



EMERSON[™]
Industrial Automation



Short Form Guide
Mentor MP

High Performance DC Drive
25A to 7400A, 480V to 690V
two or four quadrant operation

Part Number: 0476-0003-01
Issue: 1



www.controltechniques.com

General Information

The manufacturer accepts no liability for any consequences resulting from inappropriate, negligent or incorrect installation or adjustment of the optional operating parameters of the equipment or from mismatching the variable speed drive with the motor.

The contents of this guide are believed to be correct at the time of printing. In the interests of a commitment to a policy of continuous development and improvement, the manufacturer reserves the right to change the specification of the product or its performance, or the contents of the guide, without notice.

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Drive software version

This product is supplied with the latest version of software. If this product is to be used in a new or existing system with other drives, there may be some differences between their software and the software in this product. These differences may cause this product to function differently. This may also apply to drives returned from a Control Techniques Service Centre.

The software version of the drive can be checked by looking at Pr **11.29 (di14)** and Pr **11.34**. The software version takes the form of zz.yy.xx, where Pr **11.29** displays zz.yy and Pr **11.34** displays xx, i.e. for software version 01.01.00, Pr **11.29** would display 1.01 and Pr **11.34** would display 0.

If there is any doubt, contact a Control Techniques Drive Centre.

Environmental statement

Control Techniques is committed to minimising the environmental impacts of its manufacturing operations and of its products throughout their life cycle. To this end, we operate an Environmental Management System (EMS) which is certified to the International Standard ISO 14001. Further information on the EMS, our Environmental Policy and other relevant information is available on request, or can be found at www.greendrives.com.

The electronic variable-speed drives manufactured by Control Techniques have the potential to save energy and (through increased machine/process efficiency) reduce raw material consumption and scrap throughout their long working lifetime. In typical applications, these positive environmental effects far outweigh the negative impacts of product manufacture and end-of-life disposal.

Nevertheless, when the products eventually reach the end of their useful life, they can very easily be dismantled into their major component parts for efficient recycling. Many parts snap together and can be separated without the use of tools, while other parts are secured with conventional screws. Virtually all parts of the product are suitable for recycling.

Product packaging is of good quality and can be re-used. Large products are packed in wooden crates, while smaller products come in strong cardboard cartons which themselves have a high recycled fibre content. If not re-used, these containers can be recycled. Polythene, used on the protective film and bags for wrapping product, can be recycled in the same way. Control Techniques' packaging strategy favours easily-recyclable materials of low environmental impact, and regular reviews identify opportunities for improvement.

When preparing to recycle or dispose of any product or packaging, please observe local legislation and best practice.

REACH legislation

EC Regulation 1907/2006 on the Registration, Evaluation, Authorisation and restriction of Chemicals (REACH) requires the supplier of an article to inform the recipient if it contains more than a specified proportion of any substance which is considered by the European Chemicals Agency (ECHA) to be a Substance of Very High Concern (SVHC) and is therefore listed by them as a candidate for compulsory authorisation.

For current information on how this requirement applies in relation to specific Control Techniques products, please approach your usual contact in the first instance. Control Techniques position statement can be viewed at:

http://www.controltechniques.com/CTcom/system_pages/environment/reach_regulation.aspx

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Issue Number: 1

Software: 01.00.00 onwards

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Declaration of Conformity

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MP25A4(R)	MP25A5(R)
MP45A4(R)	MP45A5(R)
MP75A4(R)	MP75A5(R)
MP105A4(R)	MP105A5(R)
MP155A4(R)	MP155A5(R)
MP210A4(R)	MP210A5(R)

These products comply with the Low Voltage Directive 2006/95/EC and the Electromagnetic Compatibility (EMC) Directive 2004/108/EC.



The DC variable speed drive products listed above have been designed and manufactured in accordance with the following European harmonized standards:

EN 61800-5-1:2007	Adjustable speed electrical power drive systems - safety requirements - electrical, thermal and energy
EN 61800-3:2004	Adjustable speed electrical power drive systems. EMC product standard including specific test methods
EN 61000-6-2:2005	Electromagnetic compatibility (EMC). Generic standards. Immunity standard for industrial environments
EN 61000-6-4:2007	Electromagnetic compatibility (EMC). Generic standards. Emission standard for industrial environments

T. Alexander
VP Technology
Newtown

Date: 19th December 2008

These electronic drive products are intended to be used with appropriate motors, controllers, electrical protection components and other equipment to form complete end products or systems. Compliance with safety and EMC regulations depends upon installing and configuring drives correctly, including using the specified input filters. The drives must be installed only by professional assemblers who are familiar with requirements for safety and EMC. The assembler is responsible for ensuring that the end product or system complies with all the relevant laws in the country where it is to be used. Refer to the User Guide. An EMC Data Sheet is also available giving detailed EMC information.

The corresponding international standards are:

IEC 61800-5-1:2007
IEC 61800-3:2004
IEC 61000-6-2:2005
IEC 61000-6-4:2006

1 Safety Information

1.1 Warnings, Cautions and Notes



A Warning contains information which is essential for avoiding a safety hazard.



A Caution contains information which is necessary for avoiding a risk of damage to the product or other equipment.

NOTE

A Note contains information which helps to ensure correct operation of the product.

1.2 Electrical safety - general warning

The voltages used in the drive can cause severe electrical shock and/or burns, and could be lethal. Extreme care is necessary at all times when working with or adjacent to the drive.

Specific warnings are given at the relevant places in this Guide.

1.3 System design and safety of personnel

The drive is intended as a component for professional incorporation into complete equipment or system. If installed incorrectly, the drive may present a safety hazard.

The drive uses high voltages and currents, carries a high level of stored electrical energy, and is used to control equipment which can cause injury.

System design, installation, commissioning and maintenance must be carried out by personnel who have the necessary training and experience. They must read this safety information and this guide carefully.

The STOP and START controls or electrical inputs of the drive must not be relied upon to ensure safety of personnel. They do not isolate dangerous voltages from the output of the drive or from any external option unit. The supply must be disconnected by an approved electrical isolation device before gaining access to the electrical connections.

The drive is not intended to be used for safety-related functions.

Careful consideration must be given to the function of the drive which might result in a hazard, either through its intended behaviour or through incorrect operation due to a fault. In any application where a malfunction of the drive or its control system could lead to or allow damage, loss or injury, a risk analysis must be carried out, and where necessary, further measures taken to reduce the risk - for example, an over-speed protection device in case of failure of the speed control, or a fail-safe mechanical brake in case of loss of motor braking.

1.4 Environmental limits

Instructions within the supplied data and information within the *Mentor MP User Guide* regarding transport, storage, installation and the use of the drive must be complied with, including the specified environmental limits. Drives must not be subjected to excessive physical force.

1.5 Access

Access must be restricted to authorized personnel only. Safety regulations which apply at the place of use must be complied with.

1.6 Fire protection

The drive enclosure is not classified as a fire enclosure. A separate fire enclosure must be provided.

1.7 Compliance with regulations

The installer is responsible for complying with all relevant regulations, such as national wiring regulations, accident prevention regulations and electromagnetic compatibility (EMC) regulations. Particular attention must be given to the cross-sectional areas of conductors, the selection of fuses and other protection, and protective ground (earth) connections.

The *Mentor MP User Guide* contains instructions for achieving compliance with specific EMC standards.

Within the European Union, all machinery in which this product is used must comply with the following directives:

98/37/EC: Safety of machinery

2004/108/EC: Electromagnetic compatibility

1.8 Motor

Ensure the motor is installed in accordance with the manufacturer's recommendations. Ensure the motor shaft is not exposed.

Low speeds may cause the motor to overheat because the cooling fan becomes less effective. The motor should be installed with a protection thermistor. If necessary, an electric force vent fan should be used.

The values of the motor parameters set in the drive affect the protection of the motor. The default values in the drive should not be relied upon.

It is essential that the correct value is entered into Pr **0.41 (SE07)**, *Motor rated current*. This affects the thermal protection of the motor.

1.9 Adjusting parameters

Some parameters have a profound effect on the operation of the drive. They must not be altered without careful consideration of the impact on the controlled system. Measures must be taken to prevent unwanted changes due to error or tampering.

1.10 Electrical installation

1.10.1 Electric shock risk

The voltages present in the following locations can cause severe electric shock and may be lethal:

- AC supply cables and connections
- Output cables and connections
- Many internal parts of the drive, and external option units

Unless otherwise indicated, control terminals are single insulated and must not be touched.

1.10.2 Stored charge

The drive contains capacitors that remain charged to a potentially lethal voltage after the AC supply has been disconnected. If the drive has been energized, the AC supply must be isolated at least ten minutes before work may continue.

2 Product information

2.1 Introduction

The *Mentor MP Short Form Guide* is designed as a concise aid to drive installation and operation. More information including the *Mentor MP User Guide* and *Mentor MP Advanced User Guide* can be found on the CD supplied with the drive.

Table 2-1 Model to frame size cross reference

Model		Frame size
MP25A4(R)	MP25A5(R)	1A
MP45A4(R)	MP45A5(R)	
MP75A4(R)	MP75A5(R)	
MP105A4(R)	MP105A5(R)	1B
MP155A4(R)	MP155A5(R)	
MP210A4(R)	MP210A5(R)	
MP350A4(R)	MP350A6(R)	2A
MP420A4(R)	MP420A6(R)	
MP550A4(R)	MP550A6(R)	
MP700A4(R)	MP700A6(R)	2B
MP825A4(R)	MP825A6(R)	
MP900A4(R)	MP900A6(R)	
MP1200A4	MP1200A6	2C
MP1850A4	MP1850A6	
MP1200A4(R)	MP1200A6(R)	2D
MP1850A4(R)	MP1850A6(R)	

2.2 Current ratings

The power ratings for the 480V, 575V and 690V configurations are shown in Table 2-2, Table 2-3 and Table 2-4

The continuous current ratings given are for a maximum ambient temperature of 40°C (104°F) and an altitude of 1000m. For operation at higher temperatures and altitudes de-rating is required. For further information refer to the *Mentor MP User Guide*.

Table 2-2 480V current ratings

Model	Maximum AC input current	DC output current		Typical motor power	
	Continuous	Continuous	Overload	@ 400Vdc	@ 500Vdc
	A	A	A	kW	hp
MP25A4(R)	22	25	37.5	9	15
MP45A4(R)	40	45	67.5	15	27
MP75A4(R)	67	75	112.5	27	45
MP105A4(R)	94	105	157.5	37.5	60
MP155A4(R)	139	155	232.5	56	90
MP210A4(R)	188	210	315	75	125
MP350A4(R)	313	350	525	125	200
MP420A4(R)	376	420	630	150	250
MP550A4(R)	492	550	825	200	300
MP700A4(R)	626	700	1050	250	400
MP825A4(R)	738	825	1237.5	300	500
MP900A4(R)	805	900	1350	340	550
MP1200A4(R)	1073	1200	1800	450	750
MP1850A4(R)	1655	1850	2775	700	1150

Table 2-3 575V current ratings

Model	Maximum AC input current	DC output current		Typical motor power (with Vdc = 630V)	
	Continuous	Continuous	Overload	kW	hp
	A	A	A		
MP25A5(R)	22	25	37.5	14	18
MP45A5(R)	40	45	67.5	25	33
MP75A5(R)	67	75	112.5	42	56
MP105A5(R)	94	105	157.5	58	78
MP155A5(R)	139	155	232.5	88	115
MP210A5(R)	188	210	315	120	160

Table 2-4 690V current ratings

Model	Maximum AC input current	DC output current		Typical motor power (with Vdc = 760V)	
	Continuous	Continuous	Overload	kW	hp
	A	A	A		
MP350A6(R)	313	350	525	240	320
MP420A6(R)	376	420	630	280	380
MP550A6(R)	492	550	825	375	500
MP700A6(R)	626	700	1050	480	640
MP825A6(R)	738	825	1237.5	560	750
MP900A6(R)	805	900	1350	650	850
MP1200A6(R)	1073	1200	1800	850	1150
MP1850A6(R)	1655	1850	2775	1300	1750

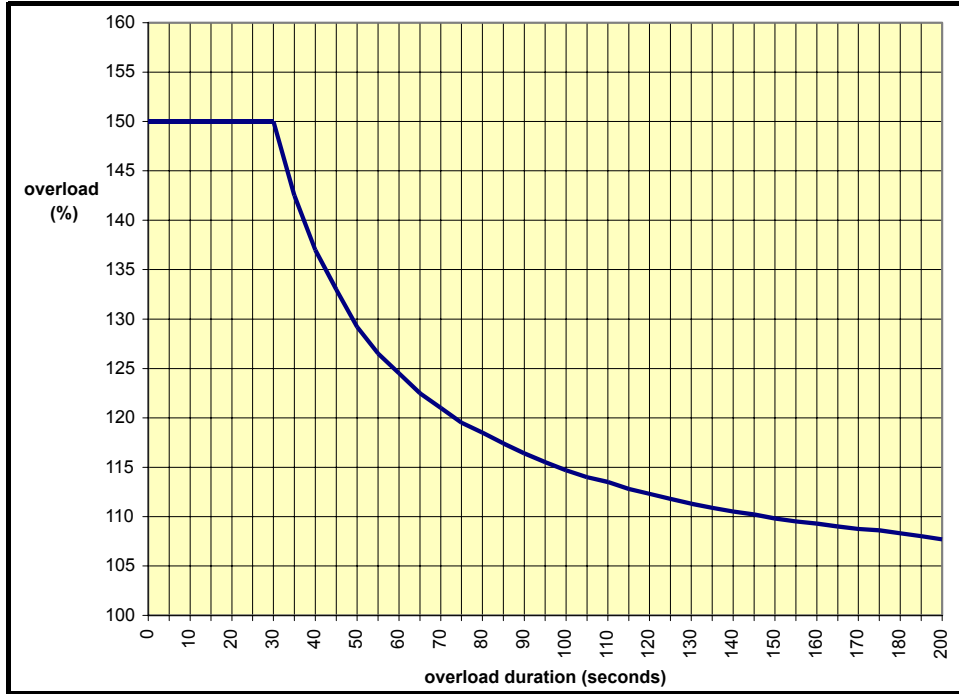
2.2.1 Typical short-term overload limits

The maximum percentage overload limit changes depending on the selected motor

Variations in motor rated current will result in changes in the maximum possible overload as detailed in the *Advanced User Guide*.

Figure 2-1 can be used to determine the maximum overload duration available for overloads between 100% and 150%. For example the maximum overload available for a period of 60s is 124%.

Figure 2-1 Maximum overload duration available



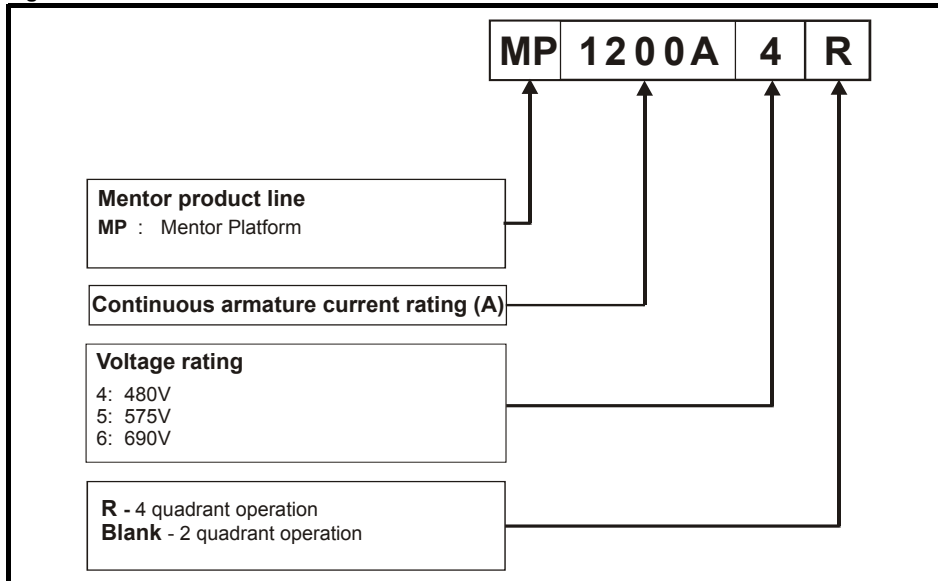
NOTE

Overload of 150% for 30s is available with ambient temperature of 40° C (104°F) up to a maximum of 10 repetitions per hour.

2.3 Model number

The way in which the model numbers for the Mentor MP range are formed is described in Figure 2-2.

Figure 2-2 Model number



2.4 Nameplate description

Figure 2-3 Typical drive rating label

Model: MP45A4R Rating: 15kW / 27HP Customer and date code: STDN39

Auxiliary input voltage/frequency/current: Aux I/P 208-480V 50-60Hz 2ph 8A

Field output voltage current: Field O/P 0-444V --- 8A

Line input voltage/frequency/current: Line I/P 24-480V 50-60Hz 3ph 38A

Armature output voltage/current/overload: Arm O/P 0-550V --- 45A 150% for 30s

Serial number: 3000005001

www.controltechniques.com Made in The UK Approvals: CE, C Tick, RoHS

Key to approvals

	CE approval	Europe
	C Tick approval	Australia
	RoHS compliant	Europe

2.4.1 Output current

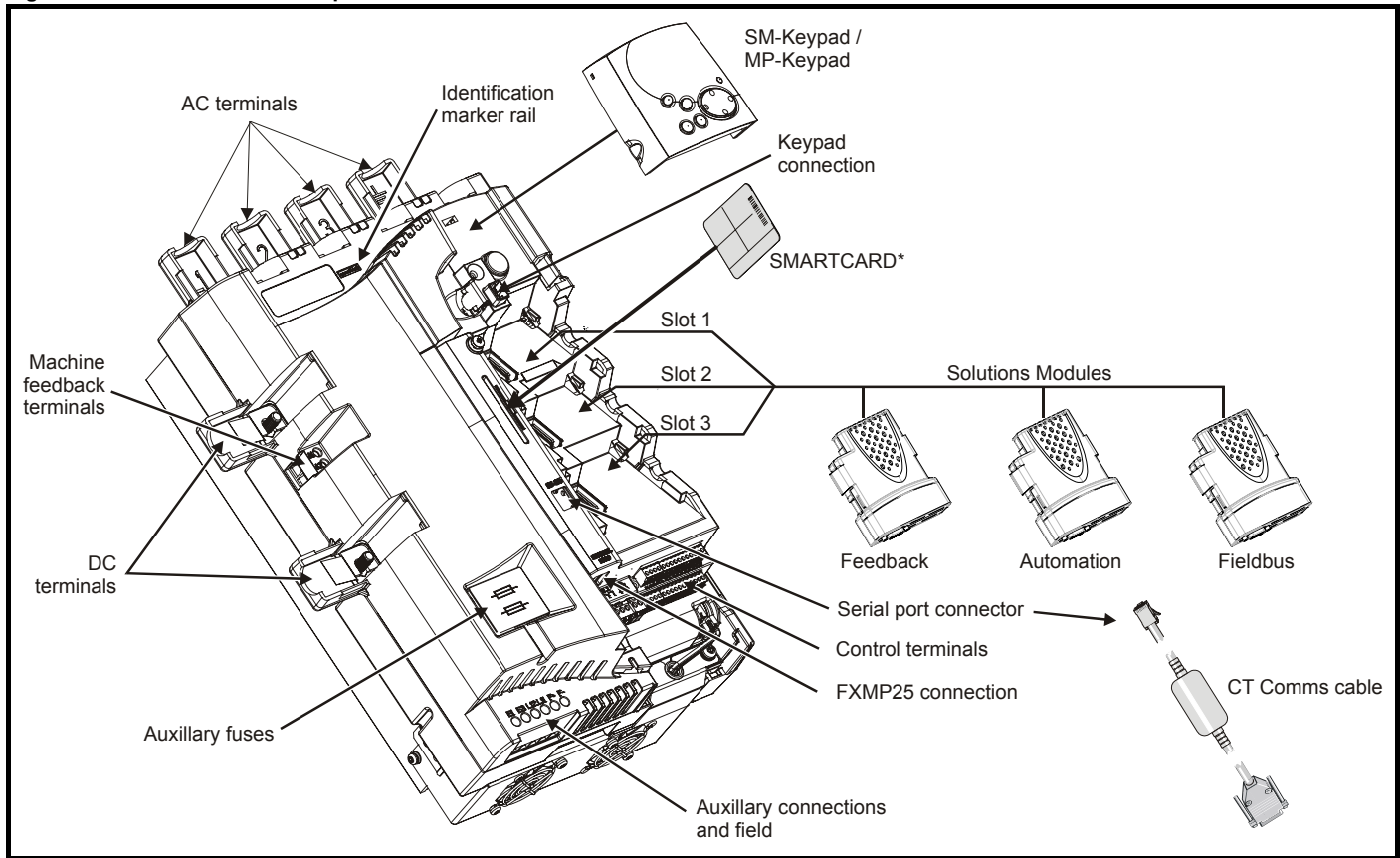
The continuous output current ratings given on the rating label are for maximum 40°C (104°F) and 1000m altitude. Derating is required for higher ambient temperatures >40°C (104°F) and higher altitude. For derating information, refer to the *Mentor MP User Guide* on the CD supplied with the drive.

2.4.2 Input current

The input current is affected by the supply voltage, frequency and load inductance. The input current given on the rating label is the typical input current.

2.5 Drive features and options

Figure 2-4 Drive features and options



* A SMARTCARD is provided as standard. For further information, refer to Chapter 7 *SMARTCARD operation* on page 37.

2.5.1 Options available for Mentor MP

All Solutions Modules are color-coded in order to make identification easy. The following table shows the color-code key and gives further details on their function.

Table 2-5 Solutions Module identification














Type	Solutions Module	Color	Name	Further Details
Feedback		Light Green	SM-Universal Encoder Plus	Universal Feedback interface Feedback interface for the following devices: Inputs <ul style="list-style-type: none"> Incremental encoders SinCos encoders SSI encoders EnDat encoders Outputs <ul style="list-style-type: none"> Quadrature Frequency and direction SSI simulated outputs
		Brown	SM-Encoder Plus	Incremental encoder interface Feedback interface for incremental encoders without commutation signals. No simulated encoder outputs available
		Dark Brown	SM-Encoder Output Plus	Incremental encoder interface Feedback interface for incremental encoders without commutation signals. Simulated encoder output for quadrature, frequency and direction signals
Automation (I/O Expansion)		Yellow	SM-I/O Plus	Extended I/O interface Increases the I/O capability by adding the following to the existing I/O in the drive: <ul style="list-style-type: none"> Digital inputs x 3 Digital I/O x 3 Analog inputs (voltage) x 2 Analog output (voltage) x 1 Relay x 2
		Yellow	SM-I/O 32	Extended I/O interface Increase the I/O capability by adding the following to the existing I/O in the drive: <ul style="list-style-type: none"> High speed digital I/O x 32 +24V output
		Dark Yellow	SM-I/O Lite	Additional I/O 1 x Analog input ($\pm 10V$ bi-polar or current modes) 1 x Analog output (0-10V or current modes) 3 x Digital input and 1 x Relay
		Dark Red	SM-I/O Timer	Additional I/O with real time clock As per SM-I/O Lite but with the addition of a Real Time Clock for scheduling drive running
		Turquoise	SM-I/O PELV	Isolated I/O to NAMUR NE37 specifications For chemical industry applications 1 x Analog input (current modes) 2 x Analog outputs (current modes) 4 x Digital input / outputs, 1 x Digital input, 2 x Relay outputs
		Olive	SM-I/O 120V	Additional I/O conforming to IEC 61131-2 120Vac 6 digital inputs and 2 relay outputs rated for 120Vac operation
		Cobalt Blue	SM-I/O 24V Protected	Additional I/O with overvoltage protection up to 48V 2 x Analog outputs (current modes) 4 x Digital input / outputs, 3 x Digital inputs, 2 x Relay outputs
Automation (Applications)		Moss Green	SM-Applications Plus	Applications Processor (with CTNet) 2 nd processor for running pre-defined and /or customer created application software with CTNet support. Enhanced performance over SM-Applications
		White	SM-Applications Lite V2	Applications Processor 2 nd processor for running pre-defined and /or customer created application software. Enhanced performance over SM-Applications Lite
		Green brown	SM-Register	Applications Processor 2 nd processor for running position capture functionality with CTNet support

Table 2-5 Solutions Module identification







Type	Solutions Module	Color	Name	Further Details
Fieldbus		Purple	SM-PROFIBUS-DP-V1	Profibus option PROFIBUS DP adapter for communications with the drive
		Medium Grey	SM-DeviceNet	DeviceNet option DeviceNet adapter for communications with the drive
		Dark Grey	SM-INTERBUS	Interbus option Interbus adapter for communications with the drive
		Light Grey	SM-CANopen	CANopen option CANopen adapter for communications with the drive
		Beige	SM-Ethernet	Ethernet option 10 base-T / 100 base-T; Supports web pages, SMTP mail and multiple protocols: DHCP IP addressing; Standard RJ45 connection
		Brown Red	SM-EtherCAT	EtherCAT option EtherCAT adapter for communications with the drive

Table 2-6 Keypad identification



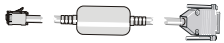
Type	Keypad	Name	Further Details
Keypad		SM-Keypad	LED keypad option Keypad with a LED display
		MP-Keypad	LCD keypad option Keypad with an alpha-numeric LCD display with Help function

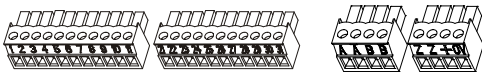

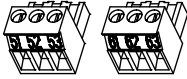


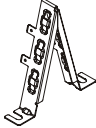
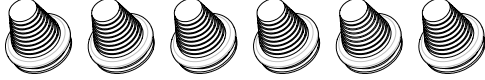
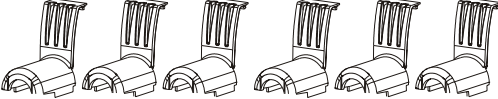
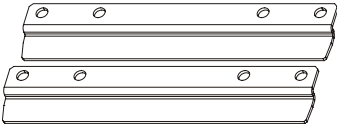
Table 2-7 Additional options

Type	Cable	Name	Further Details
Serial comms lead		CT Comms cable	CT EIA232 (4500-0087) CT USB (4500-0096)

2.6 Items supplied with the drive

The drive is supplied with a printed manual, a SMARTCARD, a safety information booklet, the Certificate of Quality, an accessory kit box including the items shown in Table 2-8, and a CD ROM containing all related product documentation and software tools.

Table 2-8 Parts supplied with the drive

Description	Size 1
Control connectors	
Tacho connector	
Relay connectors	
UL warning label	
UL warning label for heatsink temperature	
Grounding bracket	
Terminal cover grommets	
Terminal shrouds	
Mounting feet bracket	

3 Mechanical installation

3.1 Safety



WARNING

Follow the instructions

The mechanical and electrical installation instructions must be adhered to. Any questions or doubt should be referred to the supplier of the equipment. It is the responsibility of the owner or user to ensure that the installation of the drive and any external option unit, and the way in which they are operated and maintained, comply with the requirements of the Health and Safety at Work Act in the United Kingdom or applicable legislation and regulations and codes of practice in the country in which the equipment is used.



WARNING

Competence of the installer

The drive must be installed by professional assemblers who are familiar with the requirements for safety and EMC. The assembler is responsible for ensuring that the end product or system complies with all the relevant laws in the country where it is to be used.



WARNING

If the drive has been used at high load levels for a period of time, the heatsink can reach temperatures in excess of 70°C (158°F). Human contact with the heatsink should be prevented.



WARNING

Enclosure

The drive is intended to be mounted in an enclosure which prevents access except by trained and authorized personnel, and which prevents the ingress of contamination. It is designed for use in an environment classified as pollution degree 2 in accordance with IEC 60664-1. This means that only dry, non-conducting contamination is acceptable.



WARNING

The drive enclosure is not classified as a fire enclosure. A separate fire enclosure must be provided.





WARNING

Many of the drives in this product range weigh in excess of 15kg (33lb). Use appropriate safeguards when lifting these models.

A full list of drive weights can be found in the *User Guide*.

3.2 Terminal cover removal

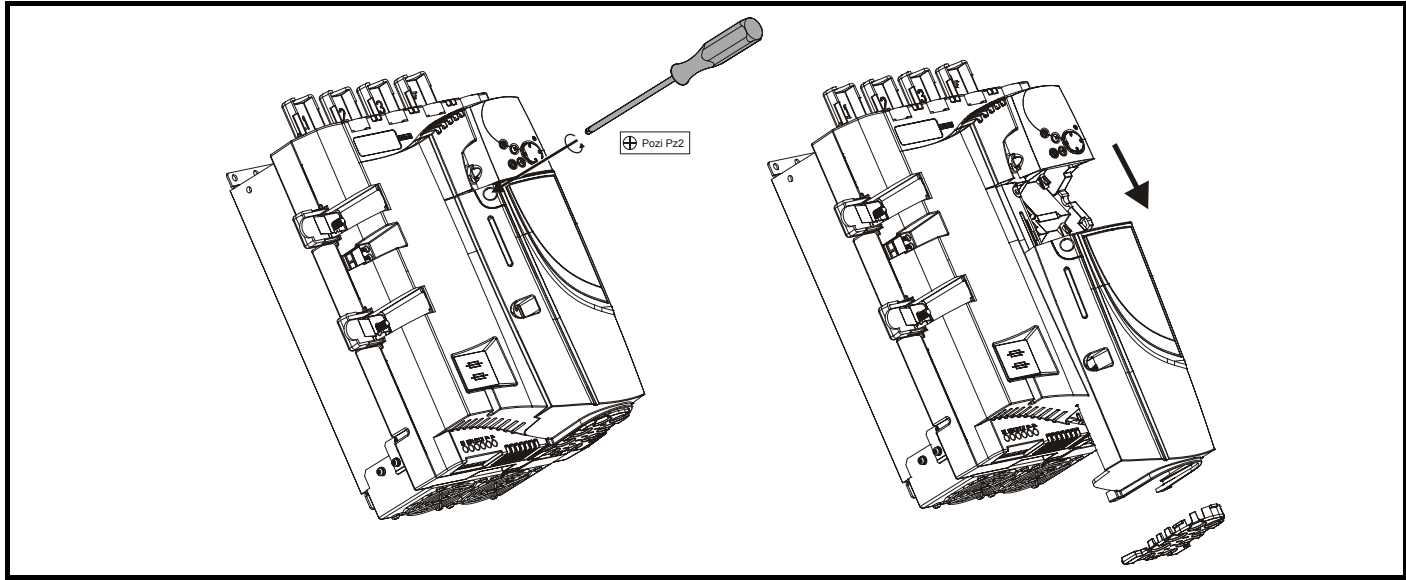
 **WARNING** Isolation device
The AC supply must be disconnected from the drive using an approved isolation device before any cover is removed from the drive or before any servicing work is performed.

 **WARNING** Stored charge
The drive contains capacitors that remain charged to a potentially lethal voltage after the AC supply has been disconnected. If the drive has been energized, the AC supply must be isolated at least ten minutes before work may continue.

3.2.1 Removing the terminal covers

Size 1 is installed with one terminal cover: Control terminal cover.

Figure 3-1 Removing the control terminal cover

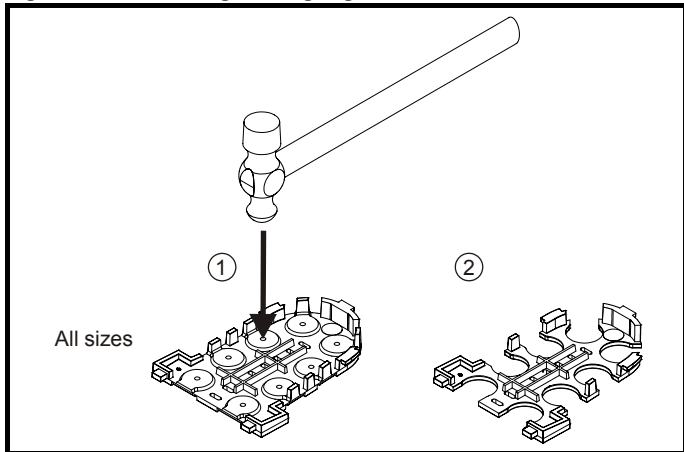


To remove a terminal cover, undo the screw and slide the terminal cover downwards.

When replacing the terminal covers the screw should be tightened with a maximum torque of 1 Nm (0.7 lb ft).

3.2.2 Removing the finger-guard and break-outs

Figure 3-2 Removing the finger-guard break-outs

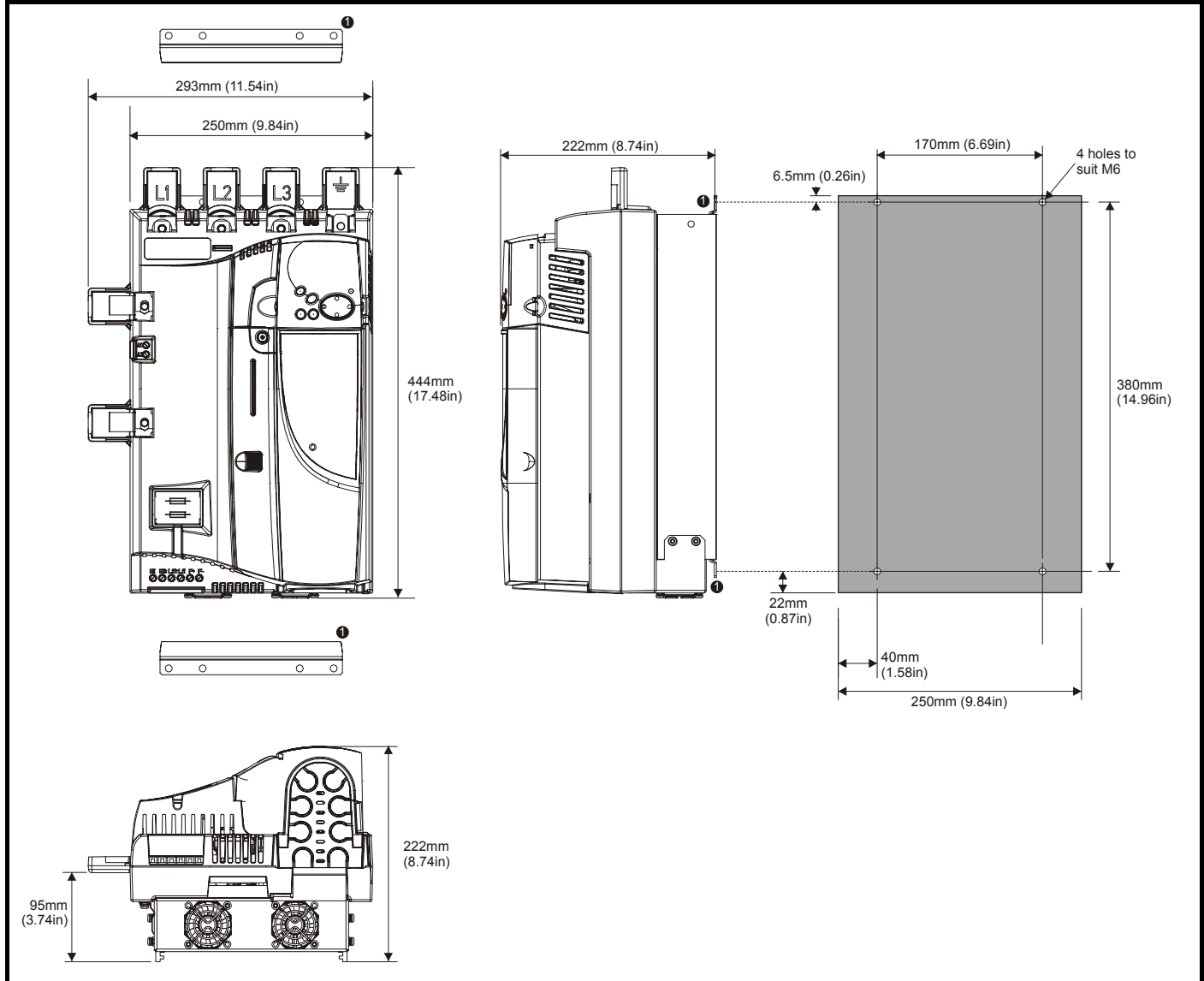


Place finger-guard on a flat solid surface and hit relevant break-outs with hammer as shown (1). Continue until all required break-outs are removed (2). Remove any flash / sharp edges once the break-outs are removed.

3.3 Mounting method

The Mentor MP can only be surface mounted.

Figure 3-3 Overall size 1A dimensions

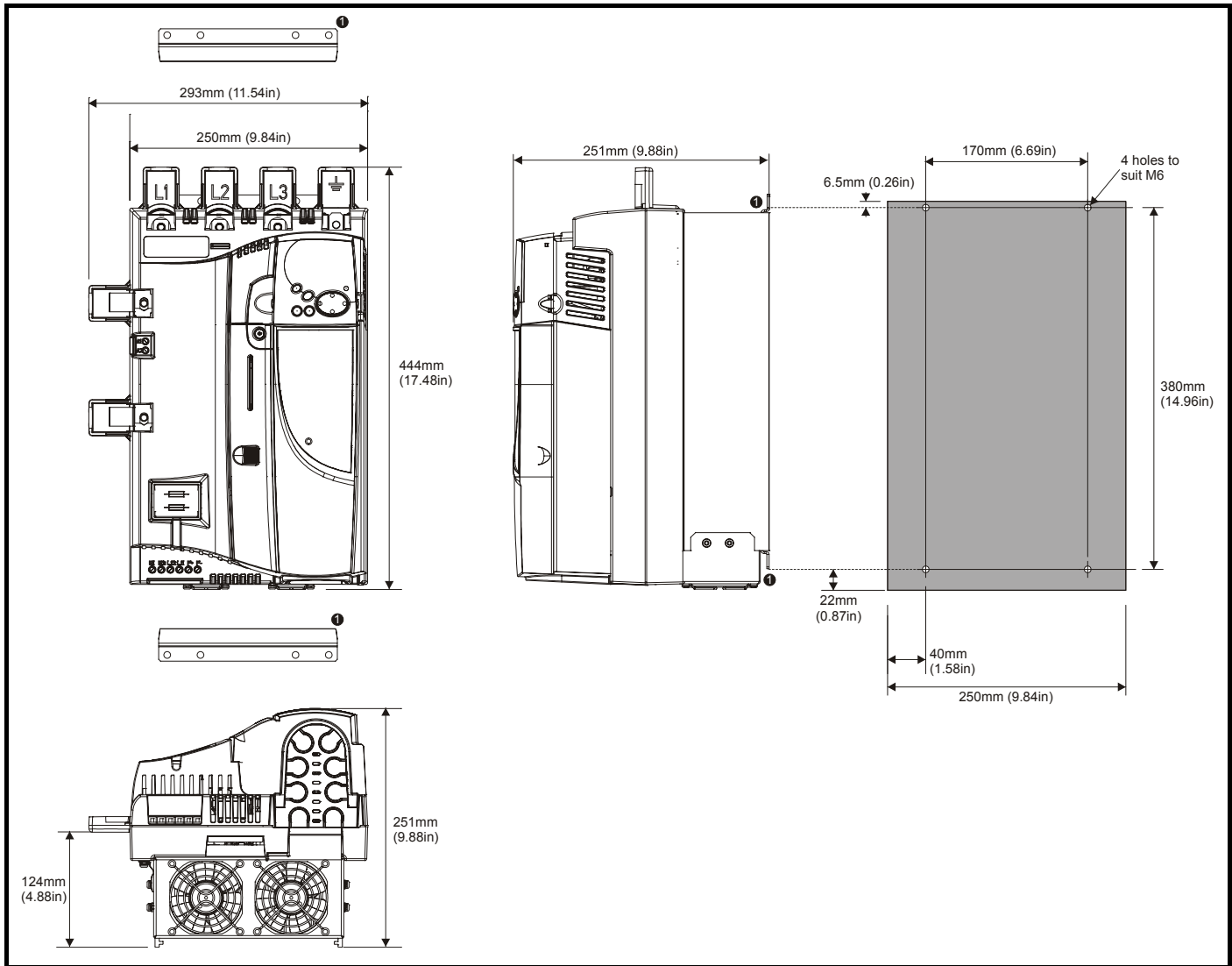


1. The two outer holes must be used for mounting the Mentor MP.

NOTE

With the SMARTCARD installed to the drive, the depth measurement increases by 7.6mm (0.30 in).

Figure 3-4 Overall size 1B dimensions

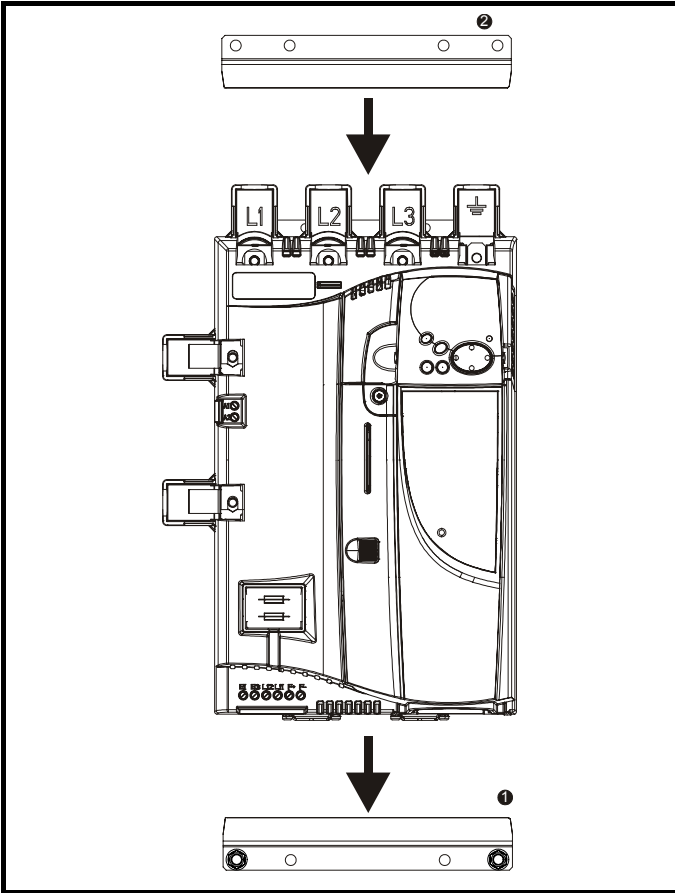


1. The two outer holes must be used for mounting the Mentor MP.

NOTE

With the SMARTCARD installed to the drive, the depth measurement increases by 7.6mm (0.30 in).

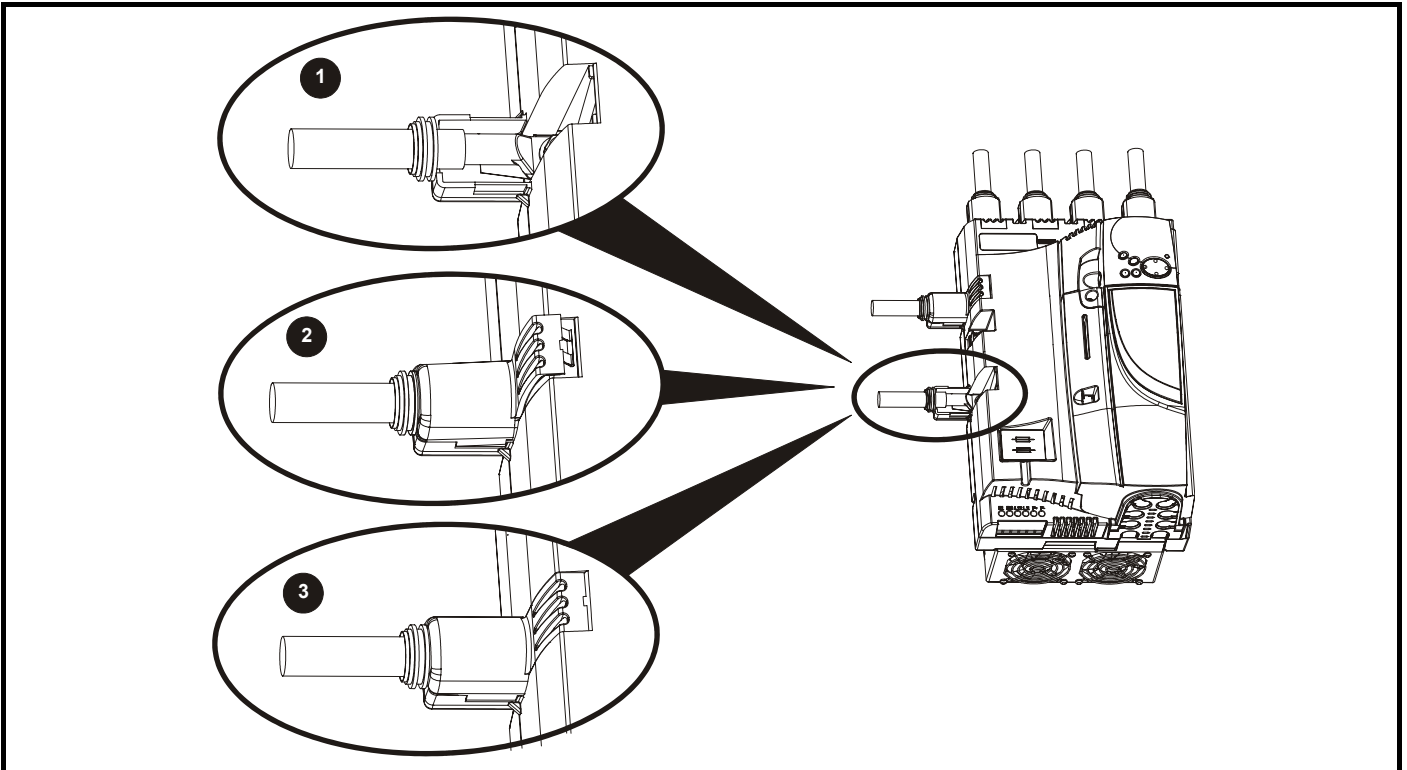
Figure 3-5 Installing the mounting bracket



The bottom mounting bracket (1) should be installed to the back plate first. The drive should then be lowered onto the bracket and slotted in. The top mounting bracket (2) should then be slotted into the drive and the top holes marked for mounting (380mm [14.96 in] from the centre of the holes on the bottom mounting bracket). Once the holes have been drilled, then fix the top mounting bracket accordingly.

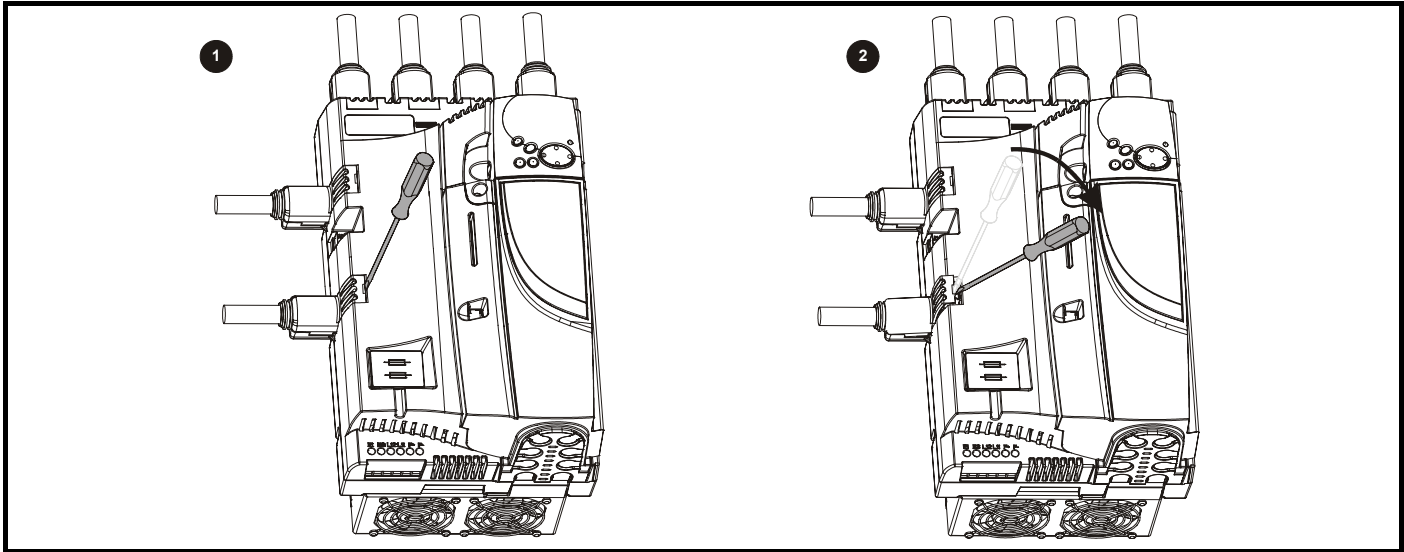
3.4 Installing and removing the terminal shrouds

Figure 3-6 Installing the terminal shrouds



1. Thread the AC supply and DC output connectors through the grommets provided and connect them to the drive.
2. Place the terminal shroud over the top of the connectors and click into place (3).

Figure 3-7 Removing the terminal shrouds



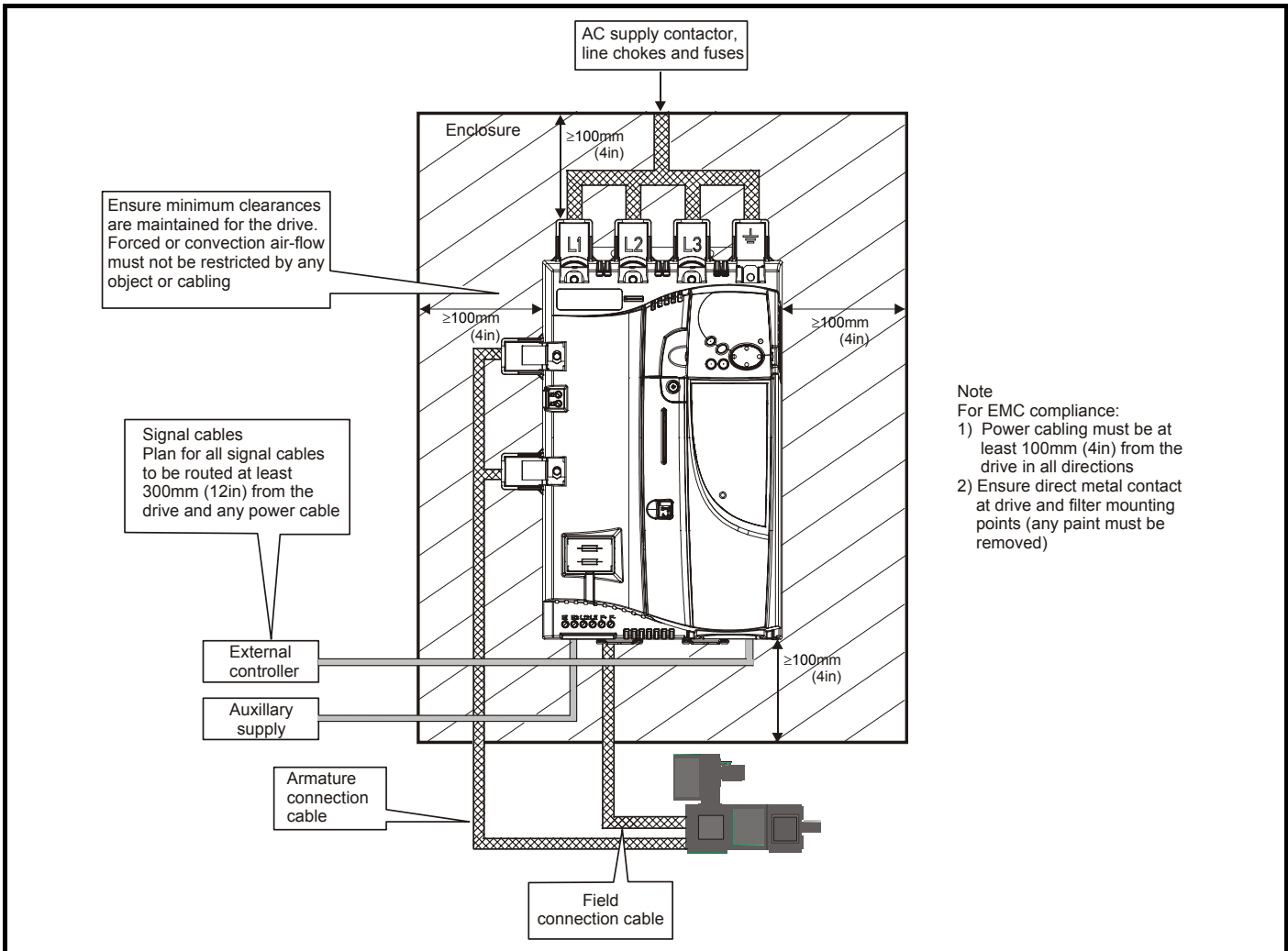
1. Insert the screwdriver into the groove as shown.
2. Lever in the direction shown to unclip the terminal shroud and remove.

3.5 Enclosure

Enclosure layout

Please observe the clearances in the diagram below taking into account any appropriate notes for other devices / auxiliary equipment when planning the installation.

Figure 3-8 Enclosure layout



4 Electrical installation



WARNING

Electric shock risk

The voltages present in the following locations can cause severe electric shock and may be lethal:

- AC supply cables and connections
- DC cables, and connections
- Many internal parts of the drive, and external option units

Unless otherwise indicated, control terminals are single insulated and must not be touched.



WARNING

Isolation device

The AC supply must be disconnected from the drive using an approved isolation device before any cover is removed from the drive or before any servicing work is performed.



WARNING

STOP function

The STOP function does not remove dangerous voltages from the drive, the motor or any external option units.



WARNING

Drives are suitable for use on supplies of installation category III and lower, according to IEC60664-1. This means they may be connected permanently to the supply at its origin in a building, but for outdoor installation additional over-voltage suppression (transient voltage surge suppression) must be provided to reduce category IV to category III.

NOTE

For details on the MOV ground (earth) disconnect, refer to the *User Guide*.

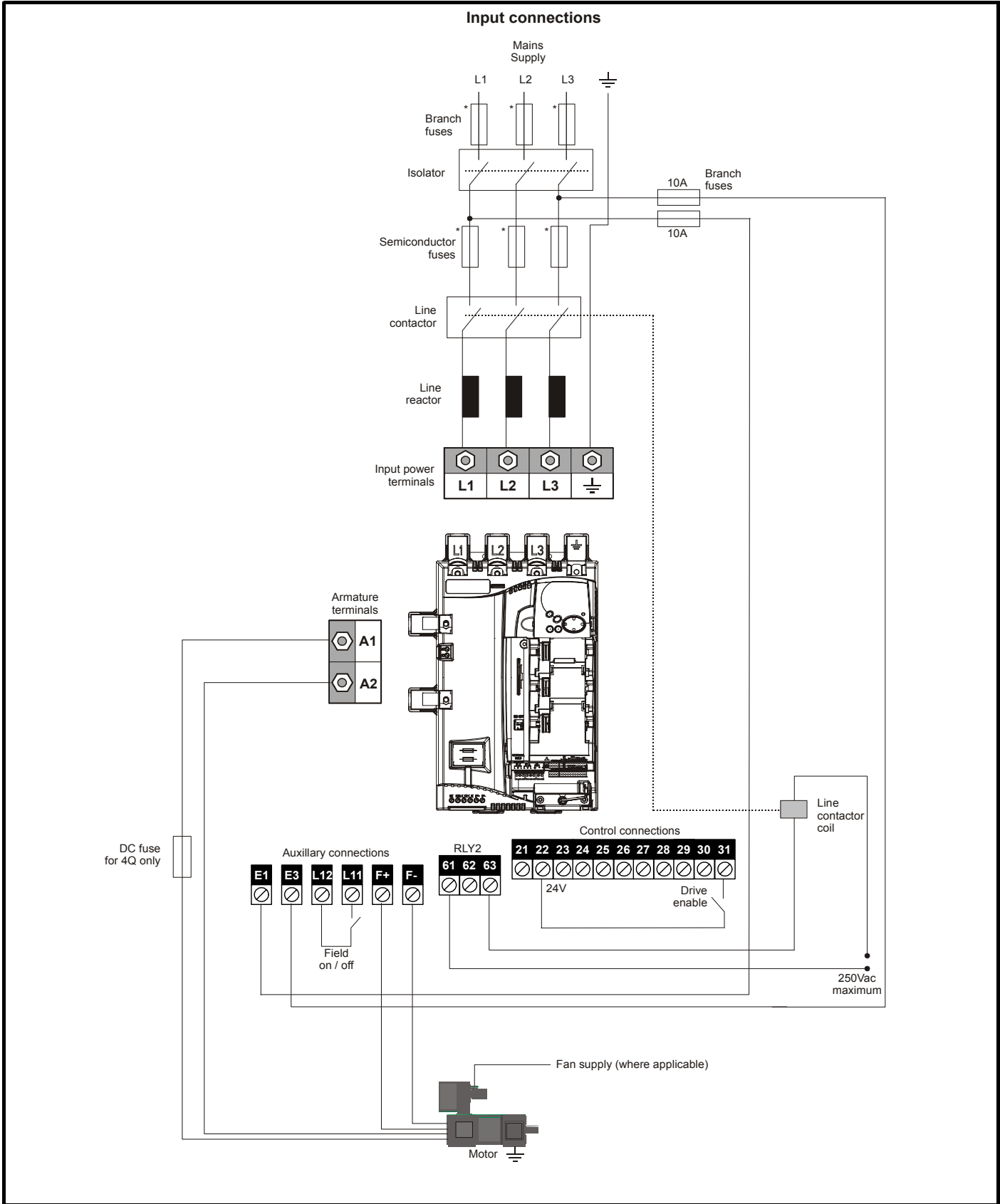
NOTE

For details on the external suppressor resistor connections, refer to the *User Guide*.

4.1 Electrical connections

Refer to Figure 4-1 to understand the function of the different power connections.

Figure 4-1 Minimum connections for 480V drive



* For fuse ratings refer to section 4.5.1 Ferraz Shawmut fuses on page 23.

4.1.1 Use of residual current device (RCD)

There are three common types of ELCB / RCD:

1. AC - detects AC fault currents
2. A - detects AC and pulsating DC fault currents (provided the DC current reaches zero at least once every half cycle)
3. B - detects AC, pulsating DC and smooth DC fault currents
 - Types A and AC should never be used with Mentor MP drives.
 - Type B must be used with all Mentor MP drives.



Only type B ELCB / RCD are suitable for use with Mentor MP drives.

If an external EMC filter is used, a delay of at least 50ms should be incorporated to ensure spurious trips are not seen. The leakage current is likely to exceed the trip level if all of the phases are not energized simultaneously.

4.2 Ground connection

The drive must be connected to the system ground of the AC supply. The ground wiring must conform to local regulations and codes of practice.



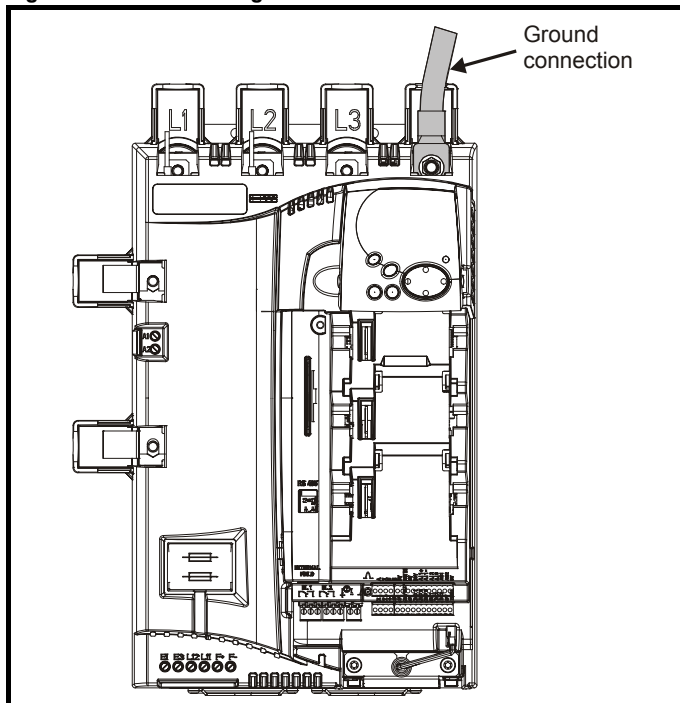
Where there is a possibility of temporary condensation or corrosion occurring, the ground connection should be protected from corrosion by suitable jointing compound.



Ground loop impedance

The ground loop impedance must conform to the requirements of local safety regulations. The drive must be grounded by a connection capable of carrying the prospective fault current until the protective device (fuse, etc.) disconnects the AC supply. The ground connections must be inspected and tested at appropriate intervals.

Figure 4-2 Location of ground connection



4.3 AC supply requirements

The standard drive is rated for a nominal supply voltage up to 480Vrms.

An optional rating of 575Vrms is available for drive sizes MP25Ax(R) to MP210Ax(R).

An optional rating of 690Vrms is available for drive sizes MP350Ax(R) and above.



The 690V variant is not suitable for use on grounded delta supplies.

4.3.1 Supply types

Drives rated for supply voltage up to 575V are suitable for use with any supply type, i.e. TN-S, TN-C-S, TT, IT, with grounding at any potential, i.e. neutral, centre or corner ("grounded-delta").

Grounded delta supplies >575V are not permitted.

4.3.2 Thyristor bridge AC supply

Table 4-1 Three phase AC supply

Specification	Product voltage variant		
	480V	575V	690V
Max nominal supply	480V	575V	690V
Tolerance	+10%	+10%	+10%
Min nominal supply	24V	500V	500V
Tolerance	-20%	-10%	-10%

4.4 Line reactors

The following recommendations for added line inductance, have been calculated based on the power drive systems standard: EN61800-3:2004 "Adjustable speed electrical power drive systems – Part 3: EMC requirements and specific test methods".

Table 4-2 and Table 4-3 show the L_{add} requirements for the range of Mentor MP, DC electric, drives to be installed in European countries meeting EMC/power-quality requirements based on EN61800-3:2004 second environment.

NOTE

The current ratings specified in Table 4-2 and Table 4-3 are for typical motor currents where the motor current ripple is no more than 50% of drive rating.

Table 4-2 Minimum values of L_{add} and inductor current rating - 400V supply

Model	L_{add} μH	Typical	Maximum
		current rating A	current rating A
MP25A4(R)	220	21	22
MP45A4(R)	220	38	40
MP75A4(R)	220	63	67
MP105A4(R)	220	88	94
MP155A4(R)	160	130	139
MP210A4(R)	120	180	188
MP350A4(R)	71	290	313
MP420A4(R)	59	350	376
MP550A4(R)	45	460	492
MP700A4(R)	36	590	626
MP825A4(R)	30	690	738
MP900A4(R)	28	750	805
MP1200A4(R)	21	1000	1073
MP1850A4(R)	18	1600	1655

Table 4-3 Minimum values of L_{add} and inductor current rating – 690V supply

Model	L_{add}	Typical current rating	Maximum current rating
	μH	A	A
MP350A6(R)	120	290	313
MP420A6(R)	100	350	376
MP550A6(R)	79	460	492
MP700A6(R)	62	590	626
MP825A6(R)	53	690	738
MP900A6(R)	48	750	805
MP1200A6(R)	36	1000	1073
MP1850A6(R)	32	1600	1655

4.4.1 Auxiliary AC supply and connections

Table 4-4 Terminal functions

Terminals	Function
E1, E3	Supply for control electronics and field controller. These terminals should be in phase with the mains supply to the drive.
L11, L12	Field on / off. When L1 and L2 are open the supply is disconnected to the field regulator so there will be no field current.
F+, F-	Field supply to the motor.
MA1, MA2	Refer to <i>User Guide</i>

Table 4-5 Line to line supply

Specification	Value
Max nominal supply	480V
Tolerance	+10%
Min nominal supply	208V
Tolerance	-10%

Each drive has an on-board field controller with the following current ratings.

Table 4-6 Current ratings

Model	Maximum continuous field current rating A
MP25A4(R) MP25A5(R) MP45A4(R) MP45A5(R) MP75A4(R) MP75A5(R) MP105A4(R) MP105A5(R) MP155A4(R) MP155A5(R) MP210A4(R) MP210A5(R)	8
MP350A4(R) MP350A6(R) MP420A4(R) MP420A6(R) MP550A4(R) MP550A6(R) MP700A4(R) MP700A6(R) MP825A4(R) MP825A6(R) MP900A4(R) MP900A6(R)	10
MP1200A4(R) MP1200A6(R) MP1850A4(R) MP1850A6(R)	20

4.5 Cable and fuse size ratings



The selection of the correct fuse is essential to ensure the safety of the installation

Maximum continuous input currents are given in section 2.2 *Current ratings* on page 6 to aid the selection of fuses and cabling. The maximum input current is dependent on the ripple content of the output current. A value of 100% ripple has been assumed for the given ratings.

The cable sizing selected when installing a Mentor MP must comply with the local wiring regulations. The information provided in this section is provided for guidance purposes only.

The power terminals on the Mentor MP have been designed to accommodate a maximum cable size of 150mm² (350kcmil) with a temperature rating of 90°C (194°F).

The actual cable size depends on a number of factors including:

- Actual maximum continuous current
- Ambient temperature
- Cable support, method and grouping
- Cable voltage drop

In applications where the motor used is of a reduced rating, the cable sizing selected can be appropriate for that motor. To protect the motor and the output cabling the drive must be programmed with the correct motor rated current.

NOTE

When using reduced cable sizes, the branch circuit protection fuse rating needs to be reduced in line with the cable size selected.

The following table shows the required cable sizes as per European and American standards, assuming 3 conductors per raceway/conduit, an ambient temperature of 40°C (104°F) and applications with high output current ripple content.

Table 4-7 Typical cable sizes

Model	IEC 60364-5-52 ^[1]		UL508c/NEC ^[2]	
	Input	Output	Input	Output
MP25A4(R) MP25A5(R)	2.5mm ²	4mm ²	8 AWG	8 AWG
MP45A4(R) MP45A5(R)	10mm ²	10mm ²	4 AWG	4 AWG
MP75A4(R) MP75A5(R)	16mm ²	25mm ²	1 AWG	1/0 AWG
MP105A4(R) MP105A5(R)	25mm ²	35mm ²	1/0 AWG	1/0 AWG
MP155A4(R) MP155A5(R)	50mm ²	70mm ²	3/0 AWG	4/0 AWG
MP210A4(R) MP210A5(R)	95mm ²	95mm ²	300kcmil	350kcmil

NOTE

1. The maximum cable size is defined by the power terminal housing using 90°C (194°F) rated cables as per Table A.52-5 of the standard.
2. Assumes the use of 75°C (167°F) rated cables, as per Table 310.16 of the National Electrical Code.

The use of higher temperature rated cable would allow a reduction on the minimum recommended cable size for Mentor MP shown above. For high temperature cable sizing, please contact the supplier of the drive.

4.5.1 Ferraz Shawmut fuses

Ferraz Shawmut fuses are recommended for the Mentor MP.

The applications, descriptions and ratings for the Ferraz Shawmut fuses with respect to drives are shown in Table 4-8 , Table 4-9 and Table 4-10

Table 4-8 Ferraz Shawmut semiconductor fusing for 480V and 575V size 1 drives

Model		Fuse type	Rating Vac	Rating A	Catalogue number	Ref number
Auxiliary (internal for all ratings)		10x38mm ferrule	690	12.5	FR10GB69V12.5	H330011
MP25A4	MP25A5	22x58mm ferrule	690	32	FR22GC69V32	A220915
MP45A4	MP45A5	22x58mm ferrule	690	63	FR22GC69V63	X220912
MP75A5	MP75A5	22x58mm ferrule	690	100	FR22GC69V100	W220911
MP25A4R	MP25A5R	22x58mm ferrule	690	32	FR22GC69V32	A220915
MP45A4R	MP45A5R	22x58mm ferrule	690	63	FR22GC69V63	X220912
MP75A4R	MP75A5R	22x58mm ferrule	690	100	FR22GC69V100	W220911
MP105A4	MP105A5	Size 30 square body fuse	690	160	PC30UD69V160EF	M300092
MP155A4	MP155A5	Size 30 square body fuse	690	200	PC30UD69V200EF	N300093
MP210A4	MP210A5	Size 30 square body fuse	690	315	PC30UD69V315EF	Q300095
MP105A4R	MP105A5R	Size 70 square body fuse	1250	160	PC70UD13C160EF	T300604
MP155A4R	MP155A5R	Size 70 square body fuse	1250	200	PC70UD13C200EF	V300605
MP210A4R	MP210A5R	Size 70 square body fuse	1250	280	PC70UD12C280EF	L300712

Table 4-9 Ferraz Shawmut branch circuit protection fusing for 480V and 575V size 1 drives

Model		Fuse type	Rating Vac	Rating A	gG Catalogue number	Ref number	UL Class J alternative
Auxiliary		21x57mm cylindrical	600	10			AJT10
MP25A4	MP25A5	22x58mm ferrule	690	25	FR22GG69V25	N212072	AJT30
MP45A4	MP45A5	22x58mm ferrule	690	50	FR22GG69V50	P214626	AJT45
MP75A5	MP75A5	22x58mm ferrule	690	80	FR22GG69V80	Q217180	AJT70
MP25A4R	MP25A5R	22x58mm ferrule	690	25	FR22GG69V25	N212072	AJT30
MP45A4R	MP45A5R	22x58mm ferrule	690	50	FR22GG69V50	P214626	AJT45
MP75A4R	MP75A5R	22x58mm ferrule	690	80	FR22GG69V80	Q217180	AJT70
MP105A4	MP105A5	NH 00 knife blade	690	100	NH00GG69V100	B228460	AJT125
MP155A4	MP155A5	NH 1 knife blade	690	160	NH1GG69V160	F228487	AJT175
MP210A4	MP210A5	NH 1 knife blade	690	200	NH1GG69V200	G228488	AJT225
MP105A4R	MP105A5R	NH 00 knife blade	690	100	NH00GG69V100	B228460	AJT125
MP155A4R	MP155A5R	NH 1 knife blade	690	160	NH1GG69V160	F228487	AJT175
MP210A4R	MP210A5R	NH 1 knife blade	690	200	NH1GG69V200	G228488	AJT225

Table 4-10 Ferraz Shawmut DC protection fusing for 480V and 575V Size 1 drives

Model		Fuse Type	Rating Vdc	Rating A	Catalogue Number	Ref Number	Configuration
MP25A4R	MP25A5R	20x127mm cylindrical	1000	32	FD20GB100V32T	F089498	Single fuse
MP45A4R	MP45A5R	36x127mm cylindrical	1000	80	FD36GC100V80T	A083651	Single fuse
MP75A4R	MP75A5R	20x127mm cylindrical	1000	63	FD20GC100V63T	F083656	2 in parallel
MP105A4R	MP105A5R	Size 120 square body	750	160	D120GC75V160TF	R085253	Single fuse
MP155A4R	MP155A5R	Size 121 square body	750	250	D121GC75V250TF	Q085252	Single fuse
MP210A4R	MP210A5R	Size 122 square body	750	315	D122GC75V315TF	M085249	Single fuse

4.5.2 Alternative fusing

Cooper Bussmann or Siba fuses are an acceptable alternative (refer to the *User Guide* for more details).

4.5.3 Internal auxiliary fuses

The internal auxiliary fuses provide protection to the field controller. The fuses can rupture if there is a fault in the field circuit. The user should check the internal auxiliary fuses if the drive is tripping field loss (FdL) and the field controller is enabled.

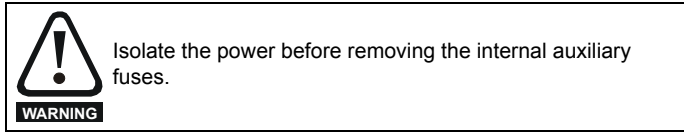
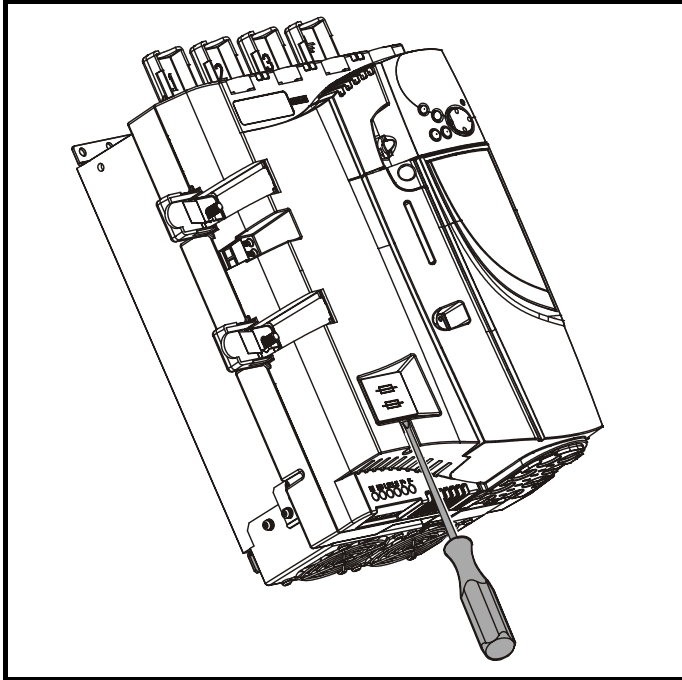


Figure 4-3 Removing the internal auxiliary fuses



Insert the screwdriver into the groove as shown above and lever downwards to remove the fuse cover. Refer to section 4.5.1 for fuse types.

4.6 Shield connections

These instructions must be followed to ensure suppression of radio-frequency emission and good noise immunity in the encoder circuit. It is recommended that the instructions for the connection of the encoder cable be followed closely and, to use the grounding bracket and grounding clamp supplied with the drive, to terminate the shields at the drive.

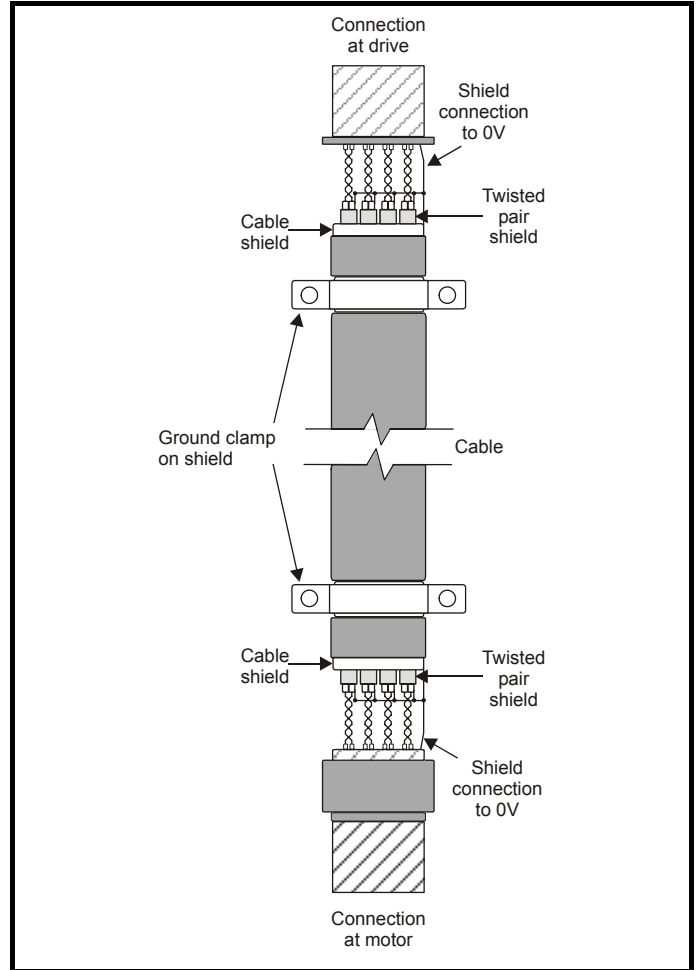
4.6.1 Motor cables

Use of a motor cable with an overall shield for the armature and field circuits may be needed if there is a critical EMC emissions requirement. Connect the shield of the motor cable to the ground terminal of the motor frame using a link that is as short as possible and not exceeding 50mm (2in) long. A full 360° termination of the shield to the terminal housing of the motor is beneficial.

4.6.2 Encoder cable

To get the best results from shielding use cable with an overall shield and separate shields on individual twisted pairs. Connect the cable as illustrated in Figure 4-4. Assemble and clamp the overall shield to the grounded metallic surfaces at the encoder and at the drive ends of the cable.

Figure 4-4 Shielded cable assembly



4.6.3 Control cables

It is recommended that signal cables should be shielded. This is essential for encoder cables, and strongly recommended for analog signal cables. For digital signals it is not necessary to use shielded cables within a panel, but this is recommended for external circuits, especially for inputs where a momentary signal causes a change of state (i.e. latching inputs).

4.7 Control connections

Refer to Figure 4-5 to understand the connection of the different power connections.



If the control circuits are to be connected to other circuits classified as Safety Extra Low Voltage (SELV) (e.g. to a personal computer), an additional isolating barrier must be included in order to maintain the SELV classification.



If any of the digital inputs (including the drive enable input) are connected in parallel with an inductive load (i.e. contactor or motor brake) then suitable suppression (i.e. diode or varistor) should be used on the coil of the load. If no suppression is used then over voltage spikes can cause damage to the digital inputs on the drive.



The control circuits are isolated from the power circuits in the drive by basic insulation (single insulation) only. The installer must ensure that the external control circuits are insulated from human contact by at least one layer of insulation (supplementary insulation) rated for use at the AC supply voltage.



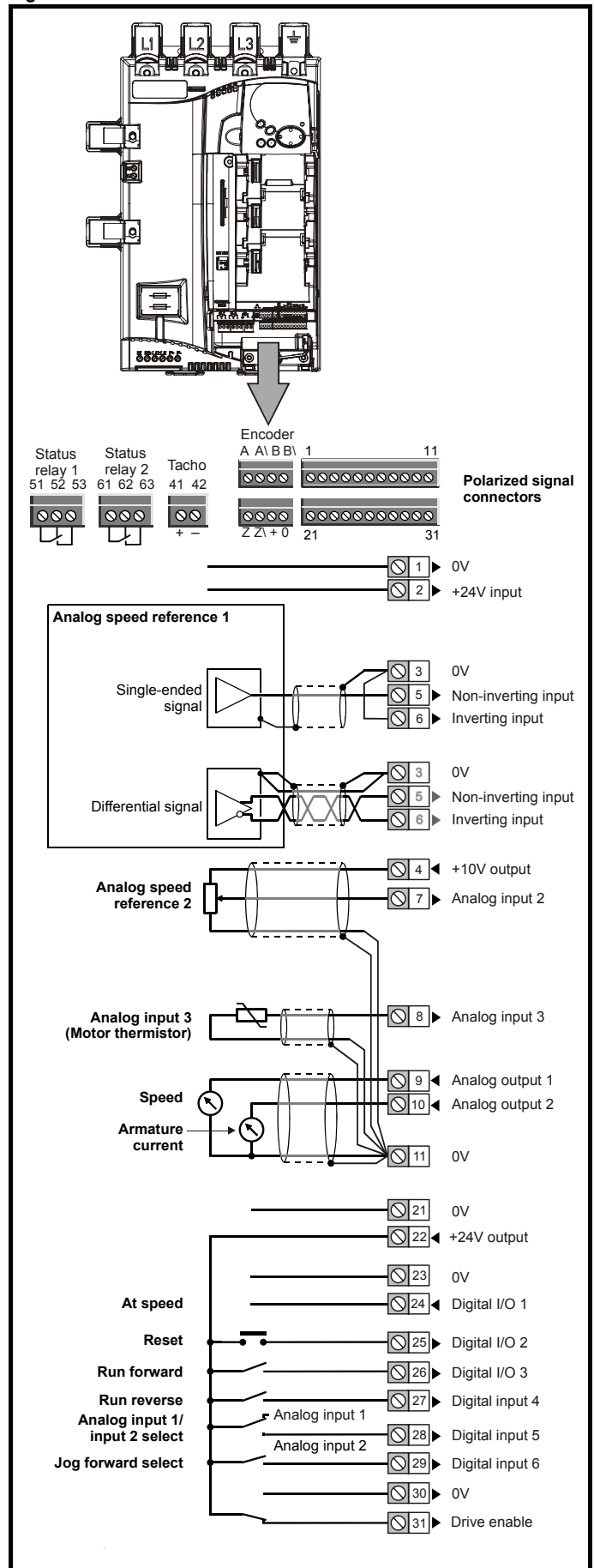
Status relay contacts are over-voltage category II.



A fuse or other over-current protection should be installed to the relay circuit.

For the full terminal descriptions, refer to the *User Guide*.

Figure 4-5 Default terminal functions



4.7.1 Serial communications connections

The Mentor MP has a serial communications port (serial port) as standard supporting two wire EIA485 communications.

Figure 4-11 Serial communications port

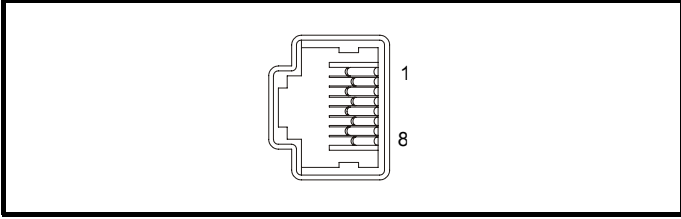


Table 4-6 RJ45 connections

Pin	Function
1	120Ω Termination resistor
2	RX TX
3	0V isolated
4	+24V (100 mA)
5	0V isolated
6	TX enable
7	RX\ TX\
8	RX\ TX\ (if termination resistors are required, link to pin 1)
Shell	0V isolated

The communications port applies a two-unit load to the communications network. Connectors 2, 3, 7 and shield must always be made to the serial communications port. Shielded cable must be used at all times.



In order to meet the requirements for SELV in IEC60950 (IT equipment) it is necessary for the control computer to be grounded. Alternatively, when a lap-top or similar device is used which has no provision for grounding, an isolation device must be incorporated in the communications lead.

5 Getting started

This chapter introduces the user interfaces, menu structure and security level of the drive.

5.1 Understanding the display

There are two types of keypad available for the Mentor MP. The SM-Keypad has an LED display, and the MP-Keypad has an LCD display.

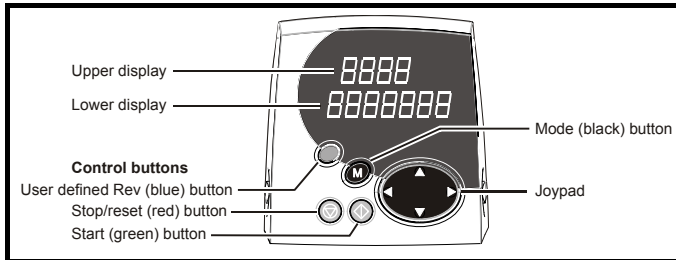
5.1.1 SM-Keypad (LED)

The display consists of two horizontal rows of 7 segment LED displays.

The upper display shows the drive status or the current menu and parameter number being viewed.

The lower display shows the parameter value or the specific trip type.

Figure 5-1 SM-Keypad



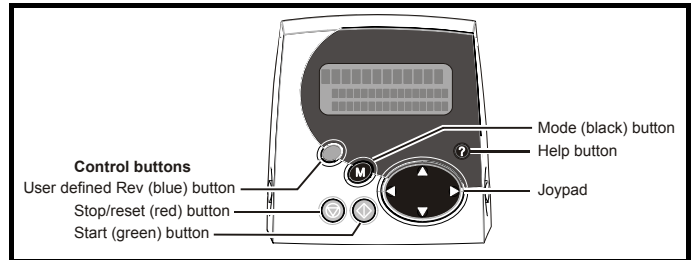
5.1.2 MP-Keypad (LCD)

The display consists of three lines of text.


The top line shows the drive status or the current menu and parameter number being viewed on the left, and the parameter value or the specific trip type on the right.

The lower two lines show the parameter name or the help text.

Figure 5-2 MP-Keypad



NOTE

The red stop  button is also used to reset the drive.

5.2 Keypad operation

Control buttons

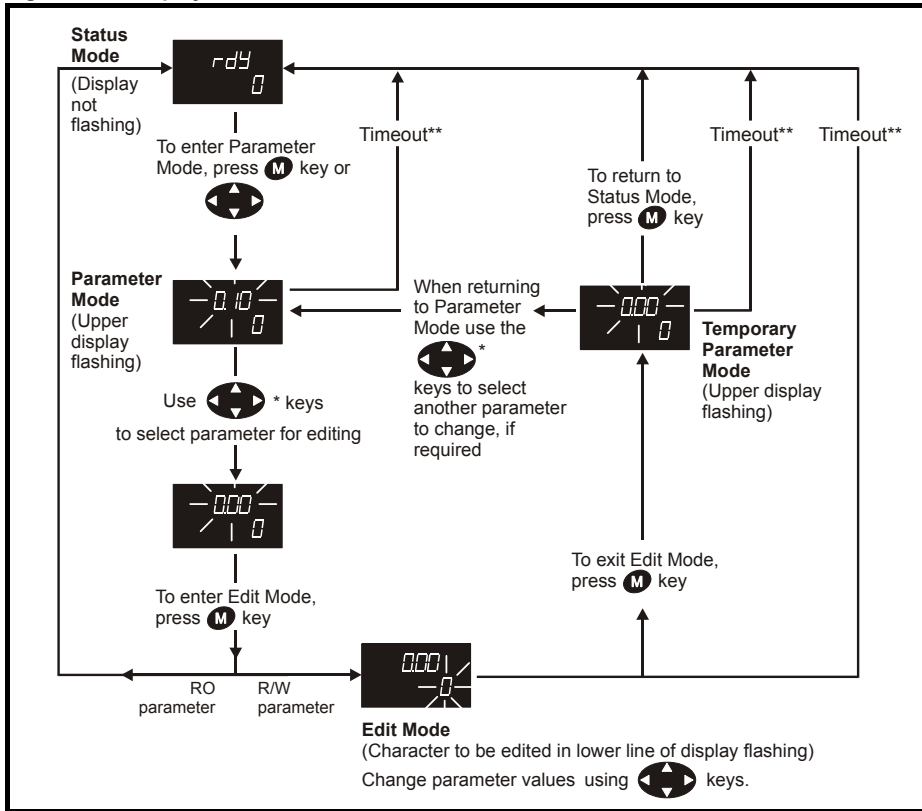
The keypad consists of:

1. Joypad - used to navigate the parameter structure and change parameter values.
2. Mode button - used to change between the display modes – parameter view, parameter edit, status.
3. Three control buttons - used to control the drive if keypad mode is selected. Refer to the *User Guide* for further information.
4. Help button (MP-Keypad only) - displays text briefly describing the selected parameter.

The Help button toggles between other display modes and parameter help mode. The up and down functions on the joypad scroll the help text to allow the whole string to be viewed. The right and left functions on the joypad have no function when help text is being viewed.

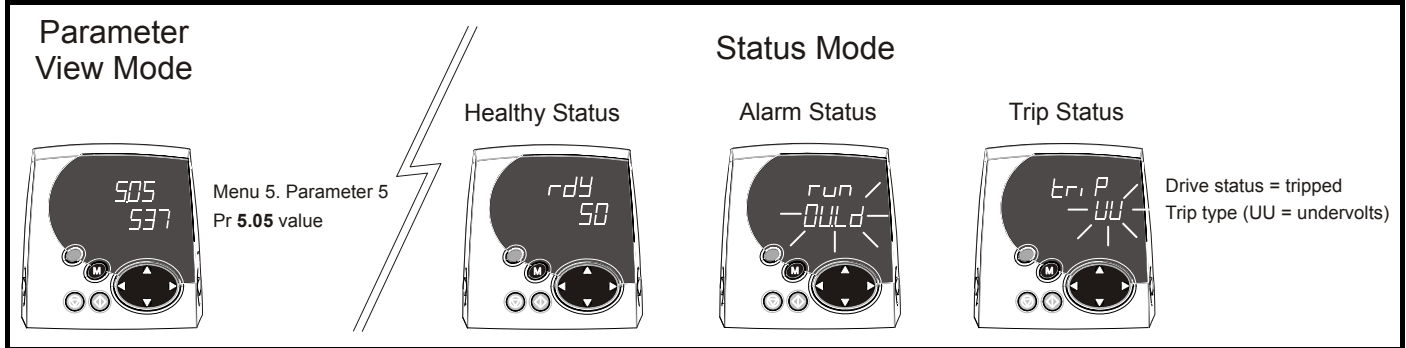
The display examples in this section show the SM-Keypad, seven segment, LED display. The examples are the same for the MP-Keypad, The exceptions is that the information displayed on the lower row on the SM-Keypad is displayed on the right hand side of the top row on the MP-Keypad.

Figure 5-3 Display modes



* can only be used to move between menus if L2 access has been enabled (SE14)
 **Time-out defined by Pr 11.41 (default value = 240s).

Figure 5-4 Mode examples



Do not change parameter values without careful consideration; incorrect values may cause damage or a safety hazard.
WARNING

NOTE
 When changing the values of parameters, make a note of the new values in case they need to be entered again.

NOTE
 For new parameter-values to apply after the AC supply to the drive is interrupted, new values must be saved (section 5.8 *Saving parameters* on page 32).

5.3 Menu 0 (sub block)

Menu 0 can be accessed by 2 methods:

1. **SE14** = 0. Sub block mode.
2. **SE14** <>0. Linear mode.

Menu 23 contains the parameters to allow menu 0 to be customized in sub block mode. The first sub block is a user defined area (USER) which is configured by the parameters in menu 22. As default there are no parameters configured to the user sub block and so it is empty. The next 7 sub blocks are pre-defined. Access to the pre-defined blocks is enabled or disabled by Pr 23.03 to Pr 23.09.

Movement between sub blocks is achieved with the left and right keys.

Pr 23.01 contains all the sub block headers.

Table 5-1 and Figure 5-5 show the result of the direction keys when **SE14** is set to L1 (0). When **SE14** is not 0 the left and right keys will allow access to the advance parameter set and menu 0 will become a linear menu.

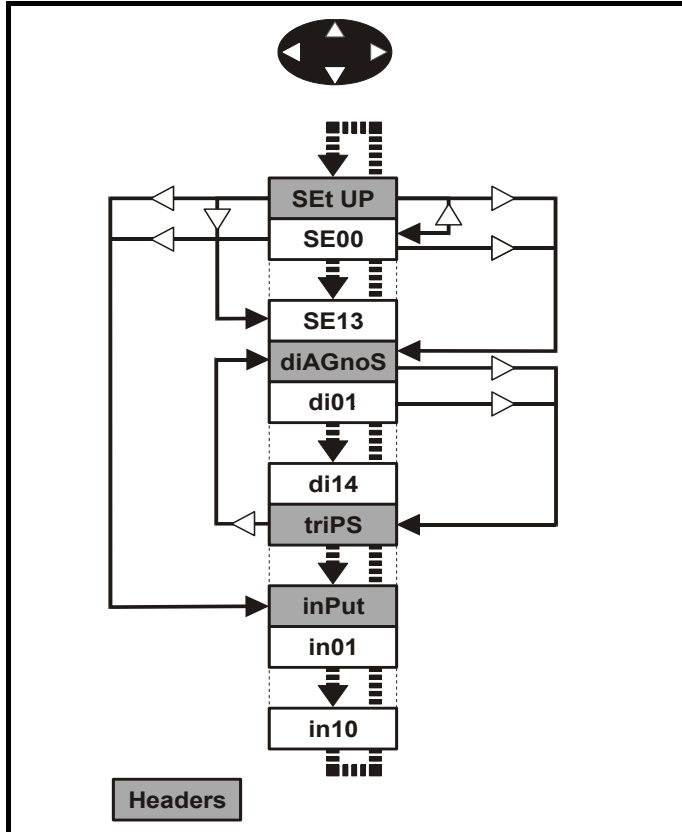
Table 5-1 Keypad navigation

Starting location	Action	Finishing location
Header	Right	Next header
	Left	Previous header
	Up	First parameter in header block
	Down	Last parameter in header block
Parameter	Right	Next header
	Left	Previous header
	Up	Next parameter in header block
	Down	Previous parameter in header block

When moving to the user block header, the user block header is only displayed if there are some valid parameters in the block. When moving between pre-defined header blocks the pre define header block is only displayed if the pre defined block is enabled.

When moving between parameters within a block, only valid parameters are displayed.

Figure 5-5 Sub block navigation



Coding

The coding defines the attributes of the parameter as follows.

Coding	Attribute
Bit	1 bit parameter
SP	Spare: not used
FI	Filtered: some parameters which can have rapidly changing values are filtered when displayed on the drive keypad for easy viewing.
DE	Destination pointer parameter: This parameter can be used to set up the location (i.e. menu/parameter number) where the destination data is to be routed.
Txt	Text: the parameter uses text strings instead of numbers.
VM	Variable maximum: the maximum of this parameter can vary.
DP	Decimal place: indicates the number of decimal places used by this parameter.
ND	No default: when defaults are loaded (except when the drive is manufactured or on EEPROM failure) this parameter is not modified.
RA	Rating dependant: this parameter is likely to have different values and ranges with drives of different voltage and current ratings. Parameters with this attribute will not be transferred to the destination drive by a SMART card when the rating of the destination drive is different from the source drive if the drive voltage ratings are different or the file is a parameter file. However, the value will be transferred if only the current rating is different and the file is a differences from default type file.
NC	Not cloned: not transferred to or from smart cards during cloning.
NV	Not visible: not visible on the keypad.
PT	Protected: cannot be used as a destination.
US	User save: saved in drive EEPROM when the user initiates a parameter save.
RW	Read/write: can be written by the user.
BU	Bit default one/unsigned: Bit parameters with this flag set to one have a default of one (all other bit parameters have a default of zero. Non-bit parameters are unipolar if this flag is one.
PS	Power-down save: automatically saved in drive EEPROM on UU trip.

23.01		Sub block headers	
RO	Txt	NC	BU
⇕	USER (0), SEt UP (1), diAGnoS (2), triPS (3), SP LOOP (4), Fb SP (5), SintEr (6), inPut (7)	⇒	USER (0)

Defines the sub block headers. Can be used by the MP-Keypad to display the same strings as the SM-Keypad.

23.02	OR of pre-defined sub block enables							
RO		NC				PT		BU
⇅	0 to 127				⇒	0		

The OR of Pr 23.03 to Pr 23.09. To be used by the MP-Keypad.

Parameter	Value
23.03	1
23.04	2
23.05	4
23.06	8
23.07	16
23.08	32
23.09	64

23.03 - 23.09	Pre-defined sub block enable							
RW	Bit						US	BU
⇅	0 to 1				⇒	1		

When this parameter is set to 1 the associated pre defined sub block is accessible. When this parameter is 0 the associated pre defined block is bypassed.

Parameter	Description	Display
23.03	Set up	SEt UP
23.04	Diagnostic	diAGnoS
23.05	Trips	triPS
23.06	Speed loop	SP LOOP
23.07	Speed feedback	Fb SP
23.08	Serial interface	SintEr
23.09	IO	InPut

5.4 Pre defined sub blocks

Menu 0	Parameter	Description	Display
00.01 to 00.20		Configured by Pr 22.01 to Pr 22.20	

Set-up

Menu 0	Parameter	Description	Display
00.21	1.00	Parameter 0	SE00
00.22	1.07	Minimum reference clamp	SE01
00.23	1.06	Maximum reference clamp	SE02
00.24	2.11	Acceleration rate	SE03
00.25	2.21	Deceleration rate	SE04
00.26	1.14	Reference selector	SE05
00.27	5.09	Armature rated voltage	SE06
00.28	5.07	Motor rated current	SE07
00.29	5.08	Base speed	SE08
00.30	11.42	Parameter cloning	SE09
00.31	5.70	Rated field current	SE10
00.32	5.73	Rated field voltage	SE11
00.33	5.77	Enable field control	SE12
00.34	5.12	Autotune	SE13
00.35	11.44	Security status	SE14

Diagnostic

Menu 0	Parameter	Description	Display
00.36	1.01	Speed reference selected	di01
00.37	1.03	Pre-ramp reference	di02
00.38	2.01	Post ramp reference	di03
00.39	3.01	Final speed reference	di04
00.40	3.02	Speed feedback	di05
00.41	3.04	Speed controller output	di06
00.42	4.03	Torque demand	di07
00.43	4.01	Current Magnitude	di08
00.44	5.56	Field current feedback	di09
00.45	5.02	Armature voltage	di10
00.46	1.11	Reference enabled indicator	di11
00.47	1.12	Reverse selected indicator	di12
00.48	1.13	Jog selected indicator	di13
00.49	11.29	Software version	di14
00.50	0.00	Spare	

Trips

Menu 0	Parameter	Description	Display
00.51	10.20	Trip 0	tr01
00.52	10.21	Trip 1	tr02
00.53	10.22	Trip 2	tr03
00.54	10.23	Trip 3	tr04
00.55	10.24	Trip 4	tr05
00.56	10.25	Trip 5	tr06
00.57	10.26	Trip 6	tr07
00.58	10.27	Trip 7	tr08
00.59	10.28	Trip 8	tr09
00.60	10.29	Trip 9	tr10

Speed loop

Menu 0	Parameter	Description	Display
00.61	3.10	Speed controller proportional gain	SP01
00.62	3.11	Speed controller integral gain	SP02
00.63	3.12	Speed controller differential feedback gain	SP03
00.64	0.00	Spare	
00.65	0.00	Spare	

Serial interface

Menu 0	Parameter	Description	Display
00.66	11.25	Baud rate	Si01
00.67	11.23	Serial address	Si02
00.68	0.00	Spare	
00.69	0.00	Spare	
00.70	0.00	Spare	

Speed feedback

Menu 0	Parameter	Description	Display
00.71	3.26	Speed feedback selector	Fb01
00.72	3.51	Tachometer rating (V/1000rpm)	Fb02
00.73	3.53	Tachometer input mode	Fb03
00.74	3.52	Tachometer speed feedback	Fb04
00.75	3.34	Drive encoder lines per revolution	Fb05
00.76	3.36	Encoder supply	Fb06
00.77	3.38	Encoder type	Fb07
00.78	3.39	Encoder termination select	Fb08
00.79	3.27	Encoder speed feedback	Fb09
00.80	0.00	Spare	

IO

Menu 0	Parameter	Description	Display
00.81	7.15	Analog input 3 mode	in01
00.82	7.01	Analog input 1	in02
00.83	7.02	Analog input 2	in03
00.84	7.03	Analog input 3	in04
00.85	8.01	I/O state 1	in05
00.86	8.02	I/O state 2	in06
00.87	8.03	I/O state 3	in07
00.88	8.04	I state 4	in08
00.89	8.05	I state 5	in09
00.90	8.06	I state 6	in10

For more information on the sub block function please refer to the *Mentor MP Advanced User Guide*.

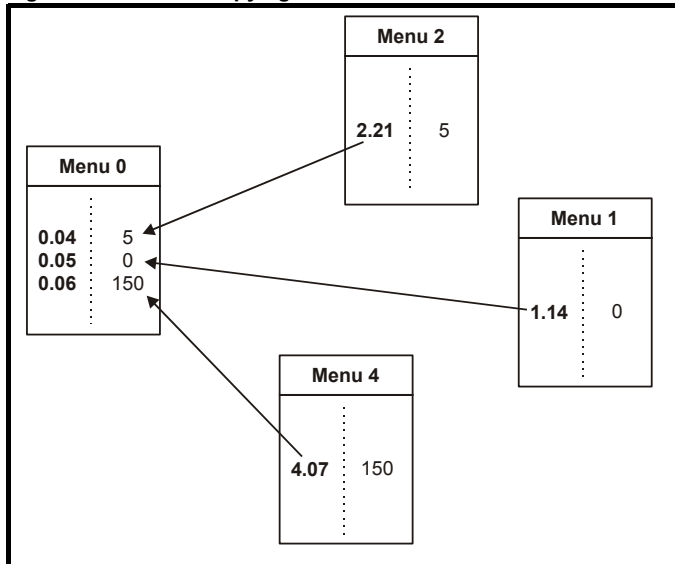
5.5 Menu 0 (linear)

Menu 0 is used to bring together various commonly used parameters for basic easy set up of the drive.

Appropriate parameters are copied from the advanced menus into menu 0 and thus exist in both locations.

For further information, refer to section 5.3 *Menu 0 (sub block)* on page 29.

Figure 5-6 Menu 0 copying



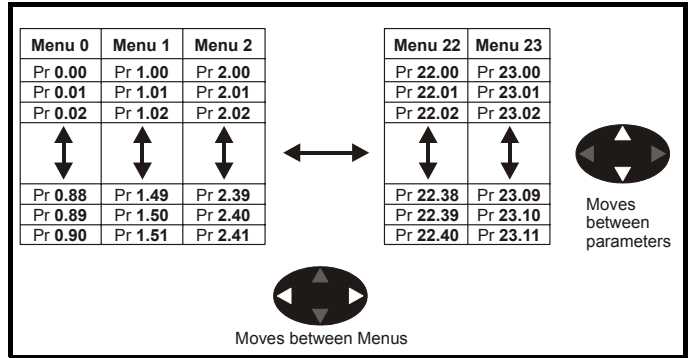
5.6 Menu structure

The drive parameter structure consists of menus and parameters.

The drive initially powers up in sub menu mode. Once Level 2 access (L2) has been enabled (refer to **SE14**) the left and right buttons are used to navigate between numbered menus.

For further information, refer to section 5.12 *Parameter access level and security* on page 33.

Figure 5-7 Menu structure



The menus and parameters roll over in both directions.

For example:

- If the last parameter is displayed, a further press will cause the display to rollover and show the first parameter.
- When changing between menus the drive remembers which parameter was last viewed in a particular menu and will display that parameter. The menus and parameters roll over in both directions.

5.7 Advanced menus

The advanced menus consist of groups of parameters appropriate to a specific function or feature of the drive. Menus 0 to 23 can be viewed on both keypads. Menus 40 and 41 are specific to the MP-Keypad (LCD). Menus 70 to 91 can be viewed with an MP-Keypad (LCD) only when an SM-Applications module is installed.

Table 5-2 Advanced menu descriptions

Menu	Description	LED	LCD
0	Commonly used basic set up parameters for quick / easy programming	✓	✓
1	Speed reference	✓	✓
2	Ramps	✓	✓
3	Speed feedback and speed control	✓	✓
4	Torque and current control	✓	✓
5	Motor control including field regulator	✓	✓
6	Sequencer and clock	✓	✓
7	Analog I/O	✓	✓
8	Digital I/O	✓	✓
9	Programmable logic, motorized pot and binary sum	✓	✓
10	Status and trips	✓	✓
11	General drive set-up	✓	✓
12	Threshold detectors and variable selectors	✓	✓
13	Position control	✓	✓
14	User PID controller	✓	✓
15	Solutions Module set-up	✓	✓
16	Solutions Module set-up	✓	✓
17	Solutions Module set-up	✓	✓
18	Application menu 1	✓	✓
19	Application menu 2	✓	✓
20	Application menu 3	✓	✓
21	Second motor parameters	✓	✓
22	Menu 0 set-up - user area	✓	✓
23	Menu 0 sub block control	✓	✓
40	Keypad configuration menu	X	✓
41	User filter menu	X	✓
70	PLC registers	X	✓
71	PLC registers	X	✓
72	PLC registers	X	✓
73	PLC registers	X	✓
74	PLC registers	X	✓
75	PLC registers	X	✓
85	Timer function parameters	X	✓
86	Digital I/O parameters	X	✓
88	Status parameters	X	✓
90	General parameters	X	✓
91	Fast access parameters	X	✓

Table 5-3 Menu 40 parameter descriptions

Parameter	Range(⇅)
40.00	Parameter 0 0 to 32767
40.01	Language selection English (0), Custom (1), French (2), German (3), Spanish (4), Italian (5)
40.02	Software version 999999
40.03	Save to flash Idle (0), Save (1), Restore (2), Default (3)
40.04	LCD contrast 0 to 31
40.05	Drive and attribute database upload was bypassed Updated (0), Bypass (1)
40.06	Browsing favourites control Normal (0), Filter (1)
40.07	Keypad security code 0 to 999
40.08	Communication channel selection Disable (0), Slot1 (1), Slot2 (2), Slot3 (3), Slave (4), Direct (5)
40.09	Hardware key code 0 to 999
40.10	Drive node ID (Address) 0 to 255
40.11	Flash ROM memory size 4Mbit (0), 8Mbit (1)
40.19	String database version number 0 to 999999
40.20	Shield saver strings and enable None (0), Default (1), User (2)
40.21	Shield saver interval 0 to 600
40.22	Turbo browse time interval 0 to 200ms

Table 5-4 Menu 41 parameter descriptions

Parameter	Range(⇅)
41.00	Parameter 0 0 to 32767
41.01 to 41.50	Browsing filter source F01 to F50 Pr 0.00 to Pr 22.99
41.51	Browsing favourites control Normal (0), Filter (1)

5.8 Saving parameters

When changing a parameter in Menu 0, the new value is saved when pressing the **M** Mode button to return to parameter view mode from parameter edit mode.

If parameters have been changed in the advanced menus, then the change will not be saved automatically. A save function must be carried out.

Procedure

- Enter SAVE in Pr **xx.00**
- Either:
 - Press the red reset button
 - Toggle the reset digital input, or
 - Carry out a drive reset through serial communications by setting Pr **10.38** to 100 (ensure that Pr **xx.00** returns to 0).

5.9 Restoring parameter defaults

Restoring parameter defaults by this method saves the default values in the drive's memory. (**SE14** and Pr **11.30** are not affected by this procedure).

Procedure

- Ensure the drive is not enabled, i.e. terminal 31 is open or Pr **6.15** is OFF (0)
- Select Eur or USA in Pr **xx.00**.
- Either:
 - Press the red reset button

- Toggle the reset digital input, or
- Carry out a drive reset through serial communications by setting Pr 10.38 to 100 (ensure that Pr. xx.00 returns to 0).

5.10 Displaying parameters with non-default values only

Select dIS.dEf in Pr xx.00, the only parameters that will be visible to the user will be those containing a non-default value. This function does not require a drive reset to become active. To deactivate this function, return to Pr xx.00 and enter a value of 0.

Please note that this function can be affected by the access level enabled. You must refer to section 5.12 *Parameter access level and security* for more information regarding access level.

5.11 Displaying destination parameters only

Select dIS.dEst in Pr xx.00, the only parameters that will be visible to the user will be destination parameters. This function does not require a drive reset to become active. To deactivate this function, return to Pr xx.00 and enter a value of 0.

Please note that this function can be affected by the access level enabled. You must refer to section 5.12 *Parameter access level and security* for further information regarding access levels.

5.12 Parameter access level and security

The parameter access levels determine whether the user has access to Menu 0 (in sub block mode) only or to all of the advanced menus (Menus 1 to 23), in addition to Menu 0 (in linear mode).

The user security determines whether the access to the user is read only or read write.

The user security and the parameter access level can operate independently of each other as shown in Table 5-5 .

Table 5-5 User security and parameter access levels

Parameter access level	User security	Menu 0 status	Advanced menus status
L1	Open	Sub block RW	Not visible
L1	Closed	Sub block RO	Not visible
L2	Open	Linear RW	RW
L2	Closed	Linear RO	RO

RW = Read / write access RO = Read only access

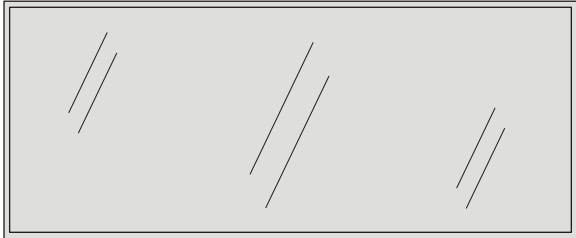
The default settings of the drive are parameter access level L1 and User Security Open, i.e. read / write access to Menu 0 with the advanced menus, not visible

5.12.1 User security

The user security, when set, prevents write access to any of the parameters (other than SE14 Access Level) in any menu.

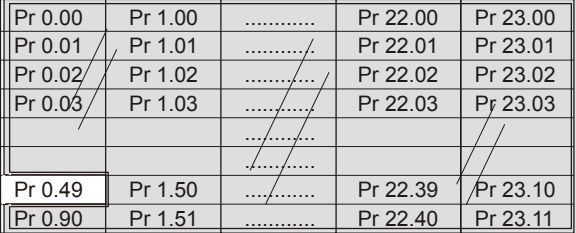
Figure 5-8 User security open

User security open - All parameters: Read / Write access



Pr 0.00	Pr 1.00	.....	Pr 22.00	Pr 23.00
Pr 0.01	Pr 1.01	.....	Pr 22.01	Pr 23.01
Pr 0.02	Pr 1.02	.....	Pr 22.02	Pr 23.02
Pr 0.03	Pr 1.03	.....	Pr 22.03	Pr 23.03
			
			
Pr 0.89	Pr 1.50	.....	Pr 22.39	Pr 23.10
Pr 0.90	Pr 1.51	.....	Pr 22.40	Pr 23.11

User security closed - All parameters: Read Only access (except SE14 and Pr 11.44)



Pr 0.00	Pr 1.00	.....	Pr 22.00	Pr 23.00
Pr 0.01	Pr 1.01	.....	Pr 22.01	Pr 23.01
Pr 0.02	Pr 1.02	.....	Pr 22.02	Pr 23.02
Pr 0.03	Pr 1.03	.....	Pr 22.03	Pr 23.03
			
			
Pr 0.49	Pr 1.50	.....	Pr 22.39	Pr 23.10
Pr 0.90	Pr 1.51	.....	Pr 22.40	Pr 23.11

5.12.2 Setting user security

Enter a value between 1 and 999 in Pr 11.30 and press the **M** button; the security code has now been set to this value. To activate the security, the access level must be set to Loc in SE14. When the drive is reset, the security code will have been activated and the drive returns to access level L1. The value of Pr 11.30 will return to 0 in order to hide the security code. At this point, the only parameter that can be changed by the user is the access level SE14.

5.12.3 Unlocking user security

Select a read write parameter to be edited and press the **M** button; the upper display will now show CodE.

Use the arrow buttons to set the security code and press the **M** button. With the correct security code entered, the display will revert to the parameter selected in edit mode. If an incorrect security code is entered the display will revert to parameter view mode.


To lock the user security again, set SE14 to Loc and press the **M** reset button.

5.12.4 Disabling user Security


Unlock the previously set security code as detailed above. Set Pr 11.30 to 0 and press the **M** button. The user security has now been disabled, and will not have to be unlocked each time the drive is powered up to allow read / write access to the parameters.

6 Running the motor



This chapter takes the new user through all the essential steps to running a motor for the first time, in each of the possible operating modes.

 Ensure that no damage or safety hazard could arise from the motor starting unexpectedly.


WARNING

 The values of the motor parameters affect the protection of the motor. The default values in the drive should not be relied upon. It is essential that the correct value is entered in **SE07 Motor rated current**. This affects the thermal protection of the motor.

CAUTION

 If the keypad mode has been used previously, ensure that the keypad reference has been set to 0 using the  buttons as if the drive is started using the keypad it will run to the speed defined by the keypad reference (Pr **0.35**).

CAUTION

 If the intended maximum speed affects the safety of the machinery, additional independent over-speed protection must be used.

WARNING




Table 6-1 Minimum control connection requirements for each control mode

Drive control method	Requirements
Terminal mode	Drive enable Speed reference Run forward or run reverse command
Keypad mode	Drive enable
Serial communications	Drive enable Serial communications link

Refer to Figure 4-1 *Minimum connections for 480V drive* on page 20 for minimum connections to get a motor running.

6.1 Quick start commissioning

Action	Detail	
Before power-up	<p>Ensure:</p> <ul style="list-style-type: none"> • Drive Enable signal is not given (terminal 31) • Run signal is not given • Motor connected • Tacho connected if one is being used • Encoder connected if one is being used 	
Power-up the drive	<p>Ensure:</p> <ul style="list-style-type: none"> • Drive displays 'inh' <p>If the drive trips, see Chapter 9 <i>Diagnostics</i> on page 67</p>	
Enter motor nameplate details	<p>Enter:</p> <ul style="list-style-type: none"> • Motor rated voltage in SE06 (V) • Motor rated current in SE07 (A) • Motor rated speed (base speed) in SE08 (rpm) • Field rated current in SE10 (A) • Field rated voltage in SE11 (V) 	
Set motor feedback parameters	<p>Incremental encoder basic set-up</p> <p>Enter:</p> <ul style="list-style-type: none"> • Drive encoder type in Fb07 = Ab (0): Quadrature encoder <div style="border: 1px solid black; padding: 5px; margin: 5px 0;"> <p>Setting the encoder voltage supply too high for the encoder could result in damage to the feedback device.</p> <p>CAUTION</p> </div> <ul style="list-style-type: none"> • Encoder power supply in Fb06 = 5V (0), 8V (1), 15V (2) or 24V (3) <p>NOTE If output voltage from the encoder is >5V, then the termination resistors must be disabled Fb08 to 0.</p> <ul style="list-style-type: none"> • Drive encoder lines per revolution (LPR) in Fb05 (set according to encoder) • Drive encoder termination resistor setting in Fb08 <ul style="list-style-type: none"> 0 = A-A\, B-B\, Z-Z\ termination resistors disabled 1 = A-A\, B-B\, termination resistors enabled, Z-Z\ termination resistors disabled 2 = A-A\, B-B\, Z-Z\ termination resistors enabled <p>Tachometer set-up</p> <p>Enter:</p> <ul style="list-style-type: none"> • Tachometer voltage rating Fb02 (V/1000 rpm) • Tachometer input mode Fb03 	
Set maximum speed	<p>Enter:</p> <ul style="list-style-type: none"> • Maximum speed in SE02 (rpm) 	
Set acceleration / deceleration rates	<p>Enter:</p> <ul style="list-style-type: none"> • Acceleration rate in SE03 (time to accelerate to maximum speed) • Deceleration rate in SE04 (time to decelerate from maximum speed) 	
Enable the field controller	<p>Field controller set-up</p> <p>To enable the internal field controller:</p> <ul style="list-style-type: none"> • Set SE12 = IntrnL <p>To enable the external field controller:</p> <ul style="list-style-type: none"> • Set SE12 = EtrnL 	
Static autotune	<p>Mentor MP is able to perform either a static, rotating or continuous autotune. The motor must be at a standstill before an autotune is enabled.</p> <p>Static autotune for current loop gains</p> <p>When this operation is performed the drive will perform an estimation of <i>Motor constant</i> (Pr 5.15), <i>Continuous proportional gain</i> (Pr 4.13), <i>Continuous integral gain</i> (Pr 4.14), <i>Discontinuous integral gain</i> (Pr 4.34), <i>Back EMF set point</i> (Pr 5.59), <i>Armature resistance</i> (Pr 5.61) and <i>Flux loop I gain</i> (Pr 5.72) with respect to the selected motor map and store the values.</p> <p>To perform a static autotune:</p> <ul style="list-style-type: none"> • Set SE13 = 1 • Close the Drive Enable signal (terminal 31). The drive will display 'rdY' • Close the run signal (terminal 26 or 27). The lower display will flash 'Auto' and 'tunE' alternatively, while the drive is performing the autotune • Remove the enable signal when the autotune has finished • Remove the run signal 	

Action	Detail	
Checking speed feedback	<ul style="list-style-type: none"> Close the enable signal. Close the run signal (terminal 26 or 27). Provide speed reference to run the drive up to a low speed, the drive will regulate its own estimated speed Check that the feedback device is functioning correctly by checking tacho input (Fb04) or encoder input (Fb09) <p>If tacho input is being used, any small error in tacho feedback (Fb04) can be trimmed out by adjusting Fb02 up or down.</p> <ul style="list-style-type: none"> When the feedback device being used is seen to be functioning correctly, stop the drive and select the correct feedback device using Fb01 <p>NOTE Because field current name plate values are normally for a cold field, the estimated speed will not be very accurate unless a rotating autotune is carried out. If reasonably accurate estimated speed, or reasonably accurate torque control is required in the field weakening range, a rotating autotune will be required to determine the motor flux characteristics (SE13 = 2)</p>	
Rotating autotune	<p>Mentor MP is able to perform either a static, rotating or continuous autotune. The motor must be at a standstill before an autotune is enabled.</p> <div style="border: 1px solid black; padding: 5px;">  <p>A rotating autotune will cause the motor to accelerate up to $\frac{1}{4}$ base speed in the direction selected regardless of the reference provided. Once complete the motor will coast to a stop. The enable signal must be removed before the drive can be made to run at the required reference. The drive can be stopped at any time by removing the run signal or removing the drive enable.</p> <p>WARNING</p> </div> <p>Rotating autotune for motor field flux set-up When selected the drive will determine the rated field current (SE10) for rated flux and the motor field winding saturation break-points (Pr 5.29), (Pr 5.30) by spinning the motor at 25% of its base speed (Pr 5.06) with respect to the selected motor map and store the values. To perform an autotune: <ul style="list-style-type: none"> Set SE13 = 2 for a rotating autotune Close the Drive Enable signal (terminal 31). The drive will display 'rdY' Close the run signal (terminal 26 or 27). The lower display will flash 'Auto' and 'tunE' alternatively, while the drive is performing the autotune Wait for the drive to display 'rdY' or 'inh' and for the motor to come to a standstill If the drive trips, see Chapter 9 <i>Diagnostics</i> on page 67. Remove the drive enable and run signal from the drive.</p> <p>Rotating autotune for speed loop set-up When selected the drive will calculate suitable values for the speed loop gains Kp (Pr 3.10), Ki (Pr 3.11), and Kd (Pr 3.12). To perform an autotune: <ul style="list-style-type: none"> Set SE13 = 3 for a rotating autotune Close the Drive Enable signal (terminal 31). The drive will display 'rdY' Close the run signal (terminal 26 or 27). The lower display will flash 'Auto' and 'tunE' alternatively, while the drive is performing the autotune Wait for the drive to display 'rdY' or 'inh' and for the motor to come to a standstill If the drive trips, see Chapter 9 <i>Diagnostics</i> on page 67. Remove the drive enable and run signal from the drive.</p>	
Save parameters	<p>Select SAVE in SE00</p> <p>Press the red  reset button or toggle the reset digital input (ensure Pr xx.00 returns to 0)</p>	
Run	<p>Drive is now ready to run</p> <ul style="list-style-type: none"> Close enable signal Close run signal Provide speed reference 	

7 SMARTCARD operation

7.1 Introduction

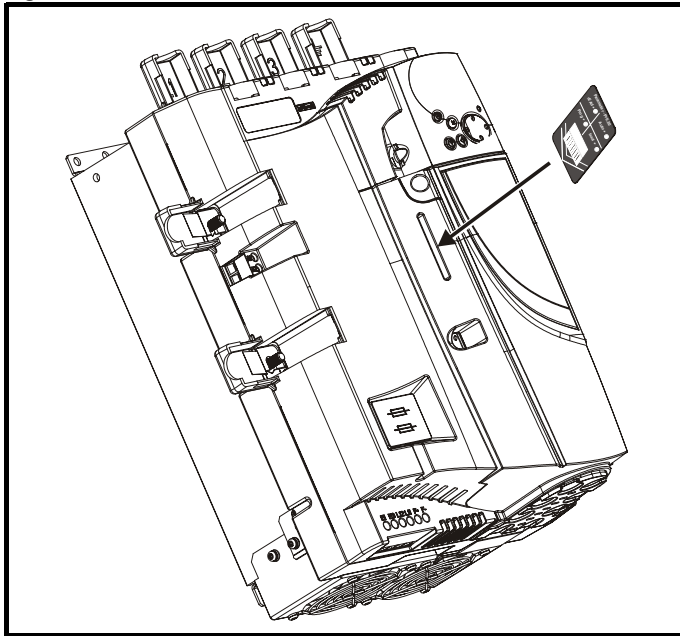
This is a standard feature that enables simple configuration of parameters in a variety of ways. The SMARTCARD can be used for:

- Parameter copying between drives
- Saving whole drive parameter sets
- Saving 'differences from default' parameter sets
- Storing Onboard PLC programs
- Automatically saving all user parameter changes for maintenance purposes
- Loading complete motor map parameters.

Refer to Figure 7-1 for installing the SMARTCARD. Ensure the SMARTCARD is inserted with the MP arrow pointing upwards.

The drive only communicates with the SMARTCARD when commanded to read or write, this means that the card may be 'hot swapped'.

Figure 7-1 Installation of the SMARTCARD



7.2 Easy saving and reading

The SMARTCARD has 999 individual data block locations. Each individual location from 1 to 499 can be used to store data.

The drive can support SMARTCARDS that have a capacity of between 4kB and 512kB.

The usage of the data block locations in the SMARTCARD are shown in Table 7-1.

Table 7-1 SMARTCARD data blocks

Data block	Type	Example of usage
1 to 499	Read / Write	Application Setup
500 to 599	Read Only	Macros

Parameter sets labelled as 'Differences from default' will be much smaller than whole parameter sets. Therefore they use a lot less memory because most applications only require a few parameters to be changed from the default setting.

Either of these indications will tell the user that data is being transferred to or from the SMARTCARD:

- SM-Keypad: The decimal point after the fourth digit in the upper display will flash.
- MP-Keypad: The symbol 'CC' will appear in the lower left hand corner of the display.

The card should not be removed during data transfer because the drive will trip. If a trip occurs you must either try to transfer the data again or, in the case of a card-to-drive transfer, the default parameters should be loaded.

7.3 Transferring data

When a code is entered into Pr **xx.00** and the drive is subsequently reset, the drive will carry out the actions listed in Table 7-2.

Table 7-2 Transferring data

Codes	Actions
Pr x.00 = rEAd 1	Transfer SMARTCARD data block 1 to the drive.
Pr x.00 = rEAd 2	Transfer SMARTCARD data block 2 to the drive.
Pr x.00 = rEAd 3	Transfer SMARTCARD data block 3 to the drive.
Pr x.00 = PrOg 1	Transfer drive parameters as difference from default to SMARTCARD data block number 1.
Pr x.00 = PrOg 2	Transfer drive parameters as difference from default to SMARTCARD data block number 2.
Pr x.00 = PrOg 3	Transfer drive parameters as difference from default to SMARTCARD data block number 3.
Pr x.00 = 2001	Transfer drive parameters as difference from defaults to a bootable SMARTCARD data block with block number 1. This will clear data block 1 on the card if it already exists.
Pr x.00 = 3yyy	Transfer drive parameters to a SMARTCARD data block number yyy.
Pr x.00 = 4yyy	Transfer drive data as difference from defaults to SMARTCARD data block number yyy.
Pr x.00 = 5yyy	Transfer drive user program to SMARTCARD data block number yyy.
Pr x.00 = 6yyy	Transfer SMARTCARD data block yyy to the drive.
Pr x.00 = 7yyy	Erase SMARTCARD data block yyy.
Pr x.00 = 8yyy	Compare drive parameters with data block yyy.
Pr x.00 = 9555	Clear SMARTCARD warning suppression flag.
Pr x.00 = 9666	Set SMARTCARD warning suppression flag.
Pr x.00 = 9777	Clear SMARTCARD read-only flag.
Pr x.00 = 9888	Set SMARTCARD read-only flag.
Pr x.00 = 9999	Erase SMARTCARD.
Pr 11.42 = Read	Transfer SMARTCARD data block 1 to the drive provided it is a parameter file.
Pr 11.42 = Prog	Transfer drive parameters to a SMARTCARD data block number 1.
Pr 11.42 = Auto	Transfer drive parameters to a SMARTCARD data block with data block number 1 provided.
Pr 11.42 = boot	Pr 11.42 has been changed since power-up.

Where yyy indicates the data block number 001 to 999, refer to Table 7-2 for restrictions on data block numbers.

NOTE

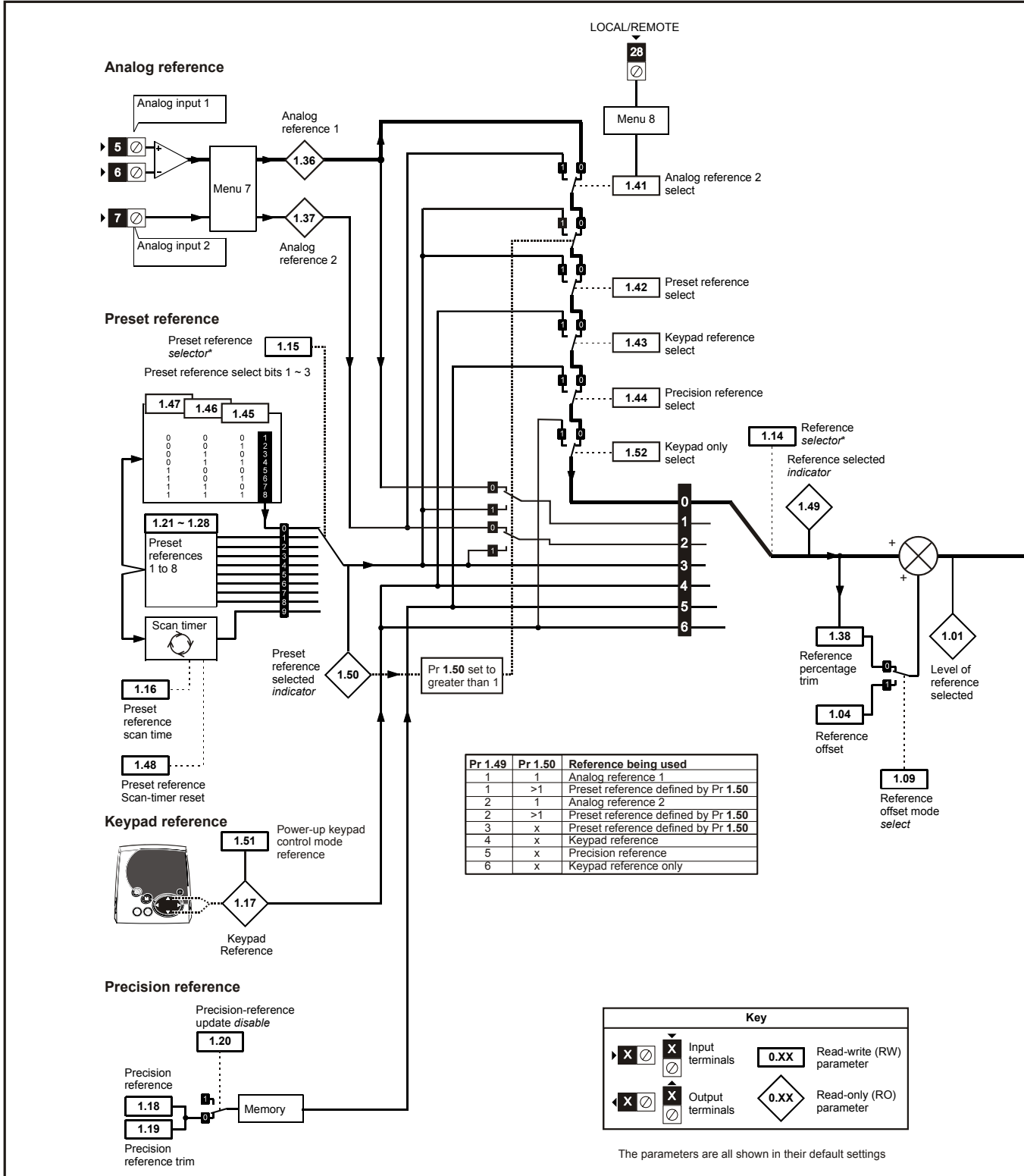
If the read only flag is set then only codes 6yyy or 9777 are effective.

8 Advanced parameters

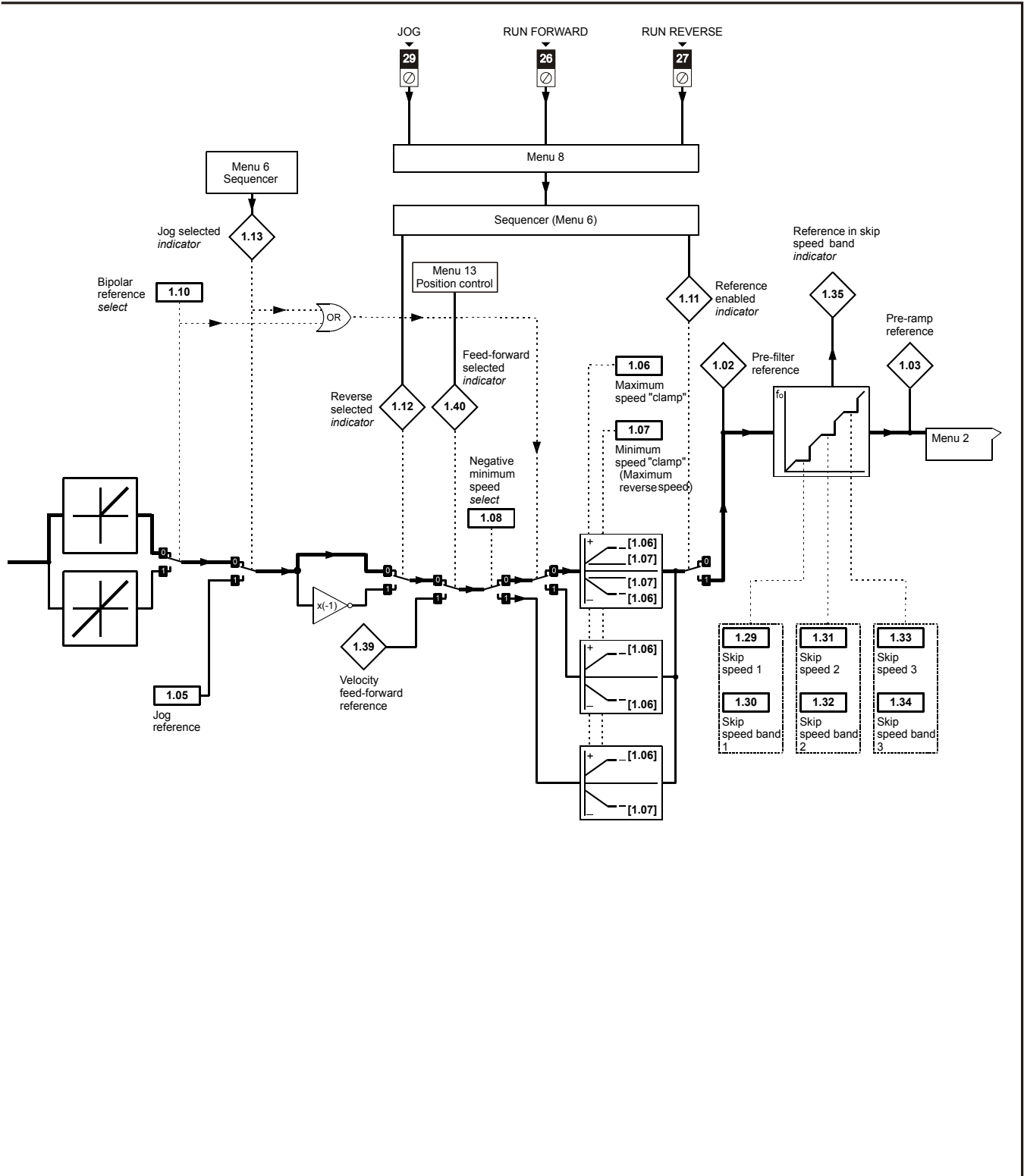
8.1 Menu 1: Speed reference

Menu 1 controls the main reference selection.

Figure 8-1 Menu 1 logic diagram



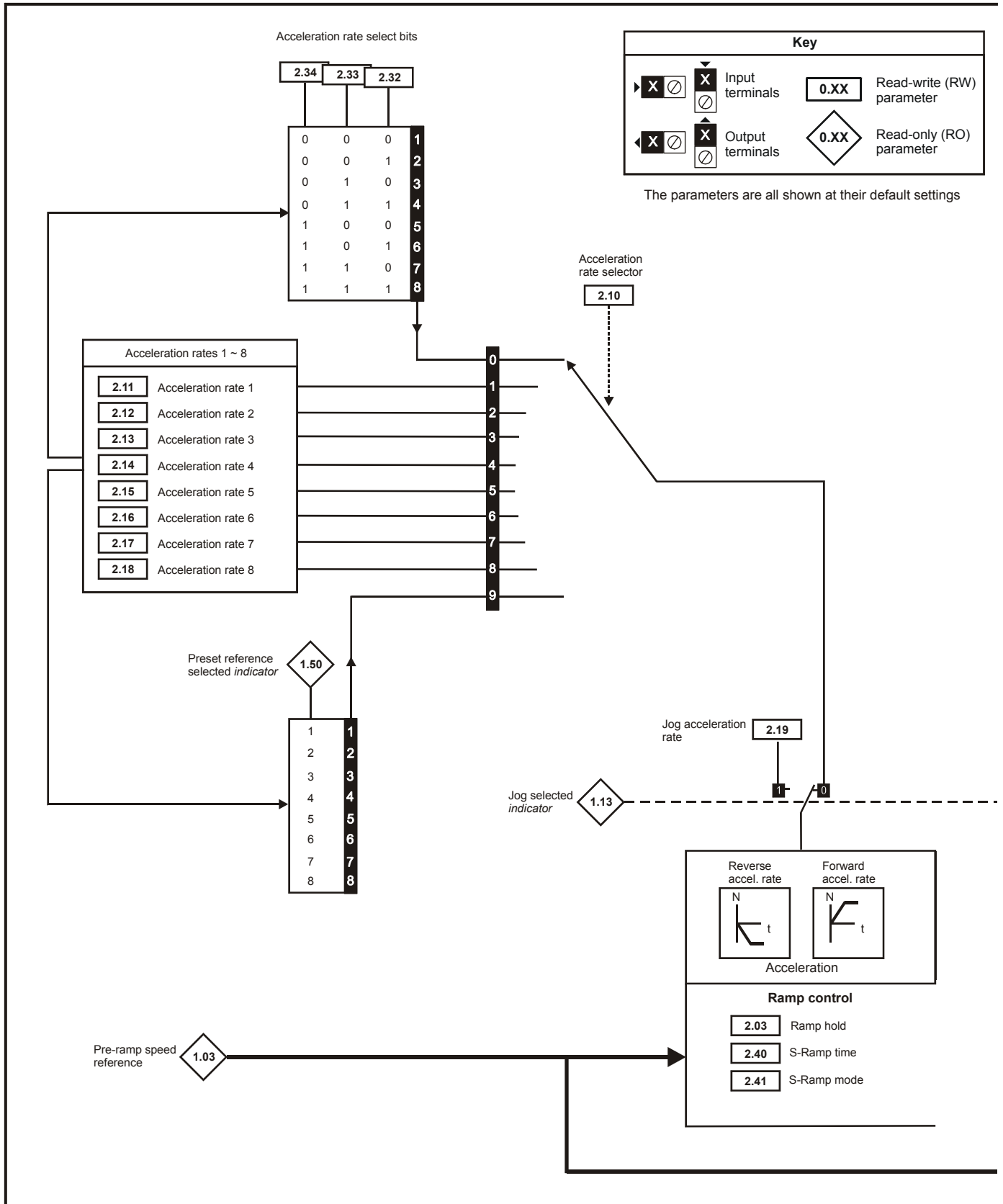
*Refer to Pr 1.14.

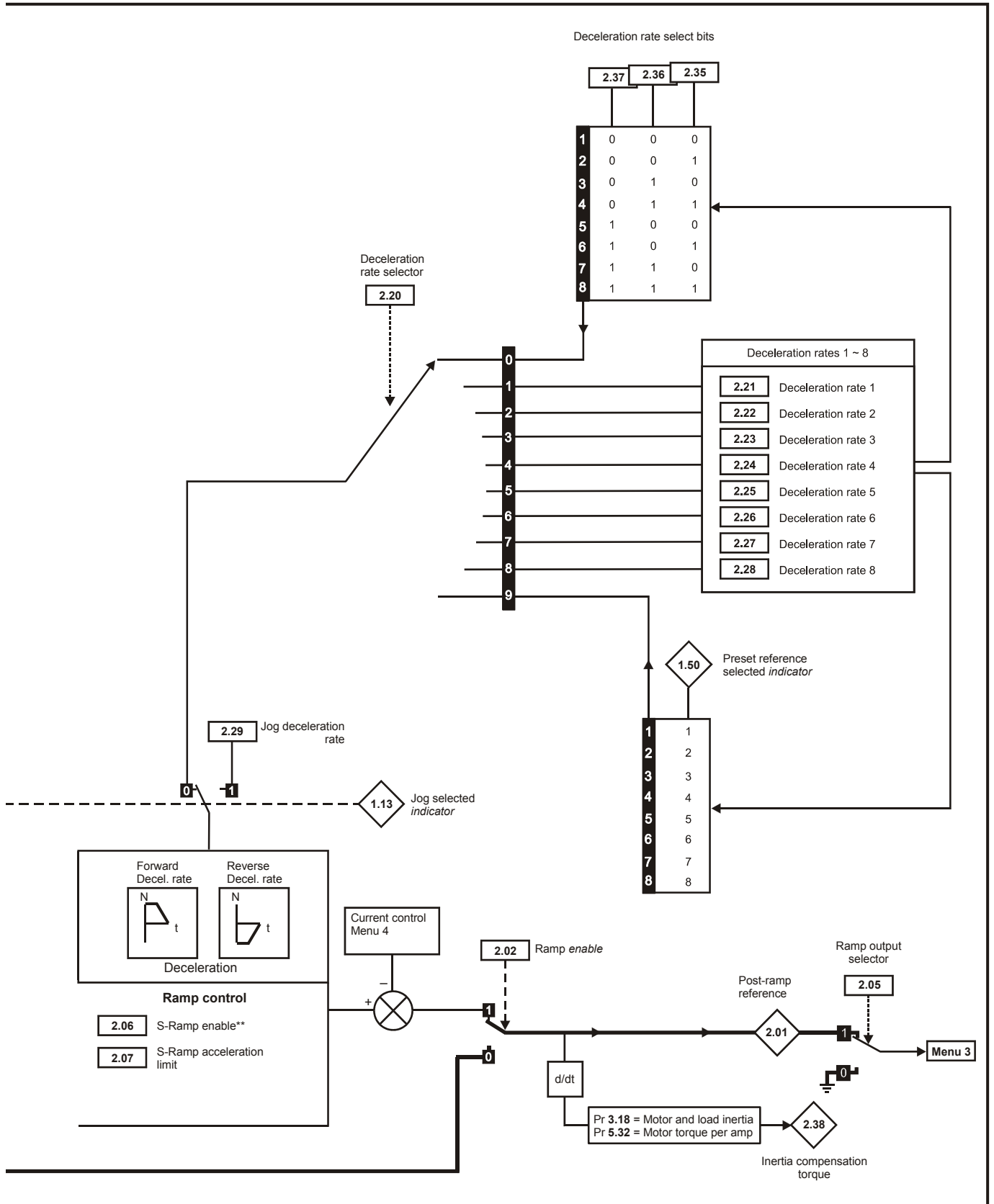


8.2 Menu 2: Ramps

The pre-ramp speed reference passes through the ramp block controlled by menu 2 before being used by the drive to produce input to the speed controller. The ramp block includes: linear ramps, and an S ramp function for ramped acceleration and deceleration.

Figure 8-2 Menu 2 logic diagram





* For more information refer to the *User Guide*.

8.3 Menu 3: Speed feedback and speed control

Speed accuracy and resolution

Digital reference resolution

When a preset speed is used the reference resolution is 0.1rpm. Improved resolution can be obtained by using the precision reference (0.001rpm).

Analog reference resolution

The analog input has a maximum resolution of 14bits plus sign. The resolution of the reference from analog inputs 2 or 3 is 10bits plus sign.

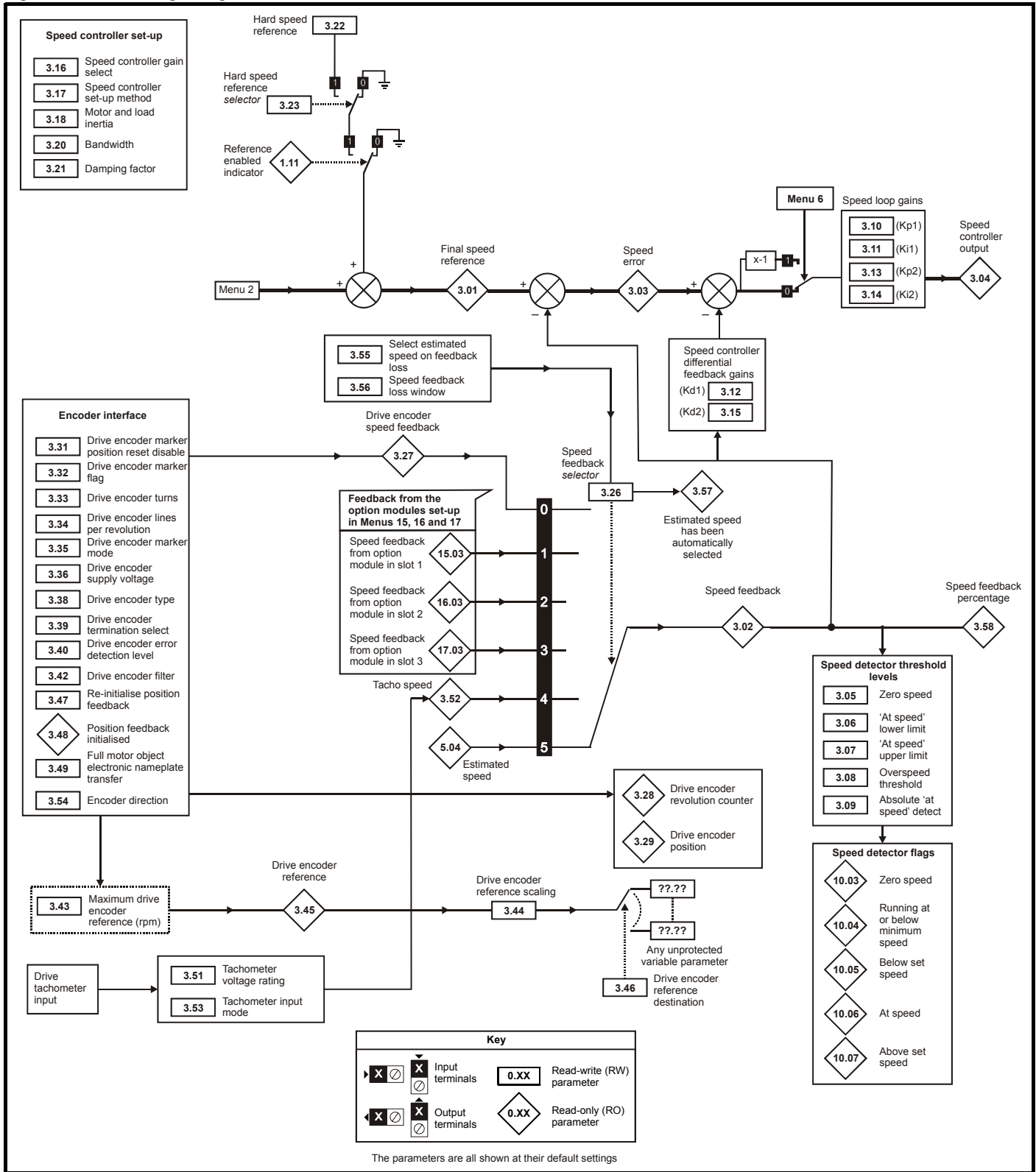
Analog feedback resolution

The resolution for both Armature voltage and tachogenerator feedback is 10bit plus sign.

Accuracy

With encoder feedback the absolute speed accuracy depends on the accuracy of the crystal used with the drive microprocessor. The accuracy of the crystal is 100ppm, and so the absolute speed accuracy is 100ppm (0.01%) of the reference, when a preset speed is used. If an analog input is used the absolute accuracy is further limited by the absolute accuracy and non-linearity of the analog input. If analog feedback is used the accuracy is even further limited.

Figure 8-3 Menu 3 logic diagram



8.4 Menu 4: Torque and current control

MOTOR1_CURRENT_LIMIT_MAX is used as the maximum for some parameters such as the user current limits. The current maximum current limit is defined as follows (with a maximum of 1000%):

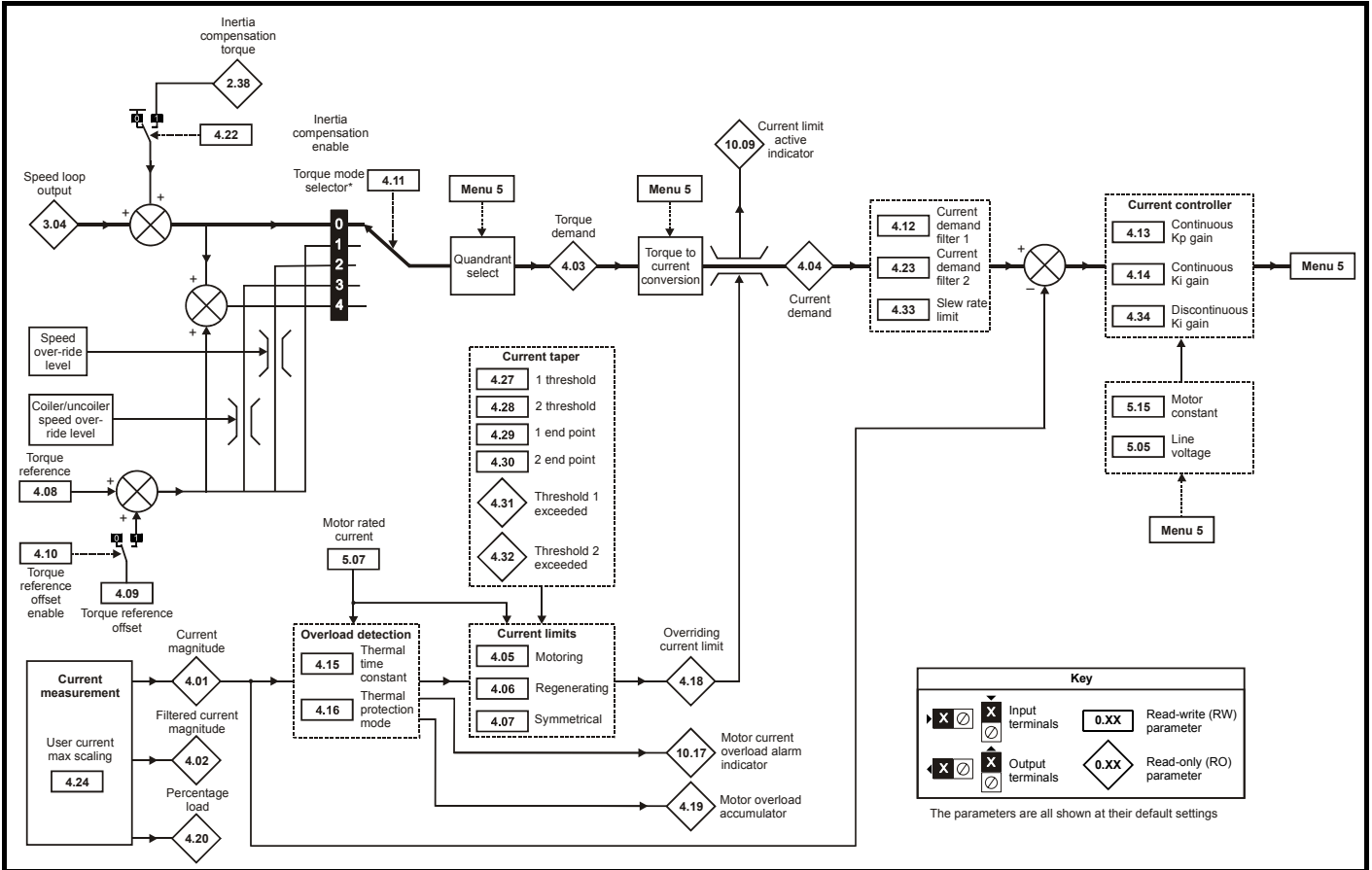
$$\text{CURRENT_LIMIT_MAX} = \left[\frac{\text{Maximum current}}{\text{Motor rated current}} \right] \times 100\%$$

Where:

Motor rated current is given by Pr 5.07

(MOTOR2_CURRENT_LIMIT_MAX is calculated from the motor map 2 parameters). The maximum current is 1.5 x drive rating.

Figure 8-4 Menu 4 logic diagram



8.5 Menu 5: Motor and field control

Figure 8-5 Menu 5 armature control logic diagram

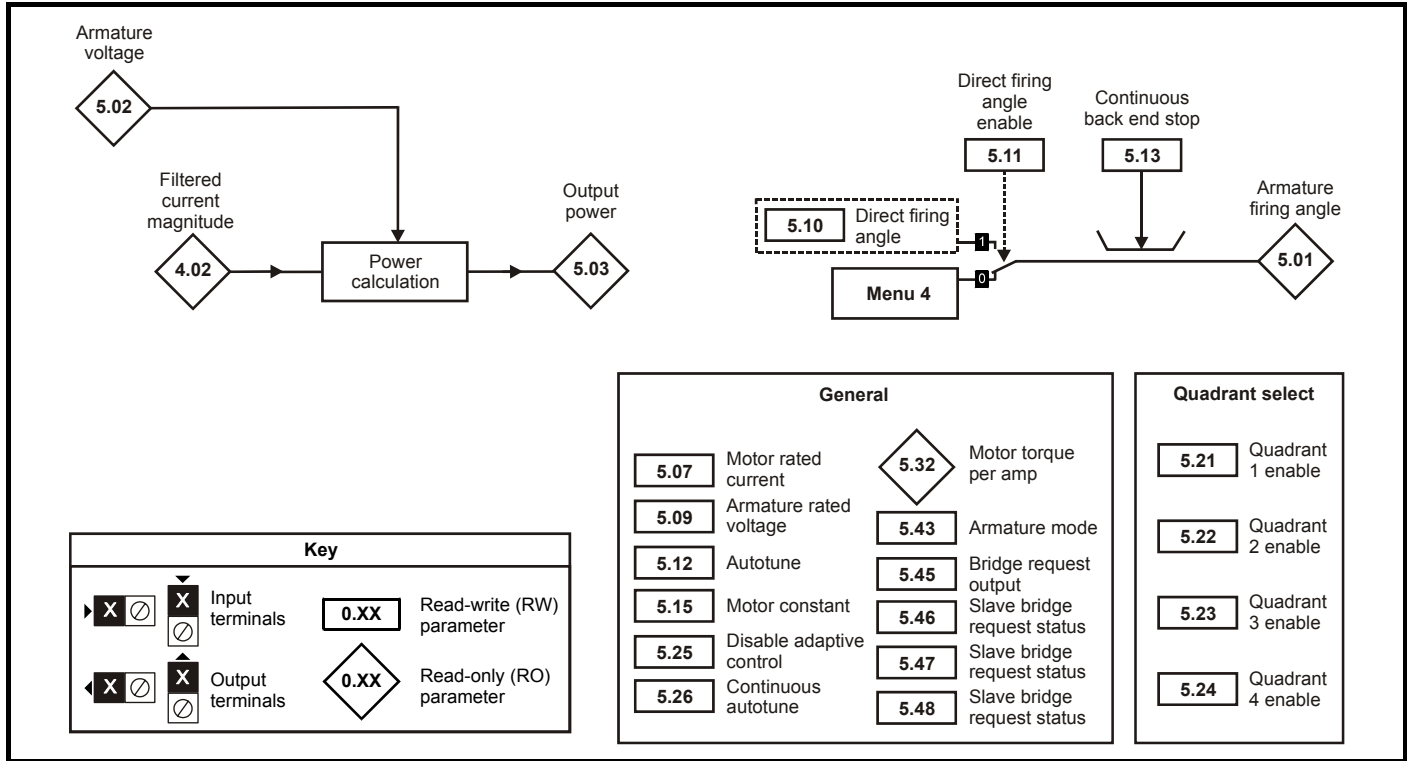
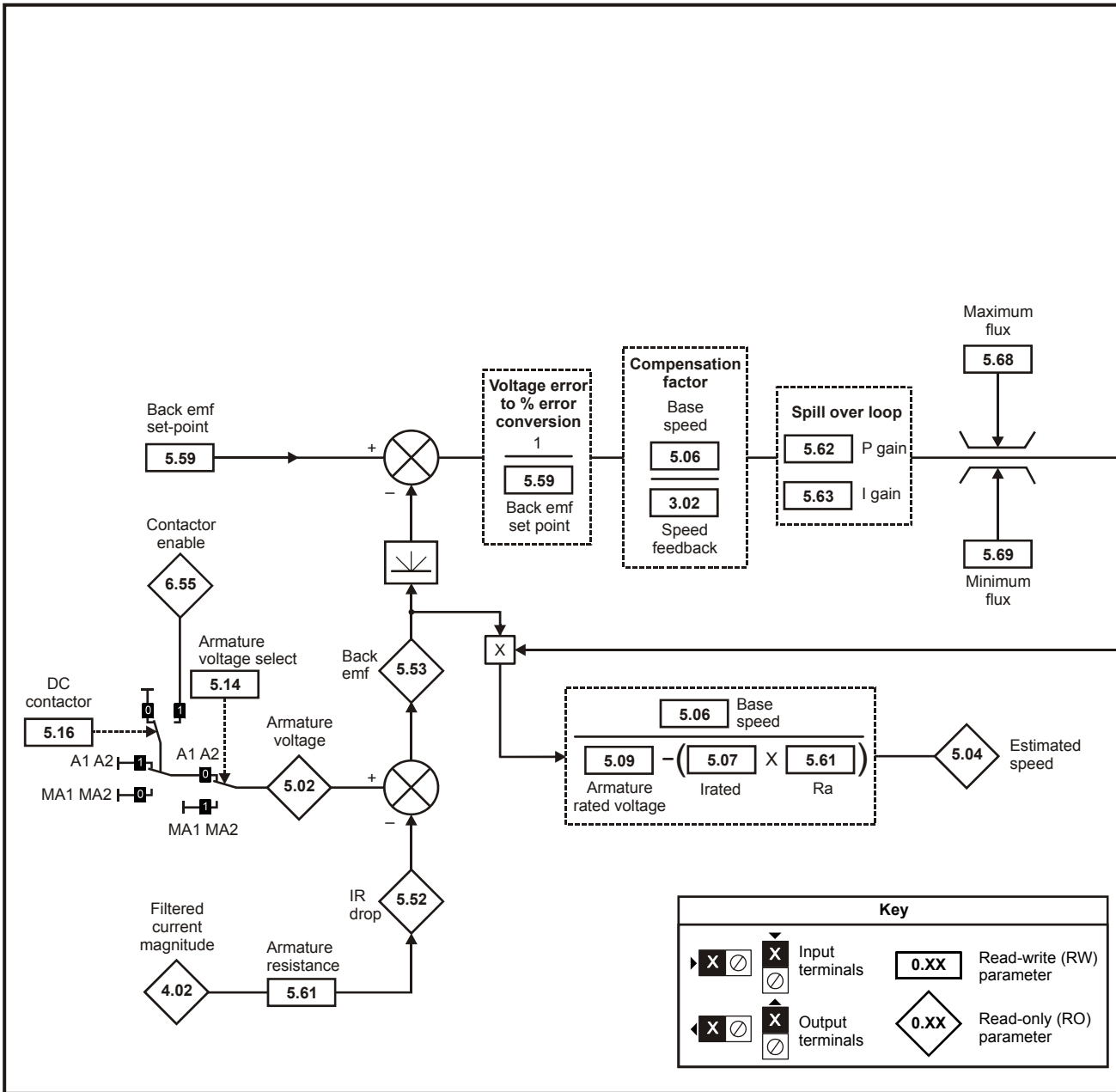
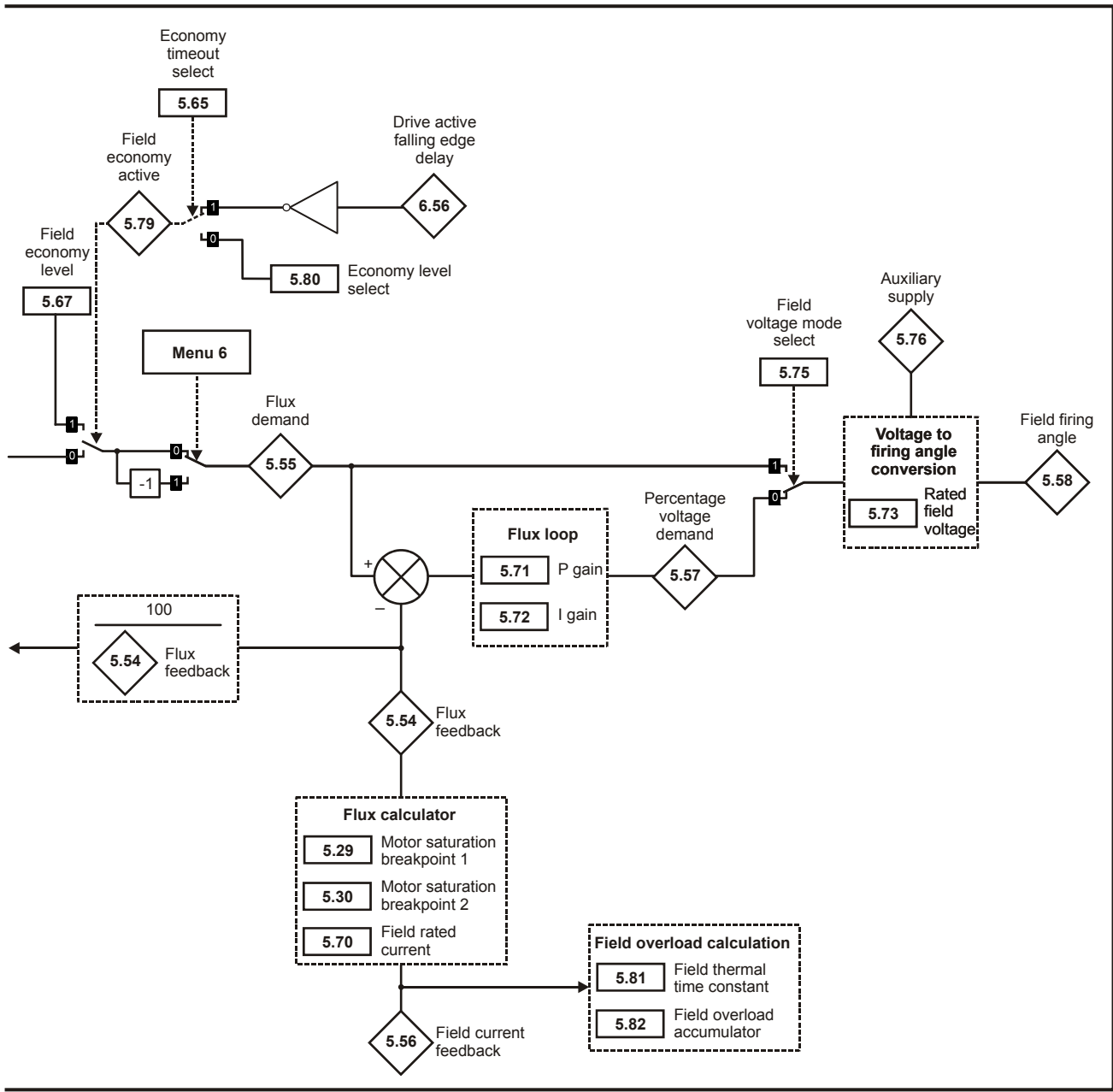


Figure 8-6 Menu 5 field control logic diagram

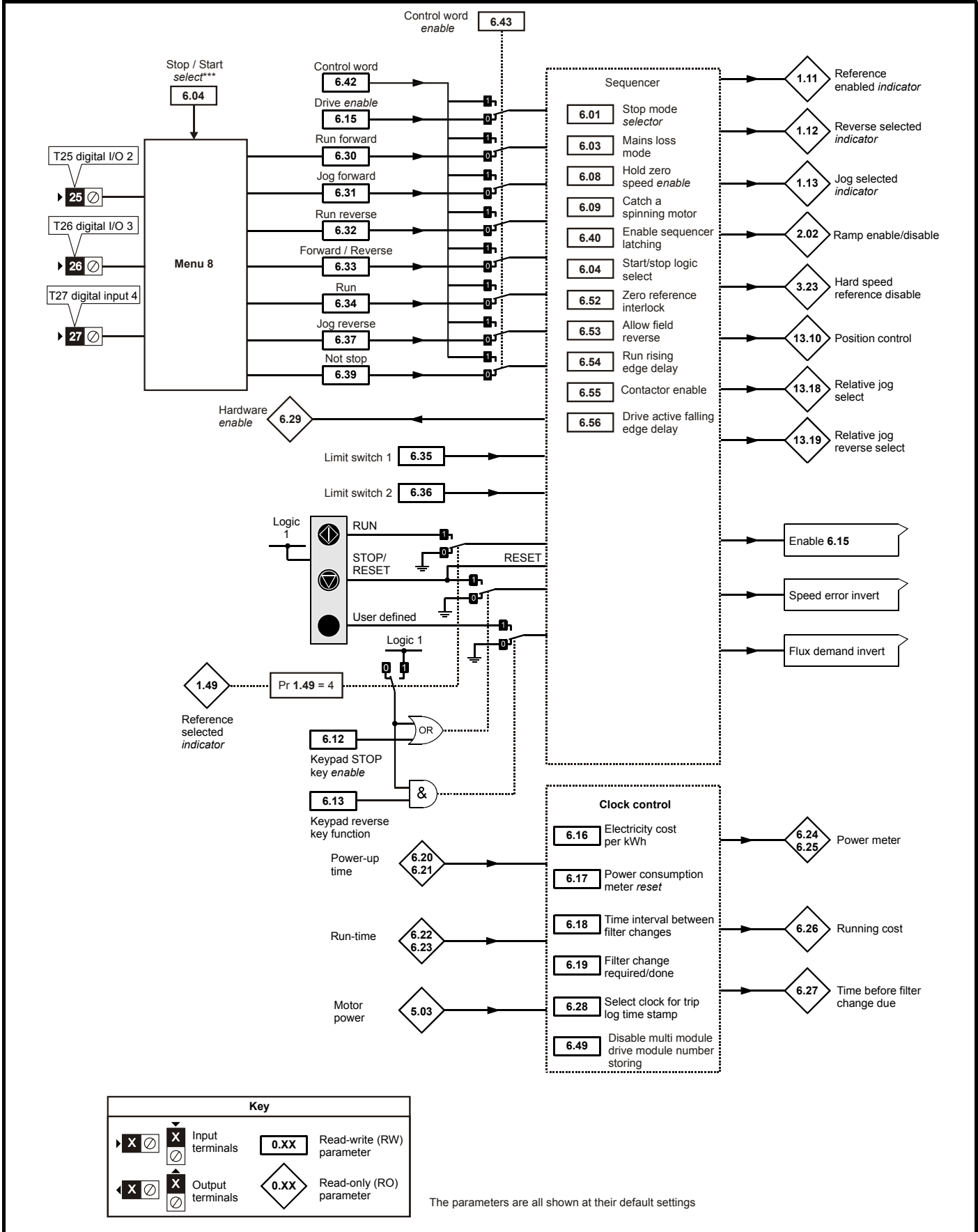


Key			
		0.XX	Read-write (RW) parameter
		0.XX	Read-only (RO) parameter



8.6 Menu 6: Sequencer and clock

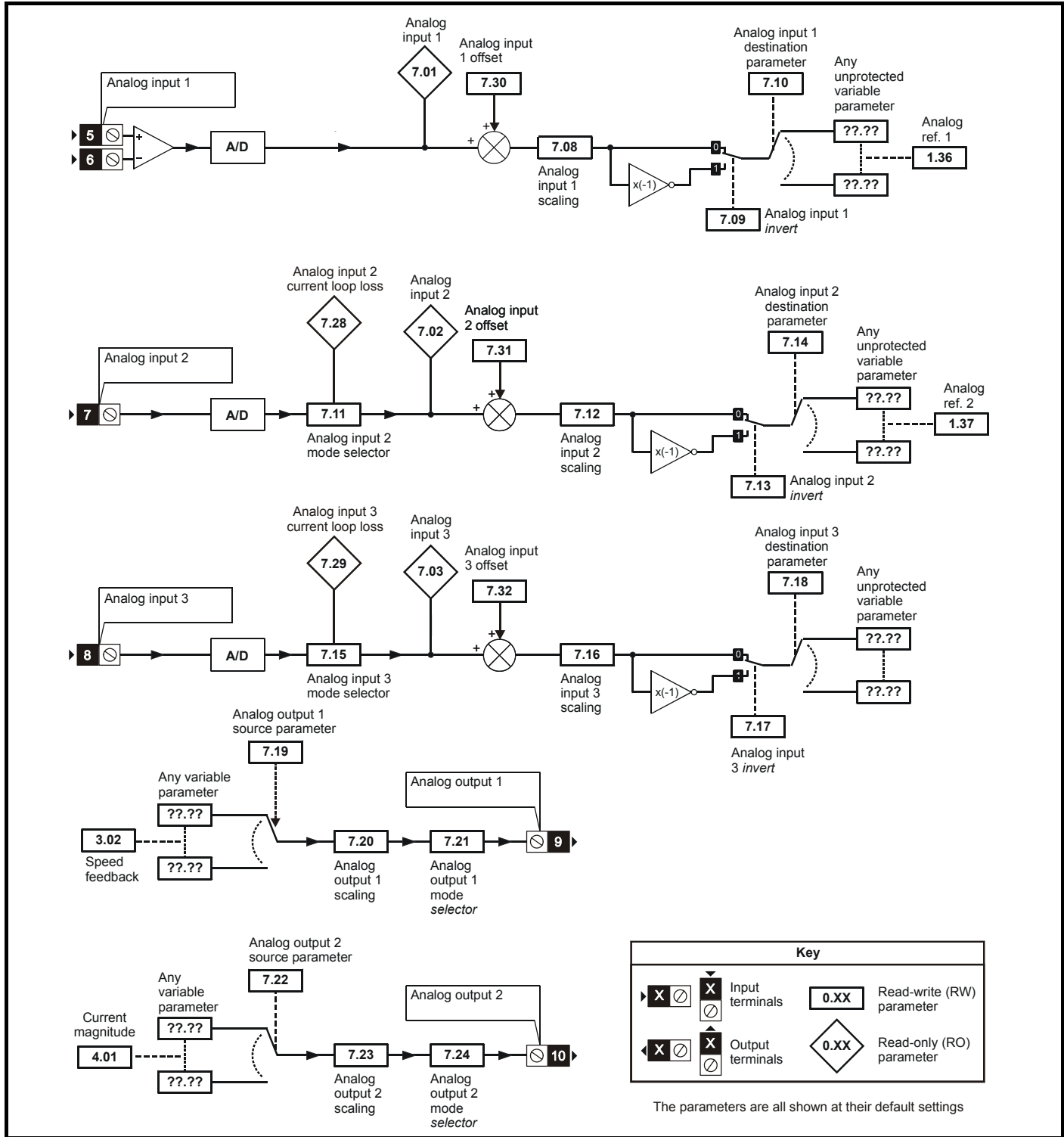
Figure 8-7 Menu 6 logic diagram



*** For more information refer to the *User Guide*.

8.7 Menu 7: Analog I/O

Figure 8-8 Menu 7 logic diagram



8.8 Menu 8: Digital I/O

Figure 8-9 Menu 8 logic diagram

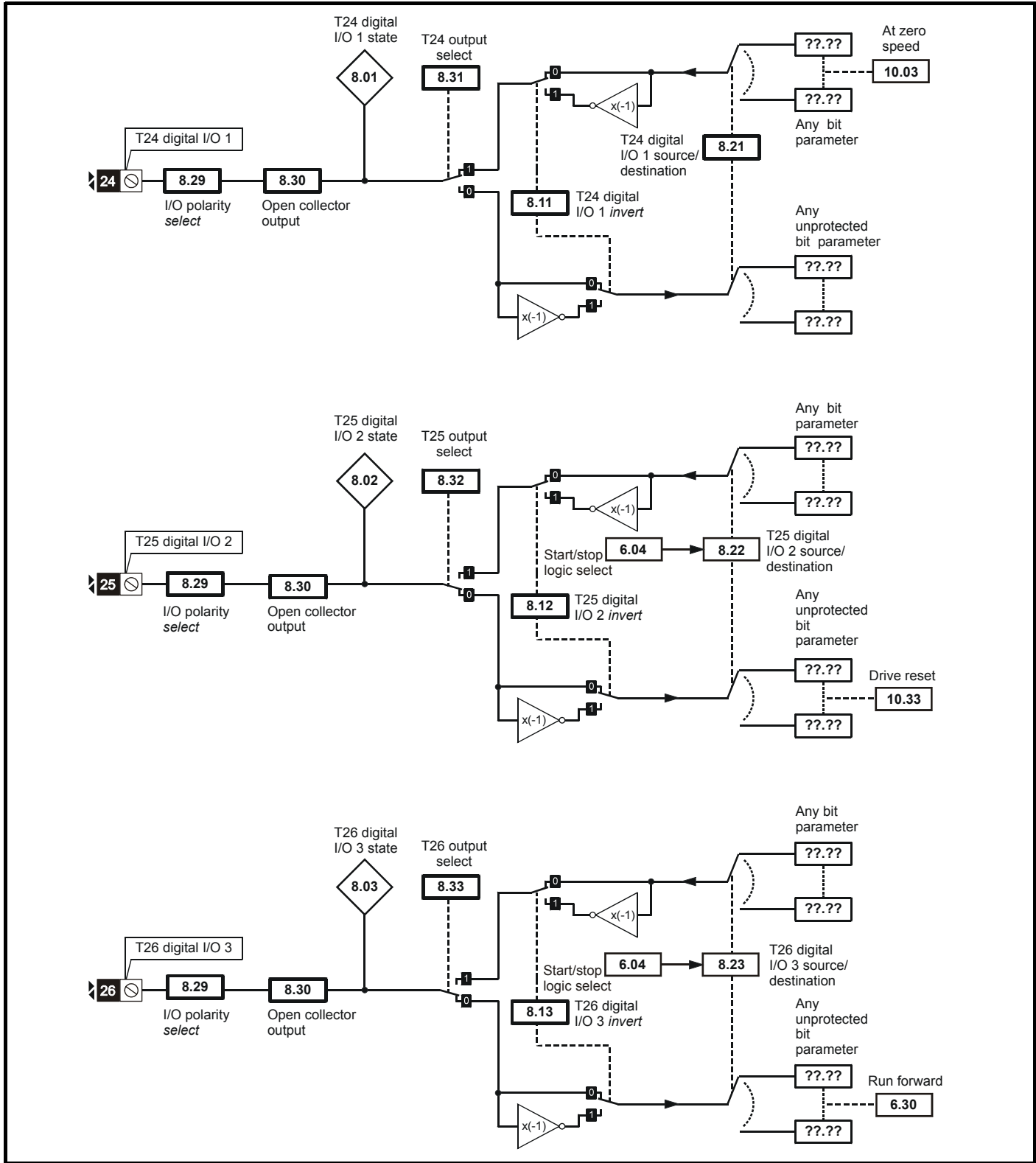
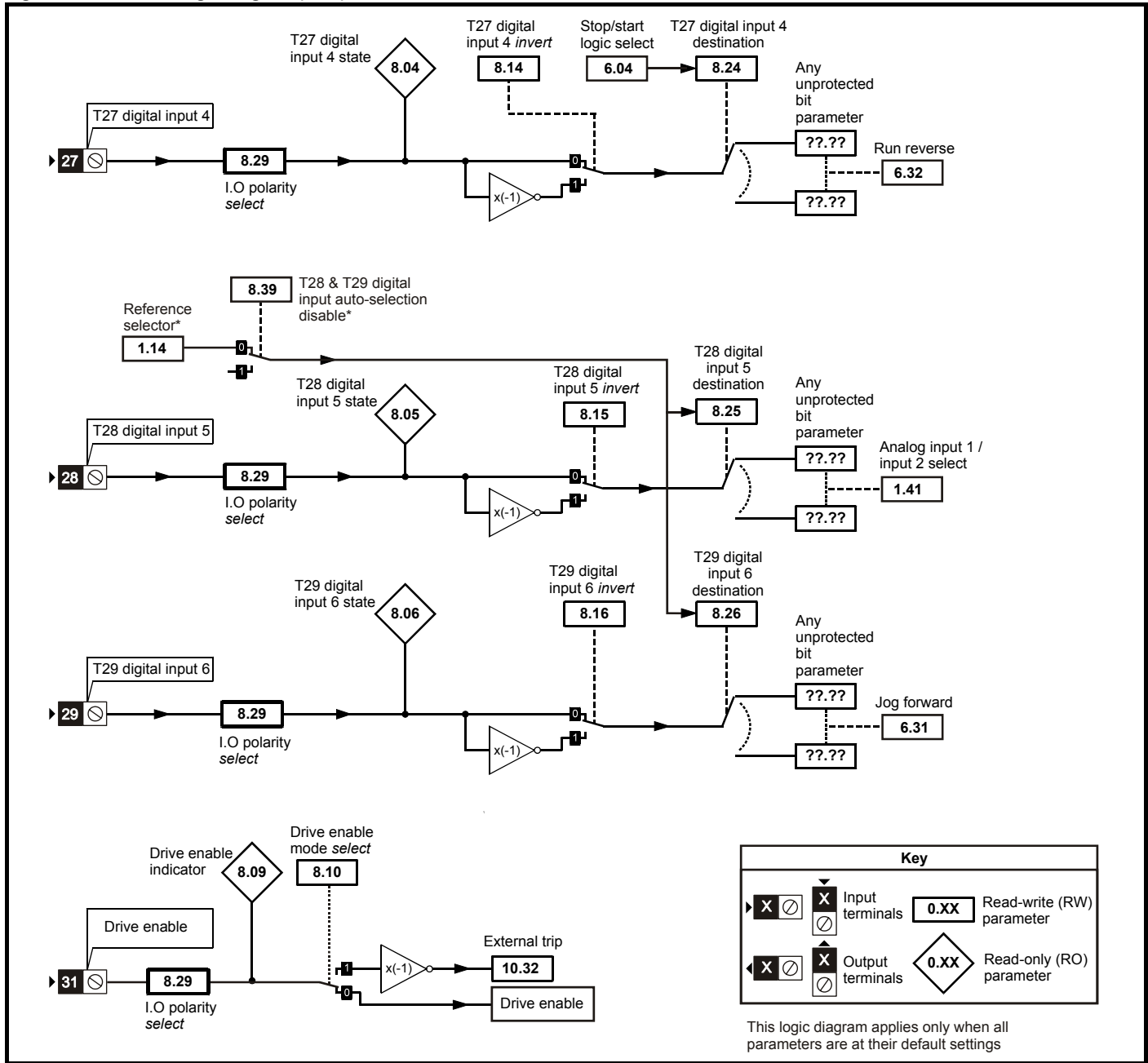
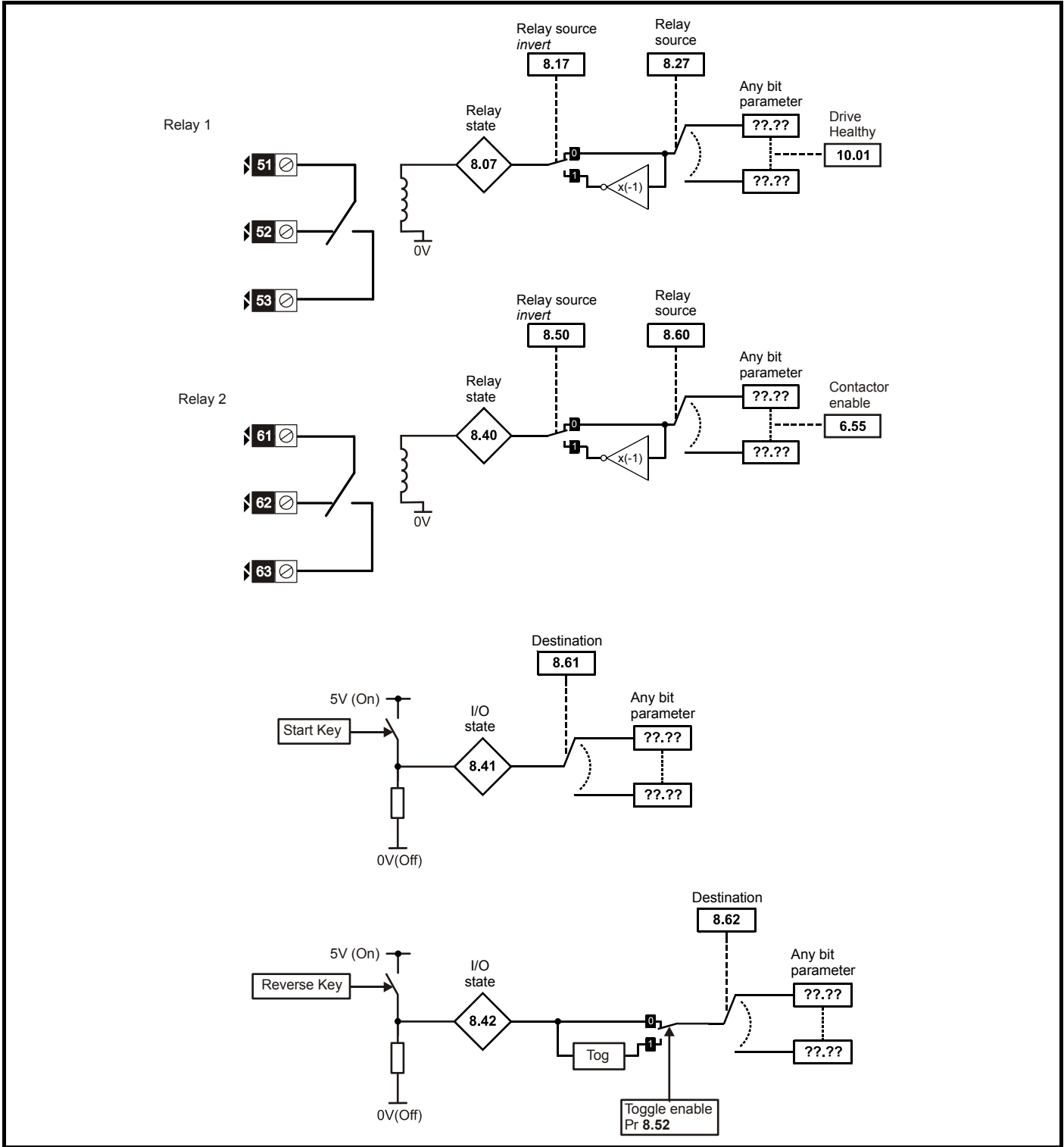


Figure 8-10 Menu 8 logic diagram (cont)



* For more information refer to the *User Guide*.

Figure 8-11 Menu 8 logic diagram (cont)



8.9 Menu 9: Programmable logic, motorized pot and binary sum

Figure 8-12 Menu 9 logic diagram: Programmable logic

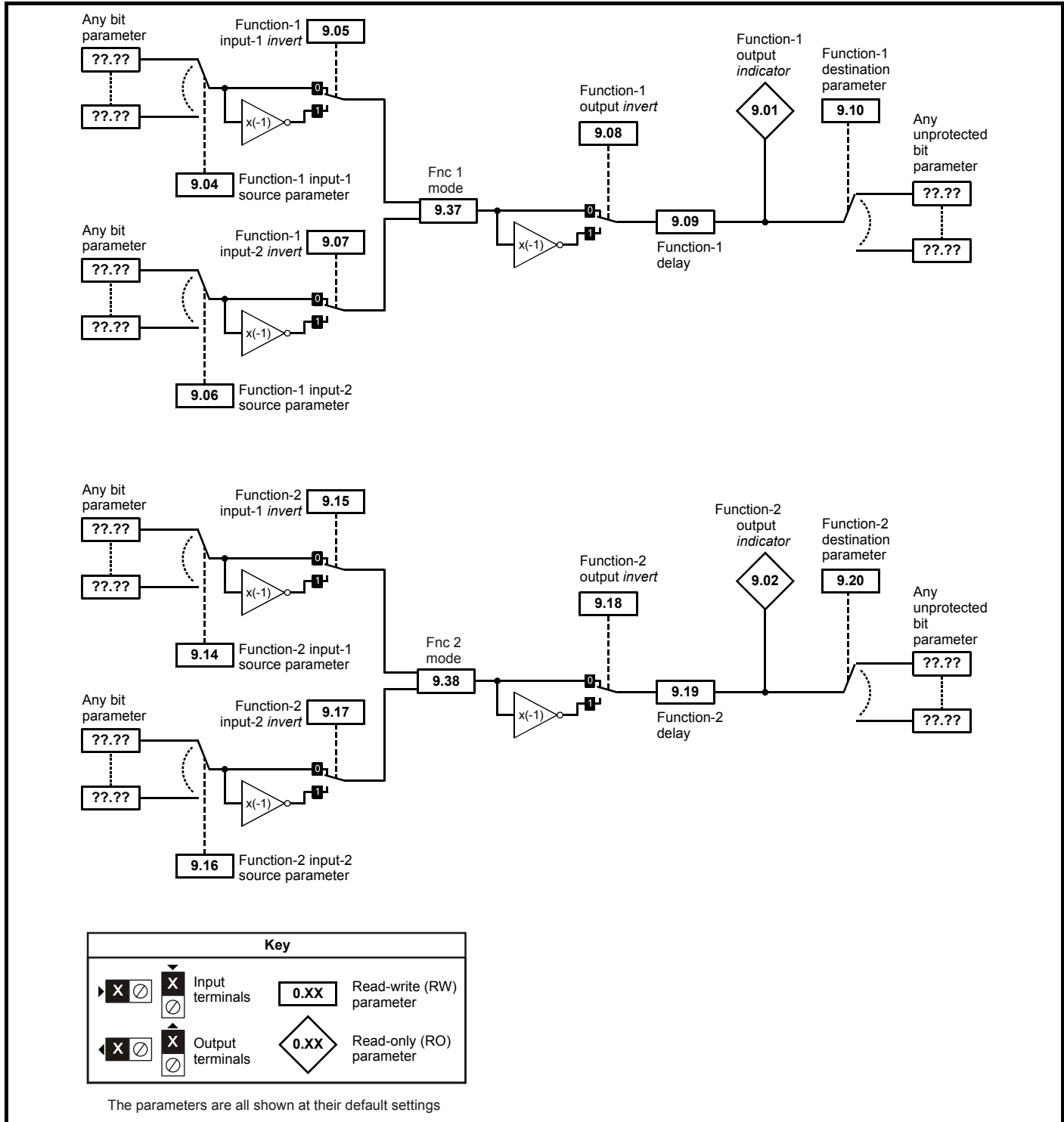
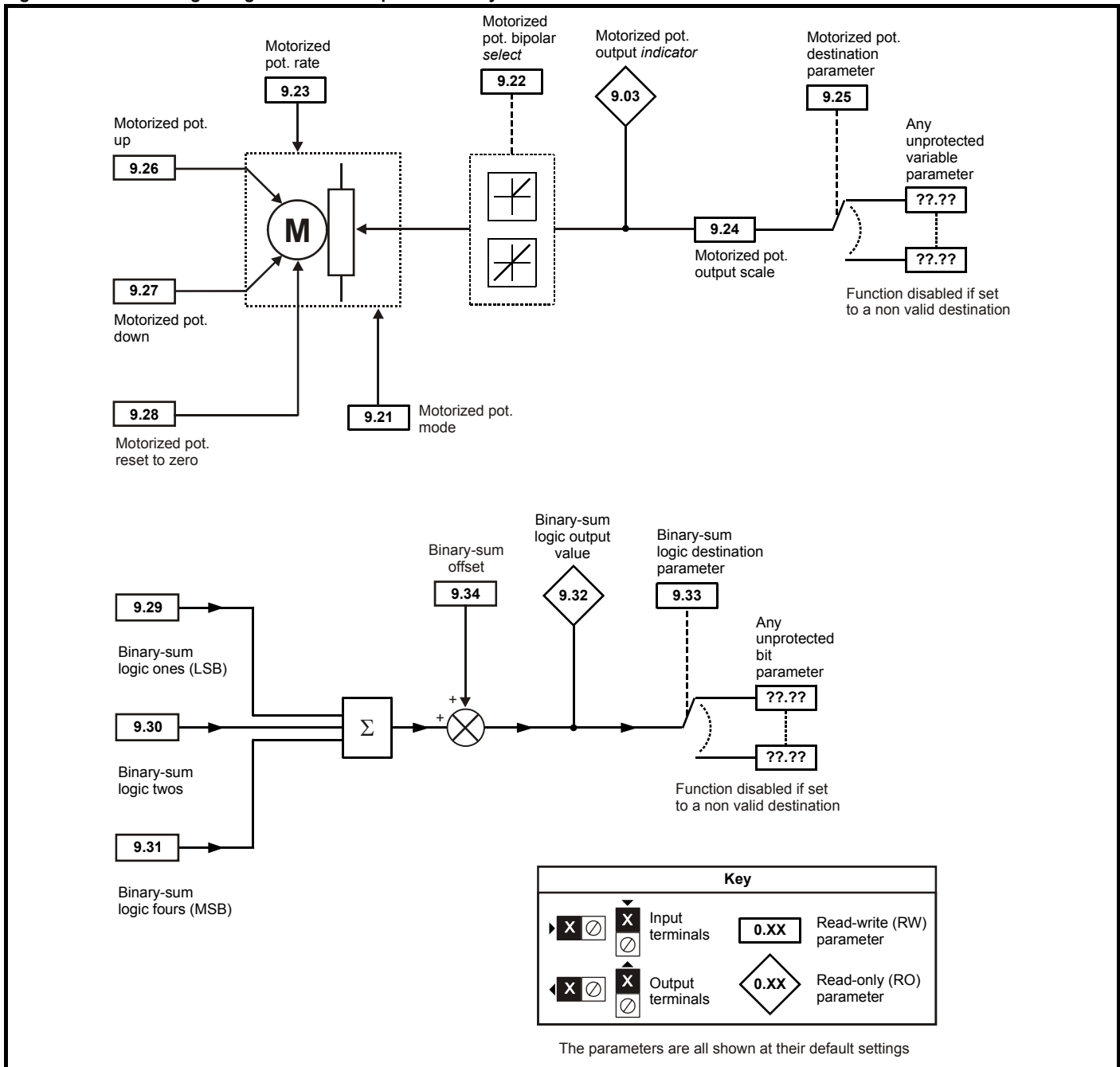


Figure 8-13 Menu 9 logic diagram: Motorized pot and binary sum



8.10 Menu 10: Status and trips

Parameter		
10.01	Drive ok	
10.02	Drive active	
10.03	Zero speed	
10.04	Running at or below minimum speed	
10.05	Below set speed	
10.06	At speed	
10.07	Above set speed	
10.08	Load reached	
10.09	Drive output is at current limit	
10.10	Regenerating	
10.13	Direction commanded	
10.14	Direction running	
10.17	Overload alarm	
10.18	Drive over temperature alarm	
10.19	Drive warning	
10.20	Trip 0	tr01
10.21	Trip 1	tr02
10.22	Trip 2	tr03
10.23	Trip 3	tr04
10.24	Trip 4	tr05
10.25	Trip 5	tr06
10.26	Trip 6	tr07
10.27	Trip 7	tr08
10.28	Trip 8	tr09
10.29	Trip 9	tr10
10.32	External trip	
10.33	Drive reset	
10.34	No. of auto-reset attempts	
10.35	Auto-reset delay	
10.36	Hold drive ok until last attempt	
10.38	User trip	
10.40	Status word	
10.41	Trip 0 time: years.days	
10.42	Trip 0 time: hours.minutes	
10.43	Trip 1 time	
10.44	Trip 2 time	
10.45	Trip 3 time	
10.46	Trip 4 time	
10.47	Trip 5 time	
10.48	Trip 6 time	
10.49	Trip 7 time	
10.50	Trip 8 time	
10.51	Trip 9 time	
10.52 to 10.61	Trip masks	
10.62 to 10.71	Stop on time masks	
10.72	Trip mask active	
10.73	Bridge active	
10.74	Electrical phase back	
10.75	Armature voltage clamp active	
10.76	Phase rotation	
10.77	Input frequency	

8.11 Menu 11: General drive set-up

Parameter		
11.21	Parameter scaling	
11.22	Parameter displayed at power-up	
11.23	Serial address	Si02
11.24	Serial mode	
11.25	Baud rate	Si01
11.26	Minimum comms transmit delay	
11.29	Software version	di14
11.30	User security code	
11.32	Current rating	
11.33	Drive voltage rating	
11.34	Software sub-version	
11.35	Number of modules	
11.36	SMARTCARD parameter data previously loaded	
11.37	SMARTCARD data number	
11.38	SMARTCARD data type / mode	
11.39	SMARTCARD data version	
11.40	SMARTCARD data checksum	
11.41	Status mode timeout	
11.42	Parameter copying	SE09
11.44	Security status	SE14
11.45	Select motor 2 parameters	
11.46	Defaults previously loaded	
11.47	Drive Onboard PLC program enable	
11.48	Drive Onboard PLC program status	
11.49	Drive Onboard PLC programming events	
11.50	Drive Onboard PLC program average scan time	
11.51	Drive Onboard PLC program first run	
11.52	Drive serial number	
11.53	Build location	
11.55	Drive rating number	
11.56	Power PCB software version	
11.57	Serial programmable source	
11.58	Serial scaling	
11.59	Mentor II parameter emulator module control	
11.60	Full power discharge time	
11.61	Full power discharge period	
11.62	External discharge resistance	
11.63	External resistor temperature	

8.12 Menu 12: Threshold detectors, variable selectors and brake control function

Figure 8-14 Menu 12 logic diagram

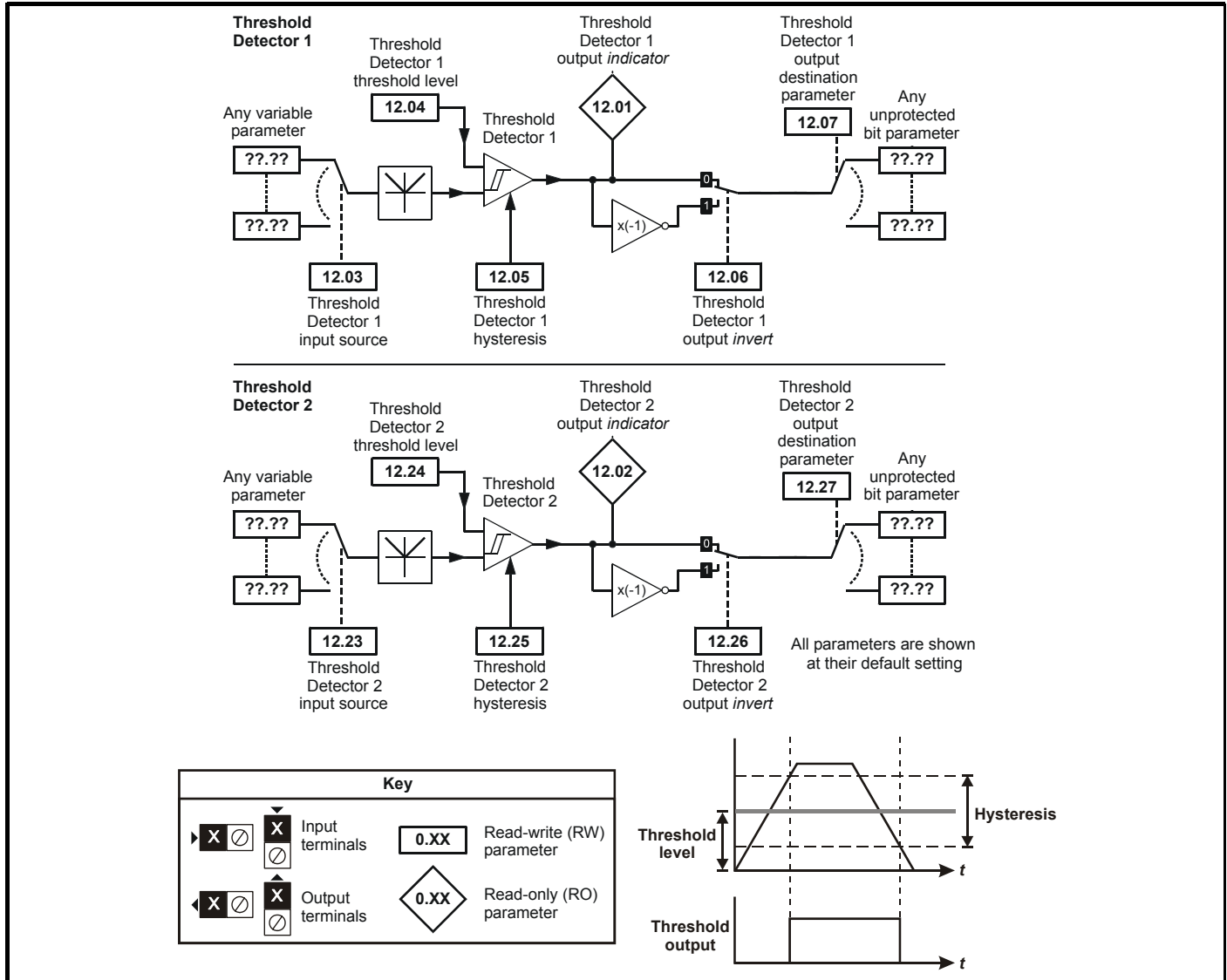


Figure 8-15 Menu 12 logic diagram (continued)

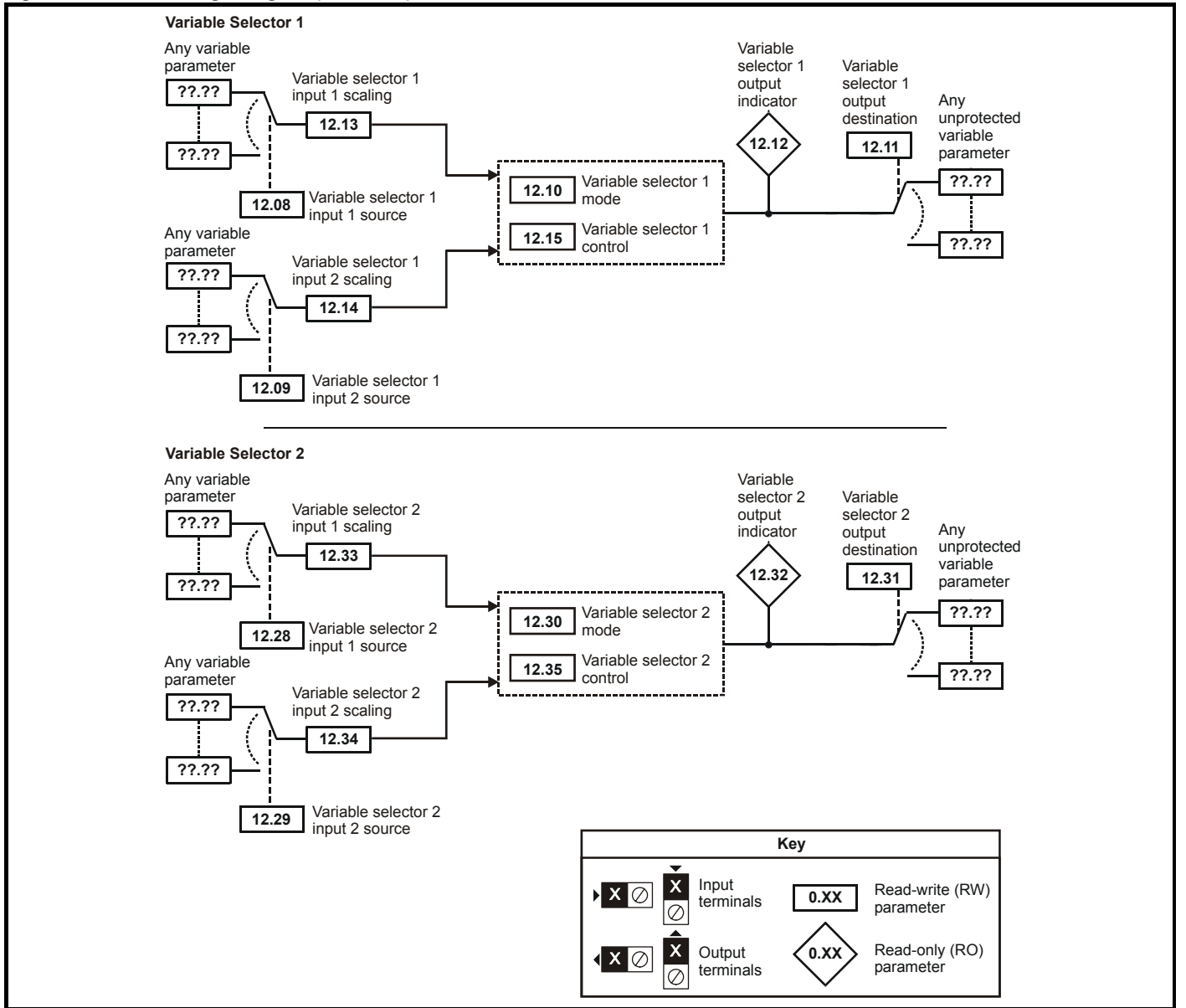
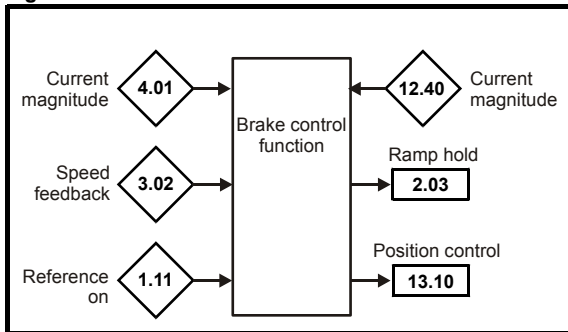
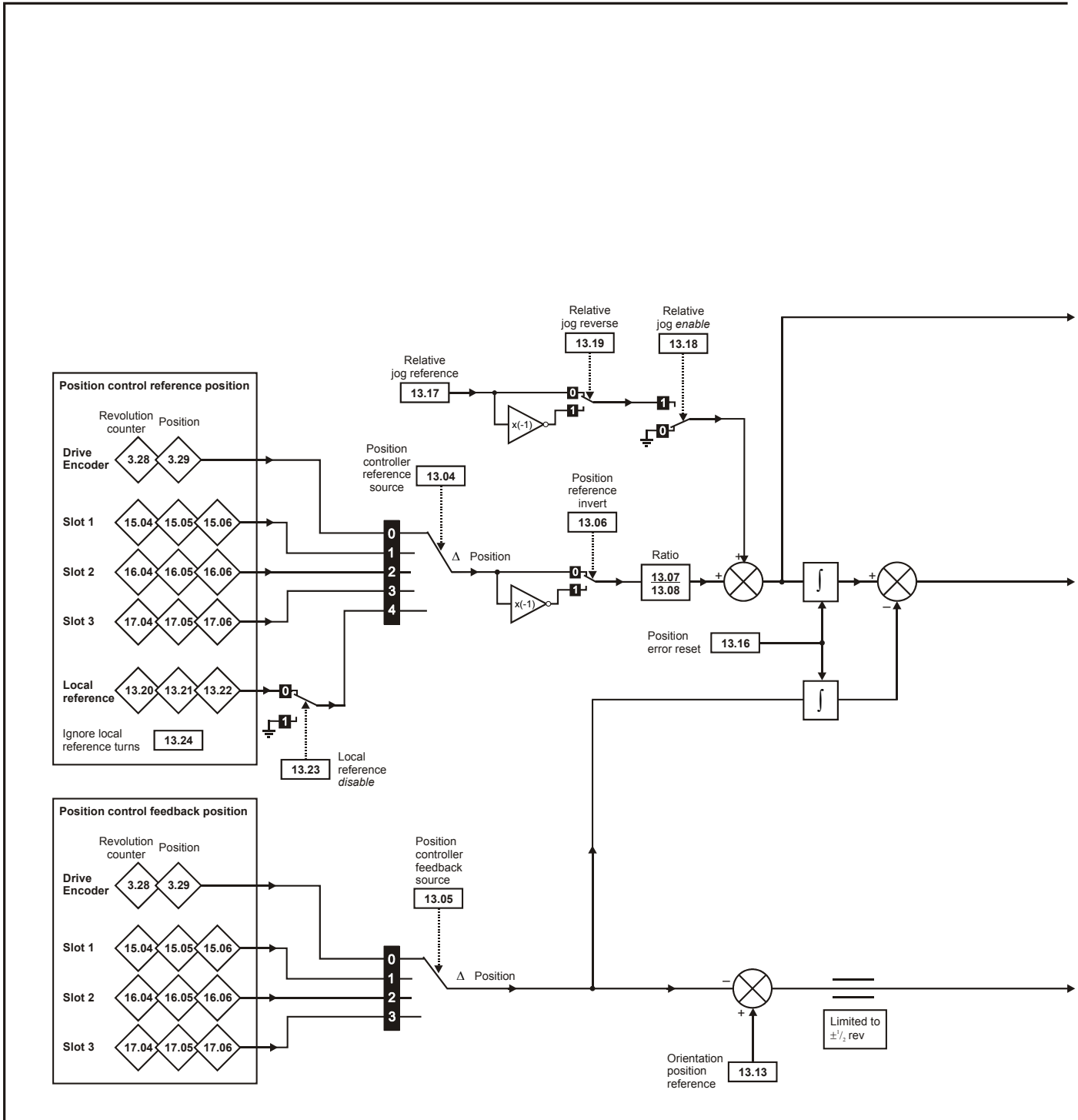


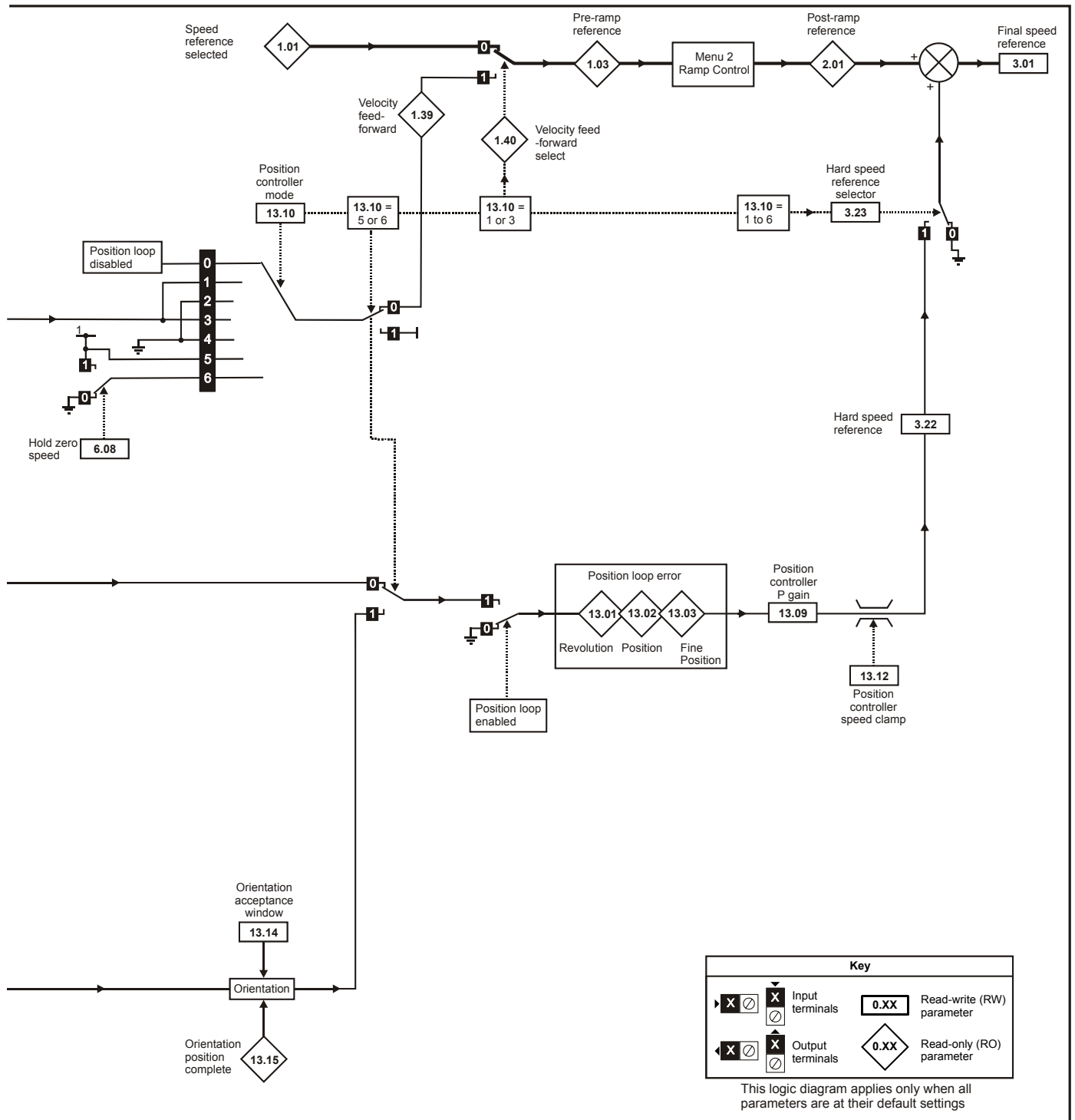
Figure 8-16 Menu 12 Brake control function



8.13 Menu 13: Position control

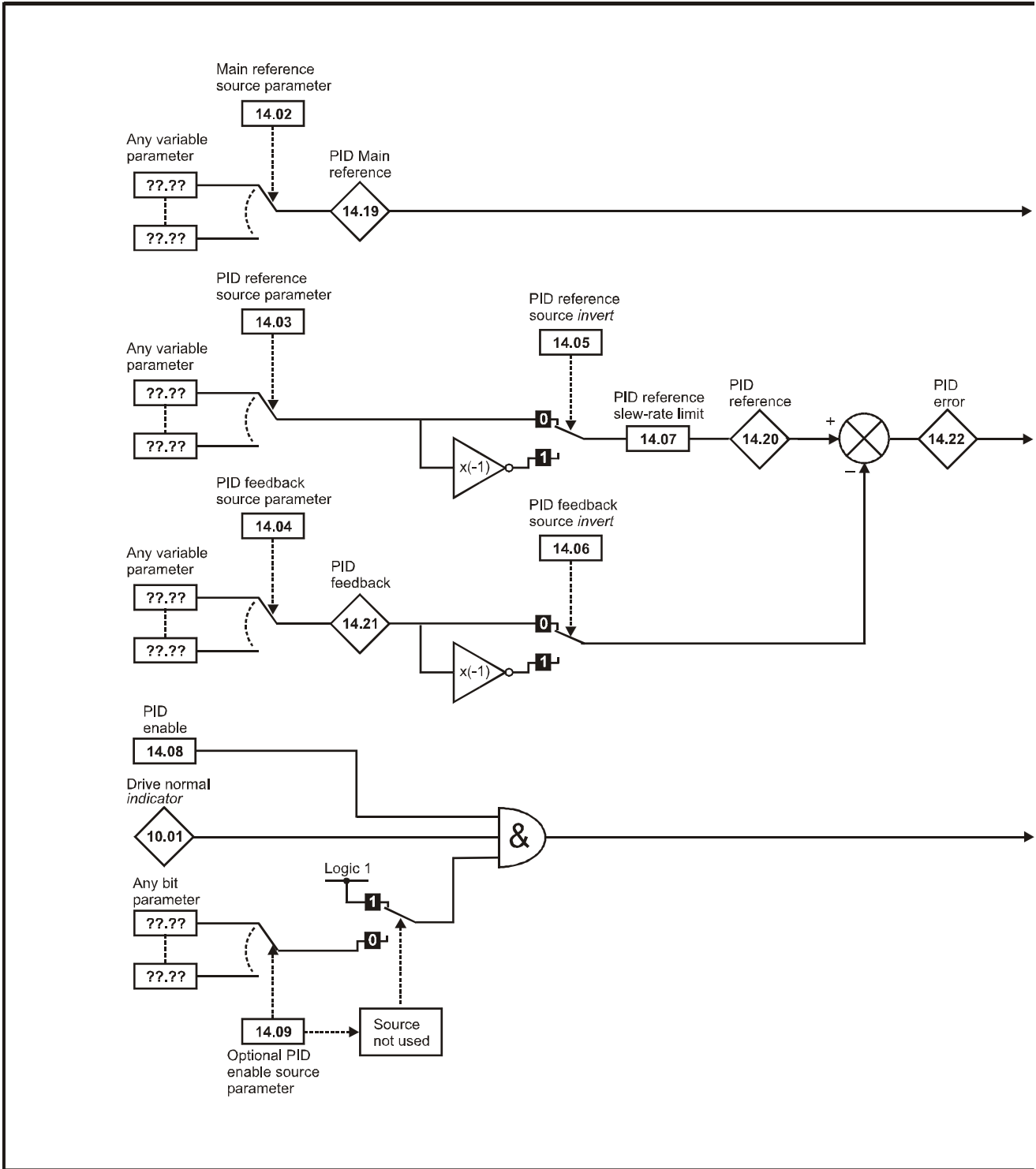
Figure 8-17 Menu 13 logic diagram

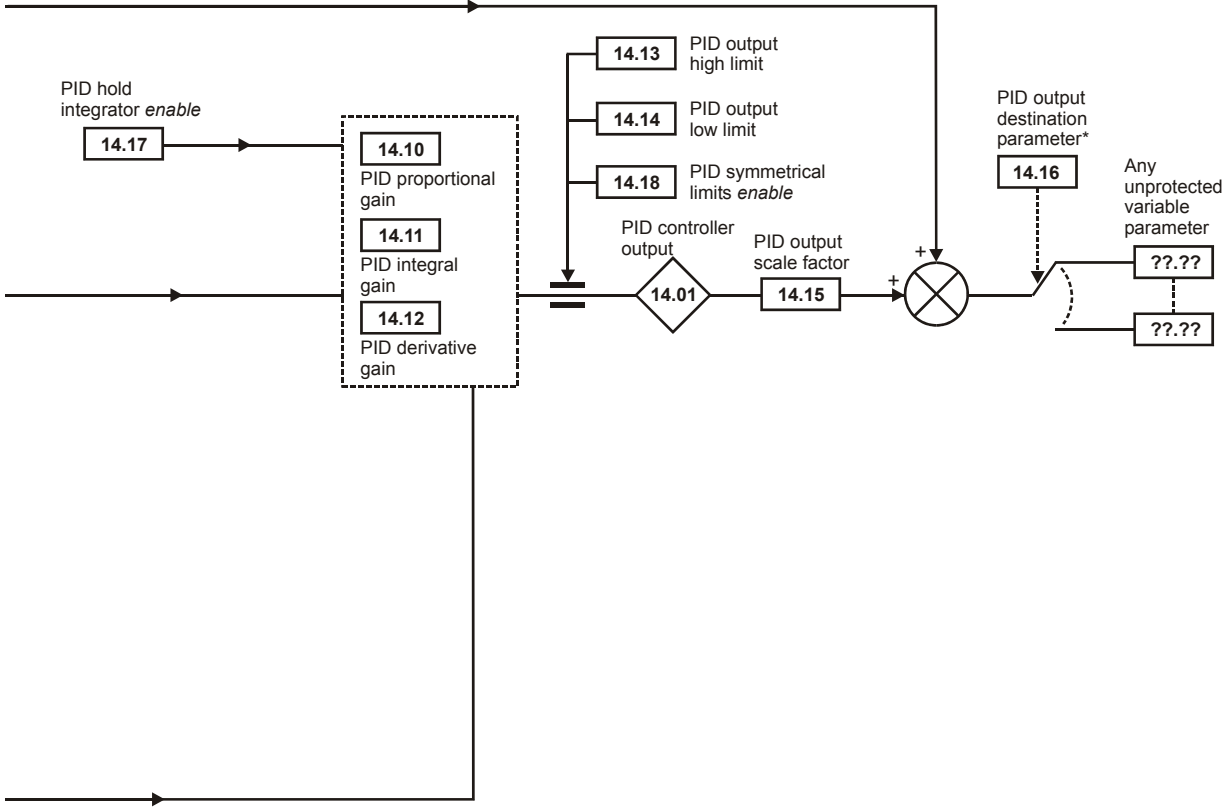




8.14 Menu 14: User PID controller

Figure 8-18 Menu 14 logic diagram





Key			
		Input terminals	Read-write (RW) parameter
		Output terminals	Read-only (RO) parameter

The parameters are all shown at their default settings

*The PID controller is only enabled if Pr 14.16 is set to a non Pr xx.00 and unprotected destination parameter.

8.15 Menus 15, 16 and 17: Solutions Module slots

Pr **x.00** and Pr **x.01** are always present in menus 15, 16 and 17. Pr **x.01** indicates which type of module is present (0 = no module installed). When a module is installed the drive provides the relevant menu (menu 15 for slot 1, 16 for slot 2 and 17 for slot 3) depending on the Solutions Module installed. The possible categories are shown below.

Solutions Module ID	Module	Category
0	No module installed	
102	SM-Universal Encoder Plus	Feedback
104	SM-Encoder Plus and SM-Encoder Output Plus	
201	SM-I/O Plus	Automation (I/O Expansion)
203	SM-I/O Timer	
204	SM-I/O PELV	
205	SM-I/O 24V Protected	
206	SM-I/O120V	
207	SM-I/O Lite	
208	SM-I/O 32	
304	SM-Applications Plus	Automation (Applications)
305	SM-Applications Lite V2	
306	SM-Register	
403	SM-PROFIBUS-DP-V1	Fieldbus
404	SM-INTERBUS	
407	SM-DeviceNet	
408	SM-CANopen	
410	SM-Ethernet	
421	SM-EtherCAT	

Refer to the specific Solutions Module User Guide for more information.

Parameters common to all categories

Parameter	
x.01	Solutions Module ID
x.50	Solutions Module error status

8.16 Menu 18, 19 & 20: Application menu 1, 2 & 3

Parameter	
18.01 (1) 19.01 (2)	Power-down saved integer
18.02 to 18.10 (1) 19.02 to 19.10 (2)	Read-only integer
18.11 to 18.30 (1) 19.11 to 19.30 (2) 20.01 to 20.20 (3)	Read-write integer
18.31 to 18.50 (1) 19.31 to 19.50 (2)	Read-write bit
20.21 to 20.40 (3)	Read-write long integer

8.17 Menu 21: Second motor parameters

Parameter	Equivalent motor map 1 parameter	
21.01	Maximum reference clamp	1.06
21.02	Minimum reference clamp	1.07
21.03	Reference selector	1.14
21.04	Acceleration rate	2.11
21.05	Deceleration rate	2.21
21.06	Base speed	5.06
21.07	Rated current	5.07
21.08	Back emf set point	5.59
21.09	Rated voltage	5.09
21.10	Armature resistance	5.61
21.11	Motor constant	5.15
21.12	Discontinuous current controller Ki gain	4.34
21.13	Continuous current controller Kp gain	4.13
21.14	Continuous current controller Ki gain	4.14
21.15	Motor 2 active	11.45
21.16	Thermal time constant	4.15
21.17	Speed controller Kp gain	3.10
21.18	Speed controller Ki gain	3.11
21.19	Speed controller Kd gain	3.12
21.21	Speed feedback selector	3.26
21.23	Rated field voltage	5.73
21.24	Rated field current	5.70
21.25	Motor saturation breakpoint 1	5.29
21.26	Motor saturation breakpoint 2	5.30
21.27	Motoring current limit	4.05
21.28	Regen current limit	4.06
21.29	Symmetrical current limit	4.07
21.30	Field thermal time constant	5.81
21.31	Flux loop P gain	5.71
21.32	Flux loop I gain	5.72
21.33	Spill over P gain	5.62
21.34	Spill over I gain	5.63

8.18 Menu 22: Additional Menu 0 set-up

Parameter	
22.01	Pr 0.01 set-up
22.02	Pr 0.02 set-up
22.03	Pr 0.03 set-up
22.04	Pr 0.04 set-up
22.05	Pr 0.05 set-up
22.06	Pr 0.06 set-up
22.07	Pr 0.07 set-up
22.08	Pr 0.08 set-up
22.09	Pr 0.09 set-up
22.10	Pr 0.10 set-up
22.11	Pr 0.11 set-up
22.12	Pr 0.12 set-up
22.13	Pr 0.13 set-up
22.14	Pr 0.14 set-up
22.15	Pr 0.15 set-up
22.16	Pr 0.16 set-up
22.17	Pr 0.17 set-up
22.18	Pr 0.18 set-up
22.19	Pr 0.19 set-up
22.20	Pr 0.20 set-up

8.19 Menu 23: Header selections

Parameter	
23.01	Sub block headers
23.02	OR of pre-defined sub block enables
23.03	SEt UP
23.04	DiAGnoS
23.05	triPS
23.06	SP LOOP
23.07	Fb SP
23.08	SintEr
23.09	InPut

9 Diagnostics

9.1 Trip indications



Users must not attempt to repair a drive if it is faulty, nor carry out fault diagnosis other than through the use of the diagnostic features described in this chapter.

If a drive is faulty, it must be returned to an authorized Control Techniques distributor for repair.

WARNING

Table 9-1 Trip indications

Trip	Number	Description
AOC	3	Instantaneous output over current detected: peak output current greater than 225%
AOP	158	Voltage has been applied to the armature but no current feedback has been detected
C.Acc	185	SMARTCARD trip: SMARTCARD read/write fail
C.Boot	177	SMARTCARD trip: Menu 0 parameter modification cannot be saved to the SMARTCARD because the necessary file has not been created on the SMARTCARD
C.BUSy	178	SMARTCARD trip: SMARTCARD can not perform the required function as it is being accessed by a Solutions Module
C.Chg	179	SMARTCARD trip: Data location already contains data
C.cpr	188	SMARTCARD trip: values stored in the drive and the values in the data block on the SMARTCARD are different
C.dat	183	SMARTCARD trip: data location specified does not contain any data
C.Err	182	SMARTCARD trip: SMARTCARD data is corrupted
C.FULL	184	SMARTCARD trip: SMARTCARD full
cL2	28	Analog input 2 current loss (current mode)
cL3	29	Analog input 3 current loss (current mode)
CL.bit	35	Trip initiated from the control word (Pr 6.42)
C.Optn	180	SMARTCARD trip: Solutions Modules installed are different between source drive and destination drive
C.Prod	175	SMARTCARD is not compatible with this drive
C.RdO	181	SMARTCARD trip: SMARTCARD has the read-only bit set
C.rtg	186	SMARTCARD trip: the voltage and/or the current rating of the source and the destination drives are different
C.Typ	187	SMARTCARD trip: SMARTCARD parameter set not compatible with drive
dEst	199	Two or more parameters are writing to the same destination parameter
EEF	31	EEPROM data corrupted: drive mode becomes open loop and serial comms will timeout with remote keypad on the drive RS485 comms port.
EnC1	189	Drive encoder trip: encoder power supply overload
EnC2	190	Drive encoder trip: wire break
EnC3	191	Drive encoder trip: overload
EnC9	197	Drive encoder trip: position feedback selected is selected from a Solutions Module slot which does not have a speed/position feedback Solutions Module installed
EnC10	198	Drive encoder trip: termination overload
Et	6	External trip from input on terminal 31
FbL	159	No signal from the tachogenerator or encoder
Fbr	160	The polarity of the feedback tachogenerator or encoder is incorrect
FdL	168	No current in the field supply circuit.
FOC	169	Excess current detected in field current feedback. If maximum current feedback is present when the firing angle is fully phased back then trip
F.OVL	157	Field I ² t overload
HFxx		Hardware fault - return drive to supplier (see <i>User Guide</i> for further information)
It.AC	20	I ² t on drive output current (refer to Pr 4.16)
O.Ld1	26	Digital output overload: total current drawn from digital outputs exceeds 200mA
O.ht1	21	Drive overheat (thyristor junction) based on thermal model
O.ht2	22	Heatsink over-temperature
O.ht3	27	External discharge resistor over-temperature
O.SPd	7	Motor speed has exceeded the over speed threshold
Pad	34	Keypad has been removed when the drive is receiving the speed reference from the keypad

Trip	Number	Description
PS	5	Internal power supply fault
PS.10V	8	10V user power supply current greater than 10mA
PS.24V	9	24V user power supply current greater than 200mA
PSAVE.Er	37	Power down save parameters in the EEPROM are corrupt
SAVE.Er	36	User save parameters in the EEPROM are corrupt
SCL	30	Drive RS485 serial comms loss to remote keypad
SL	170	One or more of the power supply phases is open circuit
S.Old	171	The maximum power the over voltage suppressor can handle has been exceeded
SL.rtd	215	Solutions Module trip: drive mode has changed and Solutions Module parameter routing is now incorrect
SL1.dF	204	Solutions Module slot X trip: Solutions Module type installed in slot X changed
SL1.Er	202	Solutions Module slot X trip: Solutions Module in slot X has detected a fault
SL1.HF	200	Solutions Module in slot 1: error. The module has detected an error and tripped the drive. The reason for the error is stored in Pr xx.50 .
SL1.nF	203	Solutions Module slot X trip: Solutions Module has been removed
SL1.tO	201	Solutions Module slot X trip: Solutions Module watchdog timeout
SL2.dF	209	Solutions Module slot X trip: Solutions Module type installed in slot X changed
SL2.Er	207	Solutions Module slot X trip: Solutions Module in slot X has detected a fault
SL2.HF	205	Solutions Module slot X trip: hardware fault
SL2.nF	208	Solutions Module slot X trip: Solutions Module has been removed
SL2.tO	206	Solutions Module slot X trip: Solutions Module watchdog timeout
SL3.dF	214	Solutions Module slot X trip: Solutions Module type installed in slot X changed
SL3.HF	210	Solutions Module in slot 3: hardware fault
SL3.nF	213	Solutions Module slot X trip: Solutions Module has been removed
SL3.tO	211	Solutions Module slot X trip: Solutions Module watchdog timeout
t002	2	Reserved
t004	4	Reserved
t010	10	Reserved
t013 to t017	13 to 17	Reserved
t019	19	Reserved
t023	23	User trip
t032	32	Reserved
t033	33	Reserved
t038 to t039	38 to 39	Reserved
t040 to t089	40 to 89	User trips
t099	99	User trip defined in 2nd processor Solutions Module code
t101	101	User trip
t102 to t111	102 to 111	Reserved
t112 to t156	112 to 156	User trip
t161 to t167	161 to 167	Reserved
t172 to t174	172 to 174	Reserved
t176	176	Reserved
t192	192	Reserved
t193	193	Reserved
t194	194	Reserved
t195	195	Reserved
t196	196	Reserved
t216	216	User trip
Th	24	Motor thermistor trip
ThS	25	Motor thermistor short circuit
TunE	18	Autotune stopped before completion
TunE1	11	The position feedback did not change or required speed could not be reached during the inertia test (refer to Pr 5.12)
TunE2	12	Position feedback direction incorrect or motor could not be stopped during the inertia test (refer to Pr 5.12)
TunE3	13	Field flux has not decayed to zero during autotune
TunE4	14	Back emf detected during autotune

Trip	Number	Description
TunE5	15	No field current detected during autotune
TunE6	16	Cannot achieve ¼ rated back emf during autotune. Reset Pr 5.70 to name plate value and re-autotune motor
UP ACC	98	Onboard PLC program: cannot access Onboard PLC program file on drive
UP div0	90	Onboard PLC program attempted divide by zero
UP OFL	95	Onboard PLC program variables and function block calls using more than the allowed RAM space (stack overflow)
UP ovr	94	Onboard PLC program attempted out of range parameter write
UP Par	91	Onboard PLC program attempted access to a non-existent parameter
UP ro	92	Onboard PLC program attempted write to a read-only parameter
UP So	93	Onboard PLC program attempted read of a write-only parameter
UP udF	97	Onboard PLC program undefined trip
UP uSEr	96	Onboard PLC program requested a trip
UU	1	Running from external +24V

9.2 Alarm indications

In any mode an alarm flashes alternately with the data displayed on the 2nd row when one of the following conditions occur. If action is not taken to eliminate any alarm except "Autotune", and "PLC" the drive may eventually trip. Alarms flash once every 640ms except "PLC" which flashes once every 10s. Alarms are not displayed when a parameter is being edited.

Table 9-1 Alarm indications

Lower display	Description
Hot	Heatsink alarm is active The temperature displayed in Pr 7.04 has exceeded the alarm level (see Pr 7.04).
OVLd	Motor overload The motor I ² t accumulator (Pr 4.19) in the drive has reached 75% of the value at which the drive will be tripped and the load on the drive is > motor rated current SE07 (Pr 5.07).
Autotune	Autotune in progress The autotune procedure has been initialised. 'Auto' and 'tunE' will flash alternately on the display.
CLt	Current limit is active Indicates that current limits are active.
PLC	Onboard PLC program is running An Onboard PLC program is installed and running. The lower display will flash 'PLC' once every 10s.
S.OV	Indicated suppressor over voltage Indicates that the over voltage suppressor voltage is within 30V of the trip level
S.rS	Suppressor resistor overload Indicates that the external voltage suppressor resistor is in an overload condition

9.3 Status indications

Table 9-2 Status indications

Upper display	Description	Drive output stage
dEC	Decelerating Speed is ramping to zero after a stop	Enabled
inh	Inhibited Enable input is inactive	Disabled
POS	Position Position control active during orientation stop	Enabled
rdY	Ready Enable closed, but drive not active	Disabled
run	Running Drive active and motor running	Enabled
StoP	Stopped Drive active, but holding zero speed.	Enabled
triP	Tripped Drive is tripped.	Disabled

10 UL Listing

INFORMATION TO BE CONFIRMED



0476-0003-01