA V-Phase Currents	-	As Trip 207, except for V-Phase	

Table 9-3. – Trip Fault Codes

Fault Code	Name	Class	Description	Parameter No. to enable Auto-reset	What can cause a trip	Remarks
209	W-Phase Sharing Failure	R	Imbalance between DELTA W-Phase Currents	-	As Trip 207, except for W-Phase	
210	Mains Amplitude Trip	R	The mains supply amplitude has been outside the limits set by P52.22 and P52.23 for longer than the time set by P52.24	-		
211	Not 40MHz CDC	N.S	The firmware fitted is only compatible with a 40MHZ CDC and the CDC in use is an older 25MHz version	-		
212	Undiagnosed Trip DELTA 1	R	Controller has detected a trip from DELTA 1 but is unable to diagnose details of the trip.	-	High amounts of electrical noise. Poor earthing. Incorrect screening of ribbon cables.	
213	Undiagnosed Trip DELTA 2	R	See 212	-		Later Delta Interface Boards (20X4381 or 20X4384) should fix this problem.
214	Undiagnosed Trip DELTA 3	R	See 212	-		
215	Undiagnosed Trip DELTA 4	R	See 212	-		
216	Undiagnosed Trip DELTA 5	R	See 212	-		
217	Undiagnosed Trip DELTA 6	R	See 212	-		
218	Undiagnosed Trip DB1	R	See 212	-		
219	Undiagnosed Trip DB2	R	See 212	-		
220	Ethernet 1 Loss	R	Ethernet Channel 1 has not received the appropriate protocol message (see P86.34) within the timeout specified by P86.33	-		
221	Ethernet 2 Loss	R	Ethernet Channel 2 has not received the appropriate protocol message (see P86.84) within the timeout specified by P86.83	-		
222	Torque Prove Fail	R	Torque has not been proved before the Torque Prove timeout has elapsed	-		
223	Brake Release Fail	R	Brake has not been released before the Brake Release timer has expired	-		
224	Download in Progress	R	Running is prohibited as Drive Coach PC package has not terminated a parameter download	-	Incorrect termination of parameter download from Drive Coach	
225 - 228	Reserved			-		
229	DSP Comms Failure	R	Communications between CDC and DSP have failed.	-		
230	User Alert 1	R	Control Flag 198 = 1	-	CF198 has been connected to something by the user – ensure that whatever it is connected to is healthy (i.e. producing a LO on CF198).	
231	User Alert 2	R	Control Flag 199 = 1	-	CF199 has been connected to something by the user – ensure that whatever it is connected to is healthy (i.e. producing a LO on CF199).	
232	User Alert 3	R	Control Flag 200 = 1	-	CF200 has been connected to something by the user – ensure that whatever it is connected to is healthy (i.e. producing a LO on CF200).	
233	User Alert 4	R	Control Flag 201 = 1	-	CF201 has been connected to something by the user – ensure that whatever it is connected to is healthy (i.e. producing a LO on CF201).	
234	User Alert 5	R	Control Flag 202 = 1	-	CF202 has been connected to something by the user – ensure that whatever it is connected to is healthy (i.e. producing a LO on CF202).	
235	User Alert 6	R	Control Flag 203 = 1	-	CF203 has been connected to something by the user – ensure that whatever it is connected to is healthy (i.e. producing a LO on CF203).	
236	User Alert 7	R	Control Flag 204 = 1	-	CF204 has been connected to something by the user – ensure that whatever it is connected to is healthy (i.e. producing a LO on CF204).	
237	User Alert 8	R	Control Flag 205 = 1	-	CF205 has been connected to something by the user – ensure that whatever it is connected to is healthy (i.e. producing a LO on CF205).	
238	User Alert 9	R	Control Flag 206 = 1	-	CF206 has been connected to something by the user – ensure that whatever it is connected to is healthy (i.e. producing a LO on CF206).	
239	User Alert 10	R	Control Flag 207 = 1	-	CF207 has been connected to something by the user – ensure that whatever it is connected to is healthy (i.e. producing a LO on CF207).	
240	Delta 1 DIB 5v Fail	R	Internal power supply failure on Delta DIB.	-	Faulty SMPS. Fault DIB.	
241	Delta 1 DIB +15v Fail	R	Internal power supply failure on Delta DIB.	-	Faulty SMPS. Fault DIB.	
242	Delta 1 DIB -15v Fail	R	Internal power supply failure on Delta DIB.	-	Faulty SMPS. Fault DIB.	
243	Delta 1 DIB Fan Fail	R	Speed feedback failure from capacitor fan for this Delta.	-	Faulty, blocked or jammed capacitor fan. If no fan is present or required, is the jumper link, TP14, on the Delta DIB in the correct position to disable the fan trip detection?	

Table 9-3. – Trip Fault Codes

Fault Code	Name	Class	Description	Parameter No. to enable Auto-reset	What can cause a trip	Remarks
244	Delta 1 DIB Over Freq. U	R	Erroneous PWM pulses have been detected by the DIB, on this phase, resulting in PWM frequency too high.	-	Incorrect screening of ribbons between controller and DIB. Screen is not connected to metalwork.	
245	Delta 1 DIB Over Freq. V	R	As Trip 244.	-	As Trip 244.	
246	Delta 1 DIB Over Freq. W	R	As Trip 244.	-	As Trip 244.	
247	Delta 1 DIB Td Error U	R	Erroneous PWM pulses have been detected by the DIB, on this phase, resulting upper/lower dead-time violation commands.	-	Incorrect screening of ribbons between controller and DIB. Screen is not connected to metalwork.	
248	Delta 1 DIB Td Error V	R	As Trip 247.	-	As Trip 247.	
249	Delta 1 DIB Td Error W	R	As Trip 247.	-	As Trip 247.	
250	Delta 2 DIB 5v Fail	R	Internal power supply failure on Delta DIB.	-	Faulty SMPS. Fault DIB.	
251	Delta 2 DIB +15v Fail	R	Internal power supply failure on Delta DIB.	-	Faulty SMPS. Fault DIB.	
252	Delta 2 DIB -15v Fail	R	Internal power supply failure on Delta DIB.	-	Faulty SMPS. Fault DIB.	
253	Delta 2 DIB Fan Fail	R	Speed feedback failure from capacitor fan for this Delta.	-	Faulty, blocked or jammed capacitor fan. If no fan is present or required, is the jumper link, TP14, on the Delta DIB in the correct position to disable the fan trip detection?	
254	Delta 2 DIB Over Freq. U	R	Erroneous PWM pulses have been detected by the DIB, on this phase, resulting in PWM frequency too high.	-	Incorrect screening of ribbons between controller and DIB. Screen is not connected to metalwork.	
255	Delta 2 DIB Over Freq. V	R	As Trip 244.	-	As Trip 244.	
256	Delta 2 DIB Over Freq. W	R	As Trip 244.	-	As Trip 244.	
257	Delta 2 DIB Td Error U	R	Erroneous PWM pulses have been detected by the DIB, on this phase, resulting upper/lower dead-time violation commands.	-	Incorrect screening of ribbons between controller and DIB. Screen is not connected to metalwork.	
258	Delta 2 DIB Td Error V	R	As Trip 247.	-	As Trip 247.	
259	Delta 2 DIB Td Error W	R	As Trip 247.	-	As Trip 247.	
260	Delta 3 DIB 5v Fail	R	Internal power supply failure on Delta DIB.	-	Faulty SMPS. Fault DIB.	
261	Delta 3 DIB +15v Fail	R	Internal power supply failure on Delta DIB.	-	Faulty SMPS. Fault DIB.	
262	Delta 3 DIB -15v Fail	R	Internal power supply failure on Delta DIB.	-	Faulty SMPS. Fault DIB.	
263	Delta 3 DIB Fan Fail	R	Speed feedback failure from capacitor fan for this Delta.	-	Faulty, blocked or jammed capacitor fan. If no fan is present or required, is the jumper link, TP14, on the Delta DIB in the correct position to disable the fan trip detection?	
264	Delta 3 DIB Over Freq. U	R	Erroneous PWM pulses have been detected by the DIB, on this phase, resulting in PWM frequency too high.	-	Incorrect screening of ribbons between controller and DIB. Screen is not connected to metalwork.	
265	Delta 3 DIB Over Freq. V	R	As Trip 244.	-	As Trip 244.	
266	Delta 3 DIB Over Freq. W	R	As Trip 244.	-	As Trip 244.	
267	Delta 3 DIB Td Error U	R	Erroneous PWM pulses have been detected by the DIB, on this phase, resulting upper/lower dead-time violation commands.	-	Incorrect screening of ribbons between controller and DIB. Screen is not connected to metalwork.	
268	Delta 3 DIB Td Error V	R	As Trip 247.	-	As Trip 247.	
269	Delta 3 DIB Td Error W	R	As Trip 247.	-	As Trip 247.	
270	Delta 4 DIB 5v Fail	R	Internal power supply failure on Delta DIB.	-	Faulty SMPS. Fault DIB.	
271	Delta 4 DIB +15v Fail	R	Internal power supply failure on Delta DIB.	-	Faulty SMPS. Fault DIB.	
272	Delta 4 DIB -15v Fail	R	Internal power supply failure on Delta DIB.	-	Faulty SMPS. Fault DIB.	
273	Delta 4 DIB Fan Fail	R	Speed feedback failure from capacitor fan for this Delta.	-	Faulty, blocked or jammed capacitor fan. If no fan is present or required, is the jumper link, TP14, on the Delta DIB in the correct position to disable the fan trip detection?	
274	Delta 4 DIB Over Freq. U	R	Erroneous PWM pulses have been detected by the DIB, on this phase, resulting in PWM frequency too high.	-	Incorrect screening of ribbons between controller and DIB. Screen is not connected to metalwork.	
275	Delta 4 DIB Over Freq. V	R	As Trip 244.	-	As Trip 244.	
276	Delta 4 DIB Over Freq. W	R	As Trip 244.	-	As Trip 244.	
277	Delta 4 DIB Td Error U	R	Erroneous PWM pulses have been detected by the DIB, on this phase, resulting upper/lower dead-time violation commands.	-	Incorrect screening of ribbons between controller and DIB. Screen is not connected to metalwork.	
278	Delta 4 DIB Td Error V	R	As Trip 247.	-	As Trip 247.	
279	Delta 4 DIB Td Error W	R	As Trip 247.	-	As Trip 247.	

Table 9-3. – Trip Fault Codes

Fault Code	Name	Class	Description	Parameter No. to enable Auto-reset	What can cause a trip	Remarks
280	Delta 5 DIB 5v Fail	R	Internal power supply failure on Delta DIB.	-	Faulty SMPS. Fault DIB.	
281	Delta 5 DIB +15v Fail	R	Internal power supply failure on Delta DIB.	-	Faulty SMPS. Fault DIB.	
282	Delta 5 DIB -15v Fail	R	Internal power supply failure on Delta DIB.	-	Faulty SMPS. Fault DIB.	
283	Delta 5 DIB Fan Fail	R	Speed feedback failure from capacitor fan for this Delta.	-	Faulty, blocked or jammed capacitor fan. If no fan is present or required, is the jumper link, TP14, on the Delta DIB in the correct position to disable the fan trip detection?	
284	Delta 5 DIB Over Freq. U	R	Erroneous PWM pulses have been detected by the DIB, on this phase, resulting in PWM frequency too high.	-	Incorrect screening of ribbons between controller and DIB. Screen is not connected to metalwork.	
285	Delta 5 DIB Over Freq. V	R	As Trip 244.	-	As Trip 244.	
286	Delta 5 DIB Over Freq. W	R	As Trip 244.	-	As Trip 244.	
287	Delta 5 DIB Td Error U	R	Erroneous PWM pulses have been detected by the DIB, on this phase, resulting upper/lower dead-time violation commands.	-	Incorrect screening of ribbons between controller and DIB. Screen is not connected to metalwork.	
288	Delta 5 DIB Td Error V	R	As Trip 247.	-	As Trip 247.	
289	Delta 5 DIB Td Error W	R	As Trip 247.	-	As Trip 247.	
290	Delta 6 DIB 5v Fail	R	Internal power supply failure on Delta DIB.	-	Faulty SMPS. Fault DIB.	
291	Delta 6 DIB +15v Fail	R	Internal power supply failure on Delta DIB.	-	Faulty SMPS. Fault DIB.	
292	Delta 6 DIB -15v Fail	R	Internal power supply failure on Delta DIB.	-	Faulty SMPS. Fault DIB.	
293	Delta 6 DIB Fan Fail	R	Speed feedback failure from capacitor fan for this Delta.	-	Faulty, blocked or jammed capacitor fan. If no fan is present or required, is the jumper link, TP14, on the Delta DIB in the correct position to disable the fan trip detection?	
294	Delta 6 DIB Over Freq. U	R	Erroneous PWM pulses have been detected by the DIB, on this phase, resulting in PWM frequency too high.	-	Incorrect screening of ribbons between controller and DIB. Screen is not connected to metalwork.	
295	Delta 6 DIB Over Freq. V	R	As Trip 244.	-	As Trip 244.	
296	Delta 6 DIB Over Freq. W	R	As Trip 244.	-	As Trip 244.	
297	Delta 6 DIB Td Error U	R	Erroneous PWM pulses have been detected by the DIB, on this phase, resulting upper/lower dead-time violation commands.	-	Incorrect screening of ribbons between controller and DIB. Screen is not connected to metalwork.	
298	Delta 6 DIB Td Error V	R	As Trip 247.	-	As Trip 247.	
299	Delta 6 DIB Td Error W	R	As Trip 247.	-	As Trip 247.	

NOTES:

1 Also refer to 6.11.2. Temperature Feedback – Parameters P11.04 to P11.14.

2 A SkiiP® is an integrated assembly of IGBTs.

3 ∗ These faults are hardware generated in the SkiiP® Transistor Module.

4 For any DELTA SkiiP® Trip Fault Code, when the DELTA CDC is operating from 24 V auxiliaries, all DELTA SkiiP® s will report faulty because they are without mains power.

9.6 USING THE HELP KEY

If the drive trips, get information on the trip by pressing ?.

A screen appears, giving four choices as shown in Figure 9-1.

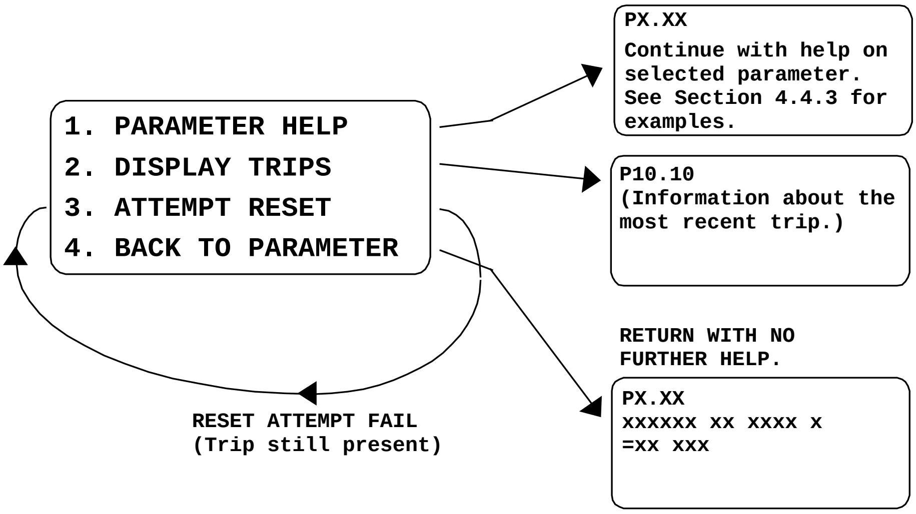


Figure 9-1. – Help Screen for Trips

PRESS

1 Allows the user to view parameter help when a trip is present.

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 Returns the parameter being viewed before ? was pressed, with no further help.

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

The HELP system works as described for trips, except that P10.00 displays the most recent Warning, as in Figure 9-2.

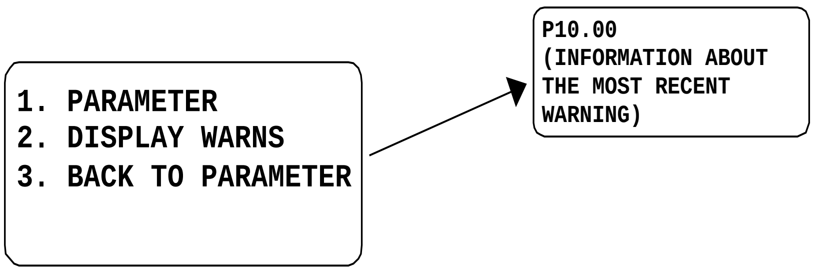


Figure 9-2. – Display of the most recent Warning

9.7 HISTORY LOG

The History Log is a user-defined record of the performance of the drive over a period of time. The method of setting up a History Log is described in Section 6.26.

9.7.1 Playing Back the History Log

To read a sample from the History Log:

a) Set the sample number required in P27.00. (The sample number applies to all ten history channels.)

b) Select the required history channel and read the value. (The meaning of this value will depend on how the History Log is configured.)

c) To read other samples in the selected history channel record, press ↵, then press ▲ or ▼ on the Navigation key to scroll through all the values in the record.

d) To exit this mode, press ESC.

Relevant Parameters are:

P27.00 - History Display Sample Number

Contains the sample that is displayed when the History Log (P27.01 to P27.10) is interrogated.

Allowed values are: 0 to 99 (sample number).

This sample number can be set by selecting and writing to P27.00 in the usual way or it can be incremented and decremented by pressing ▲ and ▼ on the Navigation key while a history record is displayed. This provides a convenient method of scrolling through all the samples in a record.

P27.01 - History Channel 1 Playback Data
P27.02 - History Channel 2 Playback Data
P27.03 - History Channel 3 Playback Data
P27.04 - History Channel 4 Playback Data
P27.05 - History Channel 5 Playback Data
P27.06 - History Channel 6 Playback Data
P27.07 - History Channel 7 Playback Data
P27.08 - History Channel 8 Playback Data
P27.09 - History Channel 9 Playback Data
P27.10 - History Channel 10 Playback Data
P27.11 - Single Element Playback Channel 1 Data
P27.12 - Single Element Playback Channel 2 Data

These parameters each contain up to 100 samples of history data. When a history channel is interrogated, the sample number displayed is determined by the value in P27.00 (for P27.01 to P27.10) and in P26.28, P26.29 for single element channels.

The meaning of the data display for each sample is determined by the configuration defined in P26.01 to P26.20, or in P26.28 and P26.29 for the single element channels.

9.8 DIAGNOSTIC HINTS

Refer to Table 9-4 for helpful hints on fault diagnosis. These hints do vary for each mode of drive operation and so each separate product manual includes a table of diagnostic hints specific to the particular product. However, Table 9-4 includes a composite list of the hints for all product operating modes. The mode is highlighted in the ‘Problem’ column of the table. The diagnostic hints are aimed mainly at the DEFAULT drive, to help with problems which may be experienced while working with this manual.

Table 9-4. – Diagnostic Hints

Problem	Possible solution
All: Healthy LED is not lit and Tripped LED is lit.	Is the plant "INTERLOCK" connected? Refer to Section 9.4 in this manual and the Wiring Diagram (for Inputs/Outputs) shown in the relevant manual.
All: Drive/SFE failure after frequent switching on & off.	The drive/SFE has correctly carried out self-protection procedures after frequent switching on and off in short period of time – specification is no more than 3 times in any 10 minutes and not more than 10 times in one hour. Replace pre-charge fuses; see 'Spare Parts' in relevant manual.
All except SFE: The drive/SFE will not run from Keypad.	The drive/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 that selects local/remote.
All: The drive/SFE will not run from the terminals.	The drive/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 that selects local/remote (or Keypad/remote for SFE). Also for AEM Machine Bridge check that the "SFE Running" output is not inhibiting the "STOP" input on DIGIN 1.
SFE: 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 not 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).
SFE: 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 "Spare Parts" in the AEM Getting Started Manual (T2002).
All: All LEDs flashing	This indicates a major software or hardware fault with the controller. Normal software operation cannot continue. Refer to Diagnostics – Failure of Firmware.
All except SFE: 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 - 10V, view value in P11.36 (c) Remote ANIN2, programmed to be 4 - 20mA, 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.
All: 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 - 20mA (20% - 100 %). The dipswitches (SW1) on the drive I/O board configure the inputs for current or voltage. Check the dipswitches against those shown at the Wiring Diagram (for Inputs/Outputs) shown in the relevant manual. Ensure 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.
All: The analogue outputs are not functioning as expected.	The default settings for ANOP1 & ANOP2 are 0 - 10 V, 0 - 100 %. The dipswitches (SW1) on the I/O board should both be set for volts (see Wiring Diagram in relevant manual). Check dipswitches against those shown at Wiring Diagram in relevant manual. 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: SFE trips on over current or over volts 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 the same phase of the supply as R/U etc. Check the wiring of ancillary components against the interconnection diagram.
SFE: Trip Code 93 (Mains Sync Fault) is displayed when run is attempted.	Check wiring of ancillary components against the interconnection diagram.

Table 9-4. – Diagnostic Hints

Problem	Possible solution
	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 the AEM Getting Started Manual (T2002).
All except SFE: Deceleration ramps not being followed, seems to take longer than set.	The drive is programmed at the factory to prevent itself tripping on over voltage 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). A dynamic brake unit may need to be fitted to achieve the required time. Check the value set in P4.12 (P23.05) and ensure that it is sufficient (note that –0.1 kW limit means "unlimited"). If not sufficient adjust it to the dynamic brake resistor surge rating in kW. A small amount of Watts (an amount the drive alone can absorb) set in P4.12 may be enough to solve the problem.
All except SFE: Motor turns slowly and draws excess current when in Vector control with encoder.	This is known as "Wrongly Phased". Check the motor phasing and check the encoder connections. Refer to the Commissioning flowchart, in the relevant manual, which suggests tests that can be made to verify the encoder integrity.
All except SFE: 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.
All except SFE: Not enough torque available after a calibration run. VECTOR MODES ONLY.	Check P21.11, 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 P12.11. If this is not true simply edit P12.15 = 1.4 x P12.11. 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 torque.
AEM Machine Bridge Warnings 134 and 136 displayed, trips on code 94 when "RUN" is pressed.	Follow the machine bridge Guided Commissioning procedure in the AEM Getting Started Manual (T2002) Section 5B.4 to choose the correct control mode.

9.8.1 Failure of Drive Firmware

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

FIRMWARE INTEGRITY
FAILURE
(E000)
SEE USER MANUAL

Figure 9-3. – Firmware Integrity Failure

When the 'Firmware Integrity Failure' statement is displayed all four LEDs on the drive will flash together. The drive is equipped with a special firmware 'net' that captures the exact state of the drive memory and processor execution state. This data is extremely useful to support and diagnose the reason why the drive firmware crashed.

The memory contents must be uploaded to a file while the drive is displaying a firmware integrity failure, otherwise the captured data will be lost. It will take about 10 minutes to complete the file. The file may be compressed with PkZip/WinZip if required.

To assist **GE Power Conversion** personnel in diagnosing the cause of the software malfunction the memory contents of the drive can be uploaded to a pc, as detailed in Section 9.8.2, and sent to **GE Power Conversion** at the address shown at the end of this manual.

9.8.2 Uploading the Failed Firmware to a PC

The memory contents can be uploaded to a pc running either Windows 3.1 or 3.11 terminal emulation or Windows 95, NT4, 2000 or XP terminal emulation. Use of a pc with any of these terminal emulations is now described.

The hardware required to carry out the file upload is:

- A pc running any of Windows 3.1, 3.11, 95 or NT4 terminal emulation;
- Terminal emulation program (3.1 or 3.11) or Hyper terminal (Windows '95, NT4, 2000 or XP) accessories;
- RS 232 lead e.g. a GDS1009-4001.

Using a PC with Windows 3.1 or 3.11 Terminal Emulation

a) Start Windows Terminal.

b) From ***Settings***, choose ***Communications***.

c) In the dialogue, change the baud rate to ***9600***; change the flow control to ***Xon/Xoff***. All the other items can be left at default (8 data, 1 stop, No parity), choose a communications port at this point.

d) Check that in ***Settings*** - Emulation, it is at its default = VT-100 [ANSI].

e) From ***Transfers***, choose ***Receive text file***.

f) Name the file.

g) Ensure the MV3000e RS232 port is connected to the PC, via the RS232 lead.

h) A capital "G", will start the E000 memory contents upload.

i) The upload takes about 10 minutes.

j) Press ***Stop*** to terminate the text transfer when complete, this saves the file.

k) After the upload, pressing the "." key will re-start the MV3000e firmware.

l) Return the file to **GE Power Conversion** as described in Section 9.8.1.

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

Using a PC with Windows 95, NT4, 2000 or XP Terminal Emulation

a) Start Windows Hyper Terminal.

b) Follow the "***wizard***" as presented.

c) Name the new connection MV3000e, and choose an icon.

d) Choose a comm. port.

e) Set communications parameters to ***9600*** Baud, ***no parity***, ***1 stop***, ***Xon/Xoff*** control.

f) Select ***File*** - ***Properties***, and from the dialogue, choose the ***settings tab***. Set the emulation to VT100.

g) Ensure the MV3000e RS232 port is connected to the pc, via the RS232 lead.

h) From Transfer, choose Capture Text.

i) Name the file.

j) A capital "G", will start the E000 memory contents upload.

k) The upload takes about 10 minutes.

l) Press ***Stop*** to terminate the text capture when complete, this saves the file.

m) After the upload, pressing the "." key will re-start the MV3000e firmware.

n) Return the file to **GE Power Conversion** as described in Section 9.8.1.

NOTE: If any problems occur when setting the communication with the "Wizard" it may be worthwhile cancelling the "Wizard" and setting the VT100 emulation before the Baud rate etc. produced a working system

9.9 EXPECTED TRIP CODES WHEN CDC IS POWERED FROM AUXILIARY 28 V INPUT

9.9.1 Introduction

The MicroCubicle™ CDC is a self-contained Printed Circuit Board (PCB), which contains circuits for the controller, the I/O, the power interfaces; connection to Fieldbus boards and an Auxiliary 28V power supply. When powering the MicroCubicle™ CDC from 28V, it is able to determine the size of the drive it is mounted in, by reading vital personality information from an E^{2}PROM mounted on a Switched Mode Power Supply (SMPS) PCB. When the auxiliary 28V is applied, a small part of the SMPS board is also powered up which allows this to happen. The MicroCubicle™ CDC, therefore, knows what type and size of drive it is in, and that affects the trips that it will display as shown in Table 9-5.

Trip code	Meaning	Reason
4	Under voltage	The mains power is off, so the DC link is not established
6	Over-temperature	The SkiiP® circuits are not powered up. Some or all trips may show, depending on the size of the MicroCubicle™ Drive.
9, 11, 13	Hardware Over-temperature U,V,W	
7, 8, 10, 12	Instantaneous Overcurrent, or Instantaneous Overcurrent U,V,W	

Table 9-5. – Expected Trip Codes when Operating a MicroCubicle™ CDC from 28V Auxiliaries

9.9.2 Trip Fault Codes Specific to Internal Dynamic Brakes

Assuming that the Dynamic Brake has been identified and the MicroCubicle™ drive then reverts to 28 V operation after the main AC has been removed, the following trip codes can be expected, depending on the type of internal DB:

- For Frame Sizes 3 and 4 DBs the internal DB will be tripped on trip 151 DB TRIP 26 under temperature.
- For Frame Sizes 6 and 7 DBs the codes in Table 9-6 apply.

Trip code	Meaning	Reason
151	DB trip	The SKiiP® circuits are not powered up. Some or all trips may show, depending on the size of the MicroCubicle™ Drive.
152	DB Hardware Over-temperature	

Table 9-6. – Expected Trip Codes for Internal (to a MicroCubicle™) Dynamic Brakes for Frame Size 6 7 Frame Size 7 Drives

9.9.3 DELTA CDC

The DELTA CDC is a different construction to the MicroCubicle™ CDC. The different functions have been separated to allow the DELTA CDC to be connected to different interfaces for future product enhancements. The CDC and a Power Interface Board (PIB) – common for the whole DELTA range – is housed in a metal container. Any optional Fieldbus boards will also be contained within this container. The I/O has been separated. To run a DELTA CDC on 28 V, apply the 28 V to TB2 on the External I/O. The DELTA CDC determines drive size and type from vital personality information, which is distributed around the DELTA System on different PCBs. (The DELTA CDC can only read the drive size information when powered via the main SMPS).

In summary:

- The DELTA Power Interface Board (DELTA PIB) informs the DELTA CDC that the drive is a DELTA drive. The number of DELTAs is determined by the number of connections made to the ribbon headers on the PIB (a maximum of 6), this information is placed into P99.00.
- The DELTA Interface board (DELTA DIB) is mounted on the DELTA transistor bridge and connects to the IGBT SKiiP® s. This PCB informs the CDC about the current rating of the DELTA, connected to the PIB. The drive nominal current is then reported in P99.05.
- The DELTA Switched Mode Power Supply (DELTA SMPS) informs the DELTA CDC of the voltage rating of the DELTA, and is used to set the Dynamic Brake voltage threshold in P23.04.

When all the information is collected the DELTA CDC has a complete picture of the DELTA system, automatically.

When powered from 28 V, the DELTA CDC can only power up the PIB board, thus it only knows how many DELTAs there are, so P99.00 is correct. The nominal current will report 1000 A, a mid value (not the actual rating of the DELTA). If the DELTA CDC is not connected to any DELTAs, it will still report that 1 DELTA is connected. When programming is completed and the mains power is applied, then the full system configuration can be determined and it will be different from the “assumed” configuration whilst powered from 28 V. Figure 9-4 shows the DELTA Configuration and the state of the User Edits at each stage. Table 9-7 shows the expected Trip Fault Codes when operating the DELTA CDC from 28 V auxiliaries.

In conclusion, any time the controller is powered from 28 V, then re-connected to the mains power, the user edits will be retained, even if the actual DELTA configuration has changed in the meantime.

See Section 10.6 for further information on powering a DELTA Controller from an auxiliary 28V.

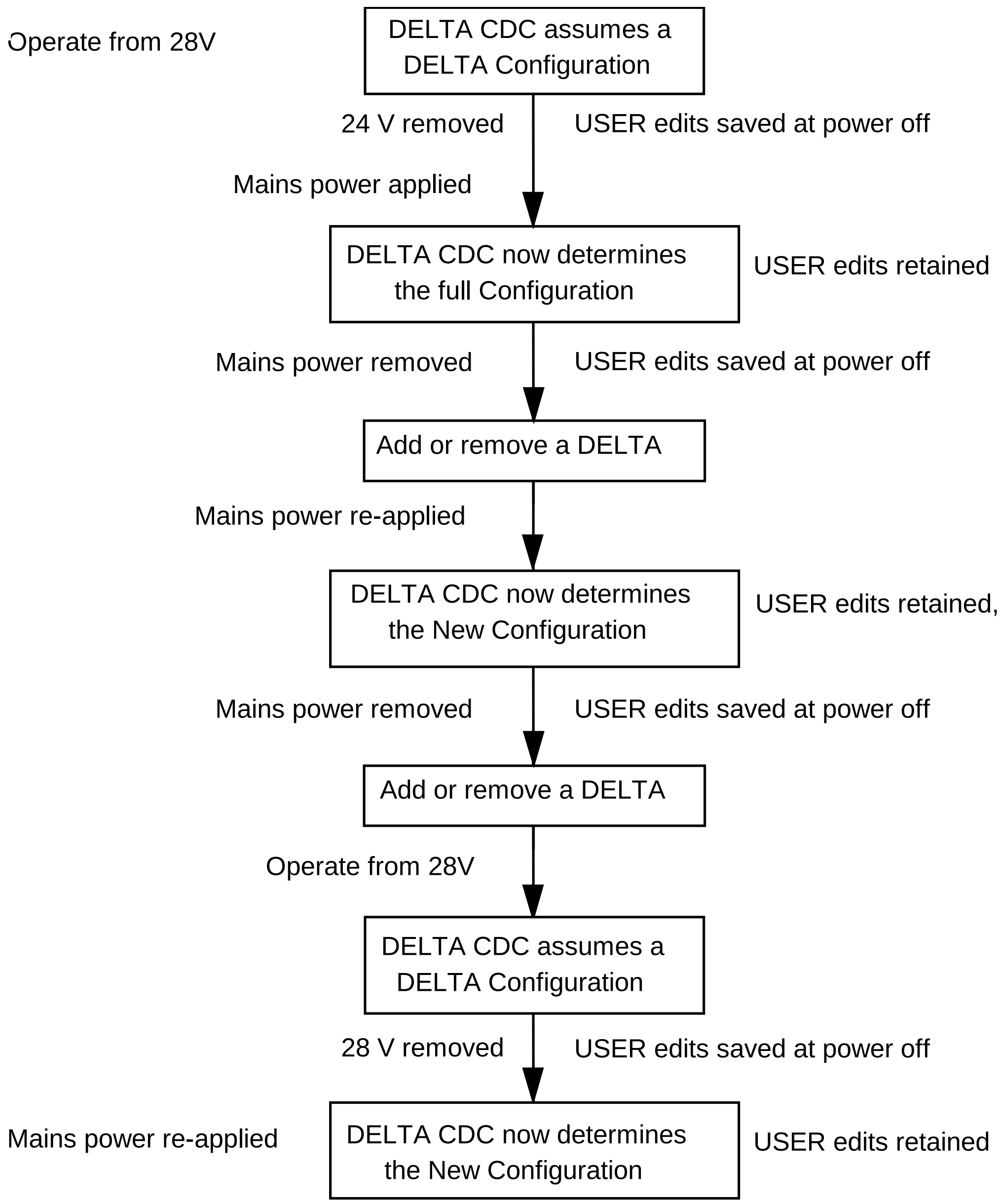


Figure 9-4. – DELTA Configuration showing the state of User Edits

Trip code	Meaning	Reason
4	Under voltage	The mains power is off, so the DC link is not established.
183, 185 ...etc	Unidentified SMPS 1, 2, ...	The DELTA CDC is unable to read the E^2PROM on the DELTA SMPS when powered from 28 V.
182, 184	Unidentified DELTA 1, 2....	The DELTA CDC is unable to read the E^2PROM on the DELTA DIB when powered from 28 V.
Any DELTA SKiiP® Trip code	All DELTA SKiiP®s will report in faulty	Without mains power the DELTA SKiiP®s will all report in as faulty

Table 9-7. – Expected Trip Fault Codes when operating a DELTA CDC from 28V Auxiliaries

9.10 PRODUCT IDENTITY RECORD

9.10.1 Introduction

The MV3000e product has been designed to minimise the number of parts required to be held for spares. All support staff should be made aware of the following:

a) Drive identity is not held in the drive controller, but distributed around the drive;

b) A serial EEPROM on a printed circuit board contains data relating to the current and voltage rating of the respective MicroCubicle™ or DELTA Module;

c) The EEPROM data is referred to as the 'Product Identity Record';

d) Because of the distribution of the drive identity the CDC and the SMPS must never be removed from the drive together or the Product Identity Record will be lost and will have to be re-entered manually.

9.10.2 Product Identity

The EEPROM includes all the details about the drive in which it is located. It is a collection of 43 items of information stored in the EEPROM during drive/DELTA test when manufactured. The details are unique to the drive or DELTA product and are used by the CDC to set internal drive size dependent parameters, set up feedback scaling and protect the power bridges.

9.10.3 Where the Drive Identity is Stored

In a MicroCubicle™ product

In a MicroCubicle™ product the whole of the Product Identity Record is stored on the SMPS board. The EEPROM circuit is powered from the CDC power supply, so when the 28 V auxiliaries are applied to the CDC, the EEPROM data can be read, so a faulty SMPS is unlikely to prevent the identity from being recovered.

In a DELTA System

A DELTA System has to behave as a complete drive, but DELTA is made up of a number of separate components, and so the identity has to be spread between these components. The DELTA SMPS stores voltage grade information about itself and the DELTA Interface Board (DIB) stores voltage grade information about the DELTA Module and DELTA rating information. All of the DELTAs have SMPS and DIB boards. The 24 V supply cannot power the EEPROMS on the DELTA modules, so mains power has to be applied to a DELTA drive before automatic configuration can take place. The EEPROM data stored in the product is summarised in Table 9-8.

If the Identity of a drive is lost, or invalid, or from a unit of a different type, then the CDC will set itself up incorrectly and the drive will not operate correctly, **this data is therefore vital and must not be corrupted or lost at any time.**

Location of EEPROM	Contents of PCB Specific Record	Product Identity Record
SMPS In MicroCubicle™ or DELTA drives	Calibration data about that specific PCB which removes the need for mechanical potentiometers to scale feedback circuits. PCB serial number and combination number. Voltage grade information.	**In a MicroCubicle™ Drive** SMPS also contains the product identity record, put in during manufacture. **In a DELTA** This part of the EEPROM is left empty during test.
DELTA Interface Board DIB) DELTA drives only	Calibration data about that specific PCB which removes the need for mechanical potentiometers to scale feedback circuits. PCB serial number and combination number.	**In a MicroCubicle™ Drive** There is no DIB fitted in a MicroCubicle™ drive. **In a DELTA** The DIB contains the product identity record, put in during manufacture.

Table 9-8. – Summary of EEPROM Data Stored in MV3000e Products

9.10.4 Why is the identity copied to the CDC

There are two major reasons why the data need to be copied into the CDC:

- So that changes to the drive hardware can be identified;
- So that it can be put back into the SMPS or the DIB if the board is replaced with a 'blank' spare from the factory, or if it is replaced by one removed from another drive.

9.10.5 How is the Drive Identity used and kept safe

When the drive powers up, this information is read by the CDC and is generally used as follows:

a) The calibration data is read and used to scale feedback signals;

b) The voltage grade data sets the Under voltage trip level and Dynamic Brake threshold voltage (P23.04);

c) The Product Identity Record Information allows protection of the drives silicon and allows parameters like P99.05 "Drive Nominal Current" to be set.

10. APPLICATION NOTES

10.1 APPLICATION NOTE FOR PROPORTIONAL DYNAMIC BRAKING

The Proportional Dynamic Braking feature provided in MV3000e firmware version 6.00 onwards provides a means of dissipating power from the DC link in a smooth and precisely controlled manner.

This Application Note explains Proportional Dynamic Braking and provides information on using the feature in several types of drive system. A revised list of dynamic braking (DB) parameters is included and a procedure for defining braking resistor requirements is provided.

10.1.1 What is it and why do we want it?

The normal method of controlling the DC link voltage by use of a DB unit and braking resistor maintains the DC link voltage below a given threshold by switching the DB unit fully on if the threshold is exceeded. This is referred to as Threshold Control. Proportional Dynamic Braking provides controlled application of a dynamic brake below the threshold, proportional to a user defined input, yet retains the basic requirement to switch fully on if the voltage threshold is exceeded. This system is therefore ideal for:

- Precisely controlled braking of machinery.
- The damping of DC link oscillations, which may occur in a small number of common DC link schemes where load fluctuations could cause instability of the DC link voltage. Before implementing this feature the user is recommended to consult **GE Power Conversion**.

10.1.2 System Features

Proportional dynamic braking can be used with MicroCubicle™ drives with internal DB units fitted, and with DELTA systems where one or more DELTA modules can be configured as a dynamic brake.

Features of the system are:

- Proportional control of the power being taken from the DC link.
- Simple, open loop reference of modulation, 100% reference = 100% modulation.
- Reference source includes DDM™ (keypad), analogue inputs, Fieldbus (FIP, PROFIBUS), RS232/RS485, CAN, parameter pointer.
- Scaling for analogue input sources.

10.1.3 How it Works

Proportional dynamic braking continuously controls the power dissipated from the DC link by using pulse width modulation (PWM) techniques to drive the braking resistor in response to a user-defined modulation demand signal. This results in the braking resistor being gated on for a period proportional to the product of the PWM period and the modulation demand.

The modulation signal may be generated externally by an analogue input or it may be derived internally from, for example, the DC link voltage. Parameters in Menu 23 allow braking to be ramped as required and enable limits to be set.

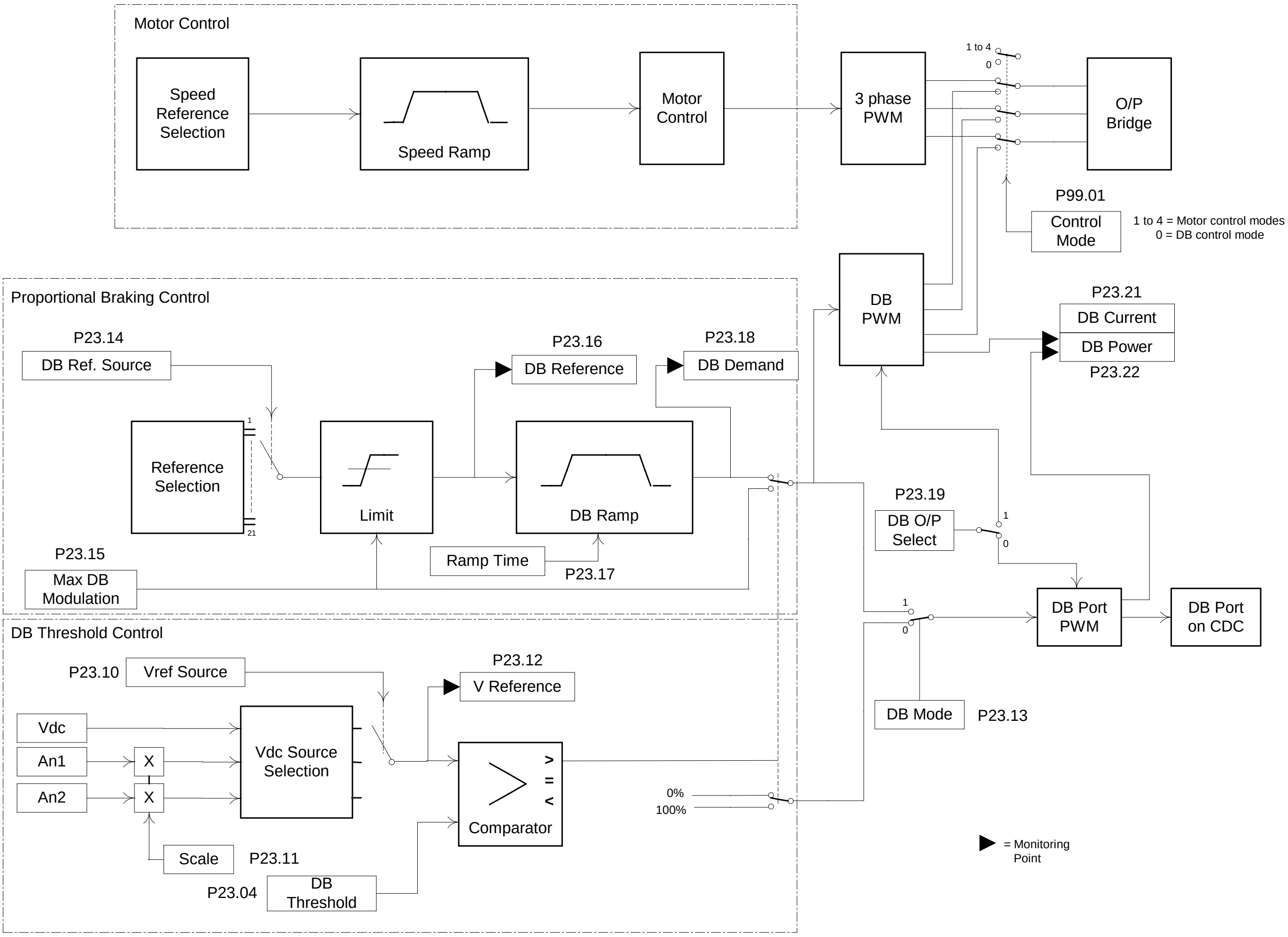


Figure 10-1. – Proportional Dynamic Braking – Control Block Diagram

The system is shown in a simple control block diagram in Figure 10-1 and Section 7 Control Diagrams Sheet 2, where the motor control circuits are included to show that in DELTA systems the output bridge can be driven either by motor control circuits or by dynamic braking signals, as selected by the user.

10.1.3.1 Proportional Braking Control

The proportional braking demand (DB Demand) is generated from a reference source selected by P23.14. A full listing of available sources is shown in Menu 23; pointer 28 is included to allow selection of a user-defined reference input from any suitable parameter. P23.15 applies limits to this signal, between 0 and 100%, and a DB ramp is then generated with P23.17 setting the ramp duration between 0 and 1000 ms to achieve the limit set in P23.15. The ramp setting is updated every 5 ms, so any duration setting between 0 and 5 ms is ignored.

Normally the resulting DB Demand output (P23.18) is routed to the PWM circuits for both the output bridge and the DB unit, for use by either dynamic braking method as required.

10.1.3.2 Threshold Protection

A reference voltage selected from either the DC link voltage or a scaled analogue input is compared with a user defined DB Threshold reference set in P23.04. If the selected reference voltage exceeds the DB Threshold, the comparator selects the Max DB Modulation input (P23.15) to generate a maximum DB Demand, overriding the proportional braking demand.

10.1.3.3 How it is Used

For MicroCubicle™ drives proportional braking uses an internal DB unit, connected via the DB connector (port) PL9 on the CDC and driving an external braking resistor.

For DELTA systems proportional braking uses one or more dedicated DELTA modules (output bridge) and a CDC configured for dynamic braking.

10.1.3.4 DB Control using the DB output connector on the CDC

This method is suitable for MicroCubicle™ drives having an internal DB unit fitted and connected via the DB port PL9. It is not suitable for DELTA systems.

Referring to Figure 10-2 , the drive is configured by P99.01 to run in one of the four "motor" operating modes, as normal. Proportional braking is selected and set up using the relevant parameters in Menu 23.

10.1.4 Operating Modes

10.1.4.1 Threshold Control

Threshold Control is the conventional method for a MicroCubicle™, controlling a DB unit and braking resistor via the DB port (PL9) on the CDC. The DB on or off decision is taken every 400µs and the DB is gated on or off for the complete 400µs period.

The switching rate of the braking resistor can be no greater than 1.25 kHz.

This mode is selected by setting P23.19 = 0 to enable the DB unit PWM circuits and setting P23.13 = 0 to select Threshold Control.

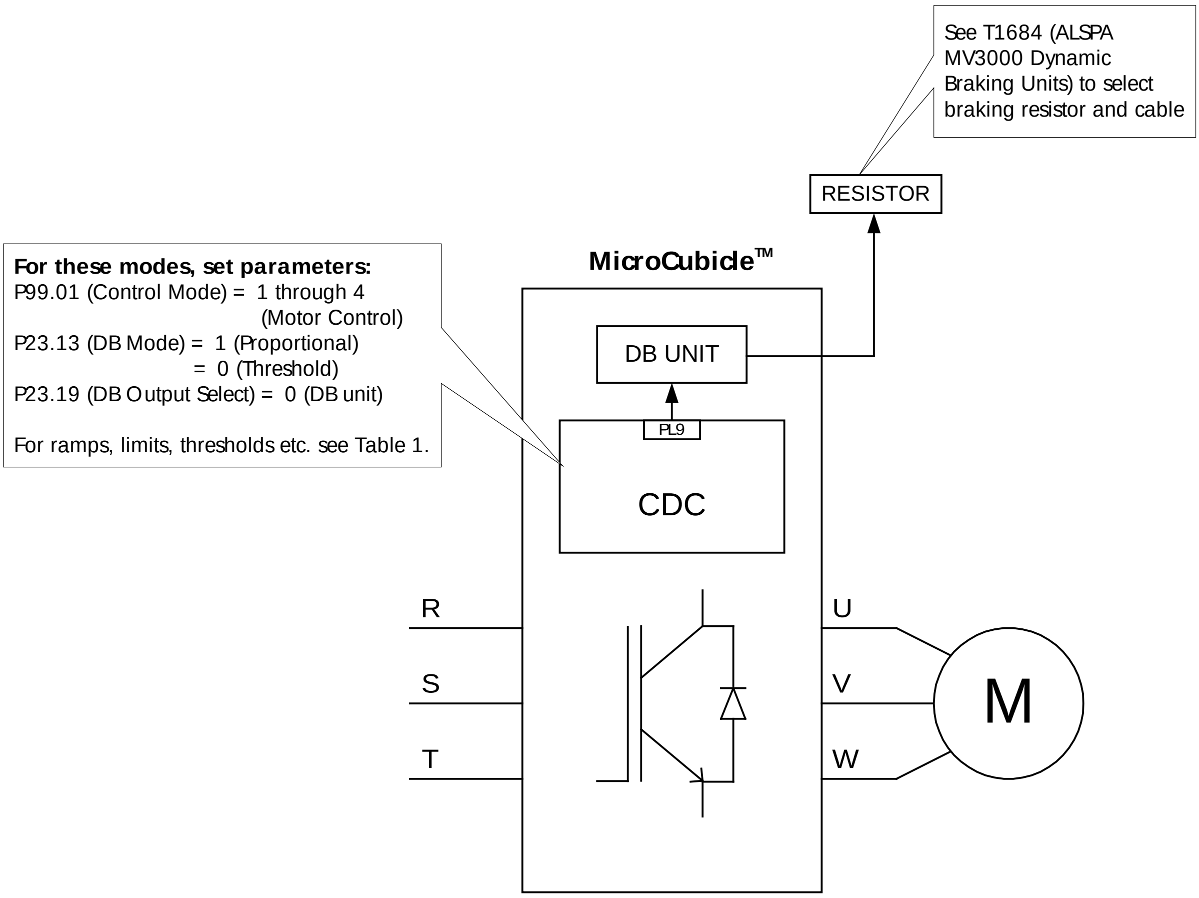


Figure 10-2. – Control of DB Unit on MicroCubicle™ CDC Connector PL9

10.1.4.2 Proportional DB Control using the DB connector PL9

This method uses the Proportional Control system previously described to gate the DB unit. A modulation level is calculated for the DB gating signal; this results in the DB resistor being gated on for a period that is proportional to the product of the PWM period and the modulation demand.

The switching rate of the braking resistor is the same as the PWM frequency contained in P35.00.

This mode is selected by setting P23.19 = 0 to enable the DB unit PWM circuits and setting P23.13 = 1 to select Proportional Control.

If the DB Threshold voltage (P23.04) is exceeded, the DB unit is driven by the Max DB Modulation output (P23.15) from the DB Threshold Control circuit.

The drive HSO (High Speed Output) capability is not available in this mode because the HSO timer is used in the DB control function. The value of P20.00 is forced to 1.

10.1.5 Proportional DB Control using the Output Bridge

This is the only method suitable for DELTA systems. One or more DELTA modules and a second DELTA controller must be available to be used as a dynamic brake.

A DELTA module or Output Bridge can easily be used as a DB unit by connecting three braking resistors of the same value and rating between the output terminals and the DC link. Figure 10-3 shows a system with two DELTA modules and controllers, having output bridge 1/controller 1 configured to drive a motor and output bridge 2/controller 2 configured for dynamic braking.

Output bridge 1 is configured to operate in a Motor Control mode by setting P99.01 = 1, 2 3 or 4 as required.

Output bridge 2 is configured to operate in DB Control mode by setting P99.01 = 0, which selects the DB PWM output to drive the output bridge. The DB PWM circuits are enabled by setting P23.19 = 1.

A modulation level is calculated for the DB gating signal. This results in the DB gating being enabled for a period that may be less than the PWM period.

The switching rate of the braking resistor is the same as the PWM frequency contained in P35.00.

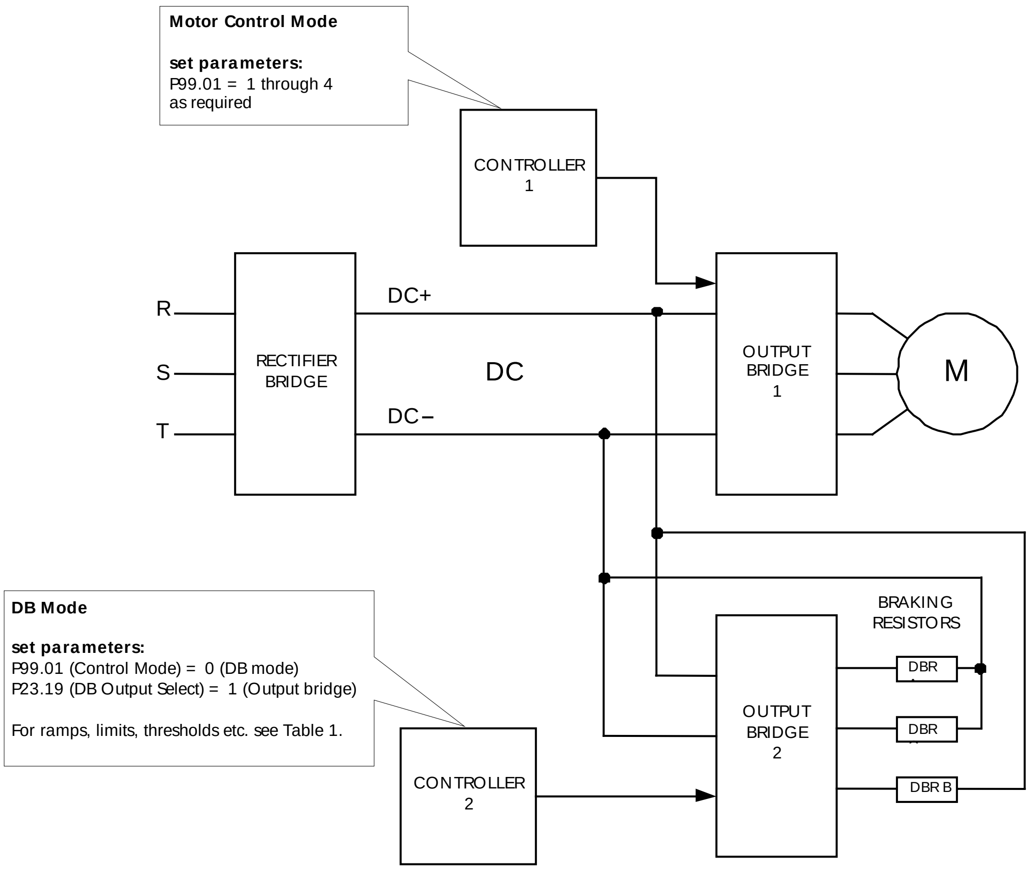


Figure 10-3. – Proportional Control using an Output Bridge

Normal motor control modes are not available in this mode. If P99.01 is not set to 0 a warning will be generated indicating that the DB is disabled.

Operation of the HSO facility is unaffected.

10.1.6 Application Note for P20.00 when used with Dynamic Braking Proportional Control

The High Speed Output (HSO) capability of Menu 20 is not available when the Dynamic Brake Proportional Control mode of operation is used. Normally the HSO is used to transfer the speed reference from one drive to another in the form of a clock frequency but this is not available with Dynamic Braking Proportional Control because of the need to use the timer normally used for HSO. Any attempt to configure P20.00 to a value other than 1 will be prevented while a drive is in the Dynamic Braking Proportional Control mode of operation.

10.1.7 Application Notes for Commissioning

Read the Warnings and Cautions given at the beginning of Section 5 in Technical manual T1684, before carrying out these commissioning instructions.

10.1.7.1 MicroCubicle™ Systems using the DB Output Connector PL9

This procedure assumes that the Drive and internal DB unit have been correctly configured for Threshold dynamic braking as described in Section 5 of T1684.

Ensure that P99.01 (Mode Selector) is set to one of the four motor control modes, not to Mode 0.

Carry out the procedure given in T1684 Section 5.2.3, configuring for Proportional braking using the additional DB parameters P23.10 to P23.22 described in Section 6.23. Ensure that the following parameters are set as shown:

P23.13 DB Control Mode = 1 (Proportional on DB port).

P23.19 DB Output Select = 0 (DB port).

10.1.7.2 DELTA Systems using an Output Bridge

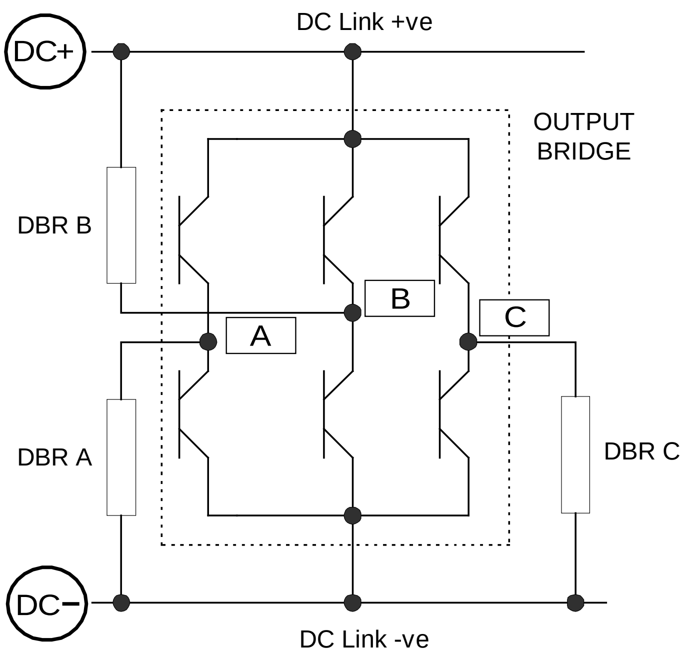


Figure 10-4. – Output Bridge Connections

This procedure assumes that the DB output bridge(s) are connected to the DC link of a serviceable DELTA system as shown in Figure 10-4, and are controlled by a separate DELTA controller (controller 2) as shown in Figure 10-3.

On controller 2 ensure that P99.01 (Mode Selector) is set to Mode 0 (DB Control), not to one of the four motor control modes.

Carry out the procedure given in T1684 Section 5.2.3. Configure the parameters in Menu 23. Ensure that the following parameters are set as shown:

P23.19 - DB Output Select = 1 (Output Bridge).

10.1.7.3 All Systems

When the relevant procedure (above) is complete, run the drive and check that on motor deceleration, the rate of motor deceleration follows that requested.

10.2 APPLICATION NOTE FOR MODBUS RTU

The message structures show that the function required defines the length of message to be sent by the master device. If the MV3000e detects an end of frame gap before the total expected message is received, message processing is reset and the MV3000e starts to look for the next message i.e. the received frame is flushed. The CRC word included at the end of each message is generated in the same way as that generated for ESP messages, i.e. the same algorithm is used.

10.3 APPLICATION NOTE FOR CURRENT CONTROL FAILURE (TRIP FAULT CODE 56) – VECTOR CONTROL MODE

The current imbalance trip is not implemented when running the motor in vector control (either with, or without, encoder). The equivalent trip to “current imbalance”, when running in Vector Control is “Current Control Failure”. If the drive cannot control the Id and Iq vector currents to the desired values (as per the demands made from the output of the vector control algorithms), then the drive issues a “Current Control Failure”. This inability to control the currents could be caused by:

- A phase loss at the motor outputs;
- The main AC input voltage has dropped very low and the vector controller has not got enough volts to generate the currents;
- The AC mains voltage has been programmed incorrectly (set too high) in P12.02;
- An encoder fault of some kind.

10.4 APPLICATION NOTE FOR CURRENT IMBALANCE (TRIP FAULT CODE 28) – FREQUENCY CONTROL ONLY

In Frequency Control (VVVF), the drive employs a current imbalance trip. The drive compares the magnitude of the three motor phases and if the magnitude of the current imbalance is 20% of Drive Full Load Current (FLC) (P99.05) or more, then the drive will trip. However, depending upon the circumstances, the drive may not always detect a phase loss/imbalance. This Application Note provides more information about those conditions.

To prevent nuisance trips when starting large or possibly unstable motors, when the current imbalance can actually be quite high legitimately, the current imbalance detection is disabled below 5 Hz and this is generally invisible to the user. However, in certain conditions, the trip may not detect properly. For example, if a phase is completely missing and the run button is pressed, the current flowing to the motor could be high enough to reach current limit. In this case, the drive will limit the output frequency, and this limit could be lower than 5 Hz, which means the current imbalance trip would remain disabled. The drive may trip on Motor I^2T or Drive It, depending on the ratio of drive to motor sizes. If the drive has been told that the motor has a separately excited fan, then the motor I^2T may never operate and the drive could continue to run the motor “single phasing” until the motor internal thermal protection operates.

The larger the motor, the larger the “single phasing” current and the more likely that the resultant current limit clamp would limit the output frequency below the 5 Hz point. The factors which may cause the output frequency to limit below 5 Hz are many, but as soon as the output frequency rises above 5 Hz, then the trip will be enabled and the problem successfully protected against.

10.5 APPLICATION NOTE FOR OPERATION OF THE TEMPERATURE TRIPS

There are two methods of temperature monitoring in the MV3000e Drives, one for the DELTA products and one for the MicroCubicle™ products. The drives use SKiiP® technology for their power switching devices. These devices provide an analogue signal for temperature feedback which is converted to °C by the software, and a signal which reports that the SKiiP® is too hot (hardware temperature). The first signal is used by the drive software to show temperature feedback from all of the main parts of the drive in Menu 11, and in Menu 45. The other signal is used as a hardware protection for the SKiiP® assemblies.

Application details for each of the temperature trips are now included.

10.5.1 Trip Fault Code 6 – Over-temperature (Software)

The drive software generates this trip when any of the items in the drive topology experience a temperature in excess of the trip value associated with that item. Once this trip has occurred the user should consult Menus 11 and 45 to determine which item is hot and hence which item has caused the trip.

DELTA rectifier bridge thermostats would also be reported via this trip code, so if a rectifier thermistor opened, the drive would trip with a Trip Fault Code 6, and consulting P11.08 would show that the rectifier had a high temperature.

10.5.2 Trip Fault Codes 9, 11, 13 – Hardware Over-temperatures in MicroCubicle™ Drives

These Trip Fault Codes are generated from the individual SKiiP® temperature monitoring circuits. If a SKiiP® circuit reports a fault, then the relevant trip message is displayed. The message is specific to the SKiiP® that is reporting the fault. For Frame Size 6 and Frame Size 7, there is a SKiiP® per phase, for Frame Size 3 and Frame Size 4, there is one SKiiP® for the whole of the power bridge, and in this case only the U Phase Trip Fault Code would be reported.

The hardware temperature trips should be preceded by the Software trip (Trip Fault Code 6), because the Software trip is set at a lower level.

10.5.3 Trip Fault Code 26 – Under-temperature

This is a Software generated trip; proceed as described for Trip Fault code 6.

10.5.4 Trip Fault Codes 32, 34, 36 … 154, 156, 158 etc. – DELTA 1 to 6 Over-temperature on U, V, W Phases

These Trip Fault Codes are also generated from the internal temperature monitoring circuitry on the SKiiP® modules, and in the DELTAs there is one SKiiP® per phase, so the trip codes are quite specific. DELTAS 1 to DELTA 6 are plugged into PL2 to PL7 respectively on the DELTA Controller.

The hardware temperature trips should be preceded by the Software trip (Trip Fault Code 6), because the software trip is set at a lower level.

10.5.5 Trip Fault Codes 151 & 152 – DB Trip and DB Hardware Over-temperature Trip

Trip Fault Code 151 will be generated when the DB has experienced an Overcurrent or an Over-temperature (the lower of the two hardware levels in Table 6-9).

Trip Fault Code 152 is generated from the internal temperature monitoring circuitry on the DB modules (the higher of the two hardware levels in Table 6-9).

The hardware temperature trips should be preceded by the Software trip (Trip Fault Code 6).

10.6 APPLICATION NOTE FOR ADDITIONAL AUXILIARY 28V DC POWERING FEATURES (MV3000 DELTA SYSTEMS & MICROCUBICLE™ DRIVES) - VERSION 8.00 & SUBSEQUENT FIRMWARE ISSUES.

10.6.1 Introduction

The MV3000e AC Drives are capable of having their controllers powered from an Auxiliary 28V DC source. The purpose of this is to enable access to the control features and set-up parameters, even when the DC link is not energised. Improvements have been made to the firmware in Version 8.00 to make the use of the auxiliary 28V even easier.

10.6.2 Versions of Firmware before Version 8.00

In the case of MicroCubicle™ AC drives, when powered from the auxiliary 28V input source, then the controller (CDC) can identify the power bridge to which it is connected.

In the case of DELTA based AC drives, when powered from an auxiliary 28V input source, then the DELTA Controller CANNOT identify the power bridge to which it is connected.

The drive firmware attempts to read the power bridge information only at power-up.

The result of this is that, if a DELTA Controller is initially powered from an auxiliary 28V input source, then trips relating to non-identification of the power bridge will result. If the mains power is subsequently applied these trips cannot be reset because the firmware needs to go through a power cycle to re-read the power bridge information.

The only way to obtain a non-tripped drive is therefore to power down the auxiliary 28V input before applying the main DC Link, so that the controller goes through a power-up cycle with the ability to read the power-bridge data i.e. with the power bridges also powered up.

10.6.3 Versions of Firmware Version 8.00 and later

Some enhancements have been introduced into the drive firmware to try and make the auxiliary 28V input source, in the case of DELTA based AC drives easier to use.

10.6.3.1 DELTA Identification Source- P10.36

This parameter tells the drive firmware from where to read its power bridge identification.

Options are: 0 = DELTA Bridge.
1 = Local Copy.

Option 0 is as versions of firmware prior to V8.00, i.e. directly from the power bridge itself. Option 1, if set at power up, enables the drive to be healthy when powered from the auxiliary 28V input as the drive uses the DELTA bridge information previously stored.

If the drive is powered from auxiliary 28V input with P10.36= 0 then the drive will be tripped with several trips relating to the non-identification of the power bridge. If, subsequently, P10.36 is changed to be = 1, then the drive will erase any previously stored local copy of the bridge identification information.

The drive will remain tripped on non-identification of DELTA trips, until the main DC Link is powered up. At this point the drive will restart and will read the DELTA information. The DELTA information is then stored in the local copy for use at the next power up.

If the drive is powered from the main DC Link with P10.36=0 and subsequently changed to P10.36=1 the drive will store the DELTA bridge information in a local copy at this point. This is then available for use at subsequent power-ups when powered form either the main DC Link or an auxiliary 28V input.

In summary:

- The drive attempts to read DELTA bridge information at power up. This will succeed if powered form the main DC Link but fail if powered from an auxiliary 28V input.
- If P10.36=1 the drive will examine the local copy of some bridge information. If it exists, it will use this copy.
- If P10.36 goes 0 to 1, and the drive is not tripped on non-identification trips, the drive will store the current bridge information on a local copy.
- If P10.36 goes 0 to 1 and the drive is tripped on non-identification trips, the drive will erase any previously stored local copies of the current bridge information to prevent their use later.
- If the drive is tripped on non-identification trips and the main DC Link is subsequently applied then the drive will restart and apply the above sequence.

Example 1- to enable the drive to mask non-identification trips when powered from an auxiliary 28V input. Initial power up from DC Link.

Power the drive initially from the main DC Link. Set P10.36= 1. The drive will store the power bridge information and on subsequent power-ups from auxiliary 28V will use this information.

Caveat: If at power-up P10.36=1 then the local information, if it already exists will be used. This could be out of date information, e.g. if the controller was moved from another drive system. In this case, set P10.36=0 and power down. Re-power from the main DC Link. The current DELTA bridge information will be read. Set P10.36= 1 to store this information.

Example 2 - to enable the drive to not be tripped on non-identification trips when powered from an auxiliary 28V input, initial power-up from an auxiliary 28V input.

Power initially from the auxiliary 28V input with P10.6=0. Set P10.36=1. This erases any previously stored local bridge information. The drive will restart when the main DC link is applied and the power bridge information will be stored at that time.

WARNING

This mechanism opens DELTA based AC Drives up to abuse.

For example, if the drive is used in this mode, i.e. with P10.36=1 and for some reason it is necessary to change a DELTA interface PCB (DIB – 20X4319) with a DIB from a different size of DELTA being used.

Because P10.36 = 1 the drive takes no notice of the data contained in the DIB and the system will operate. Subsequently if entire DELTA is placed in another drive system, with P10.36=0 the controller will then believe that the DELTA is of a different rating than it really is, as the DIB is incorrect. This may be some time after the original exchange when no error was apparent.

If P10.36=1 it is possible to put dissimilar DELTAs and DIBs into a system. The controller ignores the DELTA bridge information and will allow the system to run. As the DELTAs are of different ratings, incorrect bridge operation/ sharing will result.

10.6.3.2 Control Flag 108

P34.08 – DC Link Off

When powered from an auxiliary 28V input source, many trips will result, e.g. DC Link under voltage and trips associated with the power bridge being un-powered. Some systems may wish this to be regarded as a healthy condition, although it is not possible to RUN.

As such a new control flag has been defined-CF108: DC Link Off.

0 = Main DC Link is expected to be ON.

1 = Main DC Link is expected to be OFF.

If the DC link is expected to be OFF (CF108=1) then the trips which result from the power bridge being un-powered are defeated and running the drive is prohibited.

If the DC Link is expected to be ON (CF108=0) then all trips are recorded if present, and running is permitted.

It will be normal for the overall control system to tell the drive when the DC link is expected to be 'ON' or when it is expected to be 'OFF'.

However the system designer can program CF108 to be from one of many sources just like any other control flag (see manual), for example P34.08=-2.047.

10.7 APPLICATION NOTES FOR POSITION REFERENCE

1. Position Feedback & Reference in percent are defined as follows:

   P36.06 – 0% Position Low and P36.07 - 0% Position High make up the position that is called 0% position. The 0% position, in conjunction with the furthest away from it, (either P36.02 / P36.03 Maximum Position, or P36.04 / P36.05 Minimum Position), define the 100 % position range. It is this range that is used for the percentage positions defined above.

For example:

P36.06 (0% Position low)	= 5000
P36.07 (0% Position High)	= 7 [0% position is at 75,000]
P36.02 (Maximum Position Low)	= 0
P36.03 (Maximum Position High)	= 10 [Max Position = 100,000]
P36.04 (Minimum Position Low)	= 0
P36.05 (Minimum Position High)	= 0 [Minimum Position = 0]

As Minimum position is further away from 0% than Maximum position (i.e. Min-0% is greater than Max-0%), then minimum position is at -100 %. This means that maximum position is at +33.33%.

2 Serial Link Double Word references are in the data format defined in P36.06/P36.07, where:

Ref. 1 = low part
and
Ref 2 = high part.

10.8 APPLICATION NOTE FOR RR TRACKER

10.8.1 What the Rr Tracker Does

The Rotor Resistance tracker (Motor temperature compensation P12.05 to P12.09) only works when using an encoder. When using an encoder the drive knows exactly the rotor speed and therefore machine slip.

10.8.1.1 Case 1

Assume that for some reason the value or Rr in the drive is lower than the actual Rotor Resistance in the machine

The slip applied to the machine is calculated from $$\frac{Iq^* Rr}{\frac{Lm}{Lr}\phi^*} = \omega_{slip}$$

Where:

Iq^* is the active current reference (torque producing current)

ϕ^* is the flux reference

Lm is the magnetising inductance and Lr is the sum of the magnetising inductance and the rotor inductance.

Since slip is directly proportional to Rr, if Rr is less than the machine Rr, the drive will force a slip onto the machine, which is less than the machine slip would like to be. Consequently the machine presents a higher impedance to the inverter. For a constant current into the motor a higher impedance means a higher voltage which equals higher flux.

The combination of higher flux and the constant current generates more torque than required. The motor accelerates and the speed control responds by reducing the torque demand. The current is reduced as is the slip, but the motor is still running on a higher than nominal flux curve. The current and slip are reduced until the higher than normal flux torque/speed characteristic meets the load torque requirement and the reference speed is achieved.

Summary

In order to satisfy the load torque at a reduced slip the flux in the machine must increase. In order to achieve this increased flux in the machine the motor voltage must rise.

From Figure 10-10 if we assume that the load torque remains constant at 10000Nm if we compare the nominal flux and increased torque/slip curves, the machine must slip less at higher flux to achieve the same torque.

10.8.1.2 Case 2

Assume that Rr in the drive is higher than the Rotor Resistance in the machine.

This is the inverse of Case 1.

In this case the drive will force a slip onto the machine that will be greater than the machine would like to satisfy the load torque. Therefore in order to satisfy the load torque at increased slip the machine flux must reduce. The motor voltage will reduce and the flux in the machine will reduce.

With high slip the motor impedance is lower, for a constant current at lower impedance the motor voltage must be lower, hence the flux will be reduced. With a low flux and constant current the torque will be low, hence the speed controller will increase the Torque demand to satisfy the speed reference.

Parameters P12.04 to P12.10 enable the Rr tracker.

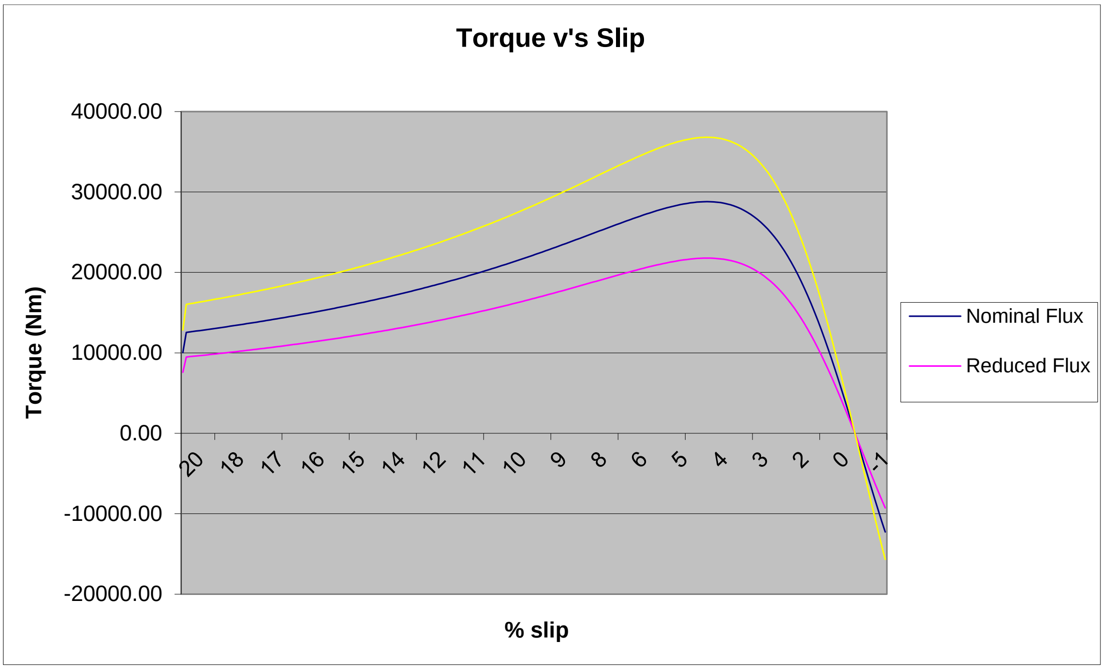


Figure 10-5. – Torque v Slip Characteristic for a Machine Bridge at Three Different Levels

10.8.2 Using the Rr Tracker

When automatic temperature compensation (of Rr) is enabled the drive will calculate the value of Rr in the drive as P12.09 * P12.15. P12.09 is limited to the range 50% to 150% of P12.15. If it is found during commissioning that the value of P12.09 is in either limit, P12.15 should be adjusted so as to allow the drive to correctly calculate the Rotor Resistance as the machine temperature changes. This will improve torque accuracy.

Parameters P12.04 to P12.10 enable the Rr tracker.

When automatic temperature compensation (of Rr) is enabled the drive will calculate the value of Rr in the drive as P12.09 * P12.15. P12.09 is limited to the range 50% to 150% of P12.15. If it is found during commissioning that the value of P12.09 is in either limit, P12.15 should be adjusted so as to allow the drive to correctly calculate the Rotor Resistance as the machine temperature changes. This will improve torque accuracy.

If the motor is cold and the torque demand > 10% the tracked value in P12.09 should track to the low end of the range.

If the motor is hot then the tracked value of Rr should track to the upper end of the range. If the machine is cold and the tracked value of Rr is high then increase Rr by 50% in P12.15. If the machine is hot and the tracked value of Rr is low then reduce P12.15 by 50%.

NOTE:

In order to verify motor voltages on unloaded machines a workaround in this situation is to decrease the power rating of the motor as dialled into P2.03. With a sufficiently low value in P2.03 the windage and friction loss should require >10% torque and the tracker will enable, thus applying correct slip and voltage to the machine.

When running motors above base speed it has been found that even on no load the value of Rr (P12.15) has a significant effect on the motor voltage. The effective value of Rr can be adjusted manually by P12.04 when the motor is unloaded. The cold value of Rr will be significantly lower than the rated hot value and hence to apply correct motor voltage on no-load to a machine P12.04 should be reduced. The Rr tracker does not start tracking until the torque demand is greater than approximately 10%. Although Rr is important on no-load the actual value of Rr cannot be tracked automatically on no-load, since the windage and friction losses do not usually account for more than 10% of rated torque.

10.9 APPLICATION NOTE FOR OVER MODULATION

When increasing either P12.36 (in Encoderless Vector Control) or P3.32 (in VVVF) above 100% modulation depth the output voltage of the inverter will contain low order harmonics.

The harmonic content of the PWM voltage for modulation depths 100% to 107% is shown in Tables 10-1 and 10-2. Using this together with the motor parameters it will be possible to calculate the expected motor harmonic current, and hence the torque ripple.

1.25kHz	**Modulation Depth %**							
	100	101	102	103	104	105	106	107
Harmonic								
1	99.7	101.2	102.5	103.2	103.8	104.4	104.9	105.4
5	0.3	0.7	1.4	2.1	3.0	4.2	5.3	6.5
7	0.4	1.1	1.7	2.0	2.1	1.7	1.5	1.2
11	0.6	1.0	1.7	1.9	1.8	1.2	0.7	0.4
13	0.2	0.3	0.2	0.3	0.6	0.5	0.4	0.2
17	1.3	1.1	1.0	1.2	1.7	2.6	3.4	4.3
19	0.1	0.1	0.2	0.1	0.4	0.4	0.4	0.3

Table 10-1. – Variation of the harmonic voltages (in percent) applied to the machine as a function of the switching frequency and the modulation depth at 1.25kHz switching frequency

2.5kHz	**Modulation Depth %**							
	100	101	102	103	104	105	106	107
Harmonic								
1	100	101.6	102.7	103.6	104.3	104.9	105.4	105.9
5	0.03	1.6	2.5	2.8	3.6	5.4	6.7	7.0
7	0.02	0.8	1.3	1.6	1.6	1.4	1.1	0.6
11	0.03	0.4	0.7	0.7	0.5	0.2	0.2	0.6
13	0.03	0.2	0.1	0.5	0.7	0.8	0.7	0.5
17	0.02	0.2	0.0	0.3	0.4	0.2	0.0	0.2
19	0.02	0.0	0.2	0.1	0.2	0.3	0.3	0.2

Table 10-2. – Variation of the harmonic voltage (in percent) applied to the machine as a function of modulation depth at 2.5kHz switching frequency

Note: $100\% = \dfrac{Vdc}{\sqrt{2}}$

10.9.1 Calculation of the 5th harmonic current in the machine.

The 5th harmonic current (the dominant harmonic current) in the motor can be calculated from:

$$I_5 \approx \frac{V_5}{5\omega(l_s + l_r)}$$

where

$$V_5 = \frac{V_{fundamental}}{\sqrt{3}} \times \%_{5th(Table\_1,2)}$$

The torque ripple (pk-pk Nm) can then be calculated:

$$Tripple_{(pk-pk)} = \frac{3\sqrt{2} \cdot I_5^{\ 2} \cdot Rr \cdot Pp}{\pi \cdot freq \cdot slip_{rated}}$$

where

Pp is the number of pole pairs
$freq$ is the rated frequency of the motor
$slip_{rated}$ is the rated (full load) slip of the machine
Rr is the rotor resistance

10.10 APPLICATION NOTE FOR ACTIVE CURRENT SHARING ERROR DIAGNOSIS

10.10.1 What can cause Active Sharing Errors?

- Delta current feedback incorrect.
- Failure to switch an upper and/or lower IGBT within the SKiiP.
- Significant impedance differences between the outputs of each Delta phase. (Which results in a voltage difference that exceeds the maximum compensation value).

10.10.2 Recommendations

a) Make designs/installations as balanced as possible.

b) Leave P35.18 set as trip. This alerts any possible sharing problems.

c) Investigate what is causing the sharing error, and make an informed decision to correct it or ignore it (by changing P35.18 to warning or no action).

d) The remaining risk is of a subsequent sharing problem developing and a set of circumstances that turn that into a Delta failure.

The most likely cause of the initial sharing trip is cubiclisation and commissioning mistakes. By investigating the cause of the sharing trip we therefore remove the major cause of Delta failure.

So far ALL investigations into a sharing trip (other then with Version 10 code) have been found to be due to a genuine fault that needed to be fixed, rather than over-sensitive sharing trip software. V10.00 issues are discussed later in paragraph 10.10.6.

10.10.3 Procedure for diagnosing active sharing error cause.

The objective of these tests is to determine which of the possible causes detailed in paragraph 1.1, is the reason for the active sharing warning.

a) If the drive is running V10.00 firmware go to paragraph 10.10.6.

b) Set the drive so it gives a warning, (not trip) on sharing error, P35.18 = 1.

c) Run the drive up such that warning messages are being generated and note the phase responsible for the sharing error.

d) Use a two channel scope and 2 * 1000A current probes or LEM current transducers. (Not Rogowski coils in that they are prone to dv/dt effects).

e) Start with current probes on the phase indicated by the sharing fault.

f) Clip CH1 current probe onto Delta 1. Use this as a “Reference Probe” with which to compare currents on the other Deltas.

g) Connect CH2 current probe onto Delta 2 then, after measurement move, in turn to Delta 3,4,5,6.

The objective is to see how the currents align throughout the sine-wave cycle. However, because of the effect of aliasing, setting the time-base on the scope so that a full cycle can be observed will give misleading waveforms that show apparent discontinuities in current.

It is therefore necessary to zoom into about a 1 ms section of the sine wave and “move around” as much as possible of the sine-wave using the trigger levels and/or trigger position.

10.10.3.1IGBT not switching

If the condition exists where the upper and lower IGBT both are not switching the phase current will be virtually zero in this Delta. The healthy Delta(s) will contribute 100% of the total phase current into the machine.

When the upper or lower IGBT only fails to switch the current will be near zero in one of the ½ cycles. In the opposing (healthy) Delta the AC current looks asymmetrical (one ½ cycle will have a larger amplitude than the other) and will appear to have a DC offset.

If either of the above are detected this means that the appropriate IGBT is not switching. The cause of this is the PWM signal generated by the controller is not getting through the ribbon / Delta Interface Board (DIB) / SKiiP ribbon / Internal SKiiP gate to the IGBT.

a) Check the ribbon cables; look for bent pins on ribbon header. Change Delta ribbons to determine if problem moves with the ribbon. If this is the case replace ribbon.

b) Connect D1 header on the controller to Delta 2 and vice-versa to determine whether problem stays lies with the particular Delta channel on the controller. If this is found to be the case, change controllers.

c) If the problem remains with the Delta module, check integrity of the ribbon cables between the DIB and the SKiiP before replacing Delta.

10.10.3.2 Current feedback faults or impedance mismatch

a) If the system is a 2 parallel Delta system go to Section 10.10.4.

Is the current in one of the Deltas phases higher than the others in both +ve and –ve ½ cycles?

YES (This can be either a current feedback which is lower than the actual current affecting both ½ cycles which is unlikely. Current feedback gain errors usually only affect one ½ cycle, or an impedance mismatch between Deltas).

If active sharing (section 10.10.8) is disabled do the currents then balance?

YES Problem is current feedback error. Replace Delta with highest current.

NO Problem is impedance mismatch between Deltas. See Section 10.10.5.

Is the current in one of the Deltas phases lower than the others in both +ve and –ve ½ cycles?

YES (This can be either a current feedback which is higher than the actual current affecting both ½ cycles which is very unlikely and has never been seen, or an impedance mismatch between Deltas).

If active sharing (Section 10.10.8) is disabled do the currents then balance?

YES Problem is current feedback error. Replace Delta.

NO Problem is impedance mismatch between Deltas. See Section 10.10.5.

Is the current in one of the Deltas phases higher or lower than the others in one of either of the +ve or –ve ½ cycles?

YES (This can be either a gain error in the current feedback which affects one of the ½ cycles or an impedance mismatch between Deltas).

If active sharing (Section 10.10.8) is disabled do the currents then balance?

YES Problem is current feedback error. Replace Delta

NO Problem is impedance mismatch between Deltas. See Section 10.10.5.

Symptoms	Probable Cause	Effect of disabling active current sharing (paragraph 11)	Action
Current in one of the Delta phases is higher than the others	Current feedback fault/gain error	Current in Delta/ phase that was higher, reduces.	Change Delta
Current in one of the Delta phases is higher	Impedance mismatch	Current remains the same	Investigate cabling, sharing reactors
Current is asymmetrical or virtually zero (Section 10.10.3.1)	The cause of this is that the IGBT is not switching. This may be due to the signal generated on the controller not getting to the IGBT.	None	Check ribbons, connectors for bent pins swap CDC to Delta ribbons. Check DIB to SKiiP ribbons.

Table 10-3. – Active Sharing Cause/Effect Summary table

10.10.4 Two Delta Systems.

For a two Delta system a slightly different procedure is required in order to identify the faulty components.

10.10.4.1 Procedure

With a 2 Delta system the following procedure must be adopted to determine whether the problem is due to impedance mismatch or current feedback errors.

a) Measure the currents in the appropriate phase of the 2 deltas and compare.

b) Disable active sharing (Section 10.10.8).

Does the phase current between the 2 Deltas equalise?

YES Problem is current feedback error in one of the 2 Deltas.

Go to Section 10.10.4.2.

NO Problem is impedance mismatch between the Deltas.

Go to Section 10.10.4.3.

10.10.4.2 Determining which Delta has current feedback fault.

a) Configure the drive as a single Delta system. By doing this for both Deltas in turn it should be possible to determine which of the 2 Deltas has the current feedback error.

b) Remove the ribbon cable between the controller and Delta 2; disconnect the 3 phase cables between Delta 2 and the sharing reactor. Remember these cables will become live when the drive is energised and therefore need to be isolated from each other and from earth. It is not necessary to disconnect the DC link from Delta 2.

c) Run the drive up to under Full load current of a single Delta system and look and compare the 3 phase currents from Delta 1 on the scope. There should be 3 balanced sine waves displaced by 120°and of the same magnitude.

Are the 3 phase sine waves balanced?

YES Then this Delta is working correctly.

NO Then this Delta has a current feedback error.

d) Repeat this procedure using Delta 2 and verify that Delta 2 operates correctly giving a balanced set of 3 phase sine waves of equal magnitude.

e) Replace Delta 1.

10.10.4.3 Determination of which Delta has impedance mismatch

a) Configure the drive as a single Delta system. By doing this for both Deltas in turn it should be possible to determine which of the 2 Deltas has the impedance mismatch.

b) Remove the ribbon cable between the controller and Delta 2; disconnect the 3 phase cables between Delta 2 and the sharing reactor. Remember these cables will become live when the drive is energised and therefore need to be isolated from each other and from earth. It is not necessary to disconnect the DC link from Delta 2.

c) Run the drive up to under Full load current of a single Delta system and look and compare the 3 phase currents from Delta 1 on the scope. There should be 3 balanced sine waves displaced by 120°and of the same magnitude.

Are the 3 phase sine waves balanced?

YES Then this Delta is working correctly and the 3 phase impedances are matched.

NO Then the impedance between the 3 phases is not matched.

d) Repeat this procedure using Delta 2 and verify that operation with Delta 2 gives a balanced set of 3 phase sine waves of equal magnitude. This will confirm that Delta 1 has the impedance mismatch.

e) Go to Section 10.10.5.

10.10.5 What to do if impedance mismatch is diagnosed

If an impedance mismatch is diagnosed using the above procedure the possible causes are:

- Cable connections between Delta and sharing reactor, and between sharing reactors and motor. Have all the connections been correctly tightened? With reference to T1689 Air Cooled Delta Technical Manual and T1693 Liquid cooled Delta Technical Manual the M10 AC cable terminations should be tightened to a torque of 27 – 40Nm.
- Are all cable lengths the same?
- Are any of the cables damaged in any way?
- Have the same value sharing reactors been fitted?

It may be necessary to change the sharing reactors to eliminate these as the source of impedance mismatch.

It has also been found that if the cables between the DC output of the rectifier and the individual Deltas are significantly different the on load DC link voltage will be different at each Delta. This can lead to sharing pulses being required in order to ensure current sharing. This condition is not normally a problem with standard cubicle layouts.

10.10.6 V10.00 issues

With V10.00 firmware there are certain conditions that can lead to active sharing errors that are not hardware related. If the firmware has been upgraded to V10.00 from V9.01, V9.02 or V9.03 and a return to factory defaults has not been carried out with V10.00 installed, active sharing will not operate correctly. Due to this and issues related to VVVF operation with V10.00 is recommended that upgrades to V10.00 are not carried out but to the latest version of firmware, currently V11.94.

10.10.7 Use of HEME clamp on current probes

It has been found that the orientation of the clamp type current probes affects the rms reading of current as displayed on the current clamp. The clamp should be clipped around the cable such that the jaws close properly and then kept at right angles to the conductor. Do not leave the clamp with its body lying close to other conductors. Whilst the orientation of the clamp affects the rms reading displayed it does/does not affect the signal output to the scope.

10.10.8 How to Disable Active Sharing

a) Set P35.18 = 0.

b) Set P35.19 = 1.

11. SOFTWARE HISTORY

11.1 VERSION 7.00

11.1.1 New Features and Enhancements

Powering down an MV DELTA based AC Drive, disconnecting (or removing) a DELTA module and re-powering the drive no longer causes the motor related parameters (see below) to return to factory default, they will remain as programmed.

Under the scenario, where an MV DELTA module is no longer part of the drive, the Full Load Current of the drive is re-scaled in line with the number of MV DELTA units remaining connected to the MV DELTA Controller.

Trip 19 - 'New PCB' and Trip 68 - 'Unknown Drive Size' will no longer occur with this version of firmware on MVDELTA based systems

CAUTION

This means that an MV DELTA Controller can be taken from one drive and put into another drive and no warning or trip will be given to indicate that an incorrect parameter set is present. It is now up to the user to ensure that the correct parameter set for the drive into which the MV DELTA Controller has been put, is downloaded in the controller.

It is recommended that the MV DELTA Controller is deliberately reset to factory default (by setting parameter P99.17 - 'Restore Defaults' = 1) and then downloading the appropriate parameter set from either the drive's Drive Data Manager or from Drive Coach, where ever the back-up has been stored.

The result of this is a simplification of the use of parameter P10.35 and the generation of new spares items for DELTA Interface Boards (DIBs).

The following table lists the Motor related parameters that no longer return to factory default when a MV DELTA module is disconnected from an MV3000e DELTA based AC Drive.

Par No.	Function	Par No.	Function
P2.01	Motor Base Voltage	P11.77	Br. Lin. Const. @ 7.5kHz
P2.02	Motor Full Load Current	P12.00	No Load 1 at 100%V (Magnetising Current
P2.03	Motor Nominal Power	P12.11	Stator Resistance
P2.04	Motor Nominal Speed	P12.12	Stator Inductance
P3.13	VVVF Stator Resistance	P12.13	Magnetising Resistance
P3.14	VVVF Stator Inductance	P12.14	Magnetising Inductance
P3.15	VVVF Magnetising Resistance	P12.15	Rotor Resistance
P6.17	Trip Avoidance Threshold	P12.16	Rotor Inductance (Leakage Inductance)
P11.70	Br. Lin. Time @ 1.25kHz	P23.00	DB Resistor Value
P11.71	Br. Lin. Const. @ 1.25kHz	P23.01	DB Resistor Average Power
P11.72	Br. Lin. Time @ 2.5kHz	P23.02	DB Resistor Maximum Power
P11.73	Br. Lin. Const. @ 2.5kHz	P23.04	DB Voltage Threshold
P11.74	Br. Lin. Time @ 5.0kHz	P50.00	DC Link Voltage Reference
P11.75	Br. Lin. Const. @ 5.0kHz	P50.01	Line Choke Inductance
P11.76	Br. Lin. Time @ 7.5kHz	P52.17	DC Link Pre-charge Threshold

11.2 VERSION 8.00

11.2.1 New Features and Enhancements

This version of firmware has been produced; mainly to introduce new Vector Control algorithms that enhance drive performance. An improvement has also been made to the VVVF mode of control and a new mode Optimum Volts mode introduced.

11.2.1.1 Auxiliary 28V dc

The MV3000e AC Drives are capable of having their controllers powered from an Auxiliary 28V DC source. The purpose of this is to enable access to the control features and set-up parameters, even when the DC Link is not energised. Improvements have been made to the firmware in Version 8.00 to make the use of the auxiliary 28V input easier.

11.2.1.2 Vector Control

Vector Control can now be run in one of two modes.

High Dynamic Mode and Optimum Volt Mode

New Parameters

Par No	Function
P3.32	VVVF Modulation Limit
P12.35	Vector Fluxing Mode
P12.36	Optimum Volt Modulation Limit
P12.37	Optimum Volt Current Bandwidth
P35.17	Advanced Temperature Monitoring
P45.24	Temperature @ Warning/Trip
P45.27	Maximum Silicon Temperature

11.2.2 Minor Enhancements

Range of Current and Power Parameters

The range of the current and power parameters within the drive has been extended so that the drive can handle motors greater than 3200kW. Note for DB Control (Menu 23) the limit remains at 3000kW.

Parameters affected are:

Par No.	Function
P2.03	Nominal Power
P4.12	Regen Power Limit
P12.00	No-load I at 100% Volts (Magnetising Current
P12.17	No-Load I at 50% Volts
P12.18	No load I at 60% Volts
P12.19	No Load I at 70% Volts
P12.20	No-load I at 80% Volts
P12.21	No-load I at 90% Volts
P23.05	Motor Regenerative Power Limit
P33.16	Drive Continuous Current Rating
P99.05	Drive Nominal Current

Alternative Voltage Grade -DELTA Modules

Alternative voltage grade settings in DELTA based drives are not crosschecked on DELTA to DELTA. This allows DELTAs of an Alternative Voltage grade to be mixed with DELTAs of a lower voltage grade, provided the primary voltage grade and current match. The change is for future systems only as, at present, there is no Alternative Voltage grade for DELTA based drives.

Motor Library Data

The motor library data within the controllers has been enhanced to include more information on large motors.

Backup Parameter Set

To help identify parameter corruption situations, a new warning 'Backup Parameter Set in Use' has been added. The warning occurs when the backup parameter set is used because the primary parameter set is unavailable. It is in addition to Status Flag 110 - ' Backup Parameter Set in Use'.

Trip History

The Trip History has been improved to record fewer trips stored as a result of a power down of the drive. This will help to give a more meaningful Trip History and lead to less confusion when an MV3000e AC Drive is diagnosed for faults.

Analogue Inputs

To increase the scale/offset capability of the analogue inputs an intermediate clamp has been removed so that (Input Value * Gain) is not clamped at 100%.

NOTE: ((Input Value * Gain) + Offset) is still clamped at ±100%.

Parameter P12.27

The description of parameter P12.27 has changed from 'Current Control Bandwidth' to 'High Dynamic Current Control Bandwidth'.

11.3 VERSION 9.00

11.3.1 New Features and Enhancements

11.3.1.1 2nd CAN Port

New menus have been added to utilise the MV3000e 2nd CAN Port Module MVS3011-4001.

NOTE: This module can only be used on the Common Drive Controller and DELTA Controllers incorporating a 40MHz CPU. The MV3000e MicroCubicle CDC must be 20X4311 Issue E or later. The MV3000 DELTA Controller must be MVC3001-4002 incorporating 20X4341 Issue C or later.

New Menus Added

Menu 58 - 'Extended I/O 2'
Menu 65 -'CAN Port 2
Menu 66 - 'CAN2 CANopen
Menu 67 -'CAN2 DeviceNet

11.3.1.2 PROFIBUS Replacement Module MVS3007-4002

Following the replacement, due to obsolescence of the MV3000e PROFIBUS Fieldbus Coupler MVC3007-4001, a new menu - Menu 74 has been added to allow the use of the full features of the new PROFIBUS Fieldbus Coupler MVC3007-4002.

11.3.1.3 Ridethrough in VVVF Control

A new menu - Menu46 - 'Ridethrough in VVVF Control' has been added - to assist users in obtaining successful ridethrough operation in VVVF Control.

11.3.1.4 PI Flux Controller

To further enhance the performance of Vector Control an outer Flux Control Loop has been added to the Vector Control algorithms for Encoderless mode. The result of this control loop is to give improved motor volts when running at full load.

In order to benefit from this enhancement the new Common Drive Controllers fitted with the 40MHz processor must be used i.e. 20X4311 Issue D or later and 20X4341 Issue C or later.

20X4311 Issue E processors have been fitted in MV3000 MicroCubicle Drives since March 2002.

20X4341 Issue C controllers are available in the new DELTA Controller MVC3001-4002.

For earlier versions of controllers, i.e. those fitted with 25MHz processors the new control loop is disabled.

NOTES:

V9.00 Firmware will load into the earlier types but the firmware will detect the controller type and disable the Flux PI automatically.

Version 9.00 code will also remove instability at 1.25kHz PWM that may be experienced in Version 8.00 code in some applications.

11.3.2 Minor Enhancements

Parameter P12.02 - 'Nominal mains Supply

The maximum value of this parameter is now 900V, in previous firmware versions the maximum was 800V.

Parameter P52.04 - 'Current Bandwidth'

The default value of this parameter has been changed from 750rads/sec to be 600rads/sec.

New Parameters Added

Par No.	Function
P14.21	Speed Loop Integral Seed Method
P23.23	Internal DB Unit Fitted
P28.20	Interlock Terminal Auto-Reset Enable

Copyright

Copyright notice embedded in firmware.

11.4 VERSION 10.00

11.4.1 New Features and Enhancements

11.4.1.1 Active Sharing Error Detection

All versions of MV3000e AC Drives that are MVDELTA based have had the ability to make the MVDELTA modules share their currents in proportion to the total drive current. A new parameter P35.18 - 'Active Sharing Error Detection' has been added to improve active sharing. If the MV3000e is unable to force multiple MV DELTAs to share in proportion, and the current levels are high enough for this to present a potential problem for the remaining MVDELTA modules then the drive will issue a Warning or a Trip, indicating the phase sharing failure.

11.4.1.2 Encoderless Vector Control

The following parameters have been added to Menu 12 to assist in stabilising Encoderless Vector Control.

Par No	Function
P12.38	Vdc Feedforward Filter Time Constant
P12.39	Current Control Kp Factor
P12.40	Current Control Ki Factor
P12.41	Orientation Controller Kp
P12.42	Orientation Controller Ki

11.4.2 Minor Enhancements

Parameter Index

All parameters have been given a unique index number so that when used with a version of Drive Coach from V4.00 or later the detection of duplicates is more robust.

Interlock Terminal

The Interlock terminal can now be read in P11.21, Bit 15.

Additionally the Interlock terminal can now be used as a source for the:

Control Flags (P33.00 - P34.27)
Digital outputs (P7.27, P7.28, and P7.29)
Extended Digital outputs (P59.50 - P59.81, and P58.50 - P58.81)
Programmable Status Words (P41.00 - P41.31)

Trip History

Many trips occur associated with power down of the drive, as various aspects of the Power Bridge are shutting down. To assist diagnostics from the trip history, from V8.00 firmware, trips occurring after an under voltage trip occurs are not stored in the trip history log, as these are expected, associated with power down.

The trip history is now frozen after an under voltage has been logged. The trip history is re-started, and subsequent trips recorded, when the under voltage trip is reset.

SFE Mode Control Flags

Previous versions of firmware retained the same default values for the sources of Control Flags 3, 4, 5 and 6 for the motor control modes and SFE mode. This can lead to 'unexplained' Reference Loss trips originating from the speed reference source being derived from analogue reference 2 and this being <4mA. To remove this problem the default values for the sources of control flags 3 to 6 have been changed.

This does not change the stated defaults functions for the Digital Inputs. It removes unwanted functions when in SFE mode.

SKiiP Trip Current

The SKiiP trip current has been removed from the DIB cross checklist for drive size.

Motor Calibration Run

The motor calibration run program has been improved such that fewer drive trips should occur during a calibration run with encoder. During the calibration run the drive automatically sets P12.40 - 'Orientation Controller Kp' to 100 and returns it afterwards to the default setting.

Auto Temperature Compensation

Parameter P12.06 - Auto Temperature Compensation' has been changed to be a Control Flag rather than a parameter. This means that when updating to this version of code P12.06 will return to default (0.000) even if previously set =1.

11.5 VERSION 11.01

11.5.1 New Features and Enhancements

11.5.1.1 VVVF Synchrostart

Improvements have been made to the synchrostart function (starting onto a spinning motor without speed measurement) for VVVF mode operation. The modifications do not apply to Vector Control without Encoder.

The volts recovery rate for 1.25kHz operation has been corrected, as it was too low, by a factor of 2compared with 2.5kHz operation.

The improvements are to make the synchrostart function's power factor PI controller gains available for user setting. New parameters added are:

Par No	Function
P4.22	VVVF Sync PF Demand
P4.23	VVVF - Sync. PF Kp
P4.24	VVVF - Sync. PF Ki

11.5.1.2 Vector Control Without Encoder

Further improvements have been made Vector Control without Encoder.

Base flux is now calculated as Vphase/(Xm+Xs). it was Vphase/Xm. This aligns the motor voltage in 'vector control with encoder' with 'vector control without encoder'.

P12.45 Rs Gain Factor added as a scalar to edit the value of Rs where it is used throughout the firmware.

Default of P12.40 changed back to be 100% from 10%.

The following parameters have been added.

Par No	Function
P11.52	Modulation Depth
P12.32	Flux Controller Output
P12.43	Xcouple TC Factor
P12.44	Xcouple Gain Factor
P12.45	Rs Gain Factor

11.5.2 Minor Enhancements

CANopen

The default values of parameters P61.13 and P65.13 - 'Freeze/Fallback' changed to = 1 'Fallback' from 0 'Freeze'.

DELTA Sharing

DELTA sharing improved to remove to reduce the chances of trips on multiple DELTA drives.

Calibration Run

The Leakage Inductance Phase of the calibration run has been improved.

The Current Control bandwidth is increased during this phase and the current sampled only in the second 50ms of each 100ms toggle period.

VVVF Stability

VVVF stability has been improved as some induction motors may be subject to instability under light load conditions.

The defaults of parameters P3.16 and P3.17 have been changed from 1.000Hz/(%/scan) and 40scans to 4.000Hz/(%scan) and 15scans; and stability is tapered away to 0 at 0Hz.

Frame Size 8 AC Drives

Support has been added for the following Frame Size 8 AC Drives:

MV3662A6A4: MV3221R6A4: MV3750J6A4: MV31000J6A4: MV3250M6A4.

Encoder Feedback

Parameter P11.51 - 'Encoder Speed (VVVF' now reads encoder speed feedback in VVVF mode (all controllers, i.e. 25MHz and 40MHz) and encoder speed feedback in all vector control modes on 40MHz controllers only.

Action on Sharing Error

The default value of parameter P35.18 changed from 2 (Trip) to 1 (Warning).

11.6 VERSION 11.60

11.6.1 New Features and Enhancements

11.6.1.1 Common Drive Controller

This version of firmware is only compatible with Common Drive Controllers (CDC) fitted with a 40MHz processor. In the event that it is installed on an older CDC the drive will trip with Trip Code 211 - 'Not 40MHz PCB'.

11.6.1.2 PROFIBUS

This issue of firmware is released to resolve a problem with PROFIBUS.

11.6.1.3 VVVF Stability

The defaults of parameters P3.16 and P3.17 have been changed from 4.000Hz/(%/scan) to 1.000/(%scan) and 15 scans to 40scans respectively.

11.7 VERSION 11.73

11.7.1 New Features and Enhancements

11.7.1.1 Additional Mode for High Speed Digital Output

A new mode, P20.00 = -2 'Fast Trip Out', has been added to the High Speed I/O.

This mode has been added to the High Speed I/O to facilitate the triggering of oscilloscopes on a trip event.

Trips are routed to the High Speed Digital Output.

11.7.1.2 Menu 12 - Motor Advanced Settings (Vector Only) Menu

The following parameters have been added to Menu 12 - 'Motor Advanced Settings (Vector Only) Menu'.

Par No	Function
P12.32	Leakage Test Current
P12.50	Enable Power Limit
P12.51	Power Limit
P12.52	P-Limit taper Band
P12.53	Minimum Power Limit

11.7.1.3 Menu 52 - Advanced SFE Set-up Menu

The following parameters have been added to Menu 52 - 'Advanced SFE Set-up Menu'.

Par No	Function
P52.51	Frequency Timer
P52.22	Minimum Amplitude
P52.23	Maximum Amplitude
P52.24	Amplitude Timer
P52.30	Enable Ride-through
P52.31	Mains Amplitude %
P52.32	Dip Threshold
P52.33	Dip Hysteresis
P52.34	Voltage Gain Support
P52.35	Measured Dip
P52.36	Alternative Reference Source
P52.38	Alternative Reference
P52.40	Id Reference
P52.41	User Id Limit
P52.42	Id Limit
P52.43	Limited Id Reference
P52.44	Id Ramp Up Rate
P52.45	Id Ramp Down Rate
P52.46	Ramped Id Reference
P52.47	P-Limit Recover Rate
P52.48	Power Limit Feedforward

11.7.1.4 Menu 54 - Mains Monitor Menu

A new menu, Menu 54 - 'Mains Monitor Menu' has been added. This menu is only active when in SFE Mode.

11.7.1.5 Menu 91 - Fast Analogue Output Menu

Menu 91 is added as an advanced commissioning/fault finding menu, and is, generally, not available.

If required, a fast analogue output pcb must be installed after which menu 91 is visible.

Additionally for its use, it requires knowledge of the MV3000e internal variable numbers and their internal scales, to be able to set up the parameters required to be viewed. It can then be used as an advanced fault finding aid on difficult applications.

11.7.1.6 Minimum Output PWM Pulses

This version of firmware has restrictions imposed on the minimum PWM pulse width produced by the drive. These restrictions have consequences for the drive's maximum output modulation depth, and, consequently, output voltage.

See parameters P3.32 and P12.36.

11.7.2 Minor Enhancements

Parameter P99.15

Any user edits to this parameter are now retained and its value is no longer reset when the drive re-boots.

Parameter P32.0

This parameter can now be downloaded to the drive from Drive Coach.

Multiple Trip Codes

It is possible, under certain circumstances, for the DIB to report all possible faults. This means that the true fault is masked by other unwanted ones. As such this condition is now reported as 'Undiagnosed from Dx' rather than all possible trips.

11.8 VERSION 11.86

11.8.1 New Features and Enhancements

11.8.1.1 MV3000e Ethernet Interface

This release of the drive firmware introduces the MV3000e Ethernet Interface.

The interface is available in 2 versions, a single channel version and a dual channel version.

MVS3012-4001 - Ethernet Interface Single Channel
MVS3012-4002 - Ethernet Interface Dual Channel

1. 10/100MBaud Ethernet
2. MODBUS/TCP protocol
3. Ability to be able to add other protocols

A new Menu - Menu 86 -'Ethernet Interface Menu' has been introduced to enable the Ethernet module to be configured.

11.8.1.2 AC Loss Ridethrough

The AC Loss Ridethrough feature in the MV3000e has been improved for Vector Control.

THIS FEATURE HAS BEEN REMOVED FROM THE DRIVE'S VVVF MODE OF CONTROL.

This means that if the drive's firmware is upgraded and the drive was in VVVF and used this feature it will be necessary to re-commission the drive in Vector Control.

11.8.2 Minor Enhancements

Text Change

The word 'MV3000C' has been removed from parameter P99.03 and from Drive Coach.

Cross Coupling Gain Factors

Parameters P12.43 - 'Cross Coupling Time Constant' and P12.44 - 'Cross Coupling Gain Factor' are now executed in the controller's PWM task.

Fast Trip HSIO

P20=-2, this mode has been corrected so that it is not high when healthy and powered from an Auxiliary 28V dc supply.

CANopen at PWM Task

An additional CAN Protocol has been added - Drive to Drive. This is selected by setting P61.00 (P65.00) to 4. This then gives the ability to attach CANopen messages to the PWM task of the CDC using Menu 62 (Menu 65). This functionality is primarily introduced for fast power feedforward signals for AEM drives to be sent over CANopen rather than use analogue I/O.

See the CANopen Software Technical Manuals.

Menu 52 – Advanced SFE Set-up Menu

The following parameters have been added to Menu 52 - 'Advanced SFE Set-up Menu'.

Par No	Function
P52.25	Vdc Kp Scale at 0 Power
P52.26	Vdc Kp Taper Power
P52.27	Maximum Vdc Kp
P52.28	Vdc Kp Power Filter
P52.29	Calculated Vdc Kp

11.9 VERSION 11.94

11.9.1 New Features and Enhancements

11.9.1.1 Additional Logic Blocks and Brake Logic

This release of firmware includes a number of new user Logic Blocks and pre-configured logic for the operation of brakes on a crane or hoist.

Menu 40 - Summing Nodes

Added to this menu are:

- 4 Summing Nodes - E, F, G and H
- 2 Square Root functions - A and B
- 4 Comparators - U, V, W and X
- 4 Analogue Switches - A, B, C and D

Additional parameters are from P40.24 through P40.99 and these are fully detailed in Section 0.

Menu 47 - Second Logic Menu

A new menu, Menu 47 (see Section 6.47), gives access to the parameters required to configure 12 general purpose logic blocks I through T and special purpose brake logic block.

Four identical logic blocks I through L each contain the following functions:

- Comparator - allowing any variable to be compared to a fixed threshold.
- Delay - allowing the output of the comparator to have its rising edge delayed.
- Selectable Boolean Function - allowing the delay output to be combined with 2 other digital signals.

Each logic block function outputs to a Status Flag and the inputs come from previous function and Control Flags.

A second group of 8 identical logic blocks, M through T, each comprise a selectable 4 input Boolean function. The selectable boolean functions are AND, NAND, OR, NOR XOR and XNOR.

Parameters P47.80 through P47.91 are for the special Brake Logic Function.

This brake control is for operational purposes only and must not form part of the functional safety of the system. If application of brakes is required for the functional safety of the overall system, then there must be a means of applying the brakes (and keeping them applied) independently of the MV3000e.

11.9.1.2 Second User Ramp Function

An independent User Ramp Function has been added to Menu 6. Additional parameters to Menu 6 for this function are P6.20 through P6.36 and a full description is available at Section 6.6.3.

11.9.1.3 Menu 10 Trips and Warnings

Extra User Trips and Warnings have been added and nominated as Alerts as these trips and warnings cannot be auto reset via Menu 28. Additional parameters to Menu 10 for this function are P10.40 through P10.59 and a full description is available in Section 6.10.9.

11.9.1.4 Control and Status Flags

Menu 11 - Advanced Drive Monitoring

Menu 11 contains control and status flags in various locations. The following parameters contain the additional control and status flags for the new logic functions.

Par No	Function
P11.53	Control Flags 144-159
P11.54	Control Flags 160-175
P11.55	Control Flags 176-191
P11.56	Control Flags 192-207
P11.57	Status Flags 112-127
P11.58	Status Flags 128-143

Menu 34 - Control Flags 144 to 199

As well as being shown in Menu 11, the control flags 144 to 199 are duplicated in this menu to provide an easy way of locating a particular control flag.

11.9.2 Minor Enhancements

Menu 61 - CANopen Additions

It has been found that some newer CANopen interface modules, compliant with V4.01 I/O Profile now need to have analogue 'read' enabled. This is performed using Service Data Objects (SDOs). In order to enable this facility without having to have a complete CANopen master functionality for performing this requirement has been introduced onto CAN Port 1 only.

The following parameters have been added and full details are given in technical manual T2013EN Rev 0004.

Par No	Function
P61.51	Node to Access
P61.52	Object to Access
P61.53	Sub-index to Access
P61.54	Access Command
P61.55	Access Result
P61.56	Access Data Length
P61.57	Access Bytes 1 & 2
P61.58	Access Bytes 3 &4
P61.59	Access Bytes 5 & 6
P61.60	Access Bytes 7 & 8
P61.61	Access Bytes 9 & 10
P61.62	Access Bytes 11 & 12
P61.63	Access Bytes 13 & 14
P61.64	Access Bytes 15 & 16
P61.65	Access Bytes 17 & 18
P61.66	Access Bytes 19 & 20

AC Loss Ridethrough

Parameter P46.02 - 'Mains Volts Scaling' now effects P46.03 - 'Vrms Mains'.
Parameter P46.08 - 'Mains Loss Action' added.

Active Sharing

The following parameters have been added to the Active Sharing function.

Par No	Function
P35.19	Disable Sharing
P35.20	PWM Sharing Threshold
P35.21	100ms Sharing Threshold
P35.22	No. of 100ms Sharings
P35.23	Sharing Event Time

Menu 52 - Advanced SFE Set-up Menu

The following parameters have been added to Menu 52 - Advanced SFE Set-up Menu.

Par No	Function
P52.49	Dip power Limit Max Iq
P52.50	Dip maximum Iq from Grid
P52.51	Dip maximum Iq to Grid
P52.52	Load Power Feedforward Limit
P52.53	Vq mains Filter

Revised Hardware Support

Support for DELTA PIB combination 20 and the Enhanced DELTA DIB 20X4381 added.

Proportional DB

A maximum modulation depth (P23.15) of 100% is allowed in Proportional DB Mode of control.

Values between the minimum pulse limit and 100% are disallowed internally.

PWM Synchronisation

PWM synchronisation added in modes 2 and 4 via HSIO.

The following new parameters added.

Par No	Function
P35.30	PWM Sync. Offset
P35.31	PWM Sync. Compensation Delay

Rate of Rise of Temperature

Rate of Rise of Temperature measurement filtering has been improved to make this less sensitive to giving spurious trips.

11.10 VERSION 12.XX

11.10.1 New Features and Enhancements

This manual reflects changes after version 11.94 such as the addition of Menus, 54, 55 and 56 and Multiple Parameter sets, the release details are not fully known at the time of going to press.

12. ABBREVIATIONS & ACRONYMS

The following abbreviations and acronyms are used within this manual

Abbreviation/Acronym	Definition
.; x; *	Multiply
@	At
+ve	Positive
ABS; Abs	Absolute
AC; ac	Alternating Current
Accel	Acceleration
ADDR	Address
Adv	Advanced
AEM	Active Energy Management
Alt	Alternative
Amps	Amperes
AN I/P	Analogue Input
Analog	Analogue
ANIN	Analogue Input
ANOP	Analogue Output
ASCII	American Standard Code for Information Interchange
Auto	Automatic

Abbreviation/Acronym	Definition
AUX	Auxiliary
BDM	Basic Drive Module
CAL Run	Calibration Run
CAN	Controller Area Network
CDC	Common Drive Controller
CE	Compliance European
CF	Control Flag
Ch	Channel
Cntrl	Controller
Comm.	Communications
Comp.	Compensation
Const.	Constant
CONT.	Control
CPU	Central Processing Unit
CR	Carriage Return
CRC	Cyclic Redundancy Check
CSA	Canadian Standards Association
CTS	Clear to send
DB	Dynamic Brake
DC; dc	Direct Current
DCD	Carrier detect
D-D	Drive to Drive
DDM™	Drive Data Manager
Decel	Deceleration
DIB	DELTA Interface Board
Dig	Digital
DIGIN	Digital Input
DIGOUT	Digital Output
Div	Divide
DSR	Data Set Ready
DTR	Data Terminal Ready
DVM	Digital Voltage Meter
EDS	Electronic Data Sheet
EEC	European Economic Community
EEPROM; E^{2}PROM	Electrically Erasable Programmable Read Only memory
EMC	Electro-Magnetic Compliance
ENC; Enc	Encoder
ENQ	Enquire
Esc	Escape
E-Stop	Emergency Stop
Etc.	Etcetera
F	Frequency
FB	Feedback
FBC	Field Bus Controller
FIP	Factory Information Protocol
FLC	Full Load Current
Freq	Frequency
FREQ.	Frequency
FWD; Fwd	Forward

Abbreviation/Acronym	Definition
GEN	Generator
GND	Ground
HI; Hi	High
HIS	High Speed Digital Input
HS	High Speed
HSIO	High Speed Digital Input Output
HSO	High Speed Digital Output
I	Current
I mode	Current Mode
I/O	Input/Output
I/P	Input
ID	Identity
Id	Reactive current
IGBT	Insulated Gate Bi-Polar Transistor
Inj	Injection
INV	Inverse
Iq	Active Current
Kd	Derivative Gain
Ki	Integral Gain
Kp	Proportional Gain
LCN	Line Contactor
LED; led	Light Emitting Diode
LF	Line Feed
l-l	Line to line
LO; Lo	Low
LRC	Longitudinal Redundancy Check
MAGNET.; Magnet.	Magnetising
Max	Maximum
Min	Minimum
MTRIP	Motor Thermostat Trip
Mult	Multiply
MVM	Mains Voltage Monitor
NAK	Not Acknowledged
O/L	Overload
O/P	Output
PARAMS	Parameters
PC; pc	Personal; Computer
PCB; pcb	Printed Circuit Board
PF	Power Factor
PI	Proportional, Integral, (controller)
PIB	Power Interface Board
PID	Proportional, Integral, Derivative (controller)
pk-pk	Peak to Peak
PL	Plug
PLC	Programmable Logic Controller
P-Limit	Power Limit
PLL	Phase Locked Loop
PNOM	Nominal Power

Abbreviation/Acronym	Definition
Pot	Potentiometer
P-Set	Parameter Set
PSU	Power Supply Unit
PTC; ptc	Positive Thermocouple
Pu	Per unit
PWM	Pulse Width Modulation
r/min; r/minute	Revolutions per minute
Rad/s	Radians/second
Rads	Radians
Rads/s	Radians/second
REF; Ref	Reference
Regen	Regenerative
RES; Res	Resistor
REV; Rev	Reverse
Rms	Root Mean Square
RPM	Revolutions per minute
Rr	Rotor Resistance
Rs	Stator Resistance
RTS	Request to send
RTU	Remote Terminal Unit
RX; Rx	Receive
SCADA	Supervisory Control and Data Acquisition
SF	Status Flag
SFE	Sinusoidal Front End
SK	Socket
SMPS	Switched Mode Power Supply
Speed Amp	Speed Amplifier
SqRoot	Square Root
Sqrt	Square Root
SRC	Source
Sub	Subtract
Sum	Summing
Sync; Synch; Synchro	Synchronising
T. Const	Time constant
Tacho	Tachogenerator
TB	Terminal Block
TC	Time Constant
Tc	Time constant
Temp	Temperature
Thresh	Threshold
TP	Test Point
TQ; Tq	Torque
Tr	Rotor Time Constant
Trib	Tributary
TX; Tx	Transmit
UL	Underwriters Laboratory
V	Voltage
V mode	Voltage Mode
Vac	Voltage ac

Abbreviation/Acronym	Definition
Var	Variable
VCOM	FIP variable of Communications
Vd	Quadrature component of mains voltage
Vdc	Voltage dc
Vdc	DC Link Voltage
-ve	Negative
Volts	Voltage
Vq	In phase component of mains voltage
VVVF	Variable Voltage Variable Frequency
Xcouple	Cross Coupler
ZCD	Zero Crossing Detection

13. INDICES

This index applies to the English Edition of the T1679 Software Manual for the MV3000 range of drive products.

The index is prepared with word-by-word alphabetisation and is presented with page numbers for subject location.

Three indexes are included in the manual. The first index is a General Subject Index. The second index lists all the Menu and Parameter titles with cross reference to the main subject areas for each item. The third index lists all the parameters numerically with a cross-reference to Sections 5 and 6 where they are listed and described.

13.1 GENERAL SUBJECT INDEX

D

E

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P

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V

W

13.2 MENU & PARAMETER TITLE INDEX

AVID CONTROLS

13.3 PARAMETER NUMBER INDEX

14. CONTACT DETAILS FOR SALES, SERVICE & SUPPORT

www.avidcontrolsinc.com

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

Technical Support Center

USA
Avid Controls, Inc.
41261 Park 290 Dr
Waller, TX 77484 USA
Tel: +1(281)640-8600
Fax: +1(281)640-8605

For all parts enquiries:
Email: info@avidcontrolsinc.com