EMERSON
Industrial Automation

User Guide

Digitax ST

AC variable speed drive for servo motors

Part Number: 0475-0001-01
Issue: 1

CONTROL TECHNIQUES
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.

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** (or Pr **0.50**) 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.

Issue Number: 1

How to use this guide

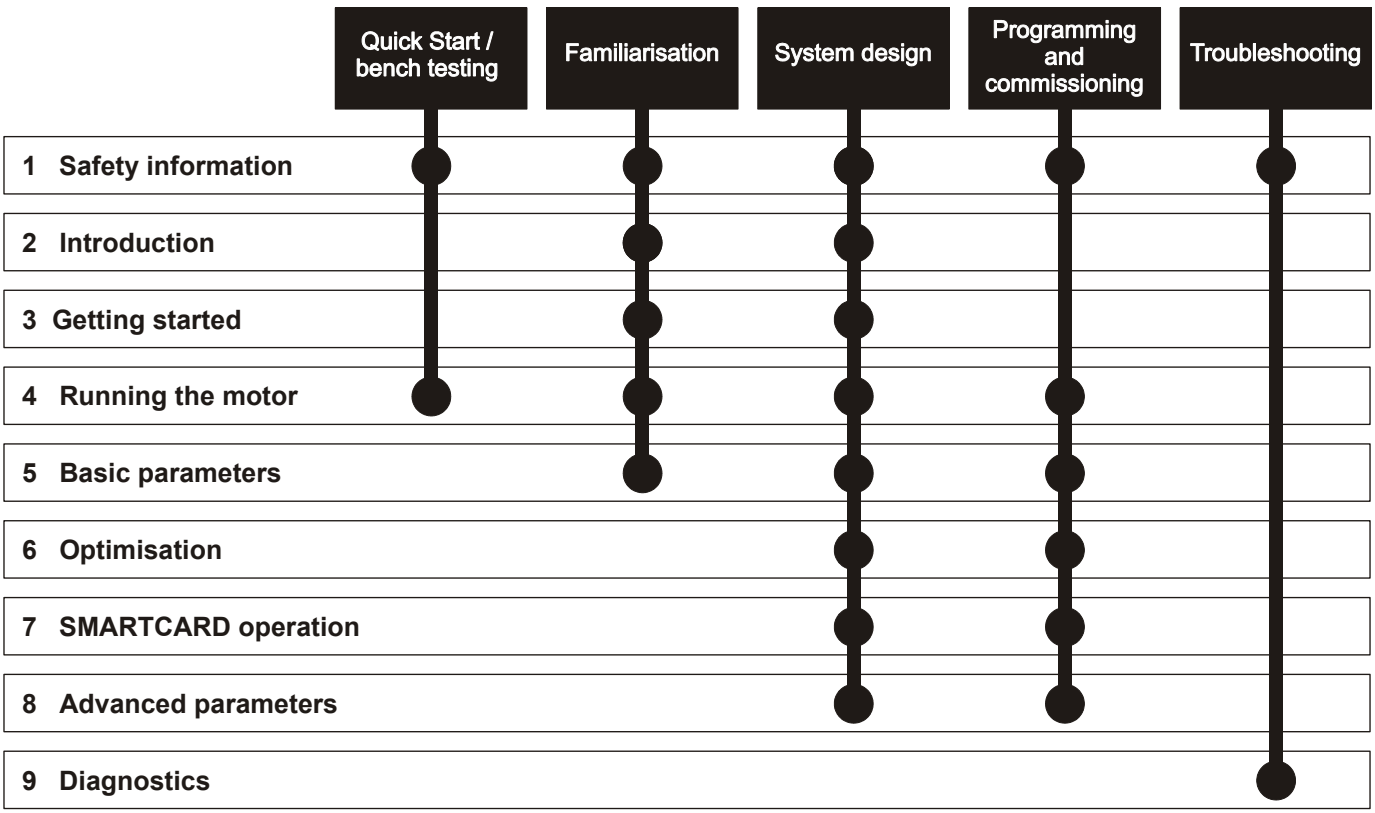
This user guide provides information for operating the drive from start to finish.

The information is in logical order, taking the reader from receiving the drive through to fine tuning the performance.

NOTE

There are specific safety warnings throughout this guide, located in the relevant sections. In addition, Chapter 1 *Safety Information* contains general safety information. It is essential that the warnings are observed and the information considered when working with or designing a system using the drive.

This map of the user guide helps to find the right sections for the task you wish to complete:



Contents

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 a 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.

Close attention is required to the electrical installation and the system design to avoid hazards either in normal operation or in the event of equipment malfunction. System design, installation, set-up 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 SAFE TORQUE OFF functions of the drive 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.

With the sole exception of the SAFE TORQUE OFF function, none of the drive functions must be used to ensure safety of personnel, i.e. they must not be used for safety-related functions.
Careful consideration must be given to the functions of the drive which might result in a hazard, either through their 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.

The SAFE TORQUE OFF function has been approved[1] as meeting the requirements of EN954-1 category 3 for the prevention of unexpected starting of the drive. It may be used in a safety-related application. The system designer is responsible for ensuring that the complete system is safe and designed correctly according to the relevant safety standards.

[1]Independent approval by BGIA is pending.

1.4 Environmental limits

Instructions regarding transport, storage, installation and use of the drive must be complied with, including the specified environmental limits. Drives must not be subjected to excessive physical force. Refer to the *Technical Data Guide.*

1.5 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 or other protection, and protective ground (earth) connections.

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

98/37/EC: Safety of machinery.
89/336/EEC: Electromagnetic Compatibility.

1.6 Motor

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

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 in parameter **0.46** motor rated current. This affects the thermal protection of the motor.

1.7 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.

1.8 Electrical installation

1.8.1 Electric shock risk

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

- AC supply cables and connections
- DC bus, dynamic brake 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.

1.8.2 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.

1.8.3 STOP function

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

1.8.4 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 energised, the AC supply must be isolated at least ten minutes before work may continue.

Normally, the capacitors are discharged by an internal resistor. Under certain, unusual fault conditions, it is possible that the capacitors may fail to discharge, or be prevented from being discharged by a voltage applied to the output terminals. If the drive has failed in a manner that causes the display to go blank immediately, it is possible the capacitors will not be discharged. In this case, consult Control Techniques or their authorised distributor.

1.8.5 Equipment supplied by plug and socket

Special attention must be given if the drive is installed in equipment which is connected to the AC supply by a plug and socket. The AC supply terminals of the drive are connected to the internal capacitors through rectifier diodes which are not intended to give safety isolation. If the plug terminals can be touched when the plug is disconnected from the socket, a means of automatically isolating the plug from the drive must be used (e.g. a latching relay).

1.8.6 Permanent magnet motors

Permanent magnet motors generate electrical power if they are rotated, even when the supply to the drive is disconnected. If that happens then the drive will become energised through its motor terminals.

If the motor load is capable of rotating the motor when the supply is disconnected, then the motor must be isolated from the drive before gaining access to any live parts.

2 Introduction

The Digitax ST family of servo drives are available with four levels of intelligence:

- Digitax ST Base
- Digitax ST Indexer
- Digitax ST Plus
- Digitax ST EZMotion

The Digitax ST Base drive operates in velocity or torque modes and is designed to operate with a centralized motion controller or as a standalone drive.

The Digitax ST Indexer drive performs point-to-point motion profiling including relative, absolute, rotary plus, rotary minus, registration and homing motion. The Digitax ST Indexer will operate as a single standalone system controller. Alternatively, the Digitax ST Indexer can form part of a distributed system where commands are sent over a fieldbus or through digital input/output signals. The Digitax ST Indexer drive is commissioned using a simple and easy to use indexing tool that resides within CTSoft, a set-up tool for Control Techniques products.

The Digitax ST plus drive offers all the features available on the Digitax ST Indexer drive with the addition of performing complex motion as a single axis or synchronized to a reference axis. This offers digital lock and electronic camming via a virtual master reference. The Digitax ST Plus drive is commissioned using a simple and easy to use indexing tool that resides within CT Soft, a set-up tool for Control Techniques products.

For more complex systems using the Digitax ST Indexer and Digitax ST Plus drives, an export feature is available that allows the user to import applications into SYPTPro for further development.

The Digitax ST EZMotion drive is part of the Motion Made Easy family of servo drives and allows the user to create programs to sequence motion, I/O control, and other machine operations in one environment. Digitax ST EZMotion also supports advanced functions such as a Position Capture Object, Multiple Profile Summation, Queuing, and Program Multitasking.

The four variants are supplied with the following product specific documentation:

- *Digitax ST Installation Guide*
- *Digitax ST Technical Data Guide (CD)*
- *Digitax ST User Guide (CD)*

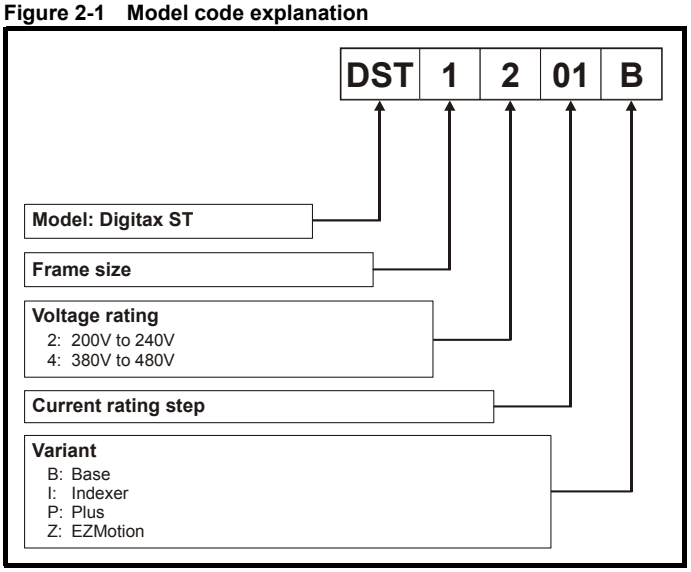
The following additional reference material is available on the CD supplied with the drive or downloadable on www.controltechniques.com.

- Advanced User Guide
- *EZMotion User/Programming Guide*
- *SM- Application Modules and Motion Processors User Guide*

2.1 Drive model numbers

Each drive variant and rating has a unique model number displayed on the rating label.

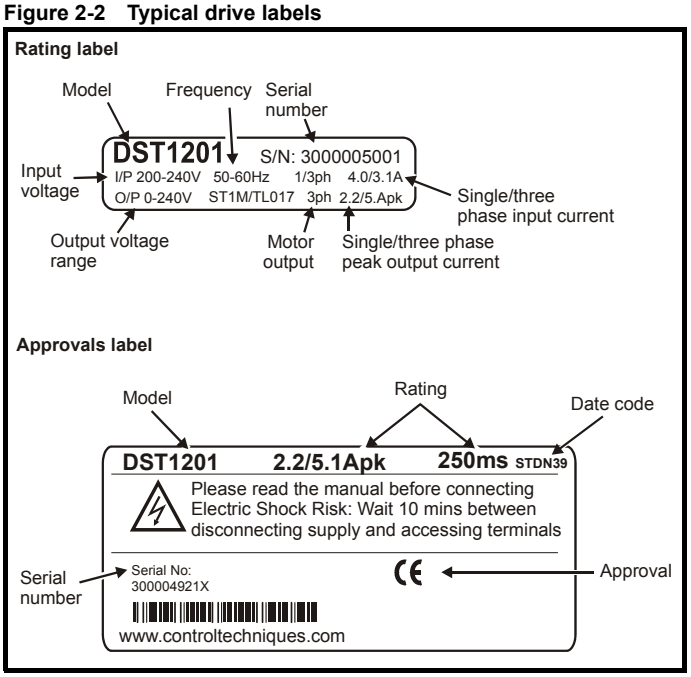
Figure 2-1 Model code explanation



2.2 Drive nameplate description

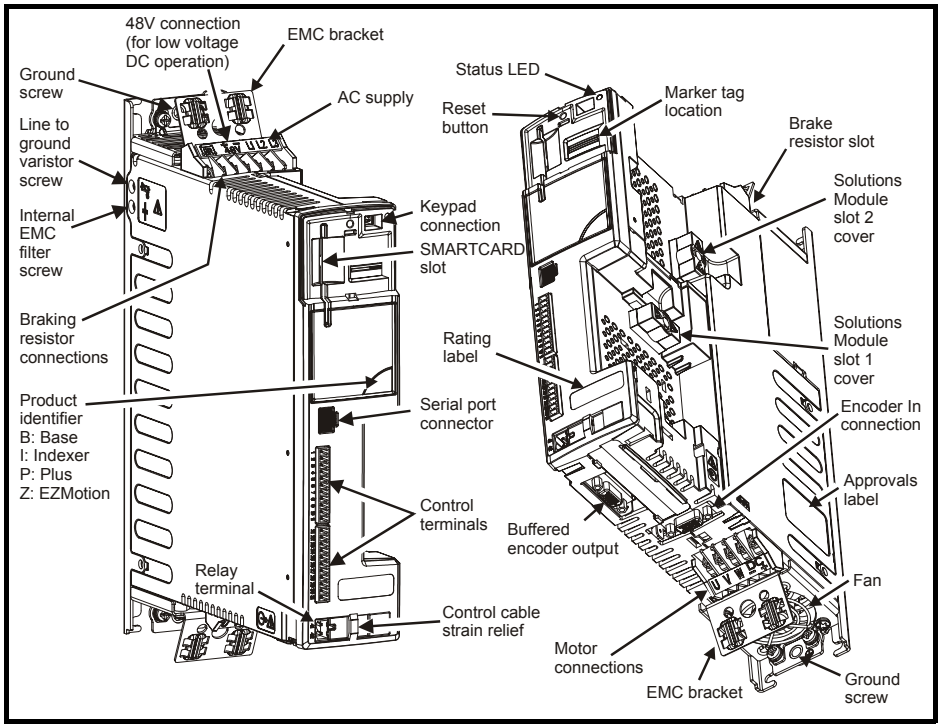
The drive rating label provides the user with various details relating to the drive variant and rating.

Figure 2-2 Typical drive labels



2.3 Features of the drive

Figure 2-3 Features of the drive

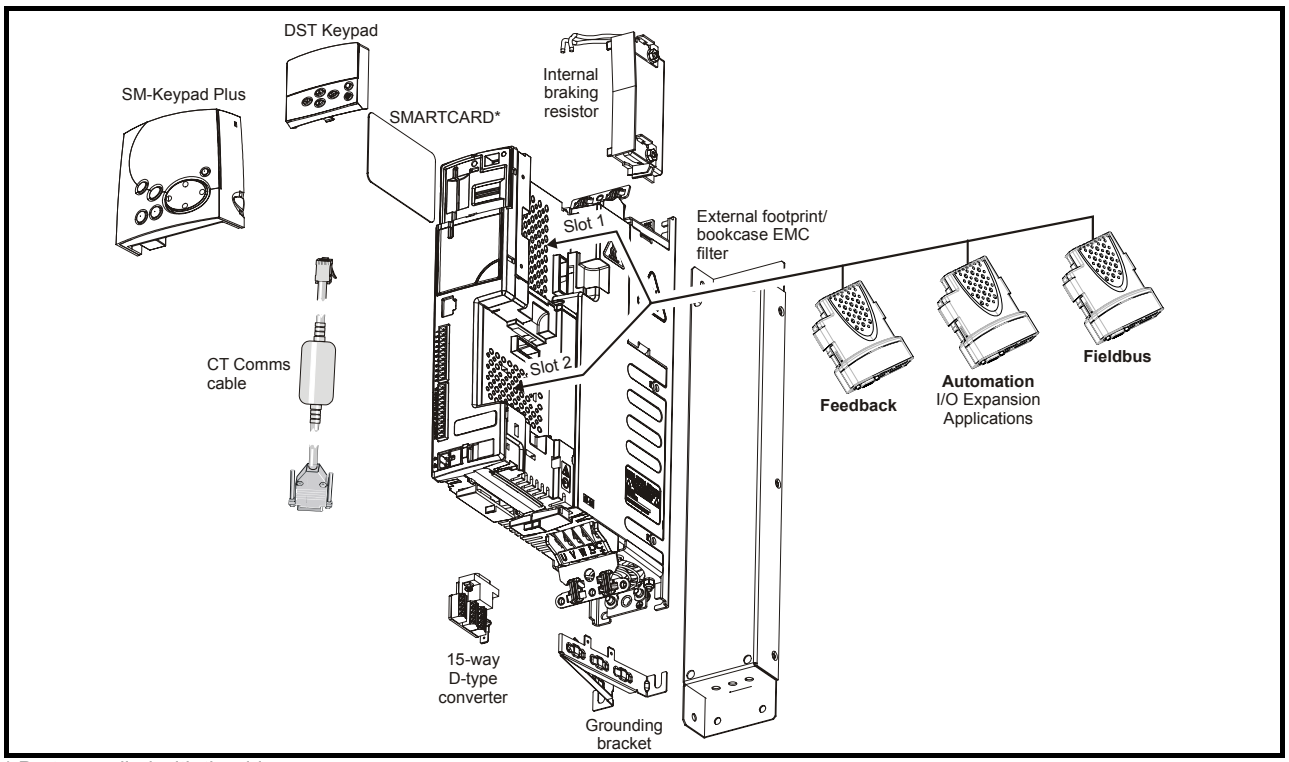


NOTE The drive is supplied with a SMARTCARD installed. Do not remove until after first power-up, as defaults are stored on the SMARTCARD.

CAUTION Static precautions must be taken when removing the Solutions Module slot covers.

2.4 Options

Various options are available for the Digitax ST range. These include:



* Parts supplied with the drive

For a complete list of options / accessories please refer to the *Technical Date Guide*.

3 Getting Started

After following the instructions given in the Digitax ST Installation Guide, this chapter introduces the user interfaces, menu structures and security level of the drive.

3.1 User interfaces

There are six user interfaces available for the various drive variants.

- CTSoft
- SYPT Pro
- EZMotion PowerTools Pro
- DST Keypad (LED)
- SM-Keypad Plus (LCD)

Table 3-1 User interface compatibility

	Digitax ST Base	Digitax ST Indexer	Digitax ST Plus	Digitax ST EZMotion
CTSoft	√	√		
SYPT Pro		√	√	
EZMotion PowerTools pro				√
DST Keypad	√	√	√	√
SM-Keypad Plus	√	√	√	√

3.1.1 User software system requirements

System requirements are:

- Windows™ 2000, XP or Vista
- Internet Explorer 5.0 or later.
- Minimum of 800x600 screen resolution with 256 colours. 1024x768 is recommended.
- 128MB RAM
- Microsoft.Net frameworks 2.0 (supplied on CD)
- Pentium III 500MHz or better recommended.
- Adobe Acrobat Reader for parameter help files access (supplied on CD provided)
- Windows™ Administrator rights to install

3.1.2 CT Soft

CTSoft is a Window™ based software set-up tool for Control Techniques Products.

CTSoft can be used for set-up and monitoring, drive parameters can be uploaded, downloaded and compared, and simple or custom menu listings can be created. Drive menus can be displayed in standard list format or as live block diagrams. CTSoft is able to communicate with a single drive or network.

For the Digitax ST Indexer and Digitax ST Plus variants, CTSoft allows users to specify and execute motion sequences using sequential function chart style diagrams.

Refer to the on-line set-up wizard and help files in CTSoft for further information.

CTSoft is available on the CD which is supplied with the drive.

3.1.3 SYPTPro (Indexer & Plus only)

SYPTPro is a professional drive programming toolkit for OEM's and End Users who wish to maximize performance of the Digitax ST Indexer or the Digitax ST Plus. SYPTPro allows the user to program in a choice of three languages, with a real-time multi-tasking environment

SYPTPro incorporates IEC61131-3 style ladder language editor. This form of programming will be familiar to all PLC programmers and is the ideal format for sequencing and I/O control.

For further information on programming with SYPTPro refer to the *SM-Applications Module And Motion Processors User Guide.*

SM-Applications Module And Motion Processors User Guide is available on the CD, which is supplied with the drive.

3.1.4 EZMotion PowerTools Pro

Applications for the Digitax ST EZMotion are developed using PowerTools Pro software. PowerTools Pro is an easy to use, Windows™ based set-up and diagnostics tool. It provides the user with the ability to create, edit and maintain the system set-up.

PowerTools Pro is designed to be the easiest to use software available for the 1 ½ axis motion controllers.

Features of PowerTools Pro include:

- Hierarchy Tree for quick navigation to any set-up view.
- Simple I/O function assignments.
- Powerful on-line diagnostic capability.
- Fill in black motion profile parameters

For further information on programming with PowerTools Pro refer to the *EZMotion User/Programming Guide*.

The *EZMotion User/Programming Guide* is available on the CD, which is supplied with the drive.

3.1.5 Digitax ST Keypad/SM-Keypad Plus

Refer to section 3.2 *Keypad operation*

3.2 Keypad operation

3.2.1 Understanding the display

There are two keypads available for the Digitax ST. The Digitax ST Keypad has an LED display and the SM-Keypad Plus has an LCD display. The Digitax ST Keypad can be installed to the drive and the SM -Keypad Plus is remotely mounted on an enclosure door.

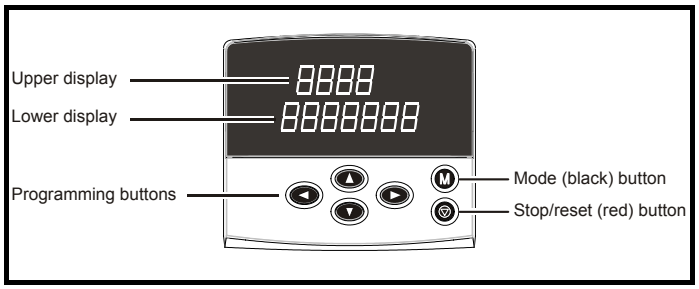
3.2.2 Digitax ST Keypad (LED)

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 3-1 Digitax ST Keypad



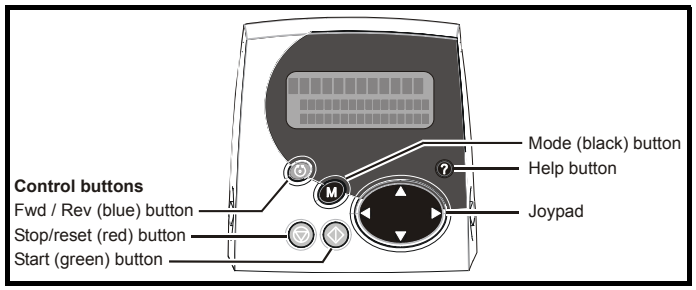
3.2.3 SM-Keypad Plus (LCD)

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 3-2 SM-Keypad Plus (remote mount only)



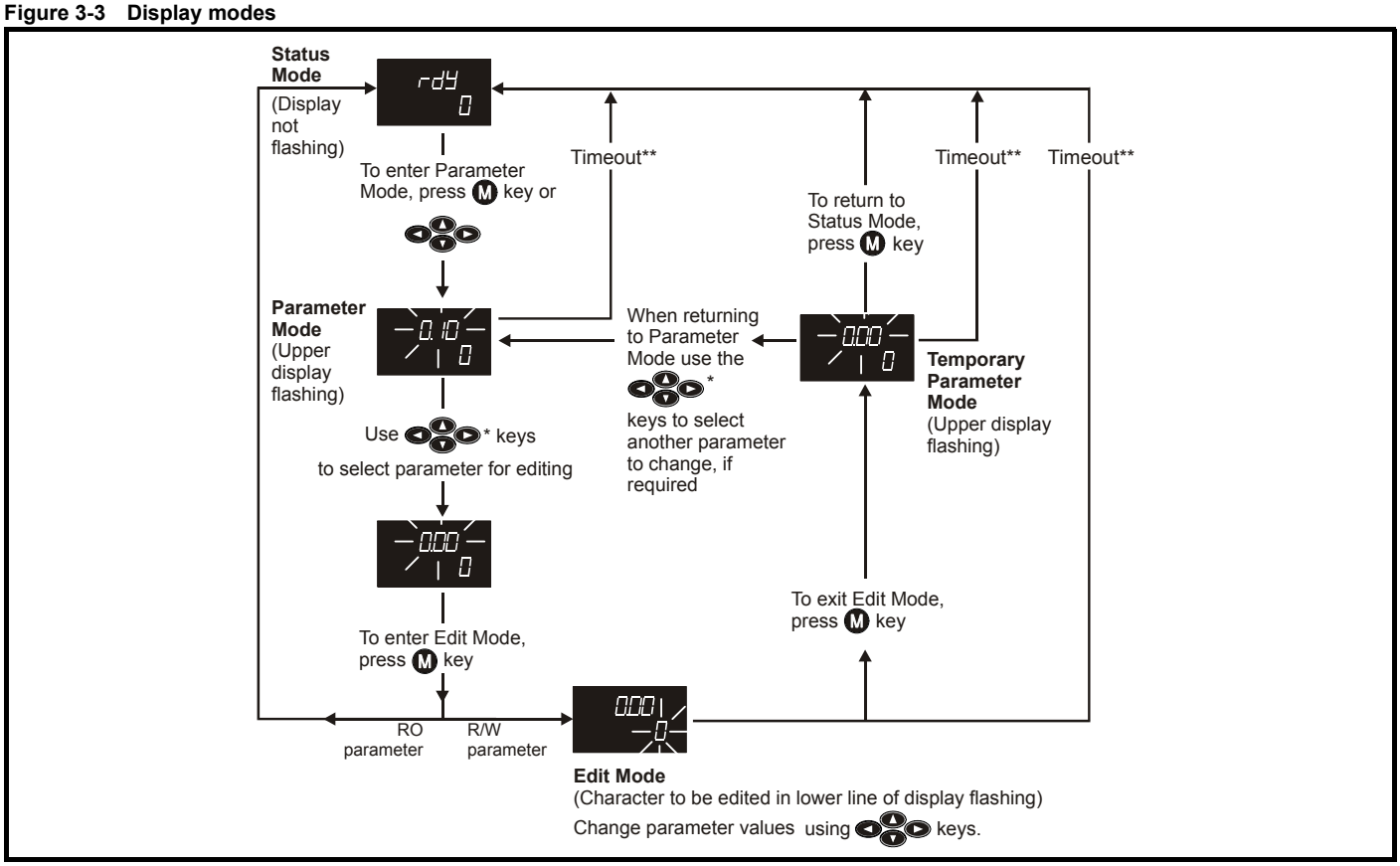
3.2.4 Keypad operation

Control buttons

The keypad consists of:

1. Programming buttons: 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. Reset button
4. Help button (Keypad Plus only) - displays text briefly describing the selected parameter.
5. Start, Fwd/Rev buttons (Keypad Plus only) - used to control the drive if Keypad mode is selected.

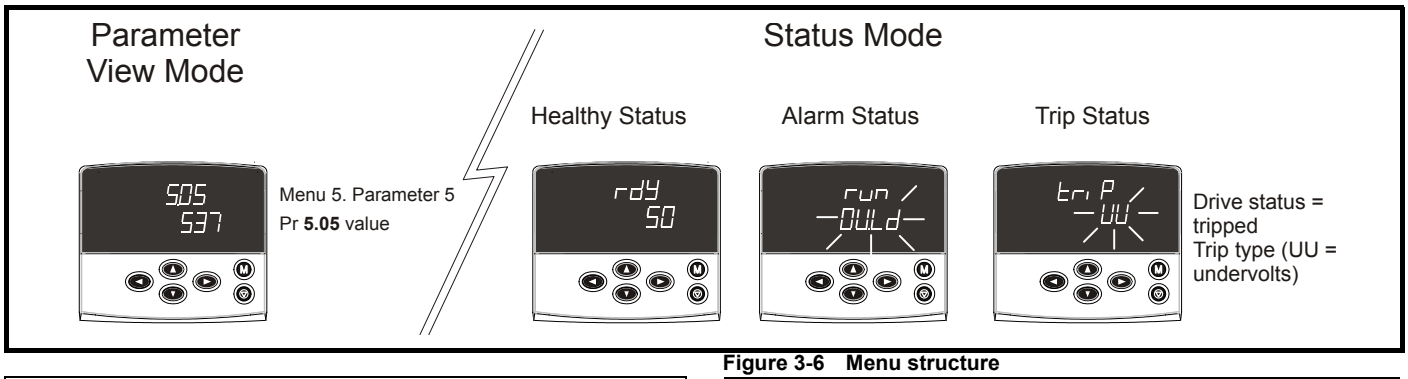
Figure 3-3 Display modes



*can only be used to move between menus if L2 access has been enabled (Pr **0.49**). Refer to section 3.2.9 *Parameter access level and security* on page 12.

Timeout defined by Pr **11.41 (default value = 240s).

Figure 3-4 Mode examples



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

NOTE

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

NOTE

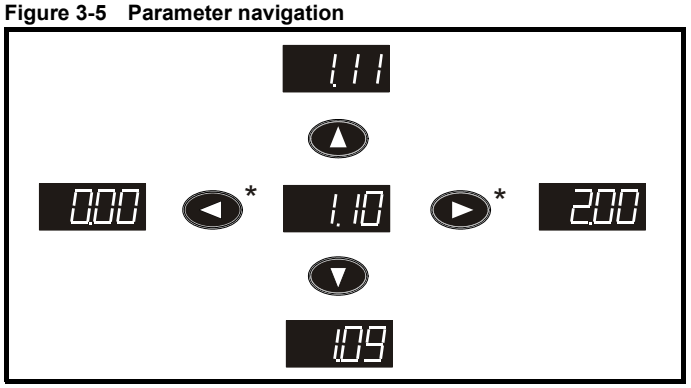
For new parameter-values to apply after the AC supply to the drive is interrupted, new values must be saved. Refer to section 3.2.7 *Saving parameters* on page 11.

3.2.5 Menu structure

The drive parameter structure consists of menus and parameters.

The drive initially powers up so that only menu 0 can be viewed. The up and down arrow buttons are used to navigate between parameters and once level 2 access (L2) has been enabled (see Pr **0.49**) the left and right buttons are used to navigate between menus. For further information, refer to section 3.2.9 *Parameter access level and security* on page 12.

Figure 3-5 Parameter navigation



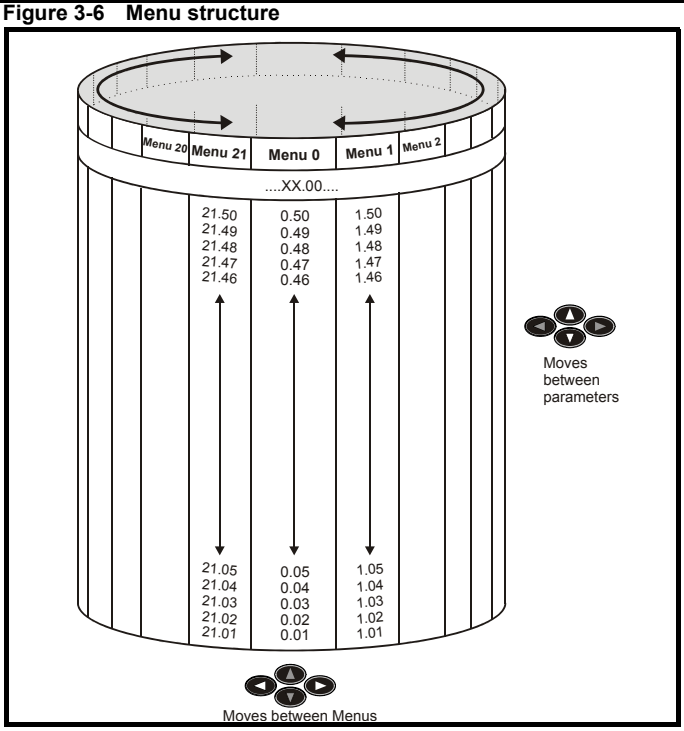
*can only be used to move between menus if L2 access has been enabled (Pr **0.49**). Refer to section 3.2.9 *Parameter access level and security* on page 12.

The menus and parameters roll over in both directions.

i.e. 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 thus displays that parameter.

Figure 3-6 Menu structure



3.2.6 Advanced menus

The advanced menus consist of groups or parameters appropriate to a specific function or feature of the drive. Menus 0 to 22 can be viewed on both keypads. Menus 40 and 41 are specific to the Keypad Plus (LCD).

Menu	Description
0	Commonly used basic set up parameters for quick / easy programming
1	Frequency / speed reference
2	Ramps
3	Slave frequency, speed feedback and speed control
4	Torque and current control
5	Motor control
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, 16	Solutions Module set-up
17	Motion processor
18	Application menu 1
19	Application menu 2
20	Application menu 3
21	Second motor parameters
22	Additional Menu 0 set-up

3.2.7 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 1000* in Pr. **xx.00**

Either:

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

*If the drive is in the under voltage trip state or is being supplied from a low voltage DC supply, a value of 1001 must be entered into Pr **xx.00** to perform a save function.

3.2.8 Restoring parameter defaults

Restoring parameter defaults by this method saves the default values in the drive's memory. (Pr **0.49** and Pr **0.34** are not affected by this procedure.)

Procedure

1. Ensure the drive is not enabled, i.e. terminal 31 is open or Pr **6.15** is Off (0)
2. Enter 1233 (EUR 50Hz settings) or 1244 (USA 60Hz settings) in Pr **xx.00**.
3. Either:

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

3.2.9 Parameter access level and security

The parameter access level determines whether the user has access to menu 0 only or to all the advanced menus (menus 1 to 22) in addition to menu 0.

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

Both the User Security and Parameter Access Level can operate independently of each other as shown in the table below:

Parameter Access Level	User Security	Menu 0 status	Advanced menus status
L1	Open	RW	Not visible
L1	Closed	RO	Not visible
L2	Open	RW	RW
L2	Closed	RO	RO

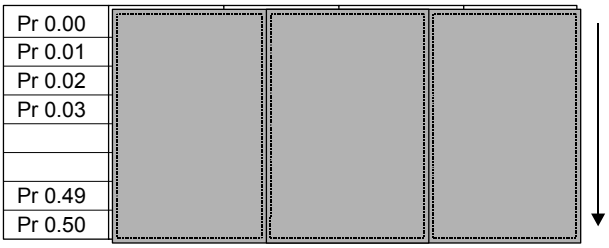
RW = Read / write access RO = Read only access

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.

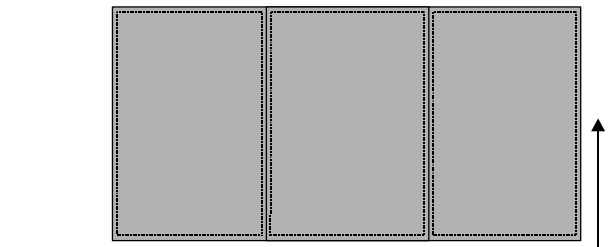
Access Level

The access level is set in Pr **0.49** and allows or prevents access to the advanced menu parameters.

L1 access selected - Menu 0 only visible



L2 access selected - All parameters visible



Pr 0.00	Pr 1.00	.....	Pr 21.00	Pr 22.00
Pr 0.01	Pr 1.01	.....	Pr 21.01	Pr 22.01
Pr 0.02	Pr 1.02	.....	Pr 21.02	Pr 22.02
Pr 0.03	Pr 1.03	.....	Pr 21.03	Pr 22.03
		.....		
		.....		
Pr 0.49	Pr 1.49	.....	Pr 21.30	Pr 22.28
Pr 0.50	Pr 1.50	.....	Pr 21.31	Pr 22.29

Changing the Access Level

The Access Level is determined by the setting of Pr **0.49** as follows:

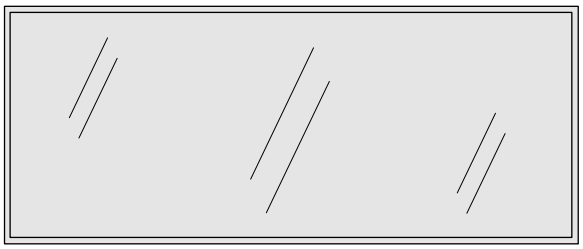
String	Value	Effect
L1	0	Access to menu 0 only
L2	1	Access to all menus (menu 0 to menu 22)

The Access Level can be changed through the keypad even if the User Security has been set.

3.2.10 User Security

The User Security, when set, prevents write access to any of the parameters (other than Pr. **0.49** and Pr **11.44** *Access Level*) in any menu.

User security open - All parameters: Read / Write access



Pr 0.00	Pr 1.00	.....	Pr 21.00	Pr 22.00
Pr 0.01	Pr 1.01	.....	Pr 21.01	Pr 22.01
Pr 0.02	Pr 1.02	.....	Pr 21.02	Pr 22.02
Pr 0.03	Pr 1.03	.....	Pr 21.03	Pr 22.03
		.....		
		.....		
Pr 0.49	Pr 1.49	.....	Pr 21.30	Pr 22.28
Pr 0.50	Pr 1.50	.....	Pr 21.31	Pr 22.29

User security closed - All parameters: Read Only access (except Pr **0.49** and Pr **11.44**)

Pr 0.00	Pr 1.00	.....	Pr 21.00	Pr 22.00
Pr 0.01	Pr 1.01	.....	Pr 21.01	Pr 22.01
Pr 0.02	Pr 1.02	.....	Pr 21.02	Pr 22.02
Pr 0.03	Pr 1.03	.....	Pr 21.03	Pr 22.03
		.....		
		.....		
Pr 0.49	Pr 1.49	.....	Pr 21.30	Pr 22.28
Pr 0.50	Pr 1.50	.....	Pr 21.31	Pr 22.29

Setting User Security

Enter a value between 1 and 999 in Pr **0.34** and press the M button; the security code has now been set to this value. In order to activate the security, the Access level must be set to Loc in Pr **0.49**. When the drive is reset, the security code will have been activated and the drive returns to Access Level L1. The value of Pr **0.34** 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 Pr **0.49**.

Unlocking User Security

Select a read write parameter to be edited and press the M button, the 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 Pr **0.49** to Loc and press the reset button.

Disabling User Security

Unlock the previously set security code as detailed above. Set Pr **0.34** 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.

3.3 Displaying parameters with non-default values only

By entering 12000 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. In order 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, refer to section 3.2.9 *Parameter access level and security* for further information regarding access level.

3.4 Displaying destination parameters only

By entering 12001 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. In order 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, refer to section 3.2.9 *Parameter access level and security* for further information regarding access level.

3.5 Communications

3.5.1 Introduction

The Digitax ST has a standard 2-wire EIA485 interface (serial communications interface) which enables all drive set-up, operation and monitoring to be carried out with a PC or PLC if required. Therefore, it is possible to control the drive entirely by serial communications without the need for a -keypad or other control cabling. The Digitax ST supports two protocols selected by parameter configuration:

- Modbus RTU
- CT ANSI

Modbus RTU has been set as the default protocol, as it is used with the PC-tools set-up software as provided on the CD ROM.

The communications port of the drive is a RJ45 socket, and is isolated from the power stage and the other control terminals.

The communications port applies a 2 unit load to the communications network.

USB/EIA232 to EIA485 Communications

An external USB/EIA232 hardware interface such as a PC cannot be used directly with the 2-wire interface of the drive. Therefore a suitable converter is required.

Suitable USB to EIA485 and EIA232 to EIA485 isolated converters are available from Control Techniques as follows:

- CT USB Comms cable (CT Part No. 4500-0096)
- CT EIA232 Comms cable (CT Part No. 4500-0087)

When using one of the above converters or any other suitable converter with the Digitax ST, it is recommended that no terminating resistors be connected on the network. It may be necessary to 'link out' the terminating resistor within the converter depending on which type is used. The information on how to link out the terminating resistor will normally be contained in the user information supplied with the converter.

3.5.2 Communications set-up parameters

The following parameters need to be set according to the system requirements.

0.35 {11.24}	**Serial mode**								
RW	Txt							US	
⇳	AnSI (0) rtU (1)				⇨	rtU (1)			

This parameter defines the communications protocol used by the 485 comms port on the drive. This parameter can be changed via the drive keypad, via a Solutions Module or via the comms interface itself. If it is changed via the comms interface, the response to the command uses the original protocol. The master should wait at least 20ms before send a new message using the new protocol. (Note: ANSI uses 7 data bits, 1

stop bit and even parity; Modbus RTU uses 8 data bits, 2 stops bits and no parity.)

Comms value	String	Communications mode
0	AnSI	ANSI
1	rtU	Modbus RTU protocol
2	Lcd	Modbus RTU protocol, but with an Keypad Plus only

ANSIx3.28 protocol
Full details of the CT ANSI communications protocol are given in the *Advanced User Guide*.

Modbus RTU protocol
Full details of the CT implementation of Modbus RTU are given in the *Advanced User Guide*.

Modbus RTU protocol, but with an SM-Keypad Plus only
This setting is used for disabling communications access when the - Keypad Plus is used as a hardware key. See the *Advanced User Guide* for more details.

0.36 {11.25}	**Serial communications baud rate**								
RW	Txt							US	
⇳	300 (0), 600 (1), 1200 (2), 2400 (3), 4800 (4), 9600 (5), 19200 (6), 38400 (7), 57600 (8)*, 115200 (9)*				⇨	19200 (6)			

* only applicable to Modbus RTU mode

This parameter can be changed via the drive keypad, via a Solutions Module or via the comms interface itself. If it is changed via the comms interface, the response to the command uses the original baud rate. The master should wait at least 20ms before sending a new message using the new baud rate.

NOTE
When using the CT EIA232 Comms cable the available baud rate is limited to 19.2k baud.

0.37 {11.23}	**Serial communications address**								
RW	Txt							US	
⇳	0 to 247				⇨	1			

Used to define the unique address for the drive for the serial interface. The drive is always a slave.

Modbus RTU
When the Modbus RTU protocol is used addresses between 0 and 247 are permitted. Address 0 is used to globally address all slaves, and so this address should not be set in this parameter

ANSI
When the ANSI protocol is used the first digit is the group and the second digit is the address within a group. The maximum permitted group number is 9 and the maximum permitted address within a group is 9. Therefore, Pr **0.37** is limited to 99 in this mode. The value 00 is used to globally address all slaves on the system, and x0 is used to address all slaves of group x, therefore these addresses should not be set in this parameter.

4 Running the motor

This chapter takes the new user through all the essential steps to running a motor for the first time.

WARNING

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

CAUTION

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 Pr **0.46** *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 **1.17**).

WARNING

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

Figure 4-1 Minimum connections to get the motor running via Serial Communications (e.g. CTSoft)

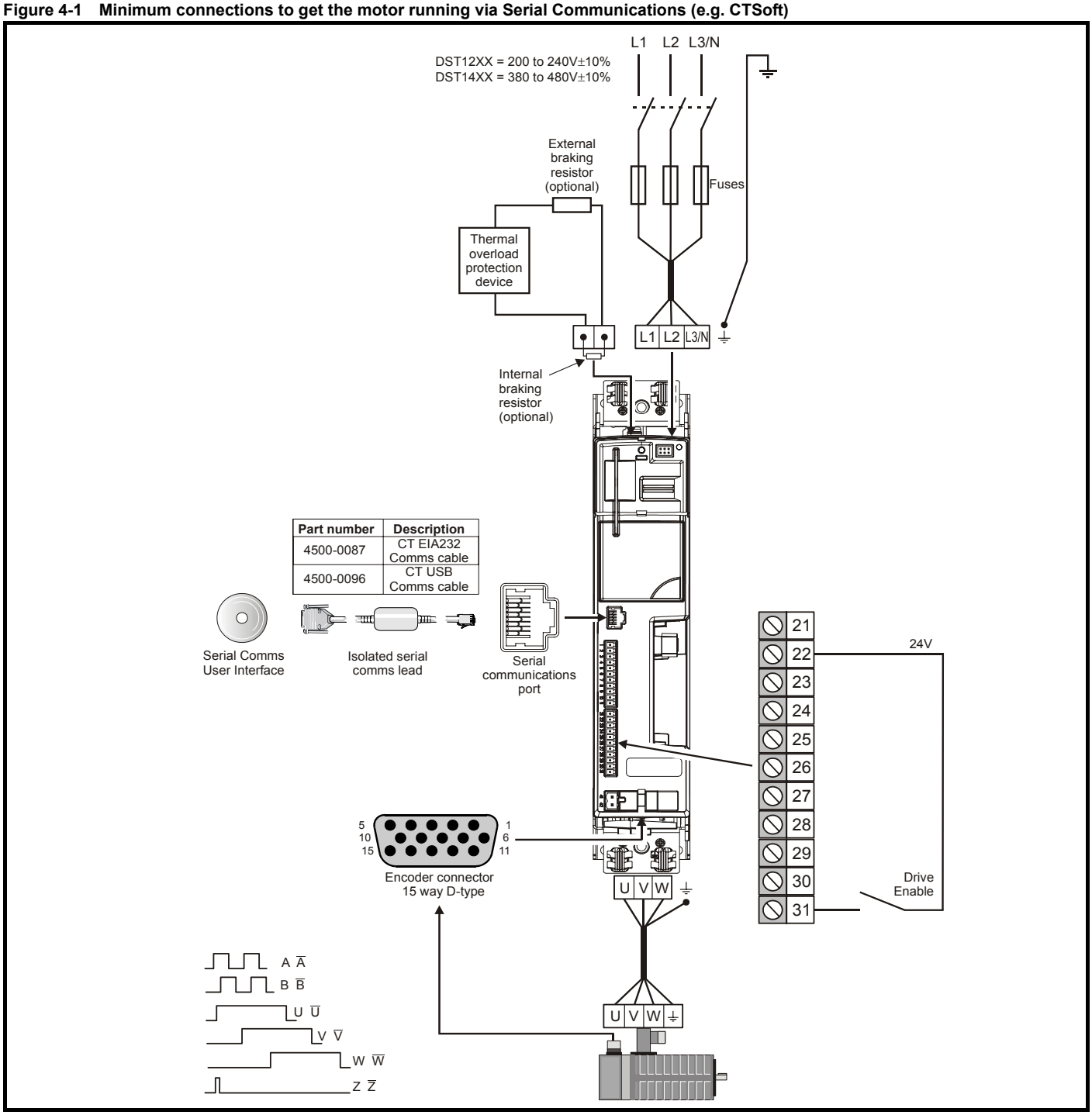


Figure 4-2 Minimum connections to get the motor running via keypad

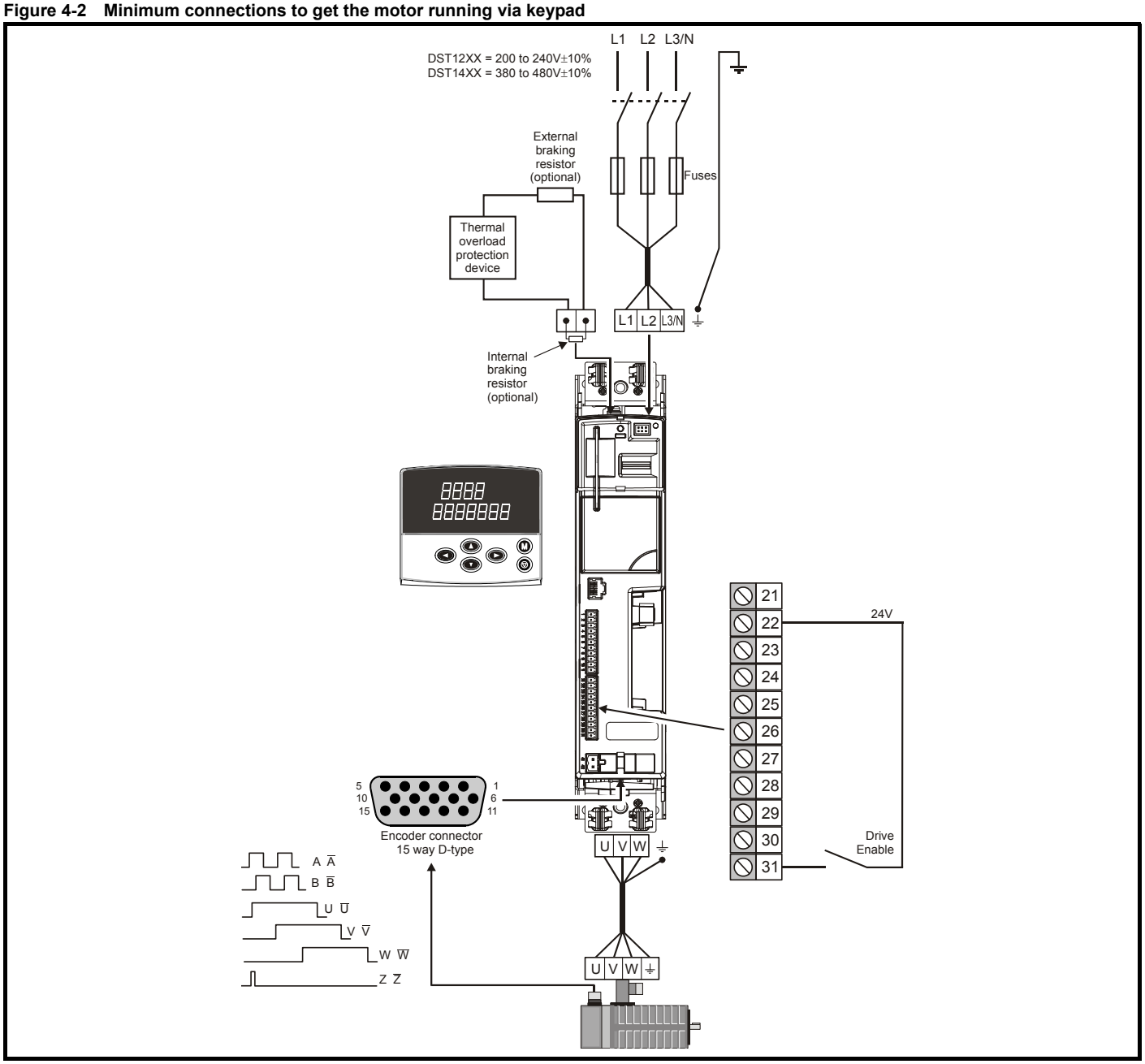
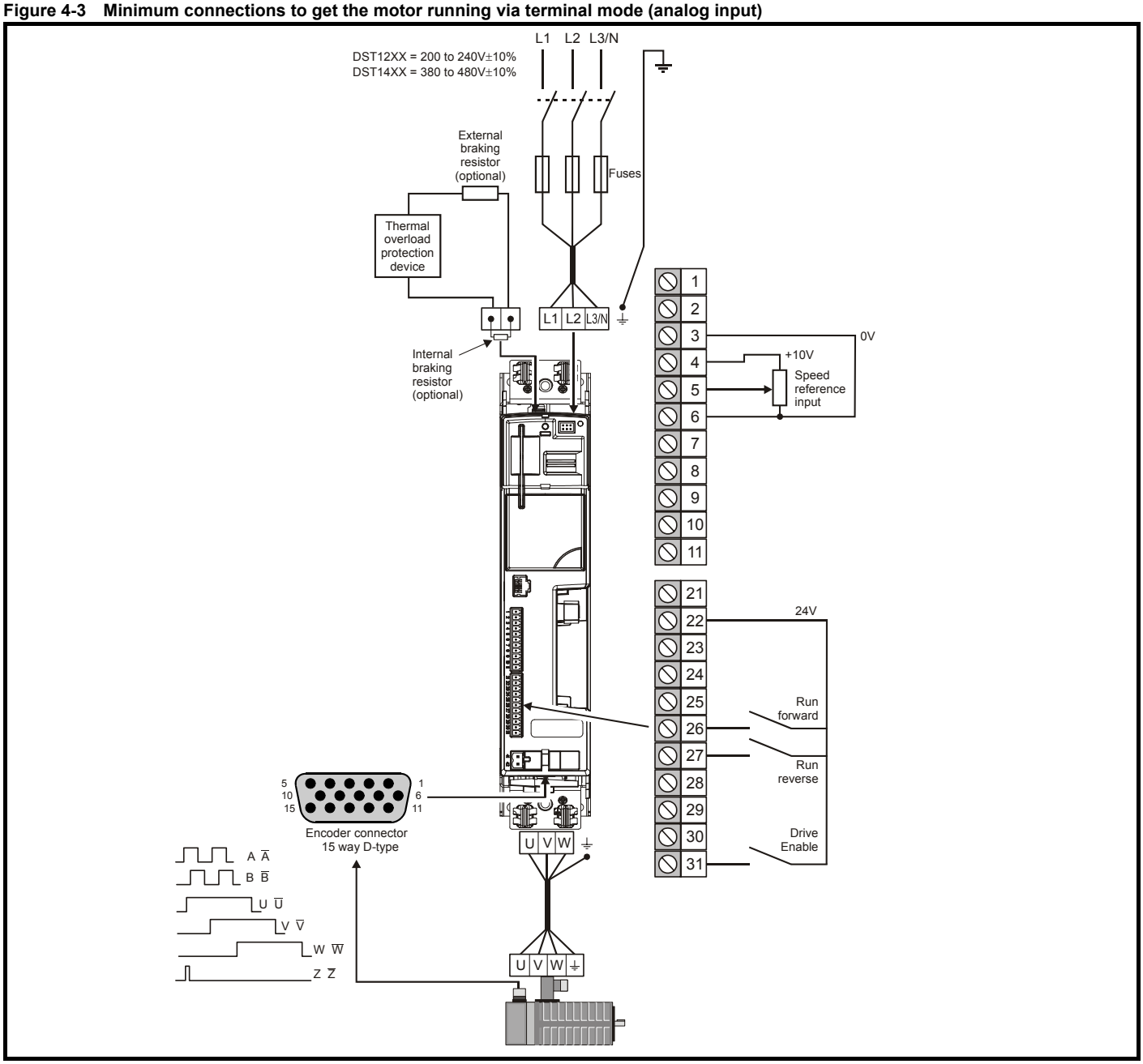
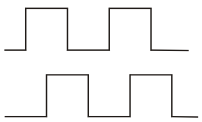
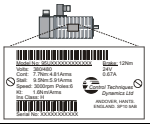
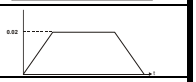
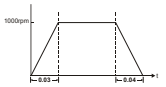
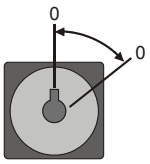


Figure 4-3 Minimum connections to get the motor running via terminal mode (analog input)



4.1 Quick Start set-up

For simplicity only an incremental quadrature encoder will be considered here. For information on setting up one of the other supported speed feedback devices, refer to section 4.2 *Setting up a feedback device* on page 19.

Action	Detail	
Before power-up	Ensure: • Drive Enable signal is not given (terminal 31) • Run signal is not given • Motor is connected • Feedback device is connected	
Power-up the drive	Ensure: • SMARTCARD is installed (first power-up only) • Drive displays 'inh' If the drive trips, see Chapter 8 *Diagnostics* on page 27.	
Set motor feedback parameters	**Incremental encoder basic set-up** Enter: • Drive encoder type in Pr. **3.38** = Ab.SErVO (3): Quadrature encoder with commutation outputs • Encoder power supply in Pr. **3.36** = 5V (0), 8V (1) or 15V (2). **NOTE** If Ab encoder voltage is greater than 5V, then the termination resistors must be disabled Pr **3.39** to 0. **CAUTION** Setting the encoder voltage supply too high for the encoder could result in damage to the feedback device. • Drive encoder Pulses Per Revolution in Pr. **3.34** (set according to encoder) • Drive encoder termination resistor setting in Pr. **3.39**: **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	
Enter motor nameplate details	Enter: • Motor rated current in Pr **0.46** (A) Ensure that this equal to or less than the Heavy Duty rating of the drive otherwise It.AC trips may occur during the autotune. • Number of poles in Pr **0.42**	
Set maximum speed	Enter: • Maximum speed in Pr **0.02** (rpm)	
Set acceleration / deceleration rates	Enter: • Acceleration rate in Pr **0.03** (s/1000rpm) • Deceleration rate in Pr **0.04** (s/1000rpm) (If braking resistor installed, set Pr **0.15** = FAST. Also ensure Pr **10.30** and Pr **10.31** are set correctly, otherwise premature 'It.br' trips may be seen.)	
Autotune	Digitax ST is able to perform a short low speed, a normal low speed or a minimal movement autotune. The motor must be at a standstill before an autotune is enabled. A normal low speed autotune will measure the encoder phase offset angle and calculate the current gains. **WARNING** The short low speed and normal low speed tests will rotate the motor by up to 2 revolutions in the direction selected, regardless of the reference provided. The minimal movement test will move the motor through an angle defined by Pr **5.38**. Once complete the motor will come to a standstill. 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. The motor must not be loaded when attempting an autotune. • The short low speed and normal low speed tests will rotate the motor by up to 2 rotations in the direction selected and the drive measures the encoder phase angle and updates the value in Pr **3.25**. The normal low speed test also measures the stator resistance, and inductance of the motor. These are used to calculate the current loop gains, and at the end of the test the values in Pr **0.38** and Pr **0.39** are updated. The short low speed test takes approximately 2s and the normal low speed test approximately 20s to complete. • The minimal movement autotune will move the motor through an angle defined by Pr **5.38**. The motor must not be loaded for this test although it will operate correctly when the load is an inertia. To perform an autotune: • Set Pr **0.40** = 1 for a short low speed autotune, Pr **0.40** = 2 for a normal low speed test or Pr **0.40** = 5 for a minimal movement autotune. • Close the run signal (terminal 26 or 27). • Close the Drive Enable signal (terminal 31). The lower display will flash 'Auto' and 'tunE' alternatively, while the drive is performing the test. • Wait for the drive to display 'rdy' or 'inh' and for the motor to come to a standstill. If the drive trips it cannot be reset until the drive enable signal (terminal 31) has been removed. See Chapter 8 *Diagnostics* on page 27. Remove the drive enabled and run signal from the drive.	
Save parameters	Enter 1000 in Pr **xx.00** Press the red reset button or toggle the reset digital input (ensure Pr **xx.00** returns to 0)	
Run	Drive is now ready to run	

4.2 Setting up a feedback device

This section shows the parameter settings which must be made to use each of the compatible encoder types with Digitax ST. For more information on the parameters listed here please refer to the *Advanced User Guide*.

4.2.1 Overview

Table 4-1 Parameters required for feedback device set-up

Parameter		Ab, Fd, Fr, Ab.SErVO, Fd.SErVO, Fr.SErVO, or SC encoders	SC.HiPEr encoder	SC.EndAt or SC.SSI encoders	EndAt encoder	SSI encoder
3.33	Drive encoder turns		✓ x	✓ x	✓ x	✓
3.34	Drive encoder lines per revolution	✓	✓ x	✓ x		
3.35	Drive encoder comms resolution		✓ x	✓ x	✓ x	✓
3.36	Drive encoder supply voltage*	✓	✓	✓	✓	✓
3.37	Drive encoder comms baud rate			✓	✓	✓
3.38	Drive encoder type	✓	✓	✓	✓	✓
3.41	Drive encoder auto configuration enable or SSI binary format select		✓	✓	✓	✓

✓ Information required
x Parameter can be set-up automatically by the drive through auto-configuration
* Pr **3.36**: If A + B >5V then disable termination resistors

Table 4-1 shows a summary of the parameters required to set-up each feedback device. More detailed information follows.

4.2.2 Detailed feedback device set-up information

Standard quadrature encoder with or without commutation signals (A, B, Z or A, B, Z, U, V, W), or Sincos encoder without serial communications		
Encoder type	Pr **3.38**	**Ab** (0) for a quadrature encoder without commutation signals **Ab.SErVO** (3) for a quadrature encoder with commutation signals **SC** (6) for a Sincos encoder without serial communications
Encoder power supply voltage	Pr **3.36**	**5V** (0), **8V** (1) or **15V** (2) **NOTE** If Ab encoder voltage is greater than 5V, then the termination resistors must be disabled Pr **3.39** to 0
Encoder number of lines per revolution	Pr **3.34**	Set to the number of lines or sine waves per revolution of the encoder.
Encoder termination selection (Ab or Ab.SErVO only)	Pr **3.39**	**0** = A, B, Z termination resistors disabled **1** = A, B termination resistors enabled and Z termination resistors disabled **2** = A, B, Z termination resistors enabled
Encoder error detection level	Pr **3.40**	**0** = Error detection disable **1** = Wire break detection on A, B and Z inputs enabled **2** = Phase error detection (Ab.SErVO only) **3** = Wire break detection on A, B and Z inputs and phase error detection (Ab.SErVO only) Termination resistors must be enabled for wire break detection to operate

Incremental encoder with frequency and direction (F and D), or Forward and Reverse (CW and CCW) signals, with or without commutation signals		
Encoder type	Pr **3.38**	**Fd** (1) for frequency and direction signals without commutation signals **Fr** (2) for forward and reverse signals without commutation signals **Fd.SErVO** (4) for a frequency and direction encoder with commutation signals **Fr.SErVO** (5) for forward and reverse signals with commutation signals
Encoder power supply voltage	Pr **3.36**	**5V** (0), **8V** (1) or **15V** (2) **NOTE** If Ab encoder voltage is greater than 5V, then the termination resistors must be disabled Pr **3.39** to 0
Encoder number of lines per revolution	Pr **3.34**	Set to the number of pulses per revolution of the encoder divide by 2.
Encoder termination selection	Pr **3.39**	**0** = F or CW, D or CCW, Z termination resistors disabled **1** = F or CW, D or CCW termination resistors enabled and Z termination resistors disabled **2** = For CW, D or CCW, Z termination resistors enabled
Encoder error detection level	Pr **3.40**	**0** = Error detection disable **1** = Wire break detection on F & D or CW & CCW, and Z inputs enabled **2** = Phase error detection (Fd.SErVO and Fr.SErVO only) **3** = Wire break detection on F & D or CW & CCW, and Z inputs and Phase error detection (Fd.SErVO and Fr.SErVO only) Termination resistors must be enabled for wire break detection to operate

Absolute Sincos encoder with Hiperface or EnDat serial communications, or Absolute EnDat communications only encoder		
The Digitax ST is compatible with the following Hiperface encoders: SCS 60/70, SCM 60/70, SRS 50/60, SRM 50/60, SHS 170, LINCODER, SCS-KIT 101, SKS36, SKM36, SEK-53.		
Encoder type	Pr **3.38**	**SC.HiPEr** (7) for a Sincos encoder with Hiperface serial communications **EndAt** (8) for an EnDat communications only encoder **SC.EndAt** (9) for a Sincos encoder with EnDat serial communications
Encoder power supply voltage	Pr **3.36**	**5V** (0), **8V** (1) or **15V** (2)
Encoder auto configure enable	Pr **3.41**	Setting this to 1 automatically sets up the following parameters: Pr **3.33** Encoder turn bits Pr **3.34** Encoder number of lines of revolution (SC.HiPEr and SC.EndAt only) * Pr **3.35** Encoder single turn comms resolution Alternatively these parameters can be entered manually.
Encoder comms baud rate (EndAt and SC.EndAt only)	Pr **3.37**	**100** = 100k, **200** = 200k, **300** = 300k, **500** = 500k, **1000** = 1M, **1500** = 1.5M, or **2000** = 2M
Encoder error detection level (SC.HiPEr and SC.EndAt only)	Pr **3.40**	**0** = Error detection disabled **1** = Wire break detection on Sin and Cos inputs **2** = Phase error detection **3** = Wire break detection on Sin and Cos inputs and phase error detection

Absolute SSI communications only encoder, or Absolute Sincos encoder with SSI		
Encoder type	Pr **3.38**	**SSI** (10) for a SSI communications only encoder **SC.SSI** (11) for a Sincos encoder with SSI
Encoder power supply voltage	Pr **3.36**	**5V** (0), **8V** (1) or **15V** (2) **NOTE** If Ab encoder voltage is greater than 5V, then the termination resistors must be disabled Pr **3.39** to 0
Encoder number of lines per revolution. (SC.SSI only)	Pr **3.34**	Set to the number of sine waves per revolution of the encoder.
SSI binary format select	Pr **3.41**	**OFF** (0) for gray code, or **On** (1) for binary format SSI encoders
Encoder turn bits	Pr **3.33**	Set to the number of turn bits for the encoder (this is usually 12bits for a SSI encoder)
Encoder single turn comms resolution	Pr **3.35**	Set to the single turn comms resolution for the encoder (this is usually 13bits for a SSI encoder)
Encoder comms baud rate	Pr **3.37**	**100** = 100k, **200** = 200k, **300** = 300k, **500** = 500k, **1000** = 1M, **1500** = 1.5M, or **2000** = 2M
Encoder error detection level	Pr **3.40**	**0** = Error detection disabled **1** = Wire break detection on Sin and Cos inputs (SC.SSI only) **2** = Phase error detection (SC.SSI only) **3** = Wire break detection and phase error detection (SC.SSI only) **4** = SSI power supply bit monitor **5** = SSI power supply bit monitor and wire break detection (SC.SSI only) **6** = SSI power supply bit monitor and phase error detection (SC.SSI only) **7** = SSI power supply bit monitor, wire break detection and phase error detection (SC.SSI only)

UVW commutation signal only encoders*		
Encoder type	Pr **3.38**	Ab.servo
Encoder power supply voltage	Pr **3.36**	**5V** (0), **8V** (1) or **15V** (2)
Encoder number of lines per revolution	Pr **3.34**	Set to zero
Encoder error detection level	Pr **3.40**	Set to zero to disable wire break detection

* This feedback device provides very low resolution feedback and should not be used for applications requiring a high level of performance.

4.3 Setting up a buffered encoder output

The Digitax ST has a buffered encoder output, which derives its position from the drive encoder input.

This section shows the parameter settings required for the buffered Encoder output.

Pr **3.54** selects the type of buffered encoder output as shown in Table 4-2:

Table 4-2

Pr 3.54	String	Mode
0	Ab	Quadrature outputs
1	Fd	Frequency and direction outputs
2	Fr	Forward and reverse outputs
3	Ab.L	Quadrature outputs with marker lock
4	Fd.L	Frequency and direction outputs with marker lock

The buffered encoder output can scaled using Pr **3.52** as shown in the table below:

Pr 3.52	Ratio
0.0312	1/32
0.0625	1/16
0.1250	1/8
0.2500	1/4
0.5000	1/2
1.0000	1

For more information on the parameters mentioned above please refer to the Advanced User Guide.

5 Basic parameters

Menu 0 is used to bring together various commonly used parameters for basic easy set up of the drive. All the parameters in menu 0 appear in other menus in the drive (denoted by {…}).

Menus 11 and 22 can be used to change most of the parameters in menu 0. Menu 0 can also contain up to 59 parameters by setting up menu 22.

5.1 Single line descriptions

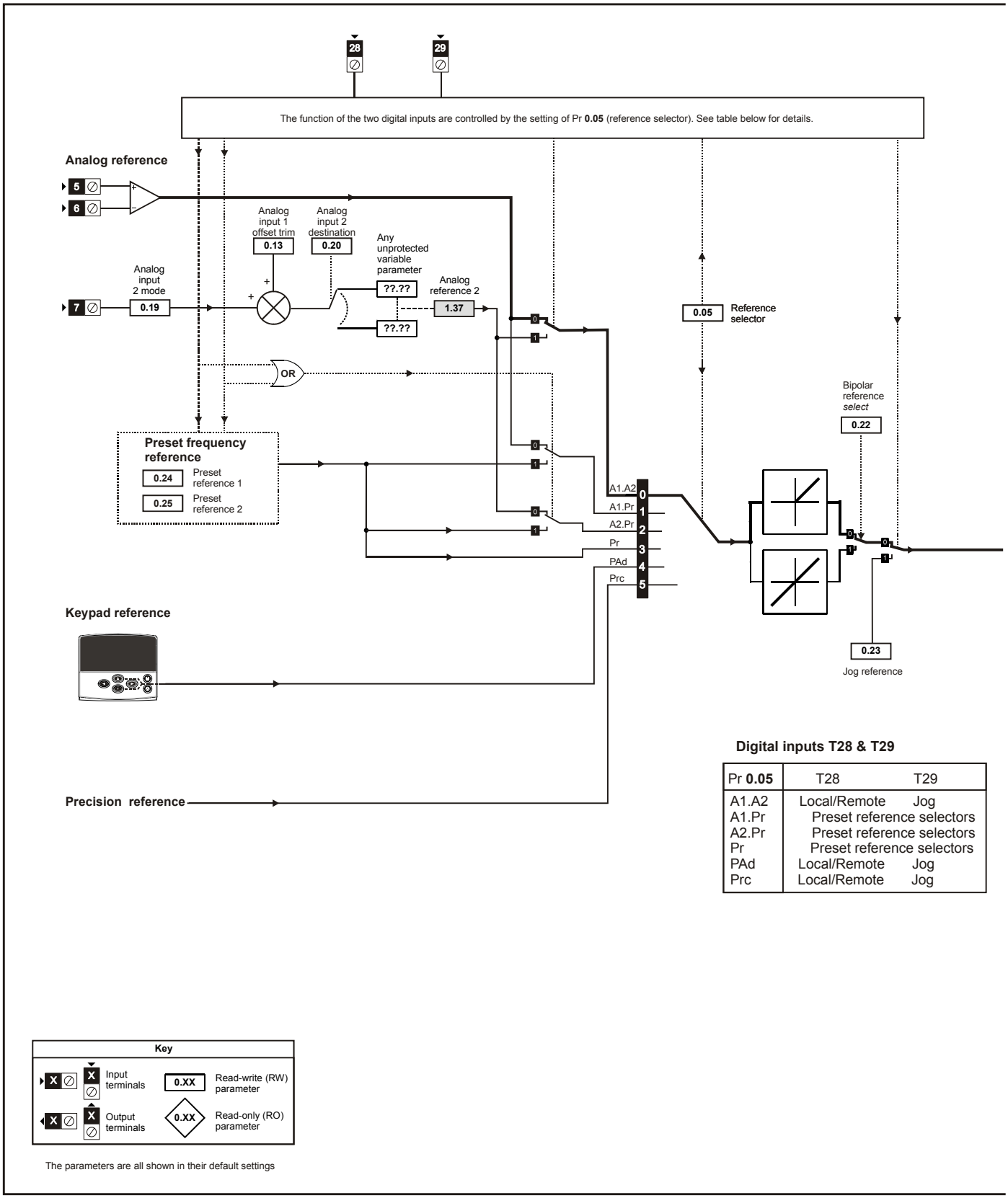
Parameter			Range(⇳)	Default(⇨)	Type					
0.00	**xx.00**	{**x.00**}	0 to 32,767	0	RW	Uni				
0.01	Minimum reference clamp	{**1.07**}	±SPEED_LIMIT_MAX Hz/rpm	0.0	RW	Bi			PT	US
0.02	Maximum reference clamp	{**1.06**}	SPEED_LIMIT_MAX Hz/rpm	3,000.0	RW	Uni				US
0.03	Acceleration rate	{**2.11**}	0.000 to 3,200.000 s/1,000rpm	0.200	RW	Uni				US
0.04	Deceleration rate	{**2.21**}	0.000 to 3,200.000 s/1,000rpm	0.200	RW	Uni				US
0.05	Reference select	{**1.14**}	A1.A2 (0), A1.Pr (1), A2.Pr (2), Pr (3), PAd (4), Prc (5)	A1.A2 (0)	RW	Txt		NC		US
0.06	Current limit	{**4.07**}	0 to Current_limit_max %	300.0	RW	Uni		RA		US
0.07	Speed controller P gain	{**3.10**}	0.0000 to 6.5535 1/rad s^{-1}	0.0100	RW	Uni				US
0.08	Speed controller I gain	{**3.11**}	0.00 to 655.35 1/rad	1.00	RW	Uni				US
0.09	Speed controller D gain	{**3.12**}	0.00000 to 0.65535 (s)	0.00000	RW	Uni				US
0.10	Motor speed	{**3.02**}	±Speed_max rpm		RO	Bi	FI	NC	PT	
0.11	Drive encoder position	{**3.29**}	0 to 65,535 $1/2^{16}$ths of a revolution		RO	Uni	FI	NC	PT	
0.12	Total motor current	{**4.01**}	0 to Drive_current_max A		RO	Uni	FI	NC	PT	
0.13	Analog input 1 offset trim	{**7.07**}	±10.000 %	0.000	RW	Bi				US
0.14	Torque mode selector	{**4.11**}	0 to 4	Speed control mode (0)	RW	Uni				US
0.15	Ramp mode select	{**2.04**}	FASt (0) Std (1)	Std (1)	RW	Txt				US
0.16	Ramp enable	{**2.02**}	OFF (0) or On (1)	On (1)	RW	Bit				US
0.17	Current demand filter time constant	{**4.12**}	0.0 to 25.0 ms	0.0	RW	Uni				US
0.18	Positive logic select	{**8.29**}	OFF (0) or On (1)	On (1)	RW	Bit			PT	US
0.19	Analog input 2 mode	{**7.11**}	0-20 (0), 20-0 (1), 4-20tr (2), 20-4tr (3), 4-20 (4), 20-4 (5), VOLt (6)	VOLt (6)	RW	Txt				US
0.20	Analog input 2 destination	{**7.14**}	Pr **0.00** to Pr **21.51**	Pr **1.37**	RW	Uni	DE		PT	US
0.21	Analog input 3 mode	{**7.15**}	0-20 (0), 20-0 (1), 4-20tr (2), 20-4tr (3), 4-20 (4), 20-4 (5), VOLt (6), th.SC (7), th (8), th.diSp (9)	th (8)	RW	Txt			PT	US
0.22	Bipolar reference select	{**1.10**}	OFF (0) or On (1)	OFF (0)	RW	Bit				US
0.23	Jog reference	{**1.05**}	0 to 4000.0 rpm	0.0	RW	Uni				US
0.24	Pre-set reference 1	{**1.21**}	±Speed_limit_max rpm	0.0	RW	Bi				US
0.25	Pre-set reference 2	{**1.22**}	±Speed_limit_max rpm	0.0	RW	Bi				US
0.26	Overspeed threshold	{**3.08**}	0 to 40,000 rpm	0	RW	Uni				US
0.27	Drive encoder lines per revolution	{**3.34**}	0 to 50,000	4096	RW	Uni				US
0.28	Keypad fwd/rev key enable	{**6.13**}	OFF (0) or On (1)	OFF (0)	RW	Bit				US
0.29	SMARTCARD parameter data	{**11.36**}	0 to 999	0	RO	Uni		NC	PT	US
0.30	Parameter cloning	{**11.42**}	nonE (0), rEAd (1), Prog (2), AutO (3), boot (4)	nonE (0)	RW	Txt		NC		*
0.31	Drive rated voltage	{**11.33**}	200 (0), 400 (1)		RO	Txt		NC	PT	
0.32	Drive rated current	{**11.32**}	0.00 to 9999.99A		RO	Uni		NC	PT	
0.34	User security code	{**11.30**}	0 to 999	0	RW	Uni		NC	PT	PS
0.35	Serial comms mode	{**11.24**}	AnSI (0), rtu (1), Lcd (2)	rtU (1)	RW	Txt				US
0.36	Serial comms baud rate	{**11.25**}	300 (0), 600 (1), 1200 (2), 2400 (3), 4800 (4), 9600 (5), 19200 (6), 38400 (7), 57600 (8) Modbus RTU only, 115200 (9) Modbus RTU only	19200 (6)	RW	Txt				US
0.37	Serial comms address	{**11.23**}	0 to 247	1	RW	Uni				US
0.38	Current loop P gain	{**4.13**}	0 to 30,000	200V drive: 75 400V drive: 150	RW	Uni				US
0.39	Current loop I gain	{**4.14**}	0 to 30,000	200V drive: 1000 400V drive: 2000	RW	Uni				US
0.40	Autotune	{**5.12**}	0 to 6	0	RW	Uni				
0.41	Maximum switching frequency	{**5.18**}	3 (0), 4 (1), 6 (2), 8 (3), 12 (4)	6 (2)	RW	Txt		RA		US
0.42	No. of motor poles	{**5.11**}	0 to 60 (Auto to 120 pole)	6 POLE (3)	RW	Txt				US
0.43	Encoder phase angle	{**3.25**}	0.0 to 359.9°	0.0	RW	Uni				US
0.44	Motor rated voltage	{**5.09**}	0 to AC_voltage_set_max V	200V drive: 230 400V drive: EUR> 400, USA> 460	RW	Uni		RA		US
0.45	Motor thermal time constant	{**4.15**}	0.0 to 3000.0	20.0	RW	Uni				US
0.46	Motor rated current	{**5.07**}	0 to Rated_current_max A	Drive rated current [**11.32**]	RW	Uni		RA		US

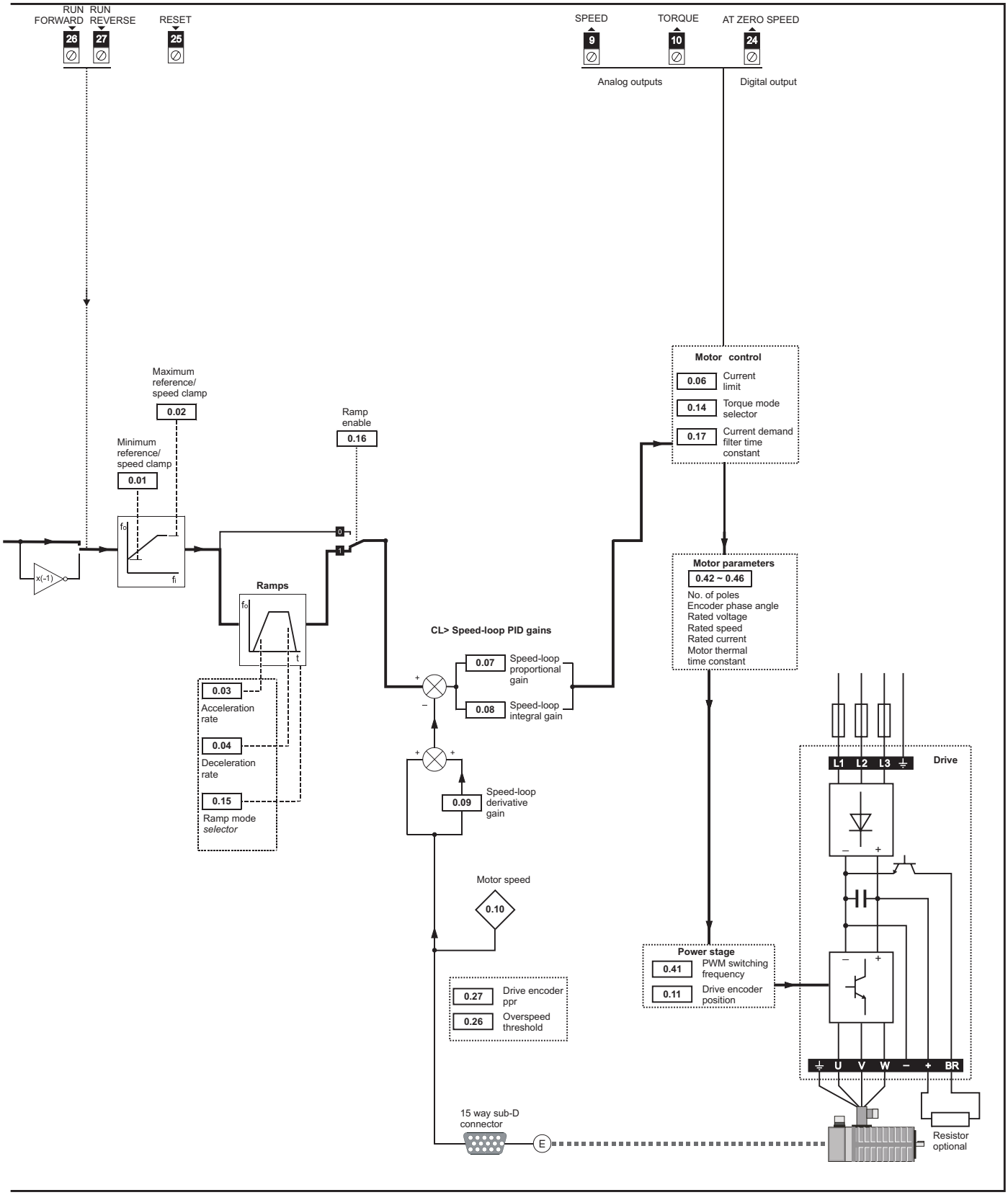
Parameter			Range(⇳)	Default(⇨)	Type					
0.48	User drive mode	{**11.32**}	SErVO (3)	SErVO (3)	RO	Txt		NC	PT	
0.49	Security status	{**11.44**}	L1 (0), L2 (1), Loc (2)		RW	Txt			PT	US
0.50	Software version	{**11.29**}	1.00 to 99.99		RO	Uni		NC	PT	
0.51	Action on trip detection	{**10.37**}	0 to 15	0	RW					US

Key:

Coding	Attribute
{X.XX}	Copied advanced parameter
RW	Read/write: can be written by the user
RO	Read only: can only be read by the user
Bit	1 bit parameter: 'On' or 'OFF' on the display
Bi	Bipolar parameter
Uni	Unipolar parameter
Txt	Text: the parameter uses text strings instead of numbers.
FI	Filtered: some parameters which can have rapidly changing values are filtered when displayed on the drive keypad for easy viewing.
DE	Destination: This parameter selects the destination of an input or logic function.
RA	Rating dependent: 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 SMARTCARDs when the rating of the destination drive is different from the source drive and the file is a parameter file.
NC	Not copied: not transferred to or from SMARTCARDs during cloning.
PT	Protected: cannot be used as a destination.
US	User save: parameter saved in drive EEPROM when the user initiates a parameter save.
PS	Power-down save: parameter automatically saved in drive EEPROM when the under volts (UV) trip occurs.

Figure 5-1 Menu 0 logic diagram




RUN FORWARD
26
RUN REVERSE
27
RESET
25
SPEED
9
TORQUE
10
AT ZERO SPEED
24
Analog outputs
Digital output
Motor control
0.06 Current limit
0.14 Torque mode selector
0.17 Current demand filter time constant
Maximum reference/ speed clamp
0.02
Minimum reference/ speed clamp
0.01
Ramp enable
0.16
Ramps
0.03 Acceleration rate
0.04 Deceleration rate
0.15 Ramp mode selector
CL> Speed-loop PID gains
0.07 Speed-loop proportional gain
0.08 Speed-loop integral gain
0.09 Speed-loop derivative gain
Motor speed
0.10
Motor parameters
0.42 ~ 0.46
No. of poles
Encoder phase angle
Rated voltage
Rated speed
Rated current
Motor thermal time constant
Power stage
0.41 PWM switching frequency
0.11 Drive encoder position
0.27 Drive encoder ppr
0.26 Overspeed threshold
Drive
L1 L2 L3
U V W – + BR
15 way sub-D connector
E
Resistor optional

5.2 Full descriptions

5.2.1 Parameter x.00

0.00 {x.00}	Parameter zero									
RW	Uni									
⇳	0 to 32,767					⇨	0			

Pr **x.00** is available in all menus and has the following functions.

Value	Action
1000	Save parameters when under voltage is not active (Pr **10.16** = 0) and low voltage DC supply is not active (Pr **6.44** = 0).
1001	Save parameters under all conditions
1070	Reset all option modules
1233	Load standard defaults
1244	Load US defaults
1255	Change drive mode with standard defaults (excluding menus 15 to 20)
1256	Change drive mode with US defaults (excluding menus 15 to 20)
2001*	Transfer drive parameters as difference from default to a bootable SMARTCARD block in data block number 001
3yyy*	Transfer drive EEPROM data to a SMART Card block number yyy
4yyy*	Transfer drive data as difference from defaults to SMART Card block number yyy
5yyy*	Transfer drive ladder program to SMART Card block number yyy
6yyy*	Transfer SMART Card data block number yyy to the drive
7yyy*	Erase SMART Card data block number yyy
8yyy*	Compare drive parameters with SMART Card data block number yyy
15yyy	Transfer the user program in the applications module in slot 1 to data block number yyy on a SMART Card
16yyy	Transfer the user program in the applications module in slot 2 to data block number yyy on a SMART Card
17yyy	Transfer the user program in the SM-Applications Modules And Motion Processors (Digitax ST Plus and Indexer) to data block number yyy on a SMART Card
18yyy	Transfer a user program in data block number yyy on a SMART Card to the applications module in slot 1
19yyy	Transfer a user program in data block number yyy on a SMART Card to the applications module in slot 2
20yyy	Transfer a user program in data block number yyy on a SMART Card to the SM-Applications Modules And Motion Processors (Digitax ST Plus and Indexer)
9555*	Clear SMARTCARD warning suppression flag
9666*	Set SMARTCARD warning suppression card
9777*	Clear SMARTCARD read-only flag
9888*	Set SMARTCARD read-only flag
9999*	Erase SMARTCARD data block 1 to 499
110zy	Transfer electronic nameplate parameters to/from drive from/ to encoder. See the *Advanced User Guide* for more information on this function.
12000**	Display non-default values only
12001**	Display destination parameters only

* See Chapter 7 *SMARTCARD Operation* for more information of these functions.

** These functions do not require a drive reset to become active. All other functions require a drive reset to initiate the function.

5.2.2 Speed limits

0.01 {1.07}	Minimum reference clamp								
RW	Bi						PT	US	
⇳	±SPEED_LIMIT_MAX Hz/rpm					⇨	0.0		

(When the drive is jogging, [**0.01**] has no effect.)

0.02 {1.06}	Maximum reference clamp								
RW	Uni							US	
⇳	SPEED_LIMIT_MAX Hz/rpm					⇨	3,000.0		

(The drive has additional over-speed protection.)

5.2.3 Ramps, speed reference selection, current limit

0.03 {2.11}	Acceleration rate								
RW	Uni							US	
⇳	0.000 to 3,200.000 s/1,000rpm					⇨	0.200		

Set Pr **0.03** at the required rate of acceleration.

Note that larger values produce lower acceleration. The rate applies in both directions of rotation.

0.04 {2.21}	Deceleration rate								
RW	Uni							US	
⇳	0.000 to 3,200.000 s/1,000rpm					⇨	0.200		

Set Pr **0.04** at the required rate of deceleration.

Note that larger values produce lower deceleration. The rate applies in both directions of rotation.

0.05 {1.14}	Reference selector								
RW	Txt						NC	US	
⇳	0 to 5					⇨	A1.A2 (0)		

Use Pr **0.05** to select the required frequency/speed reference as follows:

Setting		
A1.A2	0	Analog input 1 OR analog input 2 selectable by digital input, terminal 28
A1.Pr	1	Analog input 1 OR preset frequency/speed selectable by digital input, terminal 28 and 29
A2.Pr	2	Analog input 2 OR preset frequency/speed selectable by digital input, terminal 28 and 29
Pr	3	Pre-set frequency/speed
PAd	4	Keypad reference
Prc	5	Precision reference

Setting Pr **0.05** to 1, 2 or 3 will re-configure T28 and T29. Refer to Pr **8.39** (Pr **0.16** in OL) to disable this function.

0.06 {4.07}	Current Limit								
RW	Uni				RA			US	
⇳	0 to Current_limit_max %					⇨	300.0		

Pr **0.06** limits the maximum output current of the drive (and hence maximum motor torque) to protect the drive and motor from overload.

Set Pr **0.06** at the required maximum torque as a percentage of the rated torque of the motor, as follows:

$$[\mathbf{0.06}] = \frac{T_R}{T_{RATED}} \times 100\ (\%)$$

Where:

T_R Required maximum torque

T_{RATED} Motor rated torque

Alternatively, set 0.06 at the required maximum active (torque-producing) current as a percentage of the rated active current of the motor, as follows:

$$[\mathbf{0.06}] = \frac{I_R}{I_{RATED}} \times 100\ (\%)$$

Where:

I_R Required maximum active current

I_{RATED} Motor rated active current

0.07 {3.10}	**Speed controller proportional gain**								
RW	Uni							US	
⇳	0.0000 to 6.5535 1/rad s^{-1}			⇨	0.0100				

Pr **0.07** (**3.10**) operates in the feed-forward path of the speed-control loop in the drive. See Figure 8-3 on page 56 for a schematic of the speed controller. For information on setting up the speed controller gains, refer to Chapter 6 *Optimization* .

0.08 {3.11}	**Speed controller integral gain**								
RW	Uni							US	
⇳	0.00 to 655.35 1/rad			⇨	1.00				

Pr **0.08** (**3.11**) operates in the feed-forward path of the speed-control loop in the drive. See Figure 8-3 on page 56 for a schematic of the speed controller. For information on setting up the speed controller gains, refer to Chapter 6 *Optimization* .

0.09 {3.12}	**Speed controller differential feedback gain**								
RW	Uni							US	
⇳	0.00000 to 0.65535(s)			⇨	0.00000				

Pr **0.09** (**3.12**) operates in the feedback path of the speed-control loop in the drive. See Figure 8-3 on page 56 for a schematic of the speed controller. For information on setting up the speed controller gains, refer to Chapter 6 *Optimization* .

0.10 {3.02}	**Motor speed**								
RO	Bi	FI				NC	PT		
⇳	±Speed_max rpm			⇨					

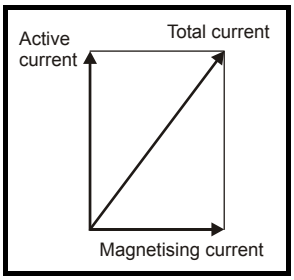
Pr **0.10** (**3.02**) indicates the value of motor speed that is obtained from the speed feedback.

0.11 {3.29}	**Drive encoder position**								
RO	Uni	FI				NC	PT		
⇳	0 to 65,535 1/2^{16}ths of a revolution			⇨					

Pr **0.11** displays the position of the encoder in mechanical values of 0 to 65,535. There are 65,536 units to one mechanical revolution.

0.12 {4.01}	**Total motor current**								
RO	Uni	FI				NC	PT		
⇳	0 to Drive_current_max A			⇨					

Pr **0.12** displays the rms value of the output current of the drive in each of the three phases. The phase currents consist of an active component and a reactive component, which can form a resultant current vector as shown in the following diagram.



The active current is the torque producing current and the reactive current is the magnetising or flux-producing current.

0.13 {7.07}	**Analog input 1 offset trim**								
RW	Bi							US	
⇳	±10.000 %			⇨	0.000				

Pr **0.13** can be used to trim out any offset in the user signal to analog input 1.

5.2.4 Jog reference, Ramp mode selector, Stop and torque mode selectors

0.14 {4.11}	**Torque mode selector**								
RW	Uni							US	
⇳	0 to 4			⇨	Speed control (0)				

Pr **0.14** is used to select the required control mode of the drive as follows:

Setting	Function
0	Speed control
1	Torque control
2	Torque control with speed override
3	Coiler/uncoiler mode
4	Speed control with torque feed-forward

0.15 {2.04}	**Ramp mode select**								
RW	Txt							US	
⇳	FASt (0) Std (1)			⇨	Std (1)				

Pr **0.15** sets the ramp mode of the drive as shown below:

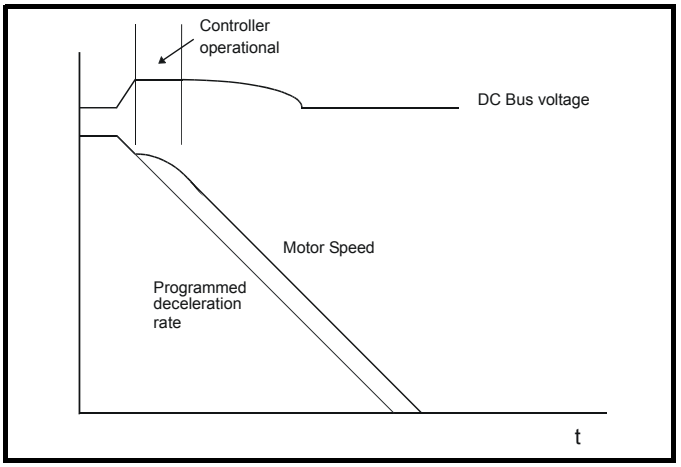
0: Fast ramp

Fast ramp is used where the deceleration follows the programmed deceleration rate subject to current limits. This mode must be used if a braking resistor is connected to the drive.

1: Standard ramp

Standard ramp is used. During deceleration, if the voltage rises to the standard ramp level (Pr **2.08**) it causes a controller to operate, the output of which changes the demanded load current in the motor. As the controller regulates the DC bus voltage, the motor deceleration increases

as the speed approaches zero speed. When the motor deceleration rate reaches the programmed deceleration rate the controller ceases to operate and the drive continues to decelerate at the programmed rate. If the standard ramp voltage (Pr **2.08**) is set lower than the nominal DC bus level the drive will not decelerate the motor, but it will coast to rest. The output of the ramp controller (when active) is a current demand that is fed to the frequency changing current controller (Open-loop modes) or the torque producing current controller (Closed-loop vector or Servo modes). The gain of these controllers can be modified with Pr **4.13** and Pr **4.14**.



2: Standard ramp with motor voltage boost

This mode is the same as normal standard ramp mode except that the motor voltage is boosted by 20%. This increases the losses in the motor, dissipating some of the mechanical energy as heat giving faster deceleration.

0.16 {2.02}	**Ramp enable**								
RW	Bit							US	
⇳	OFF (0) or On (1)				⇨	On (1)			

Setting Pr **0.16** to 0 allows the user to disable the ramps. This is generally used when the drive is required to closely follow a speed reference which already contains acceleration and deceleration ramps.

0.17 {4.12}	**Current demand filter time constant**								
RW	Uni							US	
⇳	0.0 to 25.0 ms				⇨	0.0			

A first order filter, with a time constant defined by Pr **0.17**, is provided on the current demand to reduce acoustic noise and vibration produced as a result of position feedback quantization noise. The filter introduces a lag in the speed loop, and so the speed loop gains may need to be reduced to maintain stability as the filter time constant is increased.

0.19 {7.11}	**Analog input 2 mode**								
RW	Txt							US	
⇳	0 to 6				⇨	VOLt (6)			

In modes 2 & 3 a current loop loss trip is generated if the current falls below 3mA.
In modes 2 & 4 the analog input level goes to 0.0% if the input current falls below 4mA.

Pr value	Pr string	Mode	Comments
0	0-20	0 - 20mA	
1	20-0	20 - 0mA	
2	4-20.tr	4 - 20mA with trip on loss	Trip if I < 3mA
3	20-4.tr	20 - 4mA with trip on loss	Trip if I < 3mA
4	4-20	4 - 20mA with no trip on loss	0.0% if I ≤ 4mA
5	20-4	20 – 4mA with no trip on loss	100% if I ≤ 4mA
6	VOLt	Voltage mode	

0.20 {7.14}	**Analog input 2 destination**								
RW	Uni		DE				PT	US	
⇳	Pr **0.00** to Pr **21.51**				⇨	Pr **1.37**			

Pr **0.20** sets the destination of analog input 2.

0.21 {7.15}	**Analog input 3 mode**								
RW	Txt						PT	US	
⇳	0 to 9				⇨	th (8)			

In modes 2 & 3 a current loop loss trip is generated if the current falls below 3mA.

In modes 2 & 4 the analog input level goes to 0.0% if the input current falls below 4mA.

Pr value	Pr string	Mode	Comments
0	0-20	0 - 20mA	
1	20-0	20 - 0mA	
2	4-20.tr	4 - 20mA with trip on loss	Trip if I < 3mA
3	20-4.tr	20 - 4mA with trip on loss	Trip if I < 3mA
4	4-20	4 - 20mA with no trip on loss	0.0% if I ≤ 4mA
5	20-4	20 - 4mA with no trip on loss	100% if I ≤ 4mA
6	VOLt	Voltage mode	
7	th.SC	Thermistor mode with short-circuit detection	Th trip if R > 3K3 Th reset if R < 1K8 ThS trip if R < 50R
8	th	Thermistor mode with no short-circuit detection	Th trip if R > 3K3 Th reset if R < 1K8
9	th.diSp	Thermistor mode with display only and no trip	

0.22 {1.10}	**Bipolar reference select**								
RW	Bit							US	
⇳	OFF (0) or On (1)				⇨	OFF (0)			

Pr **0.22** determines whether the reference is uni-polar or bi-polar as follows:

Pr 0.22	Function	
0	Unipolar speed/reference	
1	Bipolar speed/reference	

0.23 {1.05}	**Jog reference**								
RW	Uni							US	
⇳	0 to 4,000.0 rpm				⇨	0.0			

Enter the required value of jog/speed.

The speed limits affect the drive when jogging as follows:

Frequency-limit parameter	Limit applies
Pr **0.01** Minimum reference clamp	No
Pr **0.02** Maximum reference clamp	Yes

0.24 {1.21}	**Preset reference 1**								
RW	Bi							US	
⇳	±Speed_limit_max rpm				⇨	0.0			

0.25 {1.22}	**Preset reference 2**								
RW	Bi							US	
⇳	±Speed_limit_max rpm				⇨	0.0			

0.26 {3.08}	**Overspeed threshold**								
RW	Uni							US	
⇳	0 to 40,000 rpm				⇨	0			

If the speed feedback (Pr **3.02**) exceeds this level in either direction, an overspeed trip is produced. If this parameter is set to zero, the overspeed threshold is automatically set to 120% x SPEED_MAX.

0.27 {3.34}	**Drive encoder lines per revolution**								
RW	Uni							US	
⇳	0 to 50,000				⇨	4096			

Enter in Pr **0.27** the number of lines per revolution of the drive encoder.

0.28 {6.13}	**Keypad fwd/rev key enable**								
RW	Bit							US	
⇳	OFF (0) or On (1)				⇨	OFF (0)			

When a keypad is installed, this parameter enables the forward/reverse key.

0.29 {11.36}	**SMARTCARD parameter data**								
RO	Uni					NC	PT	US	
⇳	0 to 999				⇨	0			

This parameter shows the number of the data block last transferred from a SMARTCARD to the drive.

0.30 {11.42}	**Parameter cloning**								
RW	Txt					NC		*	
⇳	0 to 4				⇨	nonE (0)			

* Modes 1 and 2 are not user saved, Modes 0, 3 and 4 are user saved.

NOTE

If Pr **0.30** is equal to 1 or 2 this value is not transferred to the EEPROM or the drive. If Pr **0.30** is set to a 3 or 4 the value is transferred.

Pr String	Pr value	Comment
nonE	0	Inactive
rEAd	1	Read parameter set from the SMARTCARD
Prog	2	Programming a parameter set to the SMARTCARD
Auto	3	Auto save
boot	4	Boot mode

For further information, please refer to Chapter 7 *SMARTCARD Operation* .

0.31 {11.33}	**Drive rated voltage**								
RO	Txt					NC	PT		
⇳	200V (0), 400V (1)				⇨				

Pr **0.31** indicates the voltage rating of the drive.

0.32 {11.32}	**Drive rated current**								
RO	Uni					NC	PT		
⇳	0.00 to 9,999.99 A				⇨				

Pr **0.32** indicates the maximum current rating (which will allow for an overload of 300%).

0.34 {11.30}	**User security code**								
RW	Uni					NC	PT		PS
⇳	0 to 999				⇨	0			

If any number other than 0 is programmed into this parameter, user security is applied so that no parameters except parameter **0.49** can be adjusted with the keypad. When this parameter is read via a keypad it appears as zero.

For further details refer to section 3.2.9 *Parameter access level and security* .

0.35 {11.24}	**Serial comms mode**								
RW	Txt							US	
⇳	AnSI (0), rtu (1), Lcd (2)				⇨	rtU (1)			

This parameter defines the communications protocol used by the EIA485 comms port on the drive. This parameter can be changed via the drive keypad, via a Solutions Module or via the comms interface itself. If it is changed via the comms interface, the response to the command uses the original protocol. The master should wait at least 20ms before send a new message using the new protocol. (Note: ANSI uses 7 data bits, 1 stop bit and even parity; Modbus RTU uses 8 data bits, 2 stops bits and no parity.)

Comms value	String	Communications mode
0	AnSI	ANSI
1	rtU	Modbus RTU protocol
2	Lcd	Modbus RTU protocol, but with an SM-Keypad Plus only

ANSIx3.28 protocol

Full details of the CT ANSI communications protocol are the *Advanced User Guide*.

Modbus RTU protocol

Full details of the CT implementation of Modbus RTU are given in the *Advanced User Guide*.

Modbus RTU protocol, but with an SM-Keypad Plus only

This setting is used for disabling communications access when the SM-Keypad Plus is used as a hardware key. See the *Keypad Plus User Guide* for more details.

0.36 {11.25}	Serial comms baud rate								
RW	Txt							US	
⇳	300 (0), 600 (1), 1200 (2), 2400 (3), 4800 (4), 9600 (5), 19200 (6), 38400 (7), 57600 (8)*, 115200 (9)*				⇨	19200 (6)			

* only applicable to Modbus RTU mode

This parameter can be changed via the drive keypad, via a Solutions Module or via the comms interface itself. If it is changed via the comms interface, the response to the command uses the original baud rate. The master should wait at least 20ms before send a new message using the new baud rate.

0.37 {11.23}	Serial address								
RW	Uni							US	
⇳	0 to 247				⇨	1			

Used to define the unique address for the drive for the serial interface. The drive is always a slave.

Modbus RTU

When the Modbus RTU protocol is used addresses between 0 and 247 are permitted. Address 0 is used to globally address all slaves, and so this address should not be set in this parameter

ANSI

When the ANSI protocol is used the first digit is the group and the second digit is the address within a group. The maximum permitted group number is 9 and the maximum permitted address within a group is 9. Therefore, Pr **0.37** is limited to 99 in this mode. The value 00 is used to globally address all slaves on the system, and x0 is used to address all slaves of group x, therefore these addresses should not be set in this parameter.

0.38 {4.13}	Current loop P gain								
RW	Uni							US	
⇳	0 to 30,000				⇨	200V drive: 75 400V drive: 150			

0.39 {4.14}	Current loop I gain								
RW	Uni							US	
⇳	0 to 30,000				⇨	200V drive: 1,000 400V drive: 2,000			

These parameters control the proportional and integral gains of the current controller used in the open loop drive. The current controller either provides current limits or closed loop torque control by modifying the drive output frequency. The control loop is also used in its torque mode during line power supply loss, or when the controlled mode standard ramp is active and the drive is decelerating, to regulate the flow of current into the drive.

0.40 {5.12}	Autotune								
RW	Uni								
⇳	0 to 6				⇨	0			

There are five autotune tests available, a short low speed test, a normal low speed test, an inertia measurement test, a stationary test and a minimal movement test. A normal low speed should be done where possible as the drive measures the stator resistance and inductance of the motor, and from these calculates the current loop gains. An inertia measurement test should be performed separately to a short low speed or normal low speed autotune.

- A short low speed test will rotate the motor by 2 electrical revolutions (i.e. up to 2 mechanical revolutions) in the forward direction, and measure the encoder phase angle. The motor must be free from load for this test.
- A normal low speed test will rotate the motor by 2 electrical revolutions (i.e. up to 2 mechanical revolutions) in the forward direction. This test measures the encoder phase angle and updates other parameters including the current loop gains. The motor must be free from load for this test.
- The inertia measurement test can measure the total inertia of the load and the motor. This is used to set the speed loop gains and to provide torque feed forwards when required during acceleration. During the inertia measurement test the motor speed changes from $^1/_3$ to $^2/_3$ rated speed in the forward direction several times. The motor can be loaded with a constant torque load and still give an accurate result, however, non-linear loads and loads that change with speed will cause measurement errors.
- The stationary test only measures the motor resistance and inductance, and updates the current loop gain parameters. This test does not measure the encoder phase angle so this test needs to be done in conjunction with either the short low speed or minimal movement tests.
- The minimal movement test will move the motor through a small angle to measure the encoder phase angle. This test will operate correctly when the load is an inertia, and although a small amount of cogging and stiction is acceptable, this test cannot be used for a loaded motor.

To perform an autotune, set Pr **0.40** to 1 for a short low speed test, 2 for a normal low speed test, 3 for an inertia measurement test, 4 for a stationary test or 5 for a minimal movement test, and provide the drive with both an enable signal (on terminal 31) and a run signal (on terminal 26 or 27).

Following the completion of an autotune test the drive will go into the inhibit state. The drive must be placed into a controlled disable condition before the drive can be made to run at the required reference. The drive can be put in to a controlled disable condition by removing the SAFE TORQUE OFF signal from terminal 31, setting the drive enable parameter Pr **6.15** to OFF (0) or disabling the drive via the control word (Pr **6.42** & Pr **6.43**).

Setting Pr **0.40** to 6 will cause the drive to calculate the current loop gains based on the previously measured values of motor resistance and inductance. The drive does apply any voltage to the motor during this test. The drive will change Pr **0.40** back to 0 as soon as the calculations are complete (approximately 500ms).

For further information refer to section *Pr 0.40 {5.12} Autotune* on page 32.

0.41 {5.18}	Maximum switching frequency								
RW	Txt				RA			US	
⇳	3 (0), 4 (1), 6 (2), 8 (3), 12 (4)				⇨	6 (2)			

This parameter defines the required switching frequency. The drive may automatically reduce the actual switching frequency (without changing this parameter) if the power stage becomes too hot. A thermal model of the IGBT junction temperature is used based on the heatsink temperature and an instantaneous temperature drop using the drive output current and switching frequency. The estimated IGBT junction temperature is displayed in Pr **7.34**. If the temperature exceeds 145°C/ 170°C (variant dependant) the switching frequency is reduced if this is possible (i.e >3kHz). Reducing the switching frequency reduces the drive losses and the junction temperature displayed in Pr **7.34** also reduces. If the load condition persists the junction temperature may continue to rise again above 145°C/170°C (variant dependant) and the drive cannot reduce the switching frequency further the drive will initiate an 'O.ht1' trip. Every second the drive will attempt to restore the switching frequency to the level set in Pr **0.41**.

5.2.5 Motor parameters

0.42 {5.11}	**No. of motor poles**									
RW	Txt							US		
⇳	0 to 60 (Auto to 120 Pole)				⇨	6 POLE (3)				

This parameter must be set correctly for the vector control algorithms to operate correctly. When auto is selected the number of poles is set to 6.

0.43 {3.25}	**Encoder phase angle**									
RW	Uni							US		
⇳	0.0 to 359.9°				⇨	0.0				

The phase angle between the rotor flux in a servo motor and the encoder position is required for the motor to operate correctly. If the phase angle is known it can be set in this parameter by the user. Alternatively the drive can automatically measure the phase angle by performing a phasing test (see autotune in servo mode Pr **0.40**). When the test is complete the new value is written to this parameter. The encoder phase angle can be modified at any time and becomes effective immediately. This parameter has a factory default value of 0.0, but is not affected when defaults are loaded by the user.

0.44 {5.09}	**Motor rated voltage**									
RW	Uni				RA			US		
⇳	0 to AC_voltage_set_max V				⇨	200V drive: 230 400V drive: EUR> 400 USA> 460				

0.45 {4.15}	**Motor thermal time constant**									
RW	Uni							US		
⇳	0 to 3000.0				⇨	20.0				

Pr **0.45** is the motor thermal time constant of the motor, and is used (along with the motor rated current Pr **0.46**, and total motor current Pr **0.12**) in the thermal model of the motor in applying thermal protection to the motor.

Setting this parameter to 0 disables the motor thermal protection.

0.46 {5.07}	**Motor rated current**									
RW	Uni				RA			US		
⇳	0 to Rated_current_max A				⇨	Drive rated current [**11.32**]				

Enter the name-plate value for the motor rated current.

0.48 {11.31}	**User drive mode**									
RO	Txt					NC	PT			
⇳	SErVO (3)				⇨	SErVO (3)				

This parameter is read only.

5.2.6 Status information

0.49 {11.44}	**Security status**									
RW	Txt							PT	US	
⇳	0 to 2				⇨	0				

This parameter controls access via the drive keypad as follows:

Value	String	Action
0	L1	Only menu 0 can be accessed
1	L2	All menus can be accessed
2	Loc	Lock user security when drive is reset. (This parameter is set to L1 after reset.)

The keypad can adjust this parameter even when user security is set.

0.50 {11.29}	**Software version number**									
RO	Uni						NC	PT		
⇳	1.00 to 99.99				⇨					

The parameter displays the software version of the drive.

0.51 {10.37}	**Action on trip detection**									
RW	Uni							US		
⇳	0 to 15				⇨	0				

Stop on non-important trips
If bit 0 is set to zero then the drive simply trips when a non-important trip occurs. Non-important trips are: th, ths, Old1, cL2, cL3, SCL. If bit 0 is set to one the drive will stop before tripping when one of these trips is initiated, except in Regen mode where the drive trips immediately.

Disable braking IGBT trips
For details of braking IGBT trip mode see Pr **10.31**.

Disable phase loss trip
The user can disable the phase loss trip in 200V drives as these are allowed to operate from a single phase supply. If bit 2 is set to zero the phase loss trip is enabled. If bit 2 is set to one the phase loss trip is disabled in 200V drives only.

Disable braking resistor temperature monitoring failure detection
Digitax ST have an internal user instal braking resistor with a thermistor to detect overheating of the resistor. If the resistor is not installed the trip can be disabled by setting Pr **10.37** (**0.51**) to 8. If the resistor is installed then no trip is produced unless the thermistor fails. With the resistor installed Pr **10.37** must be set to zero.

6 Optimization

This chapter takes the user through methods of optimizing the product set-up, maximizing performance. The auto-tuning features of the drive simplify this task.

6.1 Motor map parameters

6.1.1 Motor control

Pr 0.46 {5.07} Motor rated current	**Defines the maximum motor continuous current**

The motor rated current parameter must be set to the maximum continuous current of the motor. The motor rated current is used in the following:

- Current limits
- Motor thermal overload protection

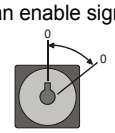
Pr 0.42 {5.11} Motor number of poles	**Defines the number of motor poles**

The motor number of poles parameter defines the number of electrical revolutions in one whole mechanical revolution of the motor. This parameter must be set correctly for the control algorithms to operate correctly. When Pr **0.42** is set to "Auto" the number of poles is 6.

Pr 0.40 {5.12} Autotune

There are five autotune tests available, a short low speed test, a normal low speed test, an inertia measurement test, a stationary test to set up current controller gains and a minimal movement phasing test. A normal low speed should be done where possible as the drive measures the stator resistance and inductance of the motor, and from these calculates the current loop gains. An inertia measurement test should be performed separately to a short low speed or normal low speed autotune.

- A short low speed test will rotate the motor by 2 electrical revolutions (i.e. up to 2 mechanical revolutions) in the direction selected. The drive applies rated current to the motor during the test and measures the encoder phase angle (Pr **3.25**). The phase angle measurement is taken when the motor has stopped at the end of the test, therefore there must be no load on the motor when it is at rest for the correct angle to be measured. This test takes approximately 2 seconds to complete and can only be used where the rotor settles to a stable position in a short time. To perform a short low speed autotune, set Pr **0.40** to 1, and provide the drive with both an enable signal (on terminal 31) and a run signal (on terminal 26 or 27).
- A normal low speed test will rotate the motor by 2 electrical revolutions (i.e. up to 2 mechanical revolutions) in the direction selected. The drive applies rated current to the motor during the test and measures the encoder phase angle (Pr **3.25**). The phase angle measurement is taken when the motor has stopped at the end of the test, therefore there must be no load on the motor when it is at rest for the correct angle to be measured. The motor resistance (Pr **5.17**) and inductance (Pr **5.24**) are then measured, and the values are used to set up the current loop gains (Pr **0.38** {**4.13**} and Pr **0.39** {**4.14**}). The whole test takes approximately 20 seconds and can be used with motors that take time to settle after the rotor has moved. During the motor inductance measurement the drive applies current pulses to the motor that produces flux that opposes the flux produced by the magnets. The maximum current applied is a quarter of rated current (Pr **0.46**). This current is unlikely to affect the motor magnets, however, if this level of current could permanently de-magnetise the magnets the rated current should be set to a lower level for the tests to avoid this. To perform a normal low speed autotune, set Pr **0.40** to 2, and provide the drive with both an enable signal (on terminal 31) and a run signal (on terminal 26 or 27).



- The inertia measurement test can measure the total inertia of the load and the motor. This is used to set the speed loop gains (see *Speed loop gains*) and to provide torque feed-forwards when required during acceleration.

  During the inertia measurement test the drive attempts to accelerate the motor in the direction selected up to $^{3}/_{4}$ x rated load rpm and then back to standstill. The drive uses rated torque/16, but if the motor cannot be accelerated to the required speed the drive then increases the torque progressively to $x^{1}/_{8}$, $x^{1}/_{4}$, $x^{1}/_{2}$ and x1 rated torque. If the required speed is not achieved on the final attempt the test is aborted and a tunE1 trip is initiated. If the test is successful the acceleration and deceleration times are used to calculate the motor and load inertia which is then written to Pr **3.18**. The value of the value of motor torque per amp in Pr **5.32** and the motor rated speed in Pr **5.08** must be set up correctly before performing an inertia measurement test. To perform an Inertia measurement autotune, set Pr **0.40** to 3, and provide the drive with both an enable signal (on terminal 31) and a run signal (on terminal 26 or 27).
- The stationary test to set up current controller gains measures the stator resistance and the transient inductance of the motor, calculates the current loop gains and updates the current loop gain parameters. This test does not measure the encoder phase angle. This test should only be performed when the correct phasing angle has been set in Pr **0.43**. If the phasing angle is not correct the motor may move and the results may be incorrect. To perform a stationary test to set up current controller gains, set Pr **0.40** to 4, and provide the drive with both an enable signal (on terminal 31) and a run signal (on terminal 26 or 27).
- A minimal movement phasing test can measure the encoder phase offset by moving the motor through a small angle. Short current pulses are applied to the motor to produce a small movement and then to move the motor back to the original position. The size and length of the pulses are gradually increased (up to a maximum of motor rated current) until the movement is approximately at the level defined by Pr **5.38** electrical degrees. The resulting movements are used to estimate the phase angle. To perform a minimal movement phasing test, set Pr **0.40** to 5, and provide the drive with both an enable signal (on terminal 31) and a run signal (on terminal 26 or 27).

Following the completion of an autotune test the drive will go into the inhibit state. The drive must be placed into a controlled disable condition before the drive can be made to run at the required reference. The drive can be put in to a controlled disable condition by removing the SAFE TORQUE OFF signal from terminal 31, setting the drive enable parameter Pr **6.15** to OFF (0) or disabling the drive via the control word (Pr **6.42** & Pr **6.43**).

Current loop gains (Pr 0.38 {4.13} / Pr 0.39 {4.14})

The current loop gains proportional (Kp) and integral (Ki) gains control the response of the current loop to a change in current (torque) demand. The default values give satisfactory operation with most motors. However, for optimal performance in dynamic applications it may be necessary to change the gains to improve the performance. The proportional gain (Pr **4.13**) is the most critical value in controlling the performance. The values for the current loop gains can be calculated by one of the following:

- During a stationary or rotating autotune (see *Autotune Pr **0.40***, earlier in this table) the drive measures the stator resistance (Pr **5.17**) and transient inductance (Pr **5.24**) of the motor and calculates the current loop gains.
- By setting Pr **0.40** to 6 the drive will calculate the current loop gains from the values of stator resistance (Pr **5.17**) and transient inductance (Pr **5.24**) set in the drive.

This will give a step response with minimum overshoot after a step change of current reference. The proportional gain can be increased by a factor of 1.5 giving a similar increase in bandwidth; however, this gives a step response with approximately 12.5% overshoot. The equation for the integral gain gives a conservative value. In some applications where it is necessary for the reference frame used by the drive to dynamically follow the flux very closely (i.e. high speed closed-loop induction motor applications) the integral gain may need to have a significantly higher value.

Speed loop gains (Pr 0.07 {3.10}, Pr 0.08 {3.11}, Pr 0.09 {3.12})

The speed loop gains control the response of the speed controller to a change in speed demand. The speed controller includes proportional (Kp) and integral (Ki) feed forward terms, and a differential (Kd) feedback term. The drive holds two sets of these gains and either set may be selected for use by the speed controller with Pr **3.16**. If Pr **3.16** = 0, gains Kp1, Ki1 and Kd1 (Pr **0.07** to Pr **0.09**) are used, and if Pr **3.16** = 1, gains Kp2, Ki2 and Kd2 (Pr **3.13** to Pr **3.15**) are used. Pr **3.16** may be changed when the drive is enabled or disabled. If the load is predominantly a constant inertia and constant torque, the drive can calculate the required Kp and Ki gains to give a required compliance angle or bandwidth dependant on the setting of Pr **3.17**.

*Proportional gain (Kp), Pr **0.07 {3.10}** and Pr **3.13***

If the proportional gain has a value and the integral gain is set to zero the controller will only have a proportional term, and there must be a speed error to produce a torque reference. Therefore as the motor load increases there will be a difference between the reference and actual speeds. This effect, called regulation, depends on the level of the proportional gain, the higher the gain the smaller the speed error for a given load. If the proportional gain is too high either the acoustic noise produced by speed feedback quantization becomes unacceptable, or the closed-loop stability limit is reached.

*Integral gain (Ki), Pr **0.08 {3.11}** and Pr **3.14***

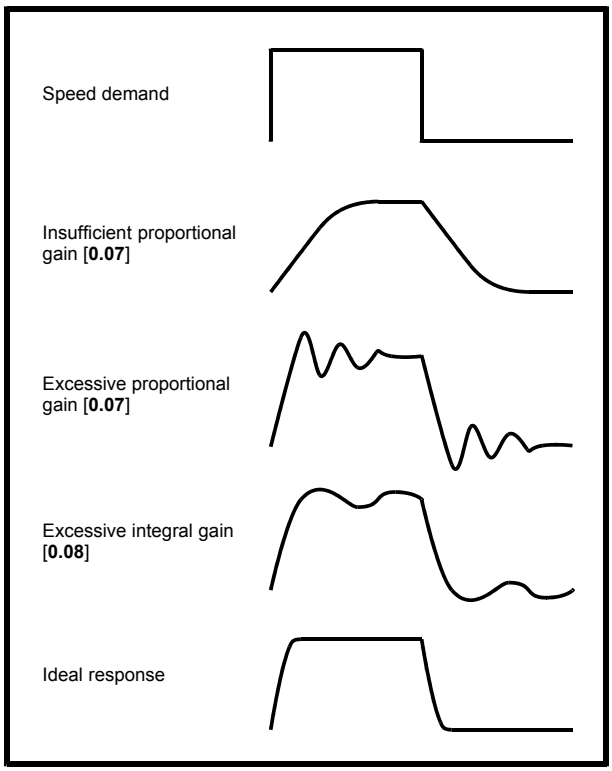
The integral gain is provided to prevent speed regulation. The error is accumulated over a period of time and used to produce the necessary torque demand without any speed error. Increasing the integral gain reduces the time taken for the speed to reach the correct level and increases the stiffness of the system, i.e. it reduces the positional displacement produced by applying a load torque to the motor. Unfortunately increasing the integral gain also reduces the system damping giving overshoot after a transient. For a given integral gain the damping can be improved by increasing the proportional gain. A compromise must be reached where the system response, stiffness and damping are all adequate for the application.

*Differential gain (Kd), Pr **0.09 {3.12}** and Pr **3.15***

The differential gain is provided in the feedback of the speed controller to give additional damping. The differential term is implemented in a way that does not introduce excessive noise normally associated with this type of function. Increasing the differential term reduces the overshoot produced by under-damping, however, for most applications the proportional and integral gains alone are sufficient.

There are three methods of tuning the speed loop gains dependant on the setting of Pr **3.17**:

1. Pr **3.17** = 0, User set-up.
   This involves the connecting of an oscilloscope to analog output 1 to monitor the speed feedback.
   Give the drive a step change in speed reference and monitor the response of the drive on the oscilloscope.
   The proportional gain (Kp) should be set up initially. The value should be increased up to the point where the speed overshoots and then reduced slightly.
   The integral gain (Ki) should then be increased up to the point where the speed becomes unstable and then reduced slightly.
   It may now be possible to increase the proportional gain to a higher value and the process should be repeated until the system response matches the ideal response as shown.
   The diagram shows the effect of incorrect P and I gain settings as well as the ideal response.
2. Pr **3.17** = 1, Bandwidth set-up
   If bandwidth based set-up is required, the drive can calculate Kp and Ki if the following parameters are set up correctly:
   - Pr **3.20** - Required bandwidth,
   - Pr **3.21** - Required damping factor,
   - Pr **5.32** - Motor torque per amp (Kt).
   - Pr **3.18** - Motor and load inertia. The drive can be made to measure the motor and load inertia by performing an inertia measurement autotune (see Autotune Pr **0.40**, earlier in this table).
3. Pr **3.17** = 2, Compliance angle set-up
   If compliance angle based set-up is required, the drive can calculate Kp and Ki if the following parameters are set up correctly:
   - Pr **3.19** - Required compliance angle,
   - Pr **3.21** - Required damping factor,
   - Pr **5.32** - Motor torque per amp (Kt).
   - Pr **3.18** - Motor and load inertia The drive can be made to measure the motor and load inertia by performing an inertia measurement autotune (see Autotune Pr **0.40**, earlier in this table).



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 cloning 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

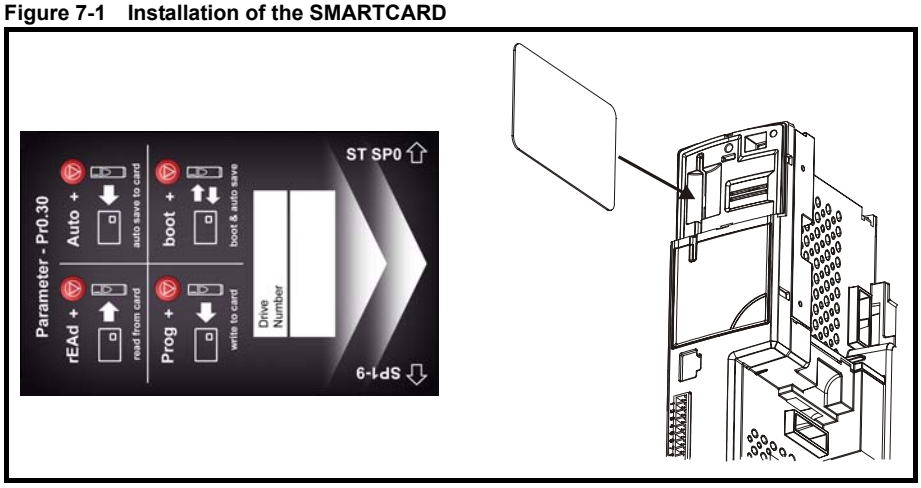
The SMARTCARD is located at the top of the module under the drive display (if installed) on the left-hand side. Ensure the SMARTCARD is inserted as shown on the SMARTCARD.

The drive only communicates with the SMARTCARD when commanded to read or write, meaning the card may be "hot swapped".

WARNING

Encoder phase angle
The encoder phase angles in Pr **3.25** and Pr **21.20** are copied to the SMARTCARD when using any of the SMARTCARD transfer methods.

Figure 7-1 Installation of the SMARTCARD

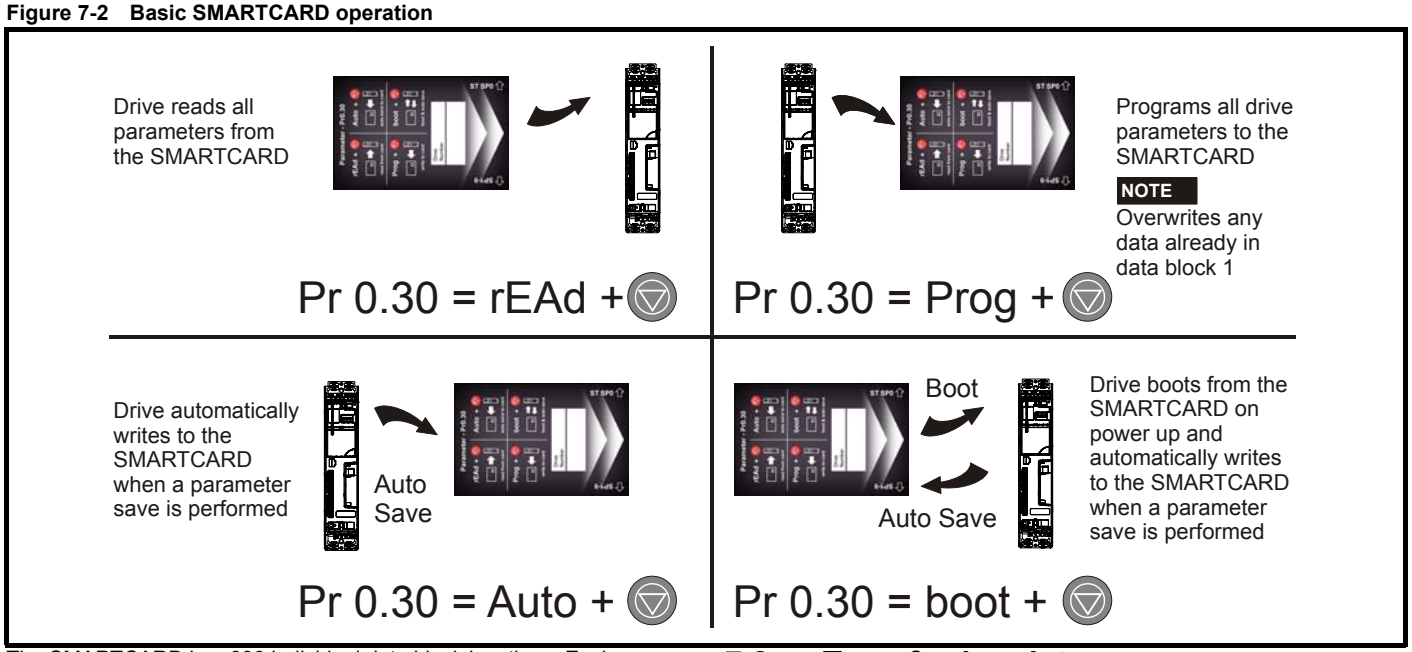


NOTE

When inserting the SMARTCARD, always ensure that ST SP0 arrow points upwards.

Easy saving and reading

Figure 7-2 Basic SMARTCARD operation



The SMARTCARD has 999 individual data block locations. Each individual location from 1 to 499 can be used to store data until the capacity of the SMARTCARD is used. The drive can support SMARTCARDs with a capacity of between 4kB and 512kB.

The data block locations of the SMARTCARD are arranged to have the following usage:

Table 7-1 SMARTCARD data blocks

Data Block	Type	Example Use
1 to 499	Read / Write	Application set ups
500 to 999	Read Only	Macros

'Differences from default' parameter sets will be much smaller than whole parameter sets and thus take up a lot less memory as most applications only require a few parameters to be changed from the default setting.

The whole card may be protected from writing or erasing by setting the read-only flag as detailed section 7.2.10 *9888 / 9777 - Setting and clearing the SMARTCARD read only flag* on page 38.

Data transfer to or from the SMARTCARD is indicated by one the following:

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

The card should not be removed during data transfer, as the drive will produce a trip. If this occurs then either the transfer should be reattempted or in the case of a card to drive transfer, default parameters should be loaded.

7.2 Transferring data

Data transfer, erasing and protecting the information is performed by entering a code in Pr **xx.00** and then resetting the drive as shown in Table 7-2.

Table 7-2 SMARTCARD codes

Code	Action
2001	Transfer drive parameters as difference from defaults to a bootable SMARTCARD block in data block number 001
3yyy	Transfer drive parameters to a SMARTCARD block number yyy
4yyy	Transfer drive data as difference from defaults to SMARTCARD block number yyy
5yyy	Transfer drive Onboard PLC program to SMARTCARD block number yyy
6yyy	Transfer SMARTCARD data block yyy to the drive
7yyy	Erase SMARTCARD data block yyy
8yyy	Compare drive parameters with block yyy
9555	Clear SMARTCARD warning suppression flag
9666	Set SMARTCARD warning suppression flag
9777	Clear SMARTCARD read-only flag
9888	Set SMARTCARD read-only flag
9999	Erase SMARTCARD

Where yyy indicates the block number 001 to 999. See Table 7-1 for restrictions on block numbers.

NOTE

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

7.2.1 Writing to the SMARTCARD

3yyy - Transfer data to the SMARTCARD

The data block contains the complete parameter data from the drive, i.e. all user save (US) parameters except parameters with the NC coding bit set. Power-down save (PS) parameters are not transferred to the SMARTCARD.

4yyy - Write default differences to a SMARTCARD

The data block only contains the parameter differences from the last time default settings were loaded.

Six bytes are required for each parameter difference. The data density is not as high as when using the 3yyy transfer method as described in the previous section, but in most cases the number of differences from default is small and the data blocks are therefore smaller. This method can be used for creating drive macros. Power-down save (PS) parameters are not transferred to the SMARTCARD.

All user save (US) parameters including those that do not have a default value (i.e. Pr **3.25** or Pr **21.20** *Encoder phase angle*), but not including those with the NC (Not copied) coding bit set can be transferred to the SMARTCARD. In addition to these parameters all menu 20 parameters (except Pr **20.00**), can be transferred to the SMARTCARD even though they are not user save parameters and have the NC coding bit set.

It is possible to transfer parameters between drives with each of the different formats, however, the data block compare function does not work with data produced by different formats.

Writing a parameter set to the SMARTCARD (Pr 11.42 = Prog (2))

Setting Pr **11.42** to Prog (2) and resetting the drive will save the parameters to the SMARTCARD, i.e. this is equivalent to writing 3001 to Pr **xx.00**. All SMARTCARD trips apply except 'C.Chg'. If the data block already exists it is automatically overwritten. When the action is complete this parameter is automatically reset to nonE (0).

7.2.2 Reading from the SMARTCARD

6yyy - Read default differences from a SMARTCARD

When the data is transferred back to a drive, using 6yyy in Pr **xx.00**, it is transferred to the drive RAM and the drive EEPROM. A parameter save is not required to retain the data after power-down. Set up data for any Solutions Modules installed are stored on the card and are transferred to the destination drive. If the Solutions Modules are different between the source and destination drive, the menus for the slots where the Solutions Module categories are different are not updated from the card and will contain their default values after the cloning action. The drive will produce a 'C.Optn' trip if the Solutions Modules installed to the source and destination drive are different or are in different slots. If the data is being transferred to a drive of a different voltage or current rating a 'C.rtg' trip will occur.

The following drive rating dependant parameters (RA coding bit set) will not be transferred to the destination drive by a SMARTCARD when the rating of the destination drive is different from the source drive and the file is a parameter file (i.e. created using the 3yyy transfer method). However drive rating dependent parameters will be transferred if only the current rating is different and the file is a differences from default type file (i.e. created using the 4yyy transfer method). If drive rating dependant parameters are not transferred to the destination drive they will contain their default values.

Pr **2.08** *Standard ramp voltage*
Pr **4.05** to Pr **4.07** and Pr **21.27** to Pr **21.29** *Current limits*
Pr **4.24**, *User current maximum scaling*
Pr **5.07**, Pr **21.07** *Motor rated current*
Pr **5.09**, Pr **21.09** *Motor rated voltage*
Pr **5.10**, Pr **21.10** *Rated power factor*
Pr **5.17**, Pr **21.12** *Stator resistance*
Pr **5.18** *Switching frequency*
Pr **5.23**, Pr **21.13** *Voltage offset*
Pr **5.24**, Pr **21.14** *Transient inductance*
Pr **5.25**, Pr **21.24** *Stator inductance*
Pr **6.06** *DC injection braking current*
Pr **6.48** *Line power supply loss ride through detection level*

Reading a parameter set from the SMARTCARD (Pr 11.42 = rEAd (1))

Setting Pr **11.42** to rEAd (1) and resetting the drive will transfer the parameters from the card into the drive parameter set and the drive EEPROM, i.e. this is equivalent to writing 6001 to Pr **xx.00**. All SMARTCARD trips apply. Once the parameters are successfully copied this parameter is automatically reset to nonE (0). Parameters are saved to the drive EEPROM after this action is complete.

NOTE

This operation is only performed if data block 1 on the card is a full parameter set (3yyy transfer) and not a default difference file (4yyy transfer). If block 1 does not exist a 'C.dAt' trip occurs.

7.2.3 Auto saving parameter changes (Pr 11.42 = Auto (3))

This setting causes the drive to automatically save any changes made to menu 0 parameters on the drive to the SMARTCARD. The latest menu 0 parameter set in the drive is therefore always backed up on the SMARTCARD. Changing Pr **11.42** to Auto (3) and resetting the drive will immediately save the complete parameter set from the drive to the card, i.e. all user save (US) parameters except parameters with the NC coding bit set. Once the whole parameter set is stored only the individual modified menu 0 parameter setting is updated.

Advanced parameter changes are only saved to the card when Pr **xx.00** is set to a 1000 and the drive reset.

All SMARTCARD trips apply, except ‘C.Chg’. If the data block already contains information it is automatically overwritten.

If the card is removed when Pr **11.42** is set to 3 Pr **11.42** is then automatically set to nonE (0).

When a new SMARTCARD is installed Pr **11.42** must be set back to Auto (3) by the user and the drive reset so the complete parameter set is rewritten to the new SMARTCARD if auto mode is still required.

When Pr **11.42** is set to Auto (3) and the parameters in the drive are saved, the SMARTCARD is also updated, therefore the SMARTCARD becomes a copy of the drives stored configuration.

At power up, if Pr **11.42** is set to Auto (3), the drive will save the complete parameter set to the SMARTCARD. The drive will display ‘cArd’ during this operation. This is done to ensure that if a user puts a new SMARTCARD in during power down the new SMARTCARD will have the correct data.

NOTE

When Pr **11.42** is set to Auto (3) the setting of Pr **11.42** itself is saved to the drive EEPROM but NOT to the SMARTCARD.

7.2.4 Booting up from the SMARTCARD on every power up (Pr 11.42 = boot (4))

When Pr **11.42** is set to boot (4) the drive operates the same as Auto mode except when the drive is powered-up. The parameters on the SMARTCARD will be automatically transferred to the drive at power up if the following are true:

- A card is inserted in the drive
- Parameter data block 1 exists on the card
- The data in block 1 is type 1 to 5 (as defined in Pr **11.38**)
- Pr **11.42** on the card set to boot (4)

The drive will display 'boot' during this operation. If the drive mode is different from that on the card, the drive gives a 'C.Typ'. trip and the data is not transferred.

If 'boot' mode is stored on the cloning SMARTCARD this makes the cloning SMARTCARD the master device. This provides a very fast and efficient way of re-programming a number of drives.

If data block 1 contains a bootable parameter set and data block 2 contains an Onboard PLC program (type 17 as defined in Pr **11.38**), then the onboard PLC program will be transferred to the drive at power up along with the parameter set in data block 1.

NOTE

‘Boot’ mode is saved to the card, but when the card is read, the value of Pr **11.42** is not transferred to the drive.

7.2.5 Booting up from the SMARTCARD on every power up (Pr xx.00 = 2001)

It is possible to create a difference from default bootable file by setting Pr **xx.00** to 2001 and resetting the drive. This type of file causes the drive to behave in the same way at power-up as a file created with boot

mode set up with Pr **11.42**. The difference from the default file is that it has the added advantage of including menu 20 parameters.

Setting Pr **xx.00** to 2001 will overwrite data block 1 on the card if it already exists.

If a data block 2 exists and contains an Onboard PLC program (type 17 as defined in Pr **11.38**), this will also be loaded after the parameters have been transferred

A bootable difference from default file can only be created in one operation and parameters cannot be added as they are saved via menu 0.

7.2.6 8yyy - Comparing the drive full parameter set with the SMARTCARD values

Setting 8yyy in Pr **xx.00**, will compare the SMARTCARD file with the data in the drive. If the compare is successful Pr **xx.00** is simply set to 0. If the compare fails a 'C.cpr' trip is initiated.

7.2.7 7yyy / 9999 - Erasing data from the SMARTCARD

Data can be erased from the SMARTCARD either one block at a time or all blocks in one go.

- Setting 7yyy in Pr **xx.00** will erase SMARTCARD data block yyy.
- Setting 9999 in Pr **xx.00** will erase all SMARTCARD data blocks

7.2.8 SM-Applications Modules And Motion Processors program to/from SMARTCARD transfer system

The following additional codes can be used in Pr **x.00** and will initiate the specified actions when a drive reset occurs.

Value	Action
15yyy	Transfer the user program in the applications module in slot 1 to data block number yyy on a SMART Card
16yyy	Transfer the user program in the applications module in slot 2 to data block number yyy on a SMART Card
17yyy	Transfer the user program in the SM-Applications Modules And Motion Processors (Digitax ST Plus and Indexer) to data block number yyy on a SMART Card
18yyy	Transfer a user program in data block number yyy on a SMART Card to the applications module in slot 1
19yyy	Transfer a user program in data block number yyy on a SMART Card to the applications module in slot 2
20yyy	Transfer a user program in data block number yyy on a SMART Card to the SM-Applications Modules And Motion Processors (Digitax ST Plus and Indexer)

If the action is not possible because there is no applications category module in the requested slot then Pr **x.00** remains at the value set by the user. If the action is not possible for any other reason a C.SLx trip is produced where x is the slot number. The possible reasons are:

1. The data block to be read from the card does not exist or the data block is of the wrong type
2. The data block to be written to the card already exists
3. A failure has occurred within the option module and it has stopped the transfer process

7.2.9 9666 / 9555 - Setting and clearing the SMARTCARD warning suppression flag

If the Solutions Modules installed to the source and destination drive are different or are in different slots the drive will produce a 'C.Optn' trip. If the data is being transferred to a drive of a different voltage or current rating a 'C.rtg' trip will occur. It is possible to suppress these trips by setting the warning suppression flag. If this flag is set the drive will not trip if the Solutions Module(s) or drive ratings are different between the source and destination drives. The Solutions Module or rating dependent parameters will not be transferred.

- Setting 9666 in Pr **xx.00** will set the warning suppression flag
- Setting 9555 in Pr **xx.00** will clear the warning suppression flag

7.2.10 9888 / 9777 - Setting and clearing the SMARTCARD read only flag

The SMART CARD may be protected from writing or erasing by setting the read only flag. If an attempt is made to write or erase a data block when the read only flag is set, a 'C.rdo' trip is initiated. When the read only flag is set only codes 6yyy or 9777 are effective.

- Setting 9888 in Pr **xx.00** will set the read only flag
- Setting 9777 in Pr **xx.00** will clear the read only flag.

7.3 Data block header information

Each data block stored on a SMARTCARD has header information detailing the following:

- A number which identifies the block (Pr **11.37**)
- The type of data stored in the block (Pr **11.38**)
- The drive mode if the data is parameter data (Pr **11.38**)
- The version number (Pr **11.39**)
- The checksum (Pr **11.40**)
- The read-only flag
- The warning suppression flag

The header information for each data block which has been used can be viewed in Pr **11.38** to Pr **11.40** by increasing or decreasing the data block number set in Pr **11.37**.

If Pr **11.37** is set to 1000 the checksum parameter (Pr **11.40**) shows the number of 16 byte pages left on the card.

If Pr **11.37** is set to 1001 the checksum parameter (Pr **11.40**) shows the total capacity of the card in 16 byte pages. Therefore, for a 4kB card this parameter would show 254.

If Pr **11.37** is set to 1002 the checksum parameter (Pr **11.40**) shows the state of the read-only (bit 0) and warning suppression flags (bit 1).

Software version xx.xx.xx: If Pr **11.37** is set to 1003, the checksum parameter (Pr **11.40**) shows the product identifier (255 = Unidrive SP, 1 = Commander GP20, 3 = Affinity)

If there is no data on the card Pr **11.37** can only have values of 0 or 1000 to 1003.

7.4 SMARTCARD parameters

Table 7-3 Key to parameter table coding

RW	Read / Write	RO	Read only	Uni	Unipolar
Bi	Bi-polar	Bit	Bit parameter	Txt	Text string
FI	Filtered	DE	Destination	NC	Not copied
RA	Rating dependent	PT	Protected	US	User save
PS	Power down save				

11.36 {0.29}	SMARTCARD parameter data previously loaded									
RO	Uni					NC	PT	US		
⇳	0 to 999				⇨	0				

This parameter shows the number of the data block last transferred from a SMARTCARD to the drive.

11.37	SMARTCARD data number									
RW	Uni					NC				
⇳	0 to 1003				⇨	0				

This parameter should have the data block number entered for which the user would like information displayed in Pr **11.38**, Pr **11.39** and Pr **11.40**.

11.38	SMARTCARD data type/mode									
RO	Txt					NC	PT			
⇳	0 to 18				⇨					

Gives the type/mode of the data block selected with Pr **11.37**

Pr 11.38	String	Type/mode	Data stored
0	FrEE	Value when Pr **11.37** = 0, 1000 to 1003	
1		Reserved	
2	3OpEn.LP	Open-loop mode parameters	Data from EEPROM
6 to 8	3Un	Unused	
9		Reserved	
10	4OpEn.LP	Open-loop mode parameters	Defaults last loaded and differences
11	4CL.VECt	Closed-loop vector mode parameters	
14 to 16	4Un	Unused	
17	LAddEr	Onboard PLC program	
18	Option	A Solutions Module file	
19	Opt.Prg	Option module program data block present	

11.39	**SMARTCARD data version**								
RW	Uni					NC			
⇳	0 to 9,999				⇨	0			

Gives the version number of the data block selected in Pr **11.37**.

11.40	**SMARTCARD data checksum**								
R0	Uni					NC	PT		
⇳	0 to 65,335				⇨				

Gives the checksum of the data block selected in Pr **11.37**.

11.42 {0.30}	**Parameter cloning**								
RW	Txt					NC		US*	
⇳	0 to 4				⇨	nonE (0)			

NOTE

If Pr **11.42** is equal to 1 or 2, this value is not transferred to the drive or saved to the EEPROM. If Pr **11.42** is set to a 3 or 4 the value is transferred.

nonE (0) = Inactive
rEAd (1) = Read parameter set from the SMARTCARD
Prog (2) = Programming a parameter set to the SMARTCARD
Auto (3) = Auto save
boot (4) = Boot mode

7.5 SMARTCARD trips

After an attempt to read, write or erase data to or from a SMARTCARD a trip may occur if there has been a problem with the command. The following trips indicate various problems as detailed in Table 7-4.

Table 7-4 Trip conditions

Trip	Diagnosis
C.Acc	**SMARTCARD trip: SMARTCARD Read / Write fail**
185	Check SMARTCARD is installed / located correctly Ensure SMARTCARD is not writing data to data location 500 to 999 Replace SMARTCARD
C.boot	**SMARTCARD trip: The menu 0 parameter modification cannot be saved to the SMARTCARD because the necessary file has not been created on the SMARTCARD**
177	A write to a menu 0 parameter has been initiated via the keypad with Pr **11.42** set to auto(3) or boot(4), but the necessary file on the SMARTCARD has not been created Ensure that Pr **11.42** is correctly set and reset the drive to create the necessary file on the SMARTCARD Re-attempt the parameter write to the menu 0 parameter
C.bUSY	**SMARTCARD trip: SMARTCARD can not perform the required function as it is being accessed by a Solutions Module**
178	Wait for the Solutions Module to finish accessing the SMARTCARD and then re-attempt the required function
C.Chg	**SMARTCARD trip: Data location already contains data**
179	Erase data in data location Write data to an alternative data location
C.Cpr	**SMARTCARD trip: The values stored in the drive and the values in the data block on the SMARTCARD are different**
188	Press the red reset button
C.dat	**SMARTCARD trip: Data location specified does not contain any data**
183	Ensure data block number is correct
C.Err	**SMARTCARD trip: SMARTCARD data is corrupted**
182	Ensure the card is located correctly Erase data and retry Replace SMARTCARD
C.Full	**SMARTCARD trip: SMARTCARD full**
184	Delete a data block or use a different SMARTCARD
C.Optn	**SMARTCARD trip: Solutions Modules installed are different between source drive and destination drive**
180	Ensure correct Solutions Modules are installed Ensure Solutions Modules are in the same Solutions Module slot Press the red reset button
C.Prod	**SMARTCARD trip: The data blocks on the SMARTCARD are not compatible with this product**
175	Erase all data on the SMARTCARD by setting Pr **xx.00** to 9999 and pressing the red reset button Replace SMARTCARD
C.rdo	**SMARTCARD trip: SMARTCARD has the Read only bit set**
181	Enter 9777 in Pr **xx.00** to allow SMARTCARD Read / Write access Ensure card is not writing to data locations 500 to 999

Table 7-4 Trip conditions

<table>
<tr><th>Trip</th><th>Diagnosis</th></tr>
<tr><td>C.rtg</td><td>SMARTCARD trip: The voltage and/or current rating of the source and destination drives are different</td></tr>
<tr><td>186</td><td>Drive rating dependent parameters (parameters with the RA coding) are 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 SMARTCARDs when the rating of the destination drive is different from the source drive and the file is a parameter file.
Press the red reset button
Drive rating parameters are:
<table>
<tr><th>Parameter</th><th>Function</th></tr>
<tr><td>2.08</td><td>Standard ramp voltage</td></tr>
<tr><td>4.05/6/7, 21.27/8/9</td><td>Current limits</td></tr>
<tr><td>4.24</td><td>User current maximum scaling</td></tr>
<tr><td>5.07, 21.07</td><td>Motor rated current</td></tr>
<tr><td>5.09, 21.09</td><td>Motor rated voltage</td></tr>
<tr><td>5.10, 21.10</td><td>Rated power factor</td></tr>
<tr><td>5.17, 21.12</td><td>Stator resistance</td></tr>
<tr><td>5.18</td><td>Switching frequency</td></tr>
<tr><td>5.23, 21.13</td><td>Voltage offset</td></tr>
<tr><td>5.24, 21.14</td><td>Transient inductance</td></tr>
<tr><td>5.25, 21.24</td><td>Stator inductance</td></tr>
<tr><td>6.06</td><td>DC injection braking current</td></tr>
<tr><td>6.48</td><td>Line power supply loss ride through detection level</td></tr>
</table>
The above parameters will be set to their default values.</td></tr>
<tr><td>C.Typ</td><td>SMARTCARD trip: SMARTCARD parameter set not compatible with drive</td></tr>
<tr><td>187</td><td>Press the red reset button
Ensure destination drive type is the same as the source parameter file drive type</td></tr>
</table>

Table 7-5 SMARTCARD status indications

Lower display	Description	Lower display	Description
boot	A parameter set is being transferred from the SMARTCARD to the drive during power-up. For further information, please refer to section 7.2.4 *Booting up from the SMARTCARD on every power up (Pr 11.42 = boot (4))* .	**cArd**	The drive is writing a parameter set to the SMARTCARD during power-up. For further information, please refer to section 7.2.3 *Auto saving parameter changes (Pr 11.42 = Auto (3))* .

8 Advanced parameters

This is a quick reference to all parameters in the drive showing units, ranges limits etc, with block diagrams to illustrate their function. Full descriptions of the parameters can be found in the *Advanced User Guide* on the supplied CD ROM.

WARNING

These advanced parameters are listed for reference purposes only. The lists in this chapter do not include sufficient information for adjusting these parameters. Incorrect adjustment can affect the safety of the system, and damage the drive and or external equipment. Before attempting to adjust any of these parameters, refer to the *Advanced User Guide*.

Table 8-1 Menu descriptions

Menu number	Description
0	Commonly used basic set up parameters for quick / easy programming
1	Speed reference
2	Ramps
3	Speed feedback and control
4	Torque and current control
5	Motor control
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, 16	Solutions Module slots
17	Digitax ST indexer/plus parameters
18	Application menu 1
19	Application menu 2
20	Application menu 3
21	Second motor parameters
22	Additional Menu 0 set-up

Default abbreviations:

EUR> European default value (50Hz AC supply frequency)
USA> USA default value (60Hz AC supply frequency)

NOTE

Parameter numbers shown in brackets {...} are the equivalent Menu 0 parameters.

In some cases, the function or range of a parameter is affected by the setting of another parameter; the information in the lists relates to the default condition of such parameters.

Table 8-2 Key to parameter table coding

Coding	Attribute
RW	Read/write: can be written by the user
RO	Read only: can only be read by the user
Bit	1 bit parameter. 'On' or 'OFF' on the display
Bi	Bipolar parameter
Uni	Unipolar parameter
Txt	Text: the parameter uses text strings instead of numbers.
FI	Filtered: some parameters which can have rapidly changing values are filtered when displayed on the drive keypad for easy viewing.
DE	Destination: This parameter selects the destination of an input or logic function.
RA	Rating dependent: 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 SMARTCARDs when the rating of the destination drive is different from the source drive and the file is a parameter file.
NC	Not copied: not transferred to or from SMARTCARDs during cloning.
PT	Protected: cannot be used as a destination.
US	User save: parameter saved in drive EEPROM when the user initiates a parameter save.
PS	Power-down save: parameter automatically saved in drive EEPROM when the under volts (UV) trip occurs. With software version V01.08.00 and later, power-down save parameters are also saved in the drive when the user initiates a parameter save.

Table 8-3 Feature look-up table

Feature	Parameter number (Pr)												
Acceleration rates	2.10	2.11 to 2.19		2.32	2.33	2.34	2.02						
Analog speed reference 1	1.36	7.10	7.01	7.07	7.08	7.09	7.25	7.26	7.30				
Analog speed reference 2	1.37	7.14	1.41	7.02	7.11	7.12	7.13	7.28	7.31				
Analog I/O	Menu 7												
Analog input 1	7.01	7.07	7.08	7.09	7.10	7.25	7.26	7.30					
Analog input 2	7.02	7.11	7.12	7.13	7.14	7.28	7.31						
Analog input 3	7.03	7.15	7.16	7.17	7.18	7.29	7.32						
Analog output 1	7.19	7.20	7.21	7.33									
Analog output 2	7.22	7.23	7.24										
Application menu	Menu 18		Menu 19		Menu 20								
At speed indicator bit	3.06	3.07	3.09	10.06	10.05	10.07							
Auto reset	10.34	10.35	10.36	10.01									
Autotune	5.12	5.17	5.24										
Binary sum	9.29	9.30	9.31	9.32	9.33	9.34							
Bipolar speed	1.10												
Brake control	12.40 to 12.49												
Braking	10.11	10.10	10.30	10.31	6.01	2.04	2.02	10.12	10.39	10.40			
Cloning	11.42	11.36 to 11.40											
Stop mode	6.01												
Comms	11.23 to 11.26												
Cost - per kWh electricity	6.16	6.17	6.24	6.25	6.26	6.40							
Current controller	4.13	4.14											
Current feedback	4.01	4.02	4.17	4.04	4.12	4.20	4.23	4.24	10.08	10.09	10.17		
Current limits	4.05	4.06	4.07	4.18	4.15	4.19	4.16	5.07	10.08	10.09	10.17		
DC bus voltage	5.05	2.08											
Deceleration rates	2.20	2.21 to 2.29		2.04	2.35 to 2.37		2.02	2.04	2.08	6.01	10.30	10.31	10.39
Defaults	11.43	11.46											
Digital I/O	Menu 8												
Digital I/O read word	8.20												
Digital I/O T24	8.01	8.11	8.21	8.31									
Digital I/O T25	8.02	8.12	8.22	8.32									
Digital I/O T26	8.03	8.13	8.23	8.33									
Digital input T27	8.04	8.14	8.24										
Digital input T28	8.05	8.15	8.25	8.39									
Digital input T29	8.06	8.16	8.26	8.39									
Digital lock	13.10	13.01 to 13.09		13.11	13.12	13.16	3.22	3.23	13.19 to 13.23				
Digital output T22	8.08	8.18	8.28										
Direction	10.13	6.30	6.31	1.03	10.14	2.01	3.02	8.03	8.04	10.40			
Display timeout	11.41												
Drive active	10.02	10.40											
Drive derivative	11.28												
Drive ok	10.01	8.27	8.07	8.17	10.36	10.40							
Dynamic performance	5.26												
Electronic nameplate	3.49												
Enable	6.15	8.09	8.10										
Encoder reference	3.43	3.44	3.45	3.46									
Encoder set up	3.33	3.34 to 3.42		3.47	3.48								
External trip	10.32	8.10	8.07										
Fan speed	6.45												
Fast disable	6.29												
Field weakening	5.22	1.06											
Filter change	6.19	6.18											
Speed reference selection	1.14	1.15											
Speed slaving	3.01	3.13	3.14	3.15	3.16	3.17	3.18						
Hard speed reference	3.22	3.23											
Current rating	5.07	11.32											
I/O sequencer	6.04	6.30	6.31	6.32	6.33	6.34	6.42	6.43	6.41				
Inertia compensation	2.38	5.12	4.22	3.18									
Jog reference	1.05	2.19	2.29										
Ke	5.33												
Keypad reference	1.17	1.14	1.43	1.51	6.12	6.13							
Kt	5.32												
Limit switches	6.35	6.36											

Feature	Parameter number (Pr)												
Line power supply loss	6.03	10.15	10.16	5.05									
Local position reference	13.20 to 13.23												
Logic function 1	9.01	9.04	9.05	9.06	9.07	9.08	9.09	9.10					
Logic function 2	9.02	9.14	9.15	9.16	9.17	9.18	9.19	9.20					
Low voltage supply	6.44	6.46											
Marker pulse	3.32	3.31											
Maximum speed	1.06												
Menu 0 set up	11.01 to 11.22		Menu 22										
Minimum speed	1.07	10.04											
Motor map	5.07	5.08	5.09	5.11									
Motor map 2	Menu 21		11.45										
Motorized potentiometer	9.21	9.22	9.23	9.24	9.25	9.26	9.27	9.28					
Offset speed reference	1.04	1.38	1.09										
Onboard PLC	11.47 to 11.51												
Open collector digital outputs	8.30												
Orientation	13.10	13.13 to 13.15											
Output	5.01	5.02	5.03	5.04									
Overspeed threshold	3.08												
Phase angle	3.25	5.12											
PID controller	Menu 14												
Position feedback - drive	3.28	3.29	3.30	3.50									
Positive logic	8.29												
Power up parameter	11.22	11.21											
Precision reference	1.18	1.19	1.20	1.44									
Preset speeds	1.15	1.21 to 1.28		1.16	1.14	1.42	1.45 to 1.48		1.50				
Programmable logic	Menu 9												
Ramp (accel / decel) mode	2.04	2.08	6.01	2.02	2.03	10.30	10.31	10.39					
Rated speed autotune	5.08												
Regenerating	10.10	10.11	10.30	10.31	6.01	2.04	2.02	10.12	10.39	10.40			
Relative jog	13.17 to 13.19												
Relay output	8.07	8.17	8.27										
Reset	10.33	8.02	8.22	10.34	10.35	10.36	10.01						
S ramp	2.06	2.07											
SAFE TORQUE OFF input	8.09	8.10											
Sample rates	5.18												
Security code	11.30	11.44											
Serial comms	11.23 to 11.26												
Skip speeds	1.29	1.30	1.31	1.32	1.33	1.34	1.35						
Smartcard	11.36 to 11.40		11.42										
Software version	11.29	11.34											
Speed controller	3.10 to 3.17		3.19	3.20	3.21								
Speed feedback	3.02	3.03	3.04										
Speed feedback - drive	3.26	3.27	3.28	3.29	3.30	3.31	3.42						
Speed reference selection	1.14	1.15	1.49	1.50	1.01								
Status word	10.40												
Supply	6.44	5.05	6.46										
Switching frequency	5.18	5.35	7.34	7.35									
Thermal protection - drive	5.18	5.35	7.04	7.05	7.06	7.32	7.35	10.18					
Thermal protection - motor	4.15	5.07	4.19	4.16	4.25	7.15							
Thermistor input	7.15	7.03	10.37										
Threshold detector 1	12.01	12.03 to 12.07											
Threshold detector 2	12.02	12.23 to 12.27											
Time - filter change	6.19	6.18											
Time - powered up log	6.20	6.21	6.28										
Time - run log	6.22	6.23	6.28										
Torque	4.03	5.32											
Torque mode	4.08	4.11	4.09	4.10									
Trip detection	10.37	10.38	10.20 to 10.29										
Trip log	10.20 to 10.29		10.41 to 10.51		6.28								
Under voltage	5.05	10.16	10.15										
Variable selector 1	12.08 to 12.15												
Variable selector 2	12.28 to 12.35												
Velocity feed forward	1.39	1.40											
Voltage controller	5.31												
Voltage mode	5.14	5.17											

Feature	Parameter number (Pr)												
Voltage rating	11.33	5.09	5.05										
Voltage supply	6.44	6.46	5.05										
Warning	10.19	10.12	10.17	10.18	10.40								
Zero speed indicator bit	3.05	10.03											

Parameter ranges and variable maximums:

The two values provided define the minimum and maximum values for the given parameter. In some cases the parameter range is variable and dependant on either:

- other parameters
- the drive rating
- drive mode
- or a combination of these

The values given in Table 8-4 are the variable maximums used in the drive.

Table 8-4 Definition of parameter ranges & variable maximums

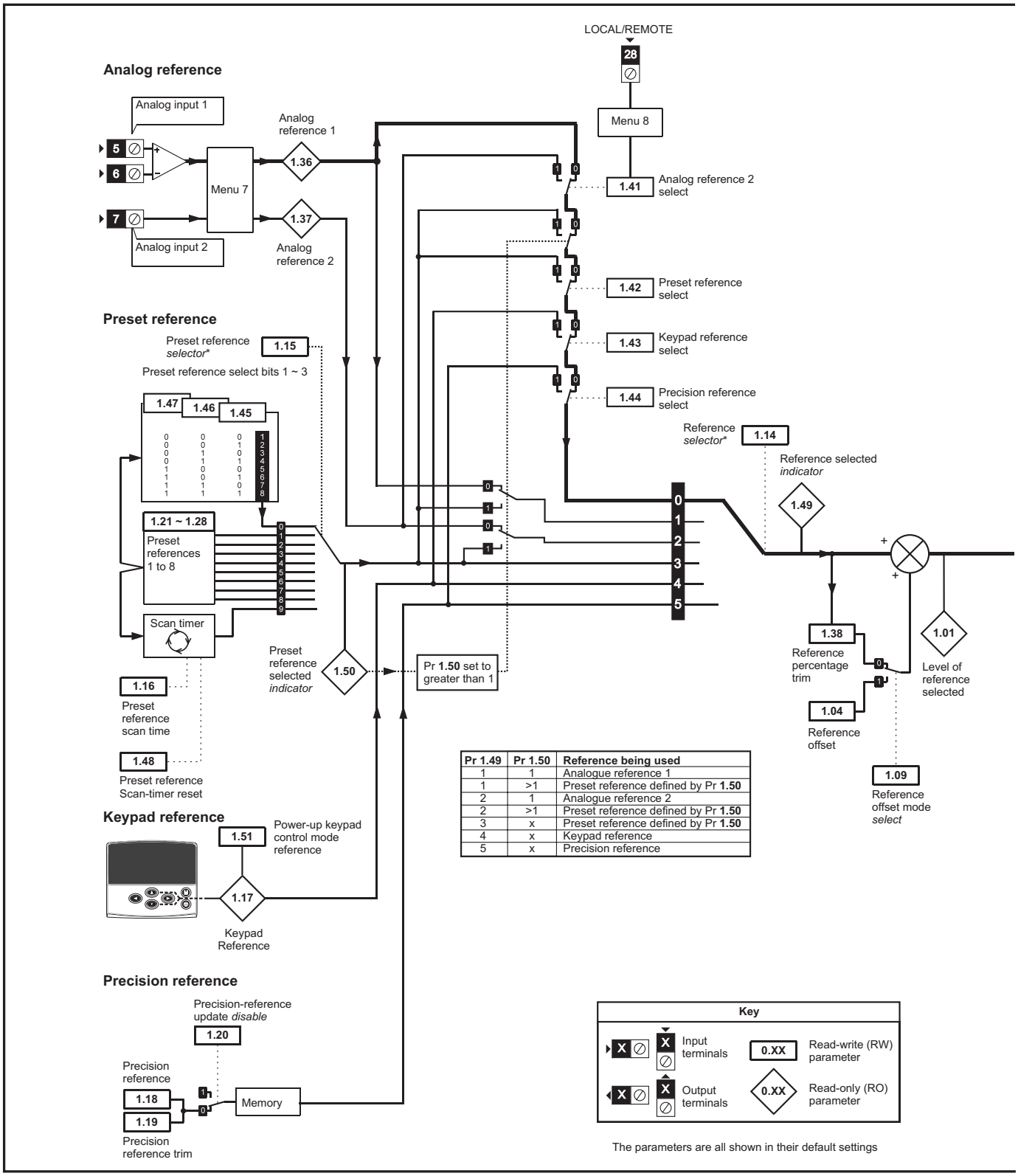
Maximum	Definition
SPEED_MAX [40000.0rpm]	**Maximum speed reference** If Pr **1.08** = 0: SPEED_MAX = Pr **1.06** If Pr **1.08** = 1: SPEED_MAX is Pr **1.06** or – Pr **1.07** whichever is the largest (If the second motor map is selected Pr **21.01** is used instead of Pr **1.06** and Pr **21.02** instead of Pr **1.07**)
SPEED_LIMIT_MAX [40000.0rpm]	**Maximum applied to speed reference limits** A maximum limit may be applied to the speed reference to prevent the nominal encoder frequency from exceeding 500kHZ. The maximum is defined by SPEED_LIMIT_MAX (in rpm) = 500kHz x 60 / ELPR = 3.0 x 10^7 / ELPR subject to an absolute maximum of 40,000 rpm. ELPR is equivalent encoder lines per revolution and is the number of lines that would be produced by a quadrature encoder. Quadrature encoder ELPR = number of lines per revolution F and D encoder ELPR = number of lines per revolution / 2 Resolver ELPR = resolution / 4 SINCOS encoder ELPR = number of sine waves per revolution Serial comms encoder ELPR = resolution / 4 This maximum is defined by the device selected with the speed feedback selector (Pr **3.26**) and the ELPR set for the position feedback device. In closed-loop vector RFC mode SPEED_LIMIT_MAX = 40,000rpm.
SPEED_MAX [40000.0rpm]	**Maximum speed** This maximum is used for some speed related parameters in menu 3. To allow headroom for overshoot etc. the maximum speed is twice the maximum speed reference. SPEED_MAX = 2 x SPEED_MAX
RATED_CURRENT_MAX [9999.99A]	**Maximum motor rated current** RATED_CURRENT_MAX = 1.36 x K_C. The motor rated current can be increased above K_C up to a level not exceeding 1.36 x K_C). (Maximum motor rated current is the maximum normal duty current rating.)
DRIVE_CURRENT_MAX [9999.99A]	**Maximum drive current** The maximum drive current is the current at the over current trip level and is given by: DRIVE_CURRENT_MAX = K_C / 0.45
AC_VOLTAGE_SET_MAX [690V]	**Maximum output voltage set-point** Defines the maximum motor voltage that can be selected. 200V drives: 240V, 400V drives: 480V
AC_VOLTAGE_MAX [930V]	**Maximum AC output voltage** This maximum has been chosen to allow for maximum AC voltage that can be produced by the drive including quasi-square wave operation as follows: AC_VOLTAGE_MAX = 0.78 x DC_VOLTAGE_MAX 200V drives: 325V, 400V drives: 650V
DC_VOLTAGE_SET_MAX [1150V]	**Maximum DC voltage set-point** 200V rating drive: 0 to 400V, 400V rating drive: 0 to 800V
DC_VOLTAGE_MAX [1190V]	**Maximum DC bus voltage** The maximum measurable DC bus voltage. 200V drives: 415V, 400V drives: 830V

Maximum	Definition
MOTOR1_CURRENT_LIMIT_MAX [1000.0%]	Where: $\text{Maximum current limit} = \left[\frac{\text{Maximum current}}{\text{Motor rated current}}\right] \times 100\%$ The Maximum current is either (1.75 x K_C) when the motor rated current set in Pr **5.07** is less than or equal to the maximum Heavy Duty current rating given by Pr **11.32**, otherwise it is (1.1 x Normal Duty rating). Motor rated current is given by Pr **5.07**
MOTOR2_CURRENT_LIMIT_MAX [1000.0%]	**Maximum current limit settings for motor map 2** This maximum current limit setting is the maximum applied to the current limit parameters in motor map 2. The formulae for MOTOR2_CURRENT_LIMIT_MAX are the same for MOTOR1_CURRENT_LIMIT_MAX except that Pr **5.07** is replaced with Pr **21.07** and Pr **5.10** is replaced with Pr **21.10**.
TORQUE_PROD_CURRENT_MAX [1000.0%]	**Maximum torque producing current** This is used as a maximum for torque and torque producing current parameters. It is MOTOR1_CURRENT_LIMIT_MAX or MOTOR2_CURRENT_LIMIT_MAX depending on which motor map is currently active.
USER_CURRENT_MAX [1000.0%]	**Current parameter limit selected by the user** The user can select a maximum for Pr **4.08** (torque reference) and Pr **4.20** (percentage load) to give suitable scaling for analog I/O with Pr **4.24**. This maximum is subject to a limit of MOTOR1_CURRENT_LIMIT_MAX. or MOTOR2_CURRENT_LIMIT_MAX depending on which motor map is currently active. USER_CURRENT_MAX = Pr **4.24**
POWER_MAX [9999.99kW]	**Maximum power in kW** The maximum power has been chosen to allow for the maximum power that can be output by the drive with maximum AC output voltage, maximum controlled current and unity power factor. Therefore POWER_MAX = √3 x AC_VOLTAGE_MAX x DRIVE_CURRENT_MAX

The values given in square brackets indicate the absolute maximum value allowed for the variable maximum.

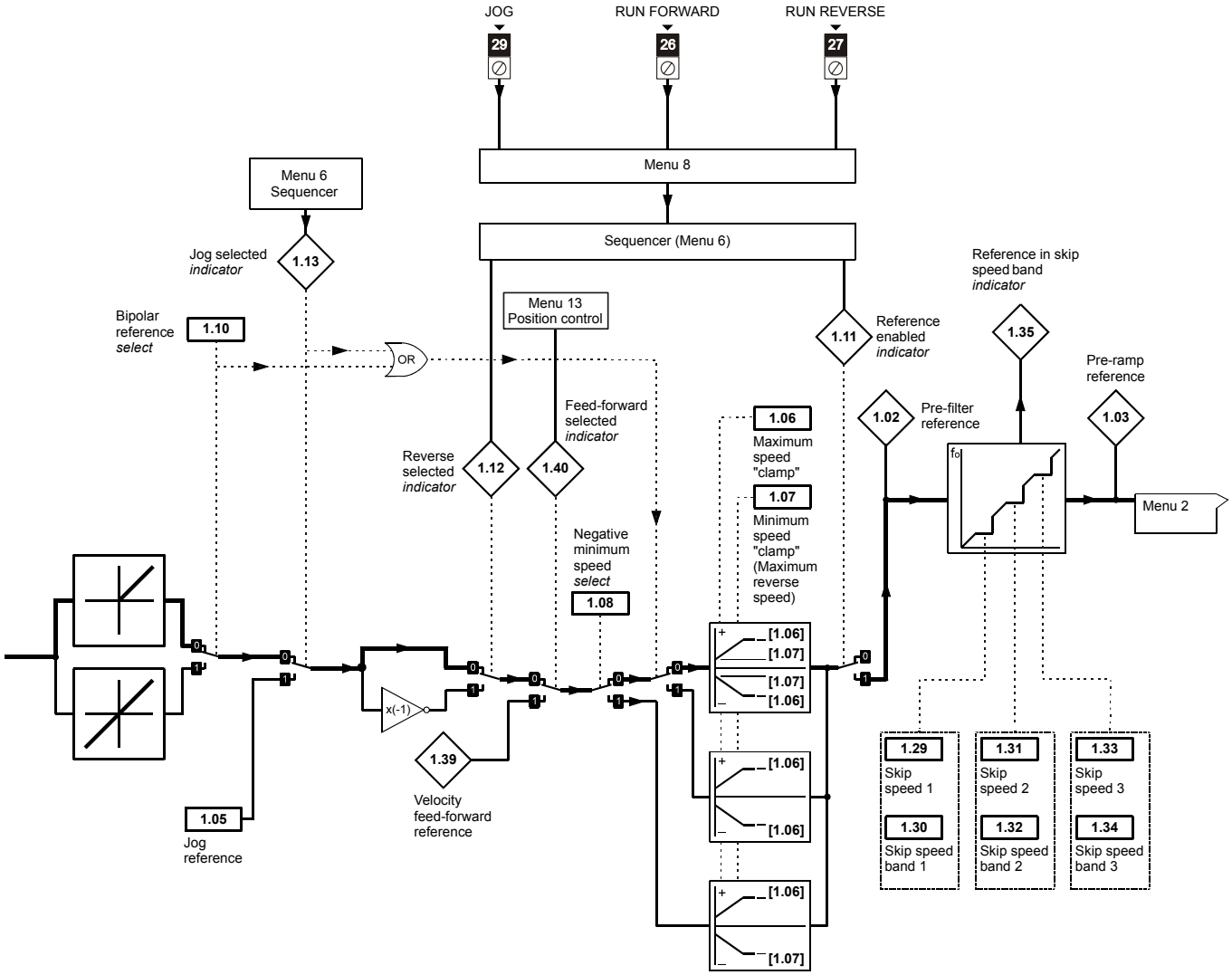
8.1 Menu 1: Speed reference

Figure 8-1 Menu 1 logic diagram



Pr 1.49	Pr 1.50	Reference being used
1	1	Analogue reference 1
1	>1	Preset reference defined by Pr **1.50**
2	1	Analogue reference 2
2	>1	Preset reference defined by Pr **1.50**
3	x	Preset reference defined by Pr **1.50**
4	x	Keypad reference
5	x	Precision reference

*For more information, refer to section 8.22.1 *Reference modes* on page 127

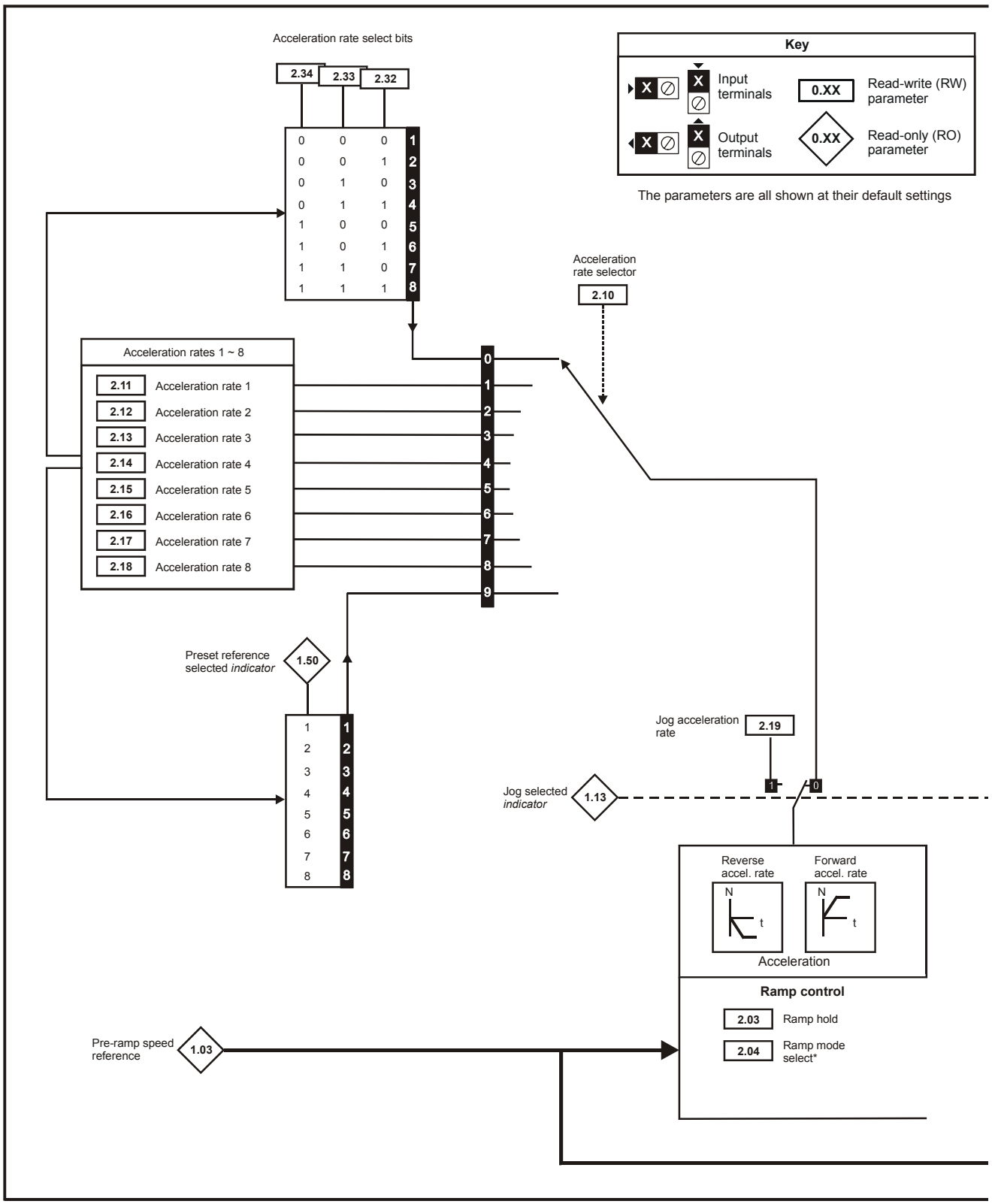

JOG
RUN FORWARD
RUN REVERSE
29
26
27
Menu 8
Sequencer (Menu 6)
Menu 6 Sequencer
Jog selected indicator
1.13
Bipolar reference select
1.10
OR
Menu 13 Position control
Feed-forward selected indicator
1.40
Reverse selected indicator
1.12
1.11
Reference enabled indicator
Reference in skip speed band indicator
1.35
Pre-ramp reference
1.03
1.02
Pre-filter reference
1.06
Maximum speed "clamp"
1.07
Minimum speed "clamp" (Maximum reverse speed)
Negative minimum speed select
1.08
Menu 2
[1.06]
[1.07]
[1.07]
[1.06]
[1.06]
[1.06]
[1.06]
[1.07]
x(-1)
1.39
Velocity feed-forward reference
1.05
Jog reference
1.29
Skip speed 1
1.30
Skip speed band 1
1.31
Skip speed 2
1.32
Skip speed band 2
1.33
Skip speed 3
1.34
Skip speed band 3

Parameter			Range(⇳)	Default(⇨)	Type					
1.01	Speed reference selected		±SPEED_MAX Hz/rpm		RO	Bi		NC	PT	
1.02	Pre-skip filter reference		±SPEED_MAX Hz/rpm		RO	Bi		NC	PT	
1.03	Pre-ramp reference		±SPEED_MAX Hz/rpm		RO	Bi		NC	PT	
1.04	Reference offset		±40,000.0 rpm	0.0	RW	Bi				US
1.05	Jog reference	{**0.23**}	0 to 4,000.0 rpm	0.0	RW	Uni				US
1.06	Maximum reference clamp	{**0.02**}	SPEED_LIMIT_MAX rpm	3,000.0	RW	Uni				US
1.07	Minimum reference clamp	{**0.01**}	±SPEED_LIMIT_MAX rpm	0.0	RW	Bi			PT	US
1.08	Negative minimum reference clamp enable		OFF (0) or On (1)	OFF (0)	RW	Bit				US
1.09	Reference offset select		OFF (0) or On (1)	OFF (0)	RW	Bit				US
1.10	Bipolar reference enable	{**0.22**}	OFF (0) or On (1)	OFF (0)	RW	Bit				US
1.11	Reference enabled indicator		OFF (0) or On (1)		RO	Bit		NC	PT	
1.12	Reverse selected indicator		OFF (0) or On (1)		RO	Bit		NC	PT	
1.13	Jog selected indicator		OFF (0) or On (1)		RO	Bit		NC	PT	
1.14	Reference selector	{**0.05**}	A1.A2 (0), A1.Pr (1), A2.Pr (2), Pr (3), PAd (4), Prc (5)	A1.A2 (0)	RW	Txt				US
1.15	Preset reference selector		0 to 9	0	RW	Uni				US
1.16	Preset reference selector timer		0 to 400.0s	10.0	RW	Uni				US
1.17	Keypad control mode reference		±SPEED_MAX Hz/rpm	0.0	RO	Bi		NC	PT	PS
1.18	Precision reference coarse		±SPEED_MAX Hz/rpm	0.0	RW	Bi				US
1.19	Precision reference fine		0.000 to 0.099 rpm	0.000	RW	Uni				US
1.20	Precision reference update disable		OFF (0) or On (1)	OFF (0)	RW	Bit		NC		
1.21	Preset reference 1	{**0.24**}	±SPEED_MAX Hz/rpm	0.0	RW	Bi				US
1.22	Preset reference 2	{**0.25**}	±SPEED_MAX Hz/rpm	0.0	RW	Bi				US
1.23	Preset reference 3		±SPEED_MAX Hz/rpm	0.0	RW	Bi				US
1.24	Preset reference 4		±SPEED_MAX Hz/rpm	0.0	RW	Bi				US
1.25	Preset reference 5		±SPEED_MAX Hz/rpm	0.0	RW	Bi				US
1.26	Preset reference 6		±SPEED_MAX Hz/rpm	0.0	RW	Bi				US
1.27	Preset reference 7		±SPEED_MAX Hz/rpm	0.0	RW	Bi				US
1.28	Preset reference 8		±SPEED_MAX Hz/rpm	0.0	RW	Bi				US
1.29	Skip reference 1		0 to 40,000 rpm	0	RW	Uni				US
1.30	Skip reference band 1		0 to 250 rpm	5	RW	Uni				US
1.31	Skip reference 2		0 to 40,000 rpm	0	RW	Uni				US
1.32	Skip reference band 2		0 to 250 rpm	5	RW	Uni				US
1.33	Skip reference 3		0 to 40,000 rpm	0	RW	Uni				US
1.34	Skip reference band 3		0 to 250 rpm	5	RW	Uni				US
1.35	Reference in rejection zone		OFF (0) or On (1)		RO	Bit		NC	PT	
1.36	Analog reference 1		±SPEED_MAX Hz/rpm		RO	Bi		NC		
1.37	Analog reference 2		±SPEED_MAX Hz/rpm		RO	Bi		NC		
1.38	Percentage trim		±100.00%	0.00	RW	Bi		NC		
1.39	Velocity feed-forward		±40,000.0 rpm		RO	Bi		NC	PT	
1.40	Velocity feed-forward select		OFF (0) or On (1)		RO	Bit		NC	PT	
1.41	Analog reference 2 select		OFF (0) or On (1)	OFF (0)	RW	Bit		NC		
1.42	Preset reference select		OFF (0) or On (1)	OFF (0)	RW	Bit		NC		
1.43	Keypad reference select		OFF (0) or On (1)	OFF (0)	RW	Bit		NC		
1.44	Precision reference select		OFF (0) or On (1)	OFF (0)	RW	Bit		NC		
1.45	Preset reference 1 select		OFF (0) or On (1)	OFF (0)	RW	Bit		NC		
1.46	Preset reference 2 select		OFF (0) or On (1)	OFF (0)	RW	Bit		NC		
1.47	Preset reference 3 select		OFF (0) or On (1)	OFF (0)	RW	Bit		NC		
1.48	Reference timer reset flag		OFF (0) or On (1)	OFF (0)	RW	Bit		NC		
1.49	Reference selected indicator		1 to 5		RO	Uni		NC	PT	
1.50	Preset reference selected indicator		1 to 8		RO	Uni		NC	PT	
1.51	Power-up keyboard control mode reference		rESEt (0), LASt (1), PrS1 (2)	rESEt (0)	RW	Txt				US

RW	Read / Write	RO	Read only	Uni	Unipolar	Bi	Bi-polar	Bit	Bit parameter	Txt	Text string		
FI	Filtered	DE	Destination	NC	Not copied	RA	Rating dependent	PT	Protected	US	User save	PS	Power down save

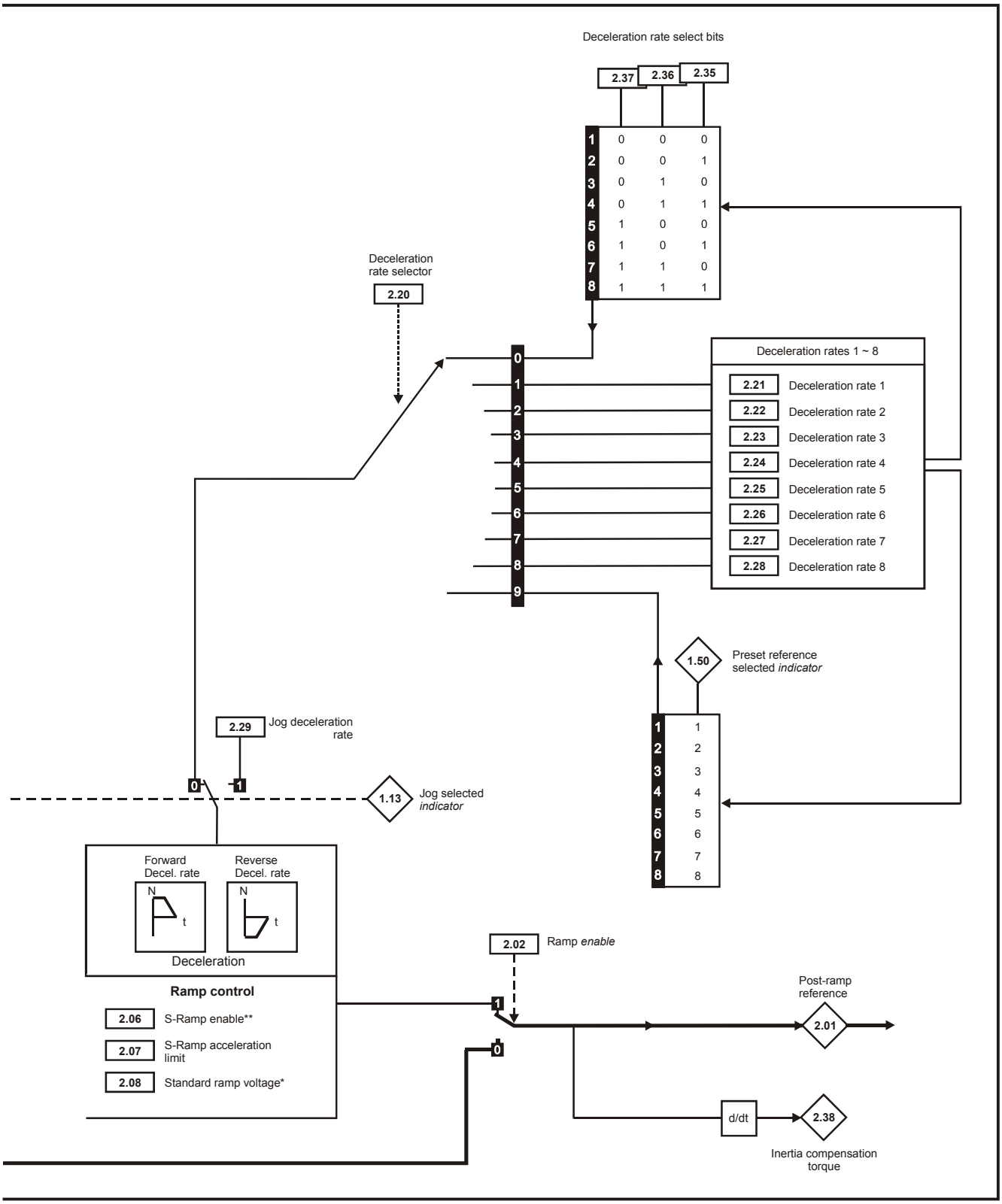
8.2 Menu 2: Ramps

Figure 8-2 Menu 2 logic diagram



*For more information, refer to section 8.22.2 *Braking Modes* on page 128.

**For more information, refer to section 8.22.3 *S ramps* on page 128.

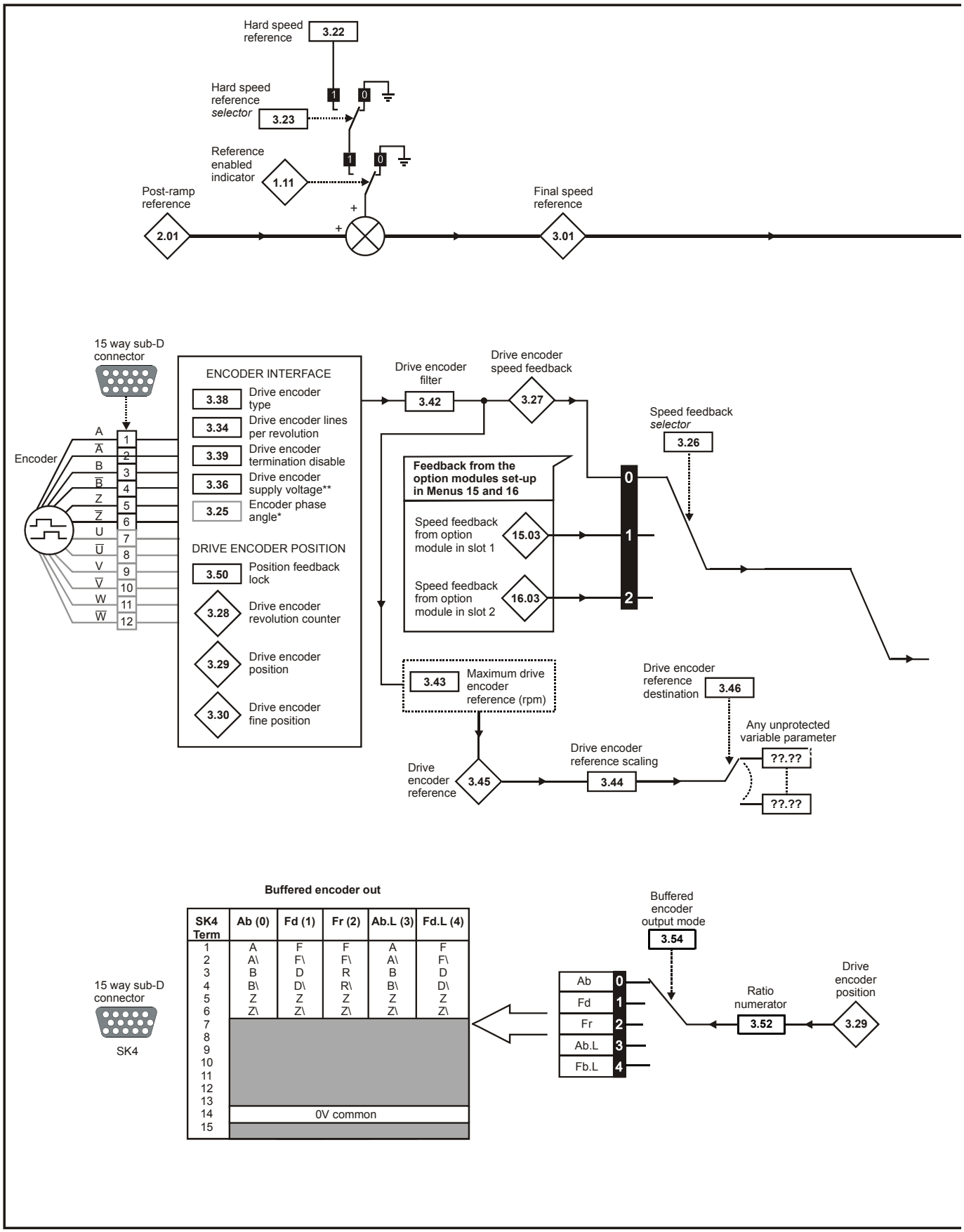

Deceleration rate select bits
2.37
2.36
2.35
1 0 0 0
2 0 0 1
3 0 1 0
4 0 1 1
5 1 0 0
6 1 0 1
7 1 1 0
8 1 1 1
Deceleration rate selector
2.20
0
1
2
3
4
5
6
7
8
9
Deceleration rates 1 ~ 8
2.21 Deceleration rate 1
2.22 Deceleration rate 2
2.23 Deceleration rate 3
2.24 Deceleration rate 4
2.25 Deceleration rate 5
2.26 Deceleration rate 6
2.27 Deceleration rate 7
2.28 Deceleration rate 8
1.50
Preset reference selected *indicator*
1 1
2 2
3 3
4 4
5 5
6 6
7 7
8 8
2.29
Jog deceleration rate
0
1
1.13
Jog selected *indicator*
Forward Decel. rate
Reverse Decel. rate
N
t
Deceleration
Ramp control
2.06 S-Ramp enable**
2.07 S-Ramp acceleration limit
2.08 Standard ramp voltage*
2.02
Ramp *enable*
1
0
Post-ramp reference
2.01
d/dt
2.38
Inertia compensation torque

Parameter			Range(⇳)	Default(⇨)	Type					
2.01	Post ramp reference		±SPEED_MAX Hz/rpm		RO	Bi		NC	PT	
2.02	Ramp enable	{**0.16**}	OFF (0) or On (1)	On (1)	RW	Bit				US
2.03	Ramp hold		OFF (0) or On (1)	OFF (0)	RW	Bit				US
2.04	Ramp mode select	{**0.15**}	FASt (0) Std (1)	Std (1)	RW	Txt				US
2.06	S ramp enable		OFF (0) or On (1)	OFF (0)	RW	Bit				US
2.07	S ramp acceleration limit		0.000 to 100.000 s^2/1000rpm	0.030	RW	Uni				US
2.08	Standard ramp voltage		0 to DC_VOLTAGE_SET_MAX V	200V drive: 375 400V drive: EUR> 750 USA> 775	RW	Uni		RA		US
2.10	Acceleration rate selector		0 to 9	0	RW	Uni				US
2.11	Acceleration rate 1	{**0.03**}	0.000 to 3,200.000 s/1,000rpm	0.200	RW	Uni				US
2.12	Acceleration rate 2		0.000 to 3,200.000 s/1,000rpm	0.200	RW	Uni				US
2.13	Acceleration rate 3		0.000 to 3,200.000 s/1,000rpm	0.200	RW	Uni				US
2.14	Acceleration rate 4		0.000 to 3,200.000 s/1,000rpm	0.200	RW	Uni				US
2.15	Acceleration rate 5		0.000 to 3,200.000 s/1,000rpm	0.200	RW	Uni				US
2.16	Acceleration rate 6		0.000 to 3,200.000 s/1,000rpm	0.200	RW	Uni				US
2.17	Acceleration rate 7		0.000 to 3,200.000 s/1,000rpm	0.200	RW	Uni				US
2.18	Acceleration rate 8		0.000 to 3,200.000 s/1,000rpm	0.200	RW	Uni				US
2.19	Jog acceleration rate		0.000 to 3,200.000 s/1,000rpm	0.000	RW	Uni				US
2.20	Deceleration rate selector		0 to 9	0	RW	Uni				US
2.21	Deceleration rate 1	{**0.04**}	0.000 to 3,200.000 s/1,000rpm	0.200	RW	Uni				US
2.22	Deceleration rate 2		0.000 to 3,200.000 s/1,000rpm	0.200	RW	Uni				US
2.23	Deceleration rate 3		0.000 to 3,200.000 s/1,000rpm	0.200	RW	Uni				US
2.24	Deceleration rate 4		0.000 to 3,200.000 s/1,000rpm	0.200	RW	Uni				US
2.25	Deceleration rate 5		0.000 to 3,200.000 s/1,000rpm	0.200	RW	Uni				US
2.26	Deceleration rate 6		0.000 to 3,200.000 s/1,000rpm	0.200	RW	Uni				US
2.27	Deceleration rate 7		0.000 to 3,200.000 s/1,000rpm	0.200	RW	Uni				US
2.28	Deceleration rate 8		0.000 to 3,200.000 s/1,000rpm	0.200	RW	Uni				US
2.29	Jog deceleration rate		0.000 to 3,200.000 s/1,000rpm	0.000	RW	Uni				US
2.32	Acceleration select bit 0		OFF (0) or On (1)	OFF (0)	RW	Bit		NC		
2.33	Acceleration select bit 1		OFF (0) or On (1)	OFF (0)	RW	Bit		NC		
2.34	Acceleration select bit 2		OFF (0) or On (1)	OFF (0)	RW	Bit		NC		
2.35	Deceleration select bit 0		OFF (0) or On (1)	OFF (0)	RW	Bit		NC		
2.36	Deceleration select bit 1		OFF (0) or On (1)	OFF (0)	RW	Bit		NC		
2.37	Deceleration select bit 2		OFF (0) or On (1)	OFF (0)	RW	Bit		NC		
2.38	Inertia compensation torque		± 1,000.0 %		RO	Bi		NC	PT	

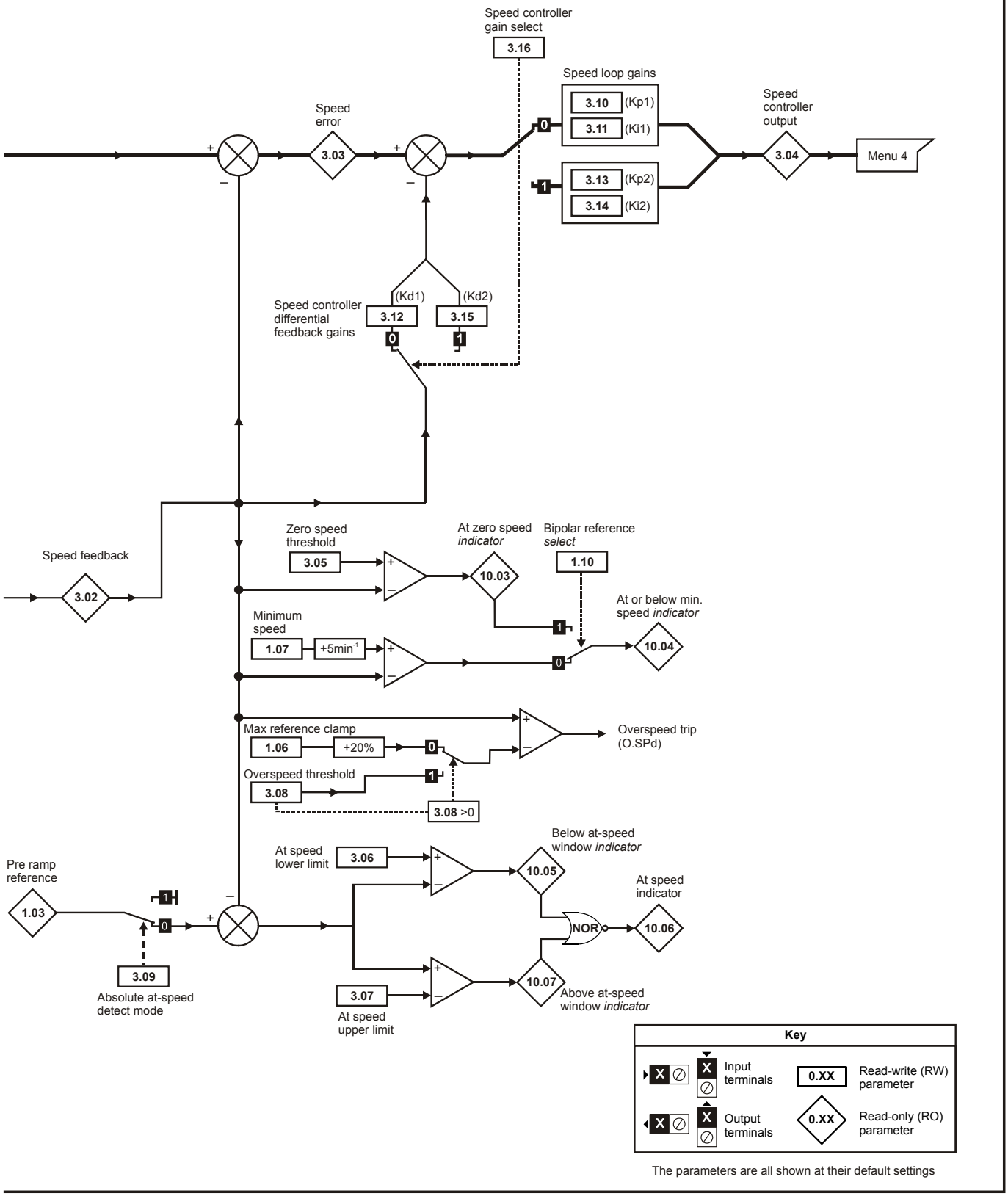
RW	Read / Write	RO	Read only	Uni	Unipolar	Bi	Bi-polar	Bit	Bit parameter	Txt	Text string		
FI	Filtered	DE	Destination	NC	Not copied	RA	Rating dependent	PT	Protected	US	User save	PS	Power down save

8.3 Menu 3: Frequency slaving, speed feedback and speed control

Figure 8-3 Menu 3 logic diagram



NOTE **If Ab encoder voltage is greater than 5V, then the termination resistors must be disabled Pr **3.39** to 0.



The parameters are all shown at their default settings

Parameter			Range(⇳)	Default(⇨)	Type					
3.01	Final speed reference		±SPEED_MAX rpm		RO	Bi	FI	NC	PT	
3.02	Speed feedback	{**0.10**}	±SPEED_MAX rpm		RO	Bi	FI	NC	PT	
3.03	Speed error		±SPEED_MAX rpm		RO	Bi	FI	NC	PT	
3.04	Speed controller output		±Torque_prod_current_max %		RO	Bi	FI	NC	PT	
3.05	Zero speed threshold		0 to 200 rpm	5	RW	Uni				US
3.06	At speed lower limit		0 to 40,000 rpm	5	RW	Uni				US
3.07	At speed upper limit		0 to 40,000 rpm	5	RW	Uni				US
3.08	Overspeed threshold	{**0.26**}	0 to 40,000 rpm	0	RW	Uni				US
3.09	Absolute 'at speed' detect		OFF (0) or On (1)	OFF (0)	RW	Bit				US
3.10	Speed controller proportional gain (Kp1)	{**0.07**}	0.0000 to 6.5535 1/rad s^{-1}	0.0100	RW	Uni				US
3.11	Speed controller integral gain (Ki1)	{**0.08**}	0.00 to 655.35 s/rad s^{-1}	1.00	RW	Uni				US
3.12	Speed controller differential feedback gain (Kd1)	{**0.09**}	0.00000 to 0.65535 s^{-1}/rad s^{-1}	0.00000	RW	Uni				US
3.13	Speed controller proportional gain (Kp2)		0.0000 to 6.5535 1/rad s^{-1}	0.0100	RW	Uni				US
3.14	Speed controller integral gain (Ki2)		0.00 to 655.35 1/rad	1.00	RW	Uni				US
3.15	Speed controller differential feedback gain (Kd2)		0.00000 to 0.65535 s	0.00000	RW	Uni				US
3.16	Speed controller gain select		OFF (0) or On (1)	OFF (0)	RW	Bit				US
3.17	Speed controller set-up method		0 to 3	0	RW	Uni				US
3.18	Motor and load inertia		0.00010 to 90.00000 kg m^2	0.00000	RW	Uni				US
3.19	Compliance angle		0.0 to 359.9 °	4.0	RW	Uni				US
3.20	Bandwidth		0 to 255 Hz	10	RW	Uni				US
3.21	Damping factor		0.0 to 10.0	1.0	RW	Uni				US
3.22	Hard speed reference		±SPEED_FREQ_MAX rpm	0.0	RW	Bi				US
3.23	Hard speed reference selector		OFF (0) or On (1)	OFF (0)	RW	Bit				US
3.25	Encoder phase angle*	{**0.43**}	0.0 to 359.9 °	0.0	RW	Uni				US
3.26	Speed feedback selector		drv (0), SLot1 (1), SLot2 (2)	drv (0)	RW	Txt				US
3.27	Drive encoder speed feedback		±40,000.0 rpm		RO	Bi	FI	NC	PT	
3.28	Drive encoder revolution counter		0 to 65,535 revolutions		RO	Uni	FI	NC	PT	
3.29	Drive encoder position	{**0.11**}	0 to 65,535 1/2^{16}ths of a revolution		RO	Uni	FI	NC	PT	
3.30	Drive encoder fine position		0 to 65,535 1/2^{32}nds of a revolution		RO	Uni	FI	NC	PT	
3.31	Drive encoder marker position reset disable		OFF (0) or On (1)	OFF (0)	RW	Bit				US
3.32	Drive encoder marker flag		OFF (0) or On (1)	OFF (0)	RW	Bit		NC		
3.33	Drive encoder turn bits / Linear encoder comms to sine wave ratio		0 to 255	16	RW	Uni				US
3.34	Drive encoder lines per revolution	{**0.27**}	0 to 50,000	4096	RW	Uni				US
3.35	Drive encoder single turn comms bits / Linear encoder comms bits / Marker mode		0 to 32 bits	0	RW	Uni				US
3.36	Drive encoder supply voltage**		5V (0), 8V (1), 15V (2)	5V (0)	RW	Txt				US
3.37	Drive encoder comms baud rate		100 (0), 200 (1), 300 (2), 400 (3), 500 (4), 1000 (5), 1500 (6), 2000 (7) kBaud	300 (2)	RW	Txt				US
3.38	Drive encoder type		Ab (0), Fd (1), Fr (2), Ab.SErvo (3), Fd.SErvo (4), Fr.SErvo (5), SC (6), SC.Hiper (7), EndAt (8), SC.EndAt (9), SSI (10), SC.SSI (11)	Ab.SErvo (3)	RW	Txt				US
3.39	Drive encoder termination select / Rotary encoder select / Comms only encoder mode		0 to 2	1	RW	Uni				US
3.40	Drive encoder error detection level		Bit 0 (LSB) = Wire break detect Bit 1 = Phase error detect Bit 2 (MSB) = SSI power supply bit monitor Value is binary sum	1	RW	Uni				US
3.41	Drive encoder auto-configuration / SSI binary format select		OFF (0) or On (1)	OFF (0)	RW	Bit				US
3.42	Drive encoder filter		0 (0), 1 (1), 2 (2), 4 (3), 8 (4), 16 (5) ms	0	RW	Txt				US
3.43	Maximum drive encoder reference		0 to 40,000 rpm	3000	RW	Uni				US
3.44	Drive encoder reference scaling		0.000 to 4.000	1.000	RW	Uni				US
3.45	Drive encoder reference		±100.0%		RO	Bi	FI	NC	PT	
3.46	Drive encoder reference destination		Pr **0.00** to **21.50**	Pr **0.00**	RW	Uni		DE	PT	US
3.47	Re-initialise position feedback		OFF (0) or On (1)	OFF (0)	RW	Bit		NC		
3.48	Position feedback initialised		OFF (0) or On (1)		RO	Bit		NC	PT	
3.49	Full motor object electronic nameplate transfer		OFF (0) or On (1)	OFF (0)	RW	Bit				US
3.50	Position feedback lock		OFF (0) or On (1)	OFF (0)	RW	Bit		NC		
3.52	Encoder simulation ratio numerator		0.0000 to 1.0000	1.0000	RW	Uni				US
3.54	Encoder simulation mode		0 to 4	0	RW	Uni				US

RW	Read / Write	RO	Read only	Uni	Unipolar	Bi	Bi-polar	Bit	Bit parameter	Txt	Text string		
FI	Filtered	DE	Destination	NC	Not copied	RA	Rating dependent	PT	Protected	US	User save	PS	Power down save

WARNING

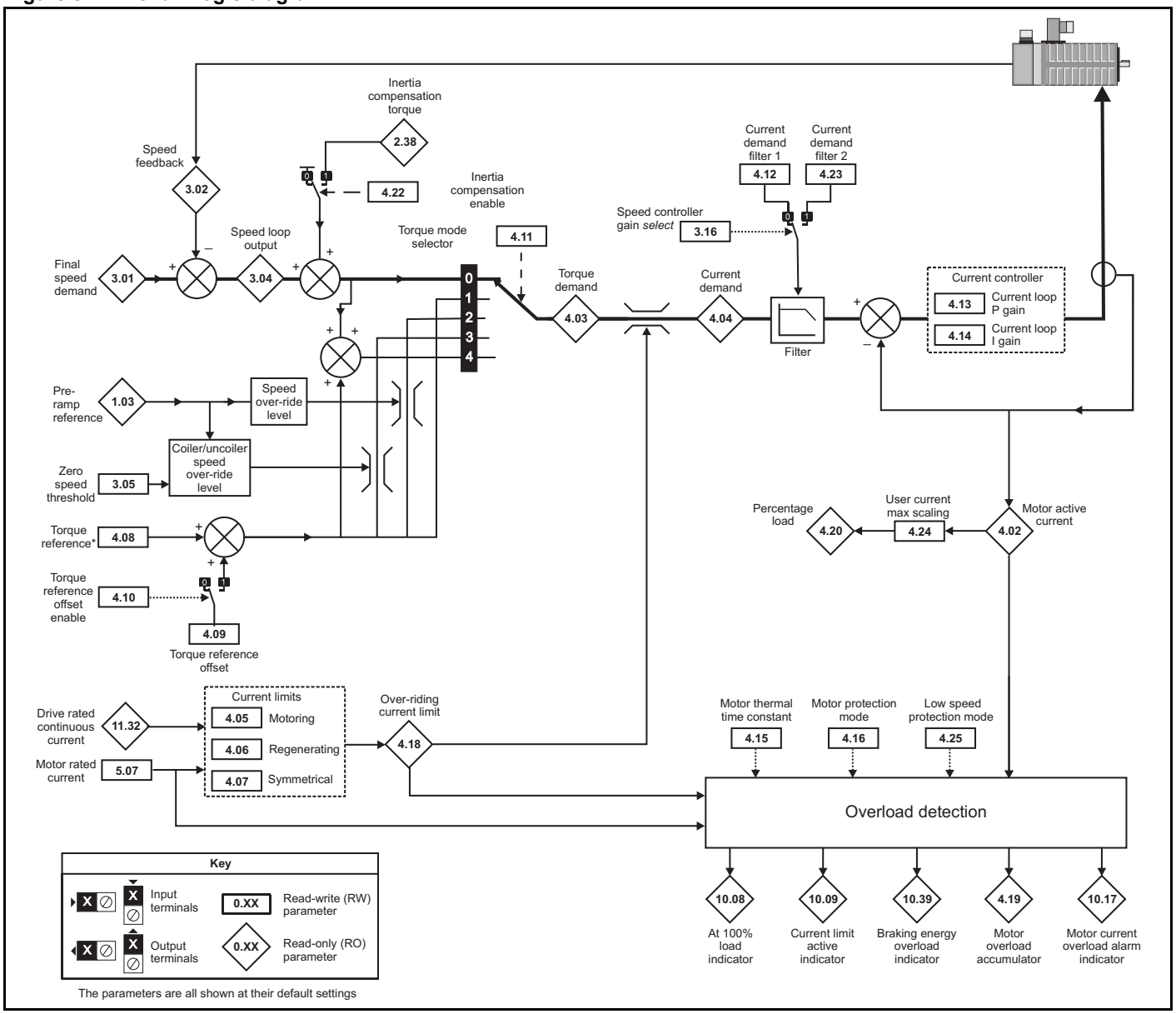
***Encoder phase angle**
The encoder phase angles in Pr **3.25** and Pr **21.20** are copied to the SMARTCARD when using any of the SMARTCARD transfer methods.

NOTE

If Ab encoder voltage is greater than 5V, then the termination resistors must be disabled Pr **3.39 to 0.

8.4 Menu 4: Torque and current control

Figure 8-4 Menu 4 logic diagram



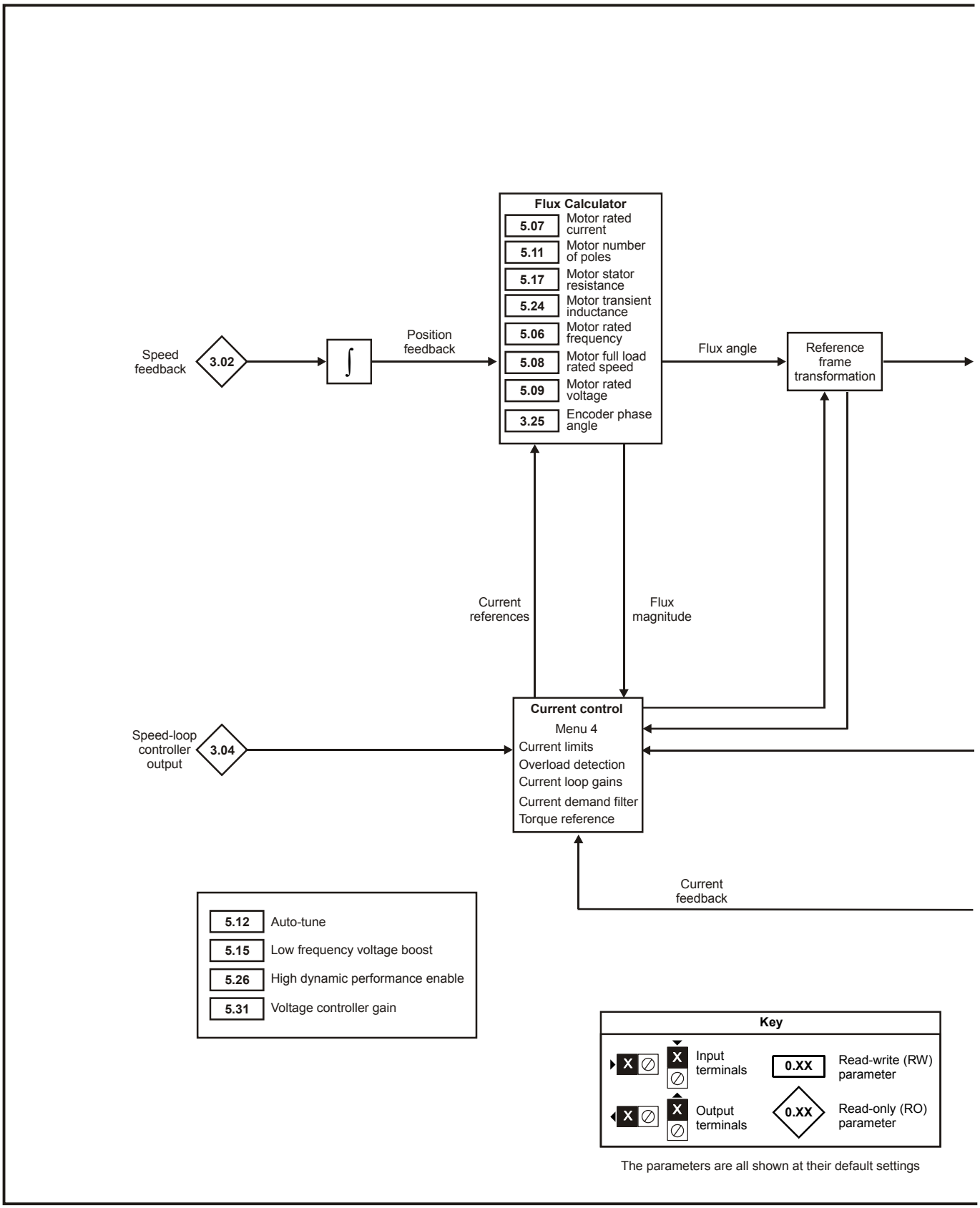
*For more information, refer to section 8.22.4 *Torque modes* on page 129.

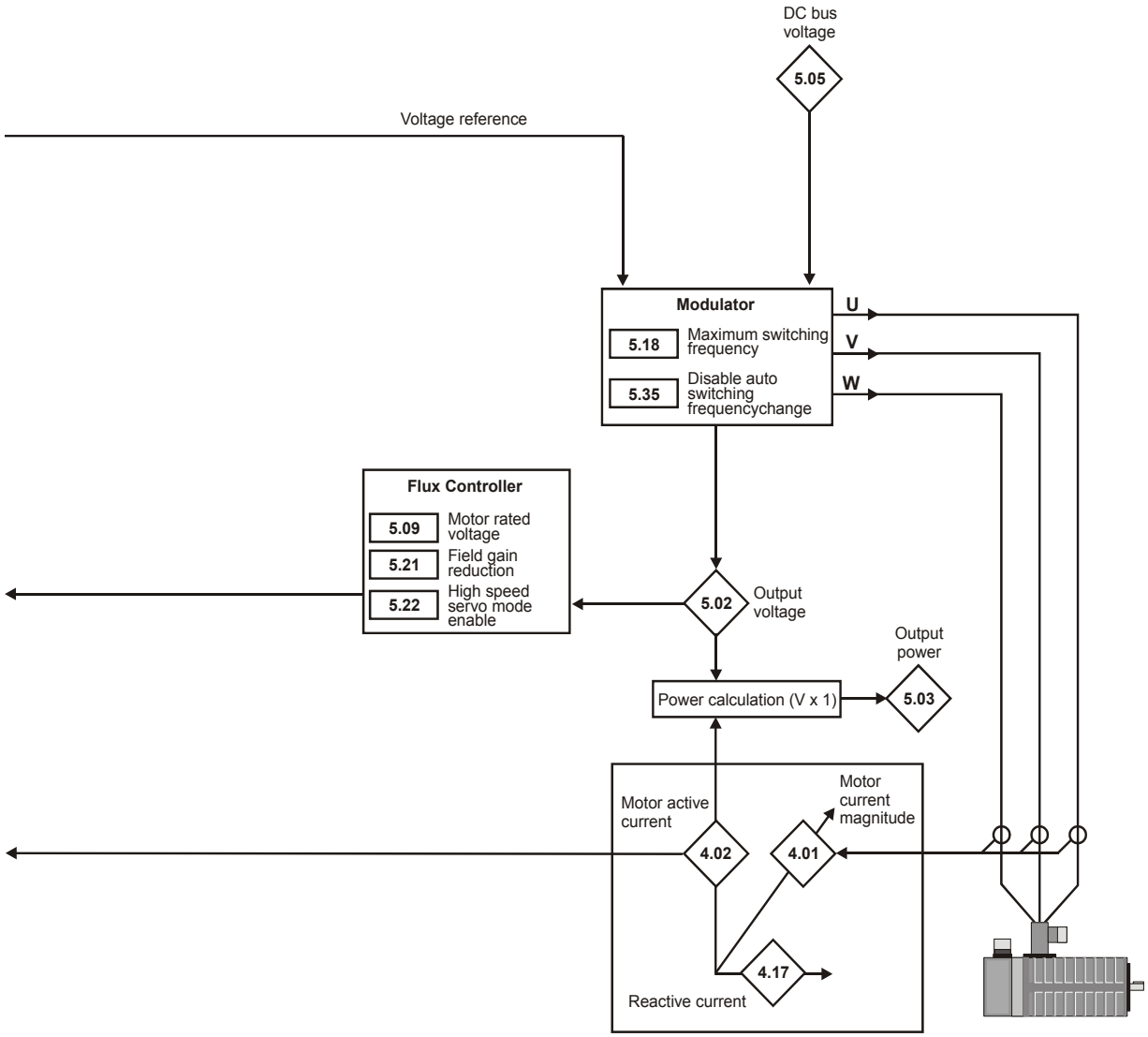
Parameter			Range(⇳)	Default(⇨)	Type					
4.01	Current magnitude	{**0.12**}	0 to DRIVE_CURRENT_MAX A		RO	Uni	FI	NC	PT	
4.02	Active current		±DRIVE_CURRENT_MAX A		RO	Bi	FI	NC	PT	
4.03	Torque demand		±TORQUE_PROD_CURRENT_MAX %		RO	Bi	FI	NC	PT	
4.04	Current demand		±TORQUE_PROD_CURRENT_MAX %		RO	Bi	FI	NC	PT	
4.05	Motoring current limit		0 to MOTOR1_CURRENT_LIMIT_MAX %	300.0	RW	Uni		RA		US
4.06	Regen current limit		0 to MOTOR1_CURRENT_LIMIT_MAX %	300.0	RW	Uni		RA		US
4.07	Symmetrical current limit	{**0.06**}	0 to MOTOR1_CURRENT_LIMIT_MAX %	300.0	RW	Uni		RA		US
4.08	Torque reference		±USER_CURRENT_MAX %	0.00	RW	Bi				US
4.09	Torque offset		±USER_CURRENT_MAX %	0.0	RW	Bi				US
4.10	Torque offset select		OFF (0) or On (1)	OFF (0)	RW	Bit				US
4.11	Torque mode selector	{**0.14**}	0 to 4	0	RW	Uni				US
4.12	Current demand filter 1	{**0.17**}	0.0 to 25.0 ms	0.0	RW	Uni				US
4.13	Current controller Kp gain	{**0.38**}	0 to 30,000	200V drive: 75 400V drive: 150	RW	Uni				US
4.14	Current controller Ki gain	{**0.39**}	0 to 30,000	200V drive: 1000 400V drive: 2000	RW	Uni				US
4.15	Thermal time constant	{**0.45**}	0.0 to 3000.0	20.0	RW	Uni				US
4.16	Thermal protection mode		0 to 1	0	RW	Bit				US
4.17	Reactive current		±DRIVE_CURRENT_MAX A		RO	Bi	FI	NC	PT	
4.18	Overriding current limit		±TORQUE_PROD_CURRENT_MAX %		RO	Uni		NC	PT	
4.19	Overload accumulator		0 to 100.0 %		RO	Uni		NC	PT	
4.20	Percentage load		±USER_CURRENT_MAX %		RO	Bi	FI	NC	PT	
4.22	Inertia compensation enable		OFF (0) or On (1)	OFF (0)	RW	Bit				US
4.23	Current demand filter 2		0.0 to 25.0 ms	0.0	RW	Uni				US
4.24	User current maximum scaling		0.0 to TORQUE_PROD_CURRENT_MAX %	300.0	RW	Uni		RA		US
4.25	Low speed thermal protection mode		OFF (0) or On (1)	OFF (0)	RW	Bit				US

RW	Read / Write	RO	Read only	Uni	Unipolar	Bi	Bi-polar	Bit	Bit parameter	Txt	Text string		
FI	Filtered	DE	Destination	NC	Not copied	RA	Rating dependent	PT	Protected	US	User save	PS	Power down save

8.5 Menu 5: Motor control

Figure 8-5 Menu 5 logic diagram



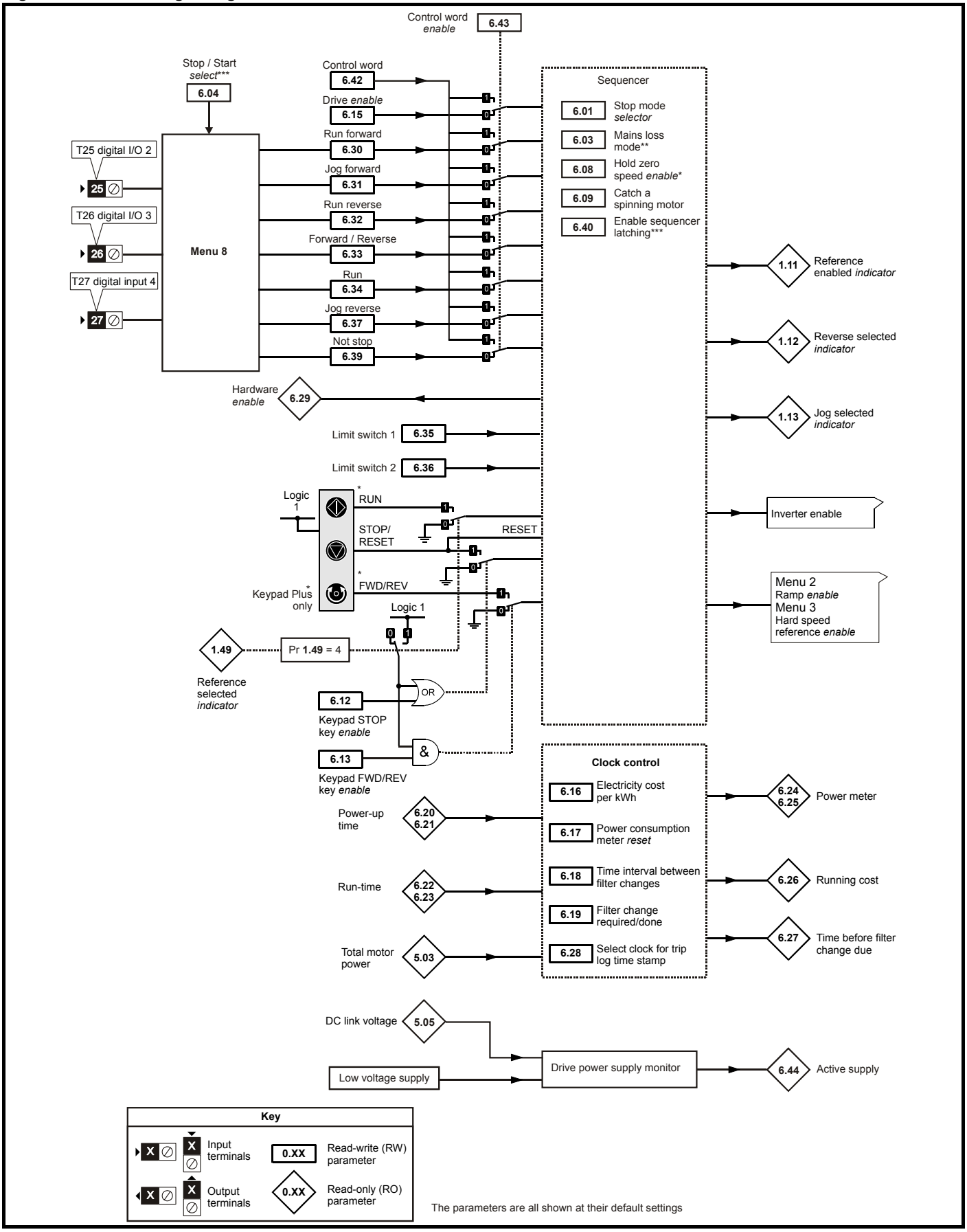

DC bus voltage
5.05
Voltage reference
Modulator
U
V
W
5.18
Maximum switching frequency
5.35
Disable auto switching frequencychange
Flux Controller
5.09
Motor rated voltage
5.21
Field gain reduction
5.22
High speed servo mode enable
5.02
Output voltage
Output power
Power calculation (V x 1)
5.03
Motor active current
Motor current magnitude
4.02
4.01
4.17
Reactive current

Parameter			Range(⇳)	Default(⇨)	Type					
5.01	Output frequency	{**0.11**}	±1,250.0 Hz		RO	Bi	FI	NC	PT	
5.02	Output voltage		0 to AC_voltage_max V		RO	Uni	FI	NC	PT	
5.03	Output power		±Power_max kW		RO	Bi	FI	NC	PT	
5.04	Motor rpm				RO	Bi	FI	NC	PT	
5.05	D.C bus voltage		0 to +DC_voltage_max V		RO	Uni	FI	NC	PT	
5.07	Motor rated current	{**0.46**}	0 to Rated_current_max A	Drive rated current [**11.32**]	RW	Uni		RA		US
5.08	Rated load rpm / rated speed		0.00 to 40,000.00 rpm	3,000.00	RW	Uni				US
5.09	Rated voltage	{**0.44**}	0 to AC_VOLTAGE_SET_MAX V	200V drive: 230 400V drive: EUR> 400, USA> 460	RW	Uni		RA		US
5.11	Number of motor poles	{**0.42**}	Auto to 120 Pole (0 to 60)	6 POLE (3)	RW	Txt				US
5.12	Autotune	{**0.40**}	SV> 0 to 6	0	RW	Uni		NC		
5.14	Action on enable		nonE (0), Ph EnL (1), Ph Init (2)	nonE(0)	RW	Txt				US
5.17	Stator resistance		0.000 to 65.000 Ω	0.0	RW	Uni		RA		US
5.18	Maximum switching frequency	{**0.41**}	3 (0), 4 (1), 6 (2), 8 (3), 12 (4)	6 (2)	RW	Txt		RA		US
5.21	Field gain reduction		OFF (0) or On (1)	OFF (0)	RW	Bit				US
5.22	High speed servo mode enable		OFF (0) or On (1)	0	RW	Bit				US
5.24	Transient inductance (σL_s)		0.000 to 500.000 mH	0.000	RW	Uni		RA		US
5.26	High dynamic performance enable		OFF (0) or On (1)	OFF (0)	RW	Bit				US
5.31	Voltage controller gain		0 to 30	1	RW	Uni				US
5.32	Motor torque per amp, K_t				RO	Uni				US
			0.00 to 500.00 N m A^{-1}	1.60	RW	Uni				US
5.33	Motor volts per 1,000 rpm, K_e		0 to 10,000 V	98	RW	Uni				US
5.35	Disable auto switching frequency change		OFF (0) or On (1)	OFF (0)	RW	Bit				US
5.36	Motor pole pitch		0 to 655.35 mm	0.00	RW	Uni				US
5.37	Actual switching frequency		3 (0), 4 (1), 6 (2), 8 (3), 12 (4), 16 (5), 6 rEd (6), 12 rEd (7)		RO	Txt		NC	PT	
5.38	Minimal movement phasing test angle		0.0 to 25.5°	5.0	RW	Uni				US
5.39	Minimal movement phasing test pulse length		0 to 3	0	RW	Uni				US

RW	Read / Write	RO	Read only	Uni	Unipolar	Bi	Bi-polar	Bit	Bit parameter	Txt	Text string		
FI	Filtered	DE	Destination	NC	Not copied	RA	Rating dependent	PT	Protected	US	User save	PS	Power down save

8.6 Menu 6: Sequencer and clock

Figure 8-6 Menu 6 logic diagram



Parameter		Range(⇳)	Default(⇨)	Type					
6.01	Stop mode	COASt (0), rP (1), no.rP (2)	no.rP (2)	RW	Txt				US
6.03	Line power supply loss mode	diS (0), StoP (1), ridE.th (2)	diS (0)	RW	Txt				US
6.04	Start / stop logic select	0 to 4	4	RW	Uni				US
6.08	Hold zero speed	OFF (0) or On (1)	On (1)	RW	Bit				US
6.09	Catch a spinning motor	0 to 1	1	RW	Uni				US
6.12	Enable stop key	OFF (0) or On (1)	OFF (0)	RW	Bit				US
6.13	Enable forward / reverse key {**0.28**}	OFF (0) or On (1)	OFF (0)	RW	Bit				US
6.15	Drive enable	OFF (0) or On (1)	On (1)	RW	Bit				US
6.16	Electricity cost per kWh	0.0 to 600.0 currency units per kWh	0	RW	Uni				US
6.17	Reset energy meter	OFF (0) or On (1)	OFF (0)	RW	Bit		NC		
6.18	Time between filter changes	0 to 30,000 hrs	0	RW	Uni				US
6.19	Filter change required / change done	OFF (0) or On (1)	OFF (0)	RW	Bit			PT	
6.20	Powered-up time: years.days	0 to 9.364 years.days		RW	Uni		NC	PT	
6.21	Powered-up time: hours.minutes	0 to 23.59 hours.minutes		RW	Uni		NC	PT	
6.22	Run time: years.days	0 to 9.364 years.days		RO	Uni		NC	PT	PS
6.23	Run time: hours.minutes	0 to 23.59 hours.minutes		RO	Uni		NC	PT	PS
6.24	Energy meter: MWh	±999.9 MWh		RO	Bi		NC	PT	PS
6.25	Energy meter: kWh	±99.99 kWh		RO	Bi		NC	PT	PS
6.26	Running cost	±32,000		RO	Bi		NC	PT	
6.27	Time before filter change due	0 to 30,000 hrs		RO	Uni		NC	PT	PS
6.28	Select clock for trip log time sampling	OFF (0) or On (1)	OFF (0)	RW	Bit				US
6.29	Hardware enable	OFF (0) or On (1)		RO	Bit		NC	PT	
6.30	Sequencing bit: Run forward	OFF (0) or On (1)	OFF (0)	RW	Bit		NC		
6.31	Sequencing bit: Jog forward	OFF (0) or On (1)	OFF (0)	RW	Bit		NC		
6.32	Sequencing bit: Run reverse	OFF (0) or On (1)	OFF (0)	RW	Bit		NC		
6.33	Sequencing bit: Forward / reverse	OFF (0) or On (1)	OFF (0)	RW	Bit		NC		
6.34	Sequencing bit: Run	OFF (0) or On (1)	OFF (0)	RW	Bit		NC		
6.35	Forward limit switch	OFF (0) or On (1)	OFF (0)	RW	Bit		NC		
6.36	Reverse limit switch	OFF (0) or On (1)	OFF (0)	RW	Bit		NC		
6.37	Sequencing bit: Jog reverse	OFF (0) or On (1)	OFF (0)	RW	Bit		NC		
6.39	Sequencing bit: Not stop	OFF (0) or On (1)	OFF (0)	RW	Bit		NC		
6.40	Enable sequencer latching	OFF (0) or On (1)	OFF (0)	RW	Bit				US
6.41	Drive event flags	0 to 65,535	0	RW	Uni		NC		
6.42	Control word	0 to 32,767	0	RW	Uni		NC		
6.43	Control word enable	OFF (0) or On (1)	OFF (0)	RW	Bit				US
6.44	Active supply	OFF (0) or On (1)		RO	Bit		NC	PT	
6.45	Force cooling fan to run at full speed	OFF (0) or On (1)	OFF (0)	RW	Bit				US
6.46	Normal low voltage supply	48V	48	RW	Uni			PT	US
6.47	Disable line power supply/ phase loss detection from input rectifier	OFF (0) or On (1)	OFF (0)	RW	Bit				US
6.48	Line power supply loss ride through detection level	0 to DC_VOLTAGE_SET_MAX V	200V drive: 205, 400V drive: 410	RW	Uni		RA		US
6.49	Disable multi-module drive module number storing on trip	OFF (0) or On (1)	OFF (0)	RW	Bit				US
6.50	Drive comms state	drv (0), SLot 1(1), SLot 2 (2)		RO	Txt		NC	PT	
6.51	External rectifier not active	OFF (0) or On (1)	OFF (0)	RW	Bit				

RW	Read / Write	RO	Read only	Uni	Unipolar	Bi	Bi-polar	Bit	Bit parameter	Txt	Text string		
FI	Filtered	DE	Destination	NC	Not copied	RA	Rating dependent	PT	Protected	US	User save	PS	Power down save

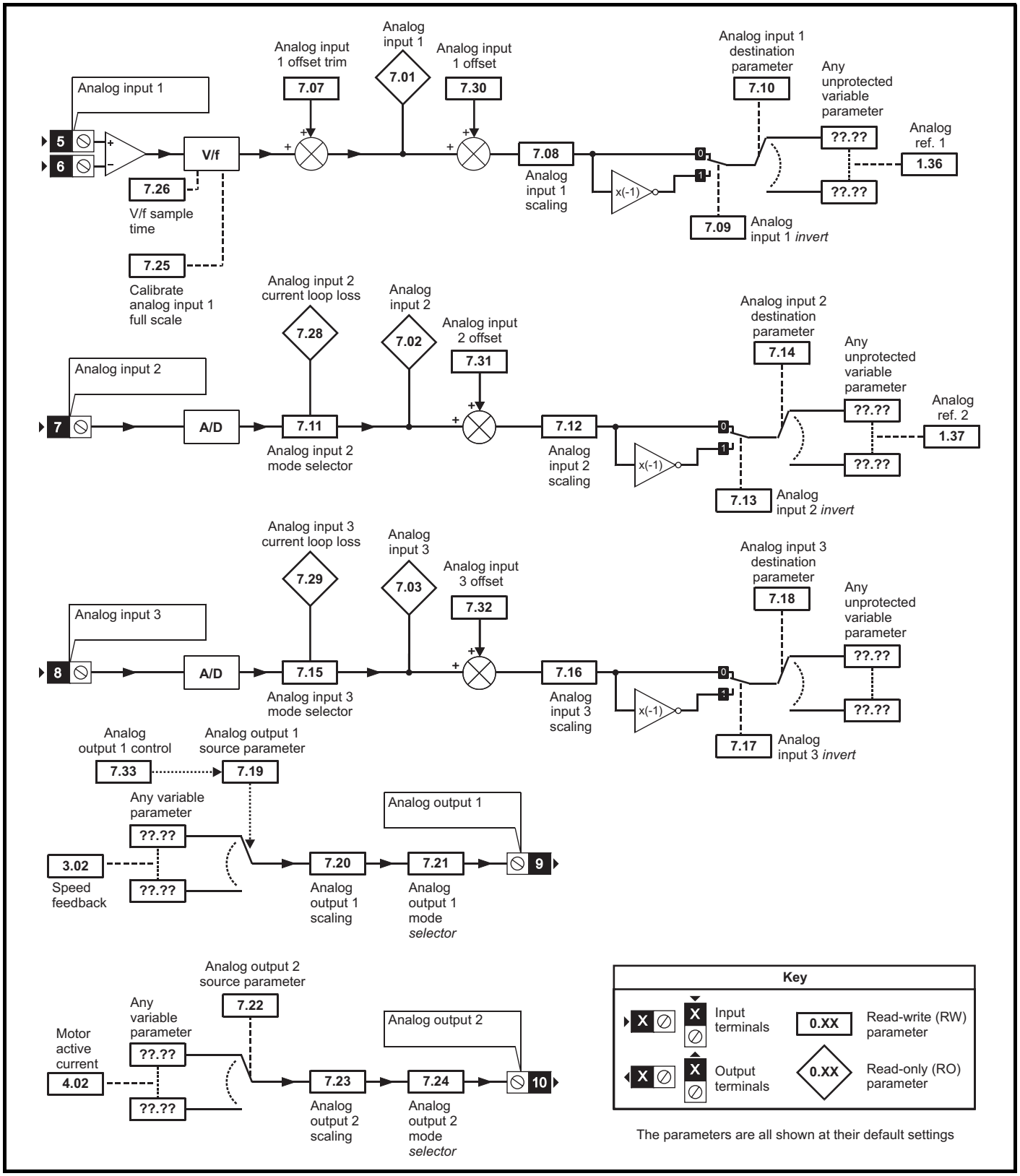
*For more information, refer to section 8.22.5 *Stop modes* on page 130.

**For more information, refer to section 8.22.6 *Line power supply loss modes* on page 130.

***For more information, refer to section 8.22.7 *Start / stop logic modes* on page 131.

8.7 Menu 7: Analog I/O

Figure 8-7 Menu 7 logic diagram

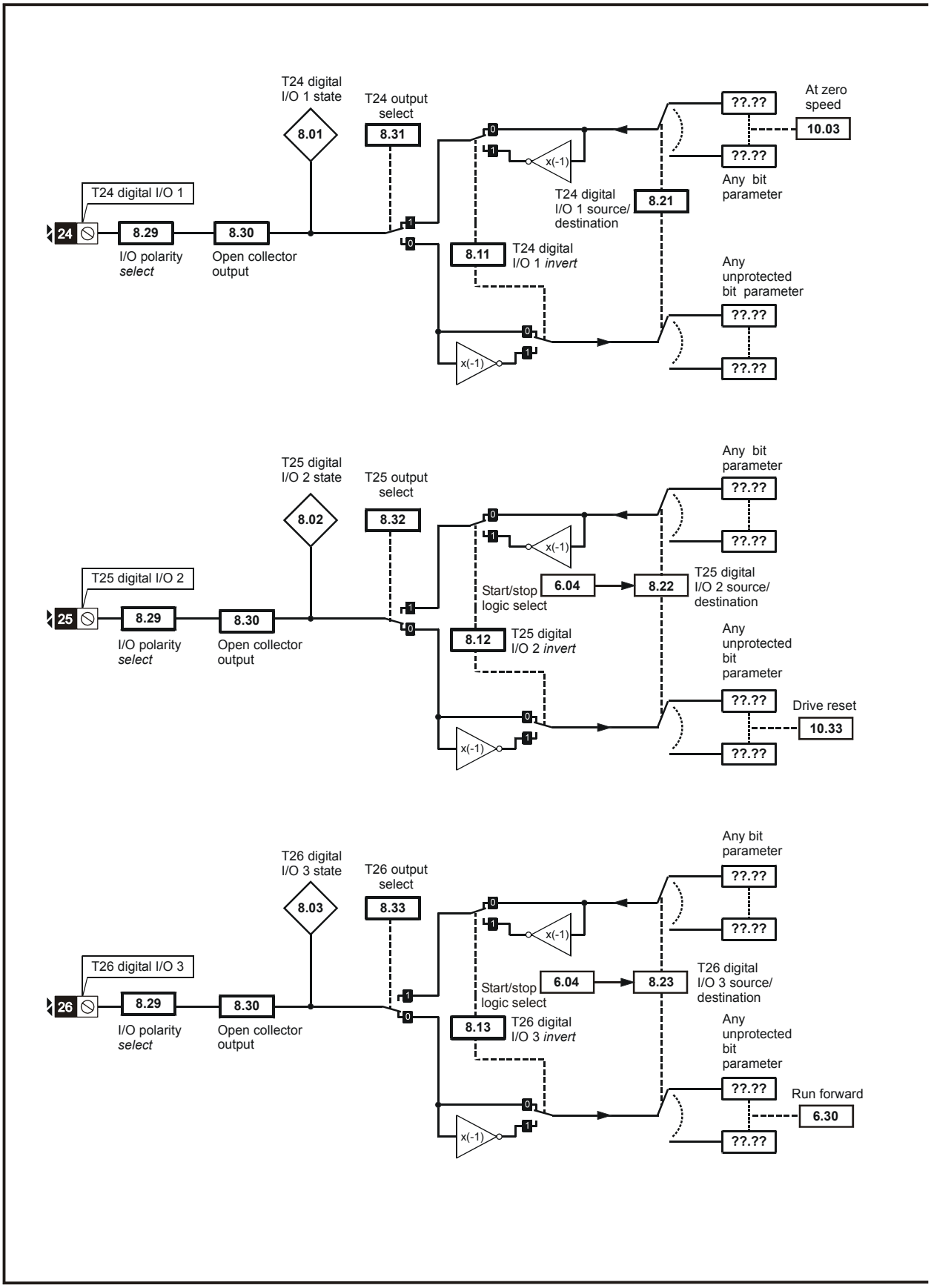


	Parameter	Range(⇳)	Default(⇨)	Type					
7.01	T5/6 analog input 1 level	±100.00 %		RO	Bi		NC	PT	
7.02	T7 analog input 2 level	±100.0 %		RO	Bi		NC	PT	
7.03	T8 analog input 3 level	±100.0 %		RO	Bi		NC	PT	
7.04	Power circuit temperature 1	-128 to 127 °C		RO	Bi		NC	PT	
7.05	Power circuit temperature 2	-128 to 127 °C		RO	Bi		NC	PT	
7.06	Control board temperature	-128 to 127 °C		RO	Bi		NC	PT	
7.07	T5/6 analog input 1 offset trim {**0.13**}	±10.000 %	0.000	RW	Bi				US
7.08	T5/6 analog input 1 scaling	0 to 4.000	1.000	RW	Uni				US
7.09	T5/6 analog input 1 invert	OFF (0) or On (1)	OFF (0)	RW	Bit				US
7.10	T5/6 analog input 1 destination	Pr **0.00** to **21.51**	Pr **1.36**	RW	Uni	DE		PT	US
7.11	T7 analog input 2 mode {**0.19**}	0-20 (0), 20-0 (1), 4-20.tr (2), 20-4.tr (3), 4-20 (4), 20-4 (5), VOLt (6)	VOLt (6)	RW	Txt				US
7.12	T7 analog input 2 scaling	0 to 4.000	1.000	RW	Uni				US
7.13	T7 analog input 2 invert	OFF (0) or On (1)	OFF (0)	RW	Bit				US
7.14	T7 analog input 2 destination {**0.20**}	Pr **0.00** to **21.51**	Pr **1.37**	RW	Uni	DE		PT	US
7.15	T8 analog input 3 mode {**0.21**}	0-20 (0), 20-0 (1), 4-20.tr (2), 20-4.tr (3), 4-20 (4), 20-4 (5), VOLt (6), th.SC (7), th (8), th.diSP (9)	th (8)	RW	Txt				US
7.16	T8 analog input 3 scaling	0 to 4.000	1.000	RW	Uni				US
7.17	T8 analog input 3 invert	OFF (0) or On (1)	OFF (0)	RW	Bit				US
7.18	T8 analog input 3 destination	Pr **0.00** to **21.51**	Pr **0.00**	RW	Uni	DE		PT	US
7.19	T9 analog output 1 source	Pr **0.00** to **21.51**	Pr **3.02**	RW	Uni			PT	US
7.20	T9 analog output 1 scaling	0.000 to 4.000	1.000	RW	Uni				US
7.21	T9 analog output 1 mode	VOLt (0), 0-20 (1), 4-20 (2), H.SPd (3)	VOLt (0)	RW	Txt				US
7.22	T10 analog output 2 source	Pr **0.00** to **21.51**	Pr **4.02**	RW	Uni			PT	US
7.23	T10 analog output 2 scaling	0.000 to 4.000	1.000	RW	Uni				US
7.24	T10 analog output 2 mode	VOLt (0), 0-20 (1), 4-20 (2), H.SPd (3)	VOLt (0)	RW	Txt				US
7.25	Calibrate T5/6 analog input 1 full scale	OFF (0) or On (1)	OFF (0)	RW	Bit		NC		
7.26	T5/6 analog input 1 sample time	0 to 8.0 ms	4.0	RW	Uni				US
7.28	T7 analog input 2 current loop loss	OFF (0) or On (1)		RO	Bit		NC	PT	
7.29	T8 analog input 3 current loop loss	OFF (0) or On (1)		RO	Bit		NC	PT	
7.30	T5/6 analog input 1 offset	±100.00 %	0.00	RW	Bi				US
7.31	T7 analog input 2 offset	±100.0 %	0.0	RW	Bi				US
7.32	T8 analog input 3 offset	±100.0 %	0.0	RW	Bi				US
7.33	T9 analog output 1 control	Fr (0), Ld (1), AdV (2)	AdV (2)	RW	Txt				US
7.34	IGBT junction temperature	±200 °C		RO	Bi		NC	PT	
7.35	Drive thermal protection accumulator	0 to 100.0 %		RO	Uni		NC	PT	
7.36	Power circuit temperature 3	-128 to 127 °C		RO	Bi		NC	PT	

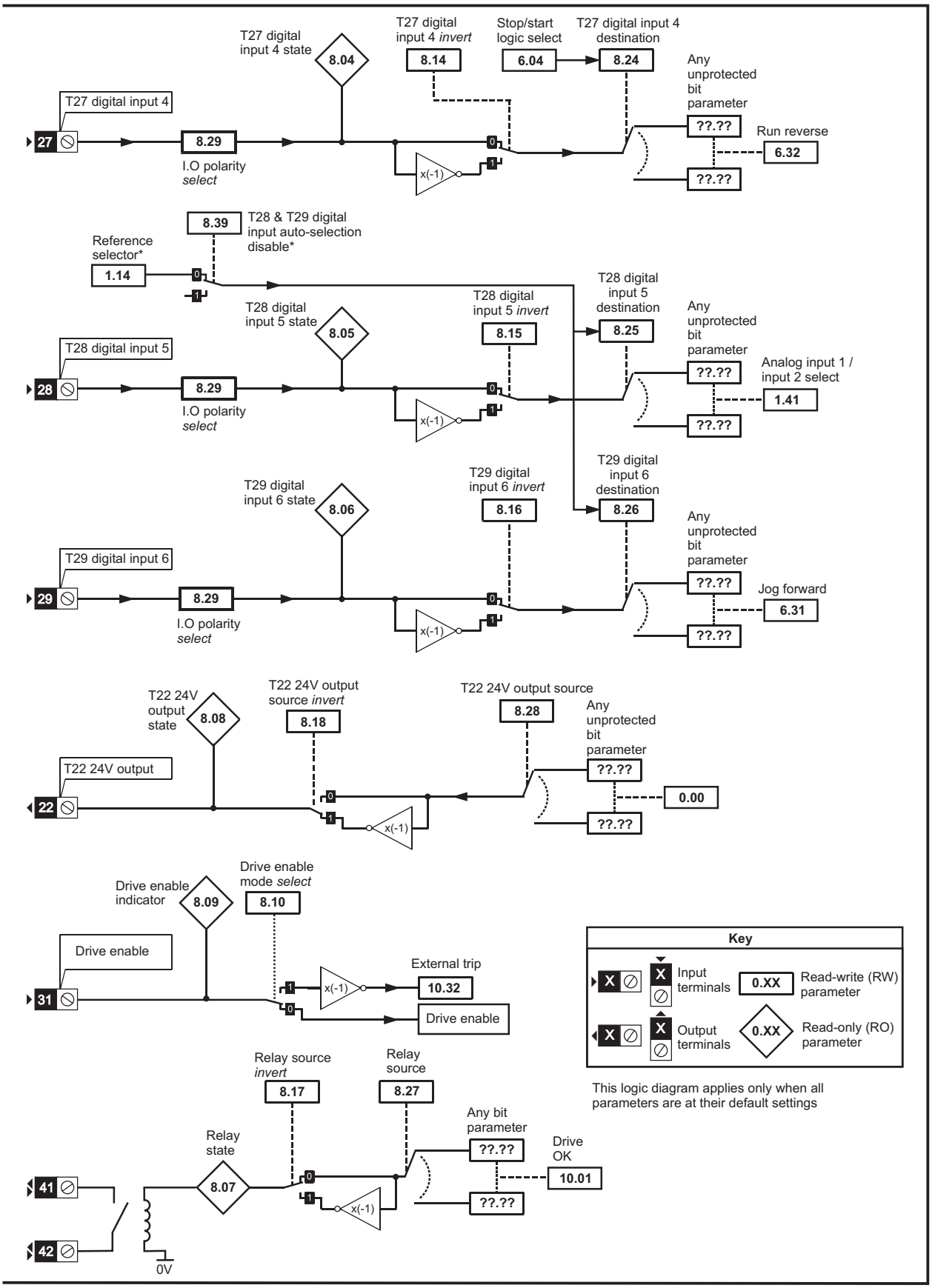
RW	Read / Write	RO	Read only	Uni	Unipolar	Bi	Bi-polar	Bit	Bit parameter	Txt	Text string		
FI	Filtered	DE	Destination	NC	Not copied	RA	Rating dependent	PT	Protected	US	User save	PS	Power down save

8.8 Menu 8: Digital I/O

Figure 8-8 Menu 8 logic diagram



*For more information, please refer to 8.22.1*Reference modes* on page 127.

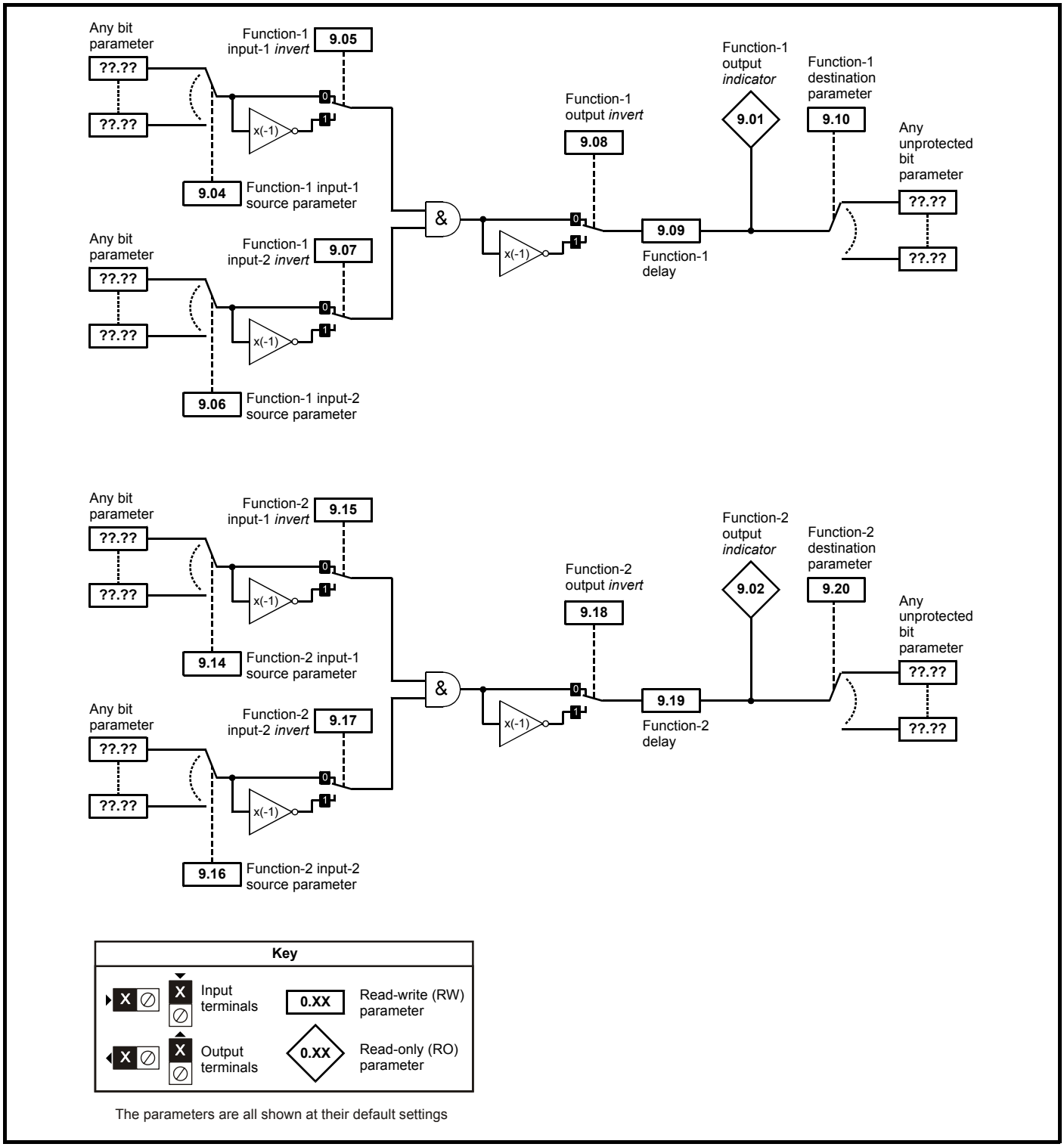

T27 digital input 4 state
8.04
T27 digital input 4 invert
8.14
Stop/start logic select
6.04
T27 digital input 4 destination
8.24
Any unprotected bit parameter
??.??
??.??
Run reverse
6.32
T27 digital input 4
27
8.29
I.O polarity select
x(-1)
8.39
T28 & T29 digital input auto-selection disable*
Reference selector*
1.14
T28 digital input 5 state
8.05
T28 digital input 5 invert
8.15
T28 digital input 5 destination
8.25
Analog input 1 / input 2 select
1.41
T28 digital input 5
28
T29 digital input 6 state
8.06
T29 digital input 6 invert
8.16
T29 digital input 6 destination
8.26
Jog forward
6.31
T29 digital input 6
29
T22 24V output state
8.08
T22 24V output source invert
8.18
T22 24V output source
8.28
0.00
T22 24V output
22
Drive enable indicator
8.09
Drive enable mode select
8.10
Drive enable
31
External trip
10.32
Drive enable
Relay source invert
8.17
Relay source
8.27
Relay state
8.07
Any bit parameter
Drive OK
10.01
41
42
0V
Key
Input terminals
Output terminals
0.XX
Read-write (RW) parameter
Read-only (RO) parameter
This logic diagram applies only when all parameters are at their default settings

Parameter		Range(⇳)	Default(⇨)	Type					
8.01	T24 digital I/O 1 state	OFF (0) or On (1)		RO	Bit		NC	PT	
8.02	T25 digital I/O 2 state	OFF (0) or On (1)		RO	Bit		NC	PT	
8.03	T26 digital I/O 3 state	OFF (0) or On (1)		RO	Bit		NC	PT	
8.04	T27 digital input 4 state	OFF (0) or On (1)		RO	Bit		NC	PT	
8.05	T28 digital input 5 state	OFF (0) or On (1)		RO	Bit		NC	PT	
8.06	T29 digital input 6 state	OFF (0) or On (1)		RO	Bit		NC	PT	
8.07	Relay state	OFF (0) or On (1)		RO	Bit		NC	PT	
8.08	T22 24V output state	OFF (0) or On (1)		RO	Bit		NC	PT	
8.09	Drive enable indicator	OFF (0) or On (1)		RO	Bit		NC	PT	
8.10	Drive enable mode select	OFF (0) or On (1)	OFF (0)	RW	Bit				US
8.11	T24 digital I/O 1 invert	OFF (0) or On (1)	OFF (0)	RW	Bit				US
8.12	T25 digital I/O 2 invert	OFF (0) or On (1)	OFF (0)	RW	Bit				US
8.13	T26 digital I/O 3 invert	OFF (0) or On (1)	OFF (0)	RW	Bit				US
8.14	T27 digital input 4 invert	OFF (0) or On (1)	OFF (0)	RW	Bit				US
8.15	T28 digital input 5 invert	OFF (0) or On (1)	OFF (0)	RW	Bit				US
8.16	T29 digital input 6 invert	OFF (0) or On (1)	OFF (0)	RW	Bit				US
8.17	Relay source invert	OFF (0) or On (1)	OFF (0)	RW	Bit				US
8.18	T22 24V output source invert	OFF (0) or On (1)	On (1)	RW	Bit				US
8.20	Digital I/O read word	0 to 511		RO	Uni		NC	PT	
8.21	T24 digital I/O 1 source/ destination	Pr **0.00** to **21.51**	Pr **10.03**	RW	Uni	DE		PT	US
8.22	T25 digital I/O 2 source/ destination	Pr **0.00** to **21.51**	Pr **10.33**	RW	Uni	DE		PT	US
8.23	T26 digital I/O 3 source/ destination	Pr **0.00** to **21.51**	Pr **6.30**	RW	Uni	DE		PT	US
8.24	T27 digital input 4 destination	Pr **0.00** to **21.51**	Pr **6.32**	RW	Uni	DE		PT	US
8.25	T28 digital input 5 destination	Pr **0.00** to **21.51**	Pr **1.41**	RW	Uni	DE		PT	US
8.26	T29 digital input 6 destination	Pr **0.00** to **21.51**	Pr **6.31**	RW	Uni	DE		PT	US
8.27	Relay source	Pr **0.00** to **21.51**	Pr **10.01**	RW	Uni			PT	US
8.28	T22 24V output source	Pr **0.00** to **21.51**	Pr **0.00**	RW	Uni			PT	US
8.29	Positive logic select {**0.18**}	OFF (0) or On (1)	On (1)	RW	Bit			PT	US
8.30	Open collector output	OFF (0) or On (1)	OFF (0)	RW	Bit				US
8.31	T24 digital I/O 1 output select	OFF (0) or On (1)	On (1)	RW	Bit				US
8.32	T25 digital I/O 2 output select	OFF (0) or On (1)	OFF (0)	RW	Bit				US
8.33	T26 digital I/O 3 output select	OFF (0) or On (1)	OFF (0)	RW	Bit				US
8.39	T28 & T29 digital input auto-selection disable	OFF (0) or On (1)	OFF (0)	RW	Bit				US
8.40	Freeze flag	OFF (0) or On (1)	OFF (0)	RW	Bit			PT	

RW	Read / Write	RO	Read only	Uni	Unipolar	Bi	Bi-polar	Bit	Bit parameter	Txt	Text string		
FI	Filtered	DE	Destination	NC	Not copied	RA	Rating dependent	PT	Protected	US	User save	PS	Power down save

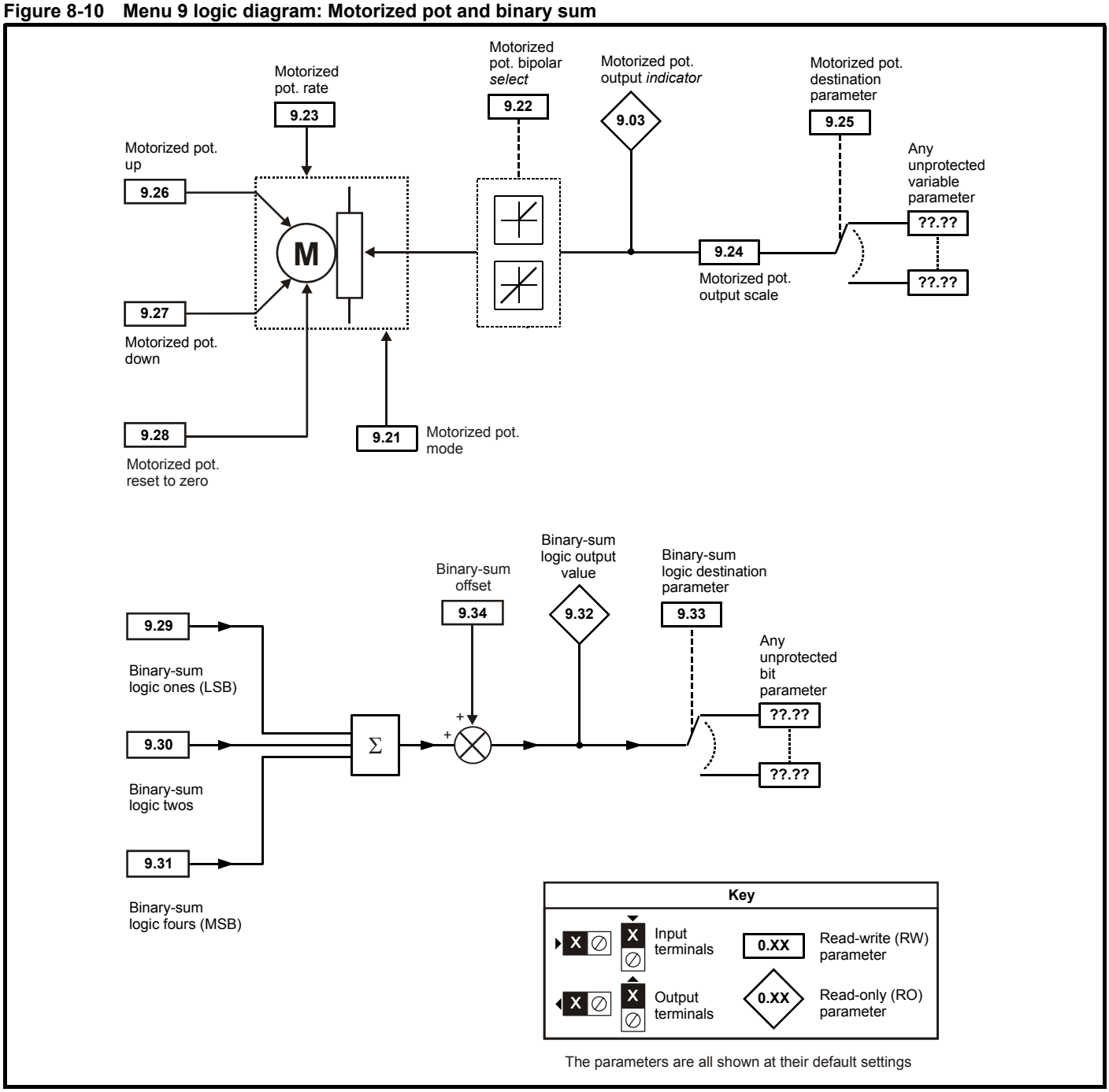
8.9 Menu 9: Programmable logic, motorized pot, binary sum and timers

Figure 8-9 Menu 9 logic diagram: Programmable logic



The parameters are all shown at their default settings

Figure 8-10 Menu 9 logic diagram: Motorized pot and binary sum



The parameters are all shown at their default settings

Parameter		Range(⇳)	Default(⇨)	Type					
9.01	Logic function 1 output	OFF (0) or On (1)		RO	Bit		NC	PT	
9.02	Logic function 2 output	OFF (0) or On (1)		RO	Bit		NC	PT	
9.03	Motorized pot output	±100.00 %		RO	Bi		NC	PT	PS
9.04	Logic function 1 source 1	Pr **0.00** to **21.51**	Pr **0.00**	RW	Uni			PT	US
9.05	Logic function 1 source 1 invert	OFF (0) or On (1)	OFF (0)	RW	Bit				US
9.06	Logic function 1 source 2	Pr **0.00** to **21.51**	Pr **0.00**	RW	Uni			PT	US
9.07	Logic function 1 source 2 invert	OFF (0) or On (1)	OFF (0)	RW	Bit				US
9.08	Logic function 1 output invert	OFF (0) or On (1)	OFF (0)	RW	Bit				US
9.09	Logic function 1 delay	±25.0 s	0.0	RW	Bi				US
9.10	Logic function 1 destination	Pr **0.00** to **21.51**	Pr **0.00**	RW	Uni	DE		PT	US
9.14	Logic function 2 source 1	Pr **0.00** to **21.51**	Pr **0.00**	RW	Uni			PT	US
9.15	Logic function 2 source 1 invert	OFF (0) or On (1)	OFF (0)	RW	Bit				US
9.16	Logic function 2 source 2	Pr **0.00** to **21.51**	Pr **0.00**	RW	Uni			PT	US
9.17	Logic function 2 source 2 invert	OFF (0) or On (1)	OFF (0)	RW	Bit				US
9.18	Logic function 2 output invert	OFF (0) or On (1)	OFF (0)	RW	Bit				US
9.19	Logic function 2 delay	±25.0 s	0.0	RW	Bi				US
9.20	Logic function 2 destination	Pr **0.00** to **21.51**	Pr **0.00**	RW	Uni	DE		PT	US
9.21	Motorized pot mode	0 to 3	2	RW	Uni				US
9.22	Motorized pot bipolar select	OFF (0) or On (1)	OFF (0)	RW	Bit				US
9.23	Motorized pot rate	0 to 250 s	20	RW	Uni				US
9.24	Motorized pot scale factor	0.000 to 4.000	1.000	RW	Uni				US
9.25	Motorized pot destination	Pr **0.00** to **21.51**	Pr **0.00**	RW	Uni	DE		PT	US
9.26	Motorized pot up	OFF (0) or On (1)	OFF (0)	RW	Bit		NC		
9.27	Motorized pot down	OFF (0) or On (1)	OFF (0)	RW	Bit		NC		
9.28	Motorized pot reset	OFF (0) or On (1)	OFF (0)	RW	Bit		NC		
9.29	Binary sum ones input	OFF (0) or On (1)	OFF (0)	RW	Bit		NC		
9.30	Binary sum twos input	OFF (0) or On (1)	OFF (0)	RW	Bit		NC		
9.31	Binary sum fours input	OFF (0) or On (1)	OFF (0)	RW	Bit		NC		
9.32	Binary sum output	0 to 255		RO	Uni		NC	PT	
9.33	Binary sum destination	Pr **0.00** to **21.51**	Pr **0.00**	RW	Uni	DE		PT	US
9.34	Binary sum offset	0 to 248	0	RW	Uni				US

RW	Read / Write	RO	Read only	Uni	Unipolar	Bi	Bi-polar	Bit	Bit parameter	Txt	Text string		
FI	Filtered	DE	Destination	NC	Not copied	RA	Rating dependent	PT	Protected	US	User save	PS	Power down save

8.10 Menu 10: Status and trips

Parameter		Range(⇳)	Default(⇨)	Type					
10.01	Drive ok	OFF (0) or On (1)		RO	Bit		NC	PT	
10.02	Drive active	OFF (0) or On (1)		RO	Bit		NC	PT	
10.03	Zero speed	OFF (0) or On (1)		RO	Bit		NC	PT	
10.04	Running at or below minimum speed	OFF (0) or On (1)		RO	Bit		NC	PT	
10.05	Below set speed	OFF (0) or On (1)		RO	Bit		NC	PT	
10.06	At speed	OFF (0) or On (1)		RO	Bit		NC	PT	
10.07	Above set speed	OFF (0) or On (1)		RO	Bit		NC	PT	
10.08	Load reached	OFF (0) or On (1)		RO	Bit		NC	PT	
10.09	Drive output is at current limit	OFF (0) or On (1)		RO	Bit		NC	PT	
10.10	Regenerating	OFF (0) or On (1)		RO	Bit		NC	PT	
10.11	Braking IGBT active	OFF (0) or On (1)		RO	Bit		NC	PT	
10.12	Braking resistor alarm	OFF (0) or On (1)		RO	Bit		NC	PT	
10.13	Direction commanded	OFF (0) or On (1) [0 = FWD, 1 = REV]		RO	Bit		NC	PT	
10.14	Direction running	OFF (0) or On (1) [0 = FWD, 1 = REV]		RO	Bit		NC	PT	
10.15	Line power supply loss	OFF (0) or On (1)		RO	Bit		NC	PT	
10.16	Under voltage active	OFF (0) or On (1)		RO	Bit		NC	PT	
10.17	Overload alarm	OFF (0) or On (1)		RO	Bit		NC	PT	
10.18	Drive over temperature alarm	OFF (0) or On (1)		RO	Bit		NC	PT	
10.19	Drive warning	OFF (0) or On (1)		RO	Bit		NC	PT	
10.20	Trip 0	0 to 230*		RO	Txt		NC	PT	PS
10.21	Trip 1	0 to 230*		RO	Txt		NC	PT	PS
10.22	Trip 2	0 to 230*		RO	Txt		NC	PT	PS
10.23	Trip 3	0 to 230*		RO	Txt		NC	PT	PS
10.24	Trip 4	0 to 230*		RO	Txt		NC	PT	PS
10.25	Trip 5	0 to 230*		RO	Txt		NC	PT	PS
10.26	Trip 6	0 to 230*		RO	Txt		NC	PT	PS
10.27	Trip 7	0 to 230*		RO	Txt		NC	PT	PS
10.28	Trip 8	0 to 230*		RO	Txt		NC	PT	PS
10.29	Trip 9	0 to 230*		RO	Txt		NC	PT	PS
10.30	Full power braking time	0.00 to 400.00 s	See Table 8-5 0.00	RW	Uni				US
10.31	Full power braking period	0.0 to 1500.0 s	See Table 8-5 0.0	RW	Uni				US
10.32	External trip	OFF (0) or On (1)	OFF (0)	RW	Bit		NC		
10.33	Drive reset	OFF (0) or On (1)	OFF (0)	RW	Bit		NC		
10.34	No. of auto-reset attempts	0 to 5	0	RW	Uni				US
10.35	Auto-reset delay	0.0 to 25.0 s	1.0	RW	Uni				US
10.36	Hold drive ok until last attempt	OFF (0) or On (1)	OFF (0)	RW	Bit				US
10.37	Action on trip detection	0 to 8	0	RW	Uni				US
10.38	User trip	0 to 255	0	RW	Uni		NC		
10.39	Braking energy overload accumulator	0.0 to 100.0 %		RO	Uni		NC	PT	
10.40	Status word	0 to 32,767		RO	Uni		NC	PT	
10.41	Trip 0 time: years.days	0.000 to 9.365 years.days		RO	Uni		NC	PT	PS
10.42	Module number for trip 0, or, Trip 0 time: hours.minutes	00.00 to 23.59 hours.minutes		RO	Uni		NC	PT	PS
10.43	Module number for trip 1, or, Trip 1 time	0 to 600.00 hours.minutes		RO	Uni		NC	PT	PS
10.44	Module number for trip 2, or, Trip 2 time	0 to 600.00 hours.minutes		RO	Uni		NC	PT	PS
10.45	Module number for trip 3, or, Trip 3 time	0 to 600.00 hours.minutes		RO	Uni		NC	PT	PS
10.46	Module number for trip 4, or, Trip 4 time	0 to 600.00 hours.minutes		RO	Uni		NC	PT	PS
10.47	Module number for trip 5, or, Trip 5 time	0 to 600.00 hours.minutes		RO	Uni		NC	PT	PS
10.48	Module number for trip 6, or, Trip 6 time	0 to 600.00 hours.minutes		RO	Uni		NC	PT	PS
10.49	Module number for trip 7, or, Trip 7 time	0 to 600.00 hours.minutes		RO	Uni		NC	PT	PS
10.50	Module number for trip 8, or, Trip 8 time	0 to 600.00 hours.minutes		RO	Uni		NC	PT	PS
10.51	Module number for trip 9, or, Trip 9 time	0 to 600.00 hours.minutes		RO	Uni		NC	PT	PS

RW	Read / Write	RO	Read only	Uni	Unipolar	Bi	Bi-polar	Bit	Bit parameter	Txt	Text string		
FI	Filtered	DE	Destination	NC	Not copied	RA	Rating dependent	PT	Protected	US	User save	PS	Power down save

*The value given for the range is that obtained via serial communication. For the text string displayed on the drive, see Chapter 8 *Diagnostics* on page 27.

Table 8-5 Defaults for Pr 10.30 and Pr 10.31

Drive rating	Pr 10.30	Pr 10.31
200V	0.00	1.7
400V	0.06	2.6

8.11 Menu 11: General drive set-up

Parameter			Range(⇳)	Default(⇨)	Type					
11.01	Parameter 0.11 set up		Pr **1.00** to Pr	Pr **3.29**	RW	Uni			PT	US
11.02	Parameter 0.12 set up		Pr **1.00** to Pr	Pr **4.01**	RW	Uni			PT	US
11.03	Parameter 0.13 set up		Pr **1.00** to Pr	Pr **7.07**	RW	Uni			PT	US
11.04	Parameter 0.14 set up		Pr **1.00** to Pr	Pr **4.11**	RW	Uni			PT	US
11.05	Parameter 0.15 set up		Pr **1.00** to Pr	Pr **2.04**	RW	Uni			PT	US
11.06	Parameter 0.16 set up		Pr **1.00** to Pr	Pr **2.02**	RW	Uni			PT	US
11.07	Parameter 0.17 set up		Pr **1.00** to Pr	Pr **4.12**	RW	Uni			PT	US
11.08	Parameter 0.18 set up		Pr **1.00** to Pr	Pr **8.29**	RW	Uni			PT	US
11.09	Parameter 0.19 set up		Pr **1.00** to Pr	Pr **7.11**	RW	Uni			PT	US
11.10	Parameter 0.20 set up		Pr **1.00** to Pr	Pr **7.14**	RW	Uni			PT	US
11.11	Parameter 0.21 set up		Pr **1.00** to Pr	Pr **7.15**	RW	Uni			PT	US
11.12	Parameter 0.22 set up		Pr **1.00** to Pr	Pr **1.10**	RW	Uni			PT	US
11.13	Parameter 0.23 set up		Pr **1.00** to Pr	Pr **1.05**	RW	Uni			PT	US
11.14	Parameter 0.24 set up		Pr **1.00** to Pr	Pr **1.21**	RW	Uni			PT	US
11.15	Parameter 0.25 set up		Pr **1.00** to Pr	Pr **1.22**	RW	Uni			PT	US
11.16	Parameter 0.26 set up		Pr **1.00** to Pr	Pr **3.08**	RW	Uni			PT	US
11.17	Parameter 0.27 set up		Pr **1.00** to Pr	Pr **3.34**	RW	Uni			PT	US
11.18	Parameter 0.28 set up		Pr **1.00** to Pr	Pr **6.13**	RW	Uni			PT	US
11.19	Parameter 0.29 set up		Pr **1.00** to Pr	Pr **11.36**	RW	Uni			PT	US
11.20	Parameter 0.30 set up		Pr **1.00** to Pr	Pr **11.42**	RW	Uni			PT	US
11.21	Parameter scaling		0.000 to 9.999	1.000	RW	Uni				US
11.22	Parameter displayed at power-up		Pr **0.00** to **00.50**	Pr **0.10**	RW	Uni			PT	US
11.23	Serial address	{**0.37**}	0 to 247	1	RW	Uni				US
11.24	Serial mode	{**0.35**}	AnSI (0), rtU (1), Lcd (2)	rtU (1)	RW	Txt			PT	US
11.25	Baud rate	{**0.36**}	300 (0), 600 (1), 1200 (2), 2400 (3), 4800 (4), 9600 (5), 19200 (6), 38400 (7), 57600 (8)*, 115200 (9)* *Modbus RTU only	19200 (6)	RW	Txt				US
11.26	Minimum comms transmit delay		0 to 250ms	2	RW	Uni				US
11.28	Drive derivative		0 to 16		RO	Uni		NC	PT	
11.29	Software version	{**0.50**}	1.00 to 99.99		RO	Uni		NC	PT	
11.30	User security code	{**0.34**}	0 to 999	0	RW	Uni		NC	PT	PS
11.32	Maximum current rating	{**0.32**}	0.00 to 9999.99A		RO	Uni		NC	PT	
11.33	Drive voltage rating	{**0.31**}	200 (0), 400 (1), 575 (2), 690 (3)		RO	Txt		NC	PT	
11.34	Software sub-version		0 to 99		RO	Uni		NC	PT	
11.35	Number of modules		0 to 10	0	RW	Uni			PT	US
11.36	SMARTCARD parameter data previously loaded	{**0.29**}	0 to 999	0	RO	Uni		NC	PT	US
11.37	SMARTCARD data number		0 to 1003	0	RW	Uni		NC		
11.38	SMARTCARD data type / mode		0 to 18		RO	Txt		NC	PT	
11.39	SMARTCARD data version		0 to 9,999	0	RW	Uni		NC		
11.40	SMARTCARD data checksum		0 to 65,335		RO	Uni		NC	PT	
11.41	Status mode timeout		0 to 250s	240	RW	Uni				US
11.42	Parameter cloning	{**0.30**}	nonE (0), rEAd (1), Prog (2), AutO (3), boot (4)	nonE (0)	RW	Txt		NC		*
11.43	Load defaults		nonE (0), Eur (1), USA (2)	nonE (0)	RW	Txt		NC		
11.44	Security status	{**0.49**}	L1 (0), L2 (1), Loc (2)		RW	Txt			PT	US
11.45	Select motor 2 parameters		OFF (0) or On (1)	OFF (0)	RW	Bit				US
11.46	Defaults previously loaded		0 to 2000		RO	Uni		NC	PT	US
11.47	Drive Onboard PLC program enable		Halt program (0) Run program: out of range = clip (1) Run program: out of range = trip (2)	Run program: out of range = trip (2)	RW	Uni				US
11.48	Drive Onboard PLC program status		-128 to +127		RO	Bi		NC	PT	
11.49	Drive Onboard PLC programming events		0 to 65,535		RO	Uni		NC	PT	PS
11.50	Drive Onboard PLC program average scan time		0 to 65,535 ms		RO	Uni		NC	PT	
11.51	Drive Onboard PLC program first run		OFF (0) or On (1)		RO	Bit		NC	PT	

* Modes 1 and 2 are not user saved, Modes 0, 3 and 4 are user saved

RW	Read / Write	RO	Read only	Uni	Unipolar	Bi	Bi-polar	Bit	Bit parameter	Txt	Text string		
FI	Filtered	DE	Destination	NC	Not copied	RA	Rating dependent	PT	Protected	US	User save	PS	Power down save

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

Figure 8-11 Menu 12 logic diagram

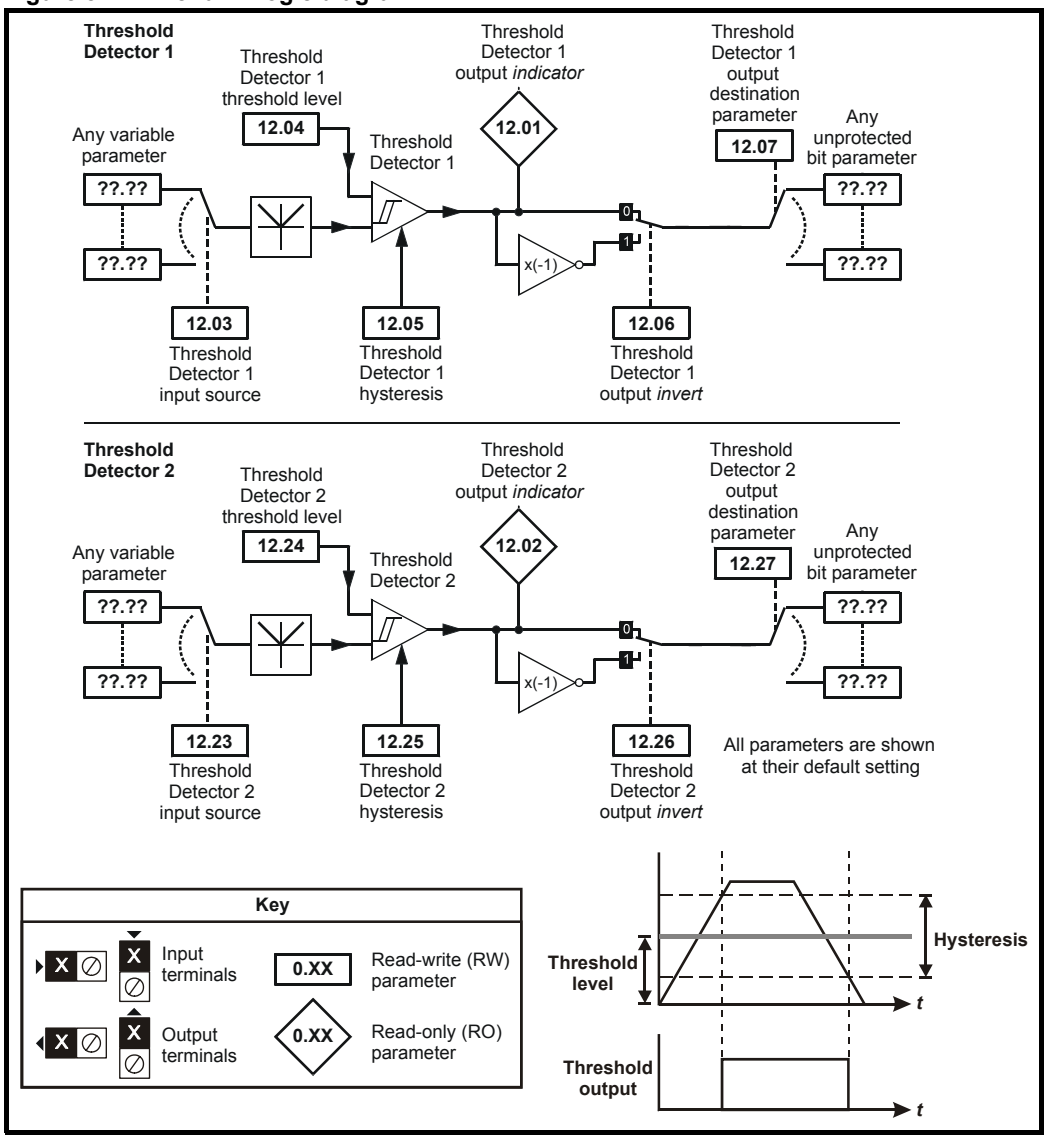
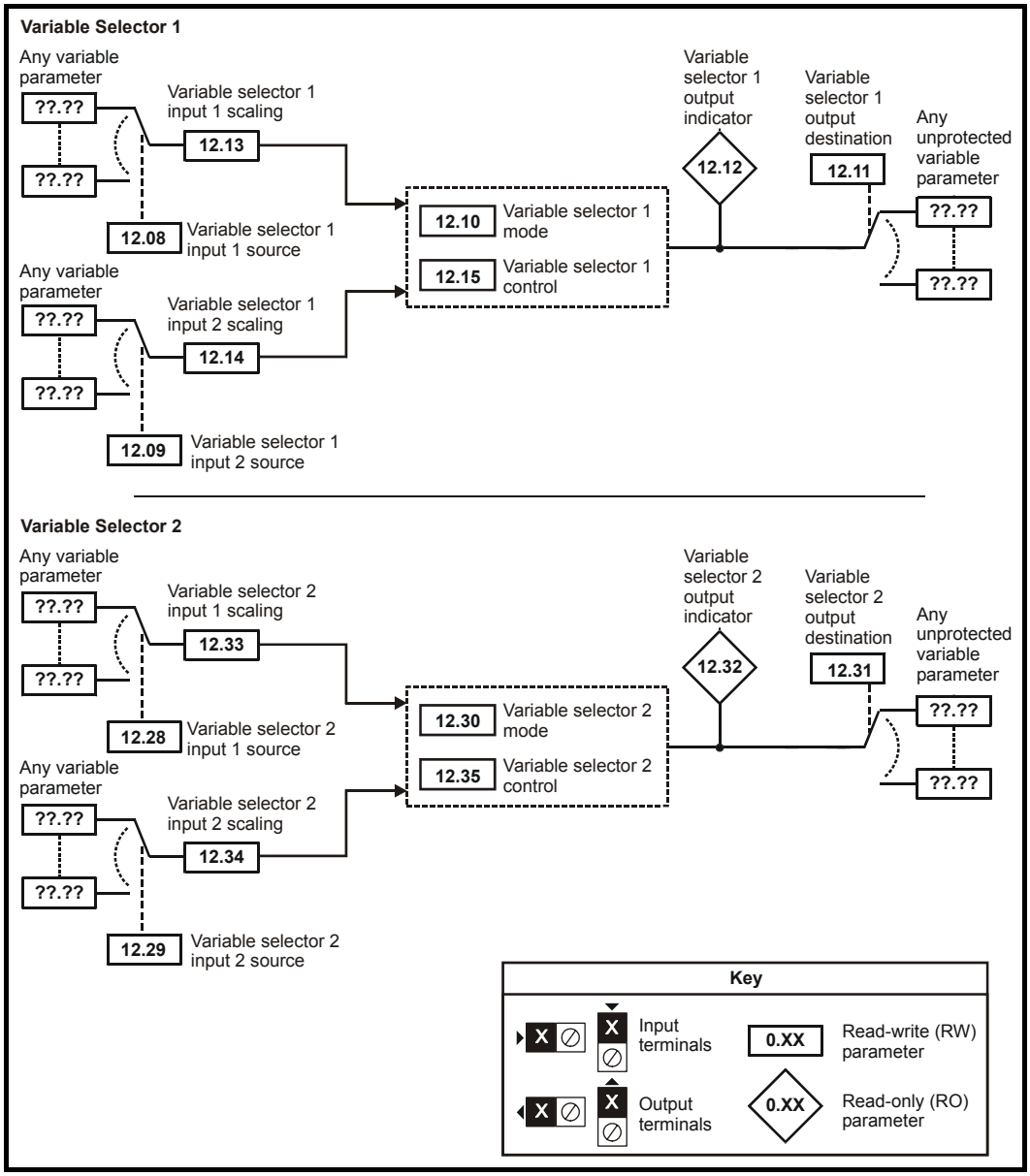


Figure 8-12 Menu 12 logic diagram (continued)



WARNING

The control terminal relay can be selected as an output to release a brake. If a drive is set up in this manner and a drive replacement takes place, prior to programming the drive on initial power up, the brake may be released.
When drive terminals are programmed to non default settings the result of incorrect or delayed programming must be considered. The use of a SMARTCARD in boot mode or an SM-Applications module can ensure drive parameters are immediately programmed to avoid this situation.

WARNING

The control terminal relay can be selected as an output to release a brake. If a drive is set up in this manner and a drive replacement takes place, prior to programming the drive on initial power up, the brake may be released.
When drive terminals are programmed to non default settings the result of incorrect or delayed programming must be considered. The use of a Smartcard in boot mode or an SM-Applications module can ensure drive parameters are immediately programmed to avoid this situation.

Figure 8-13 Brake function

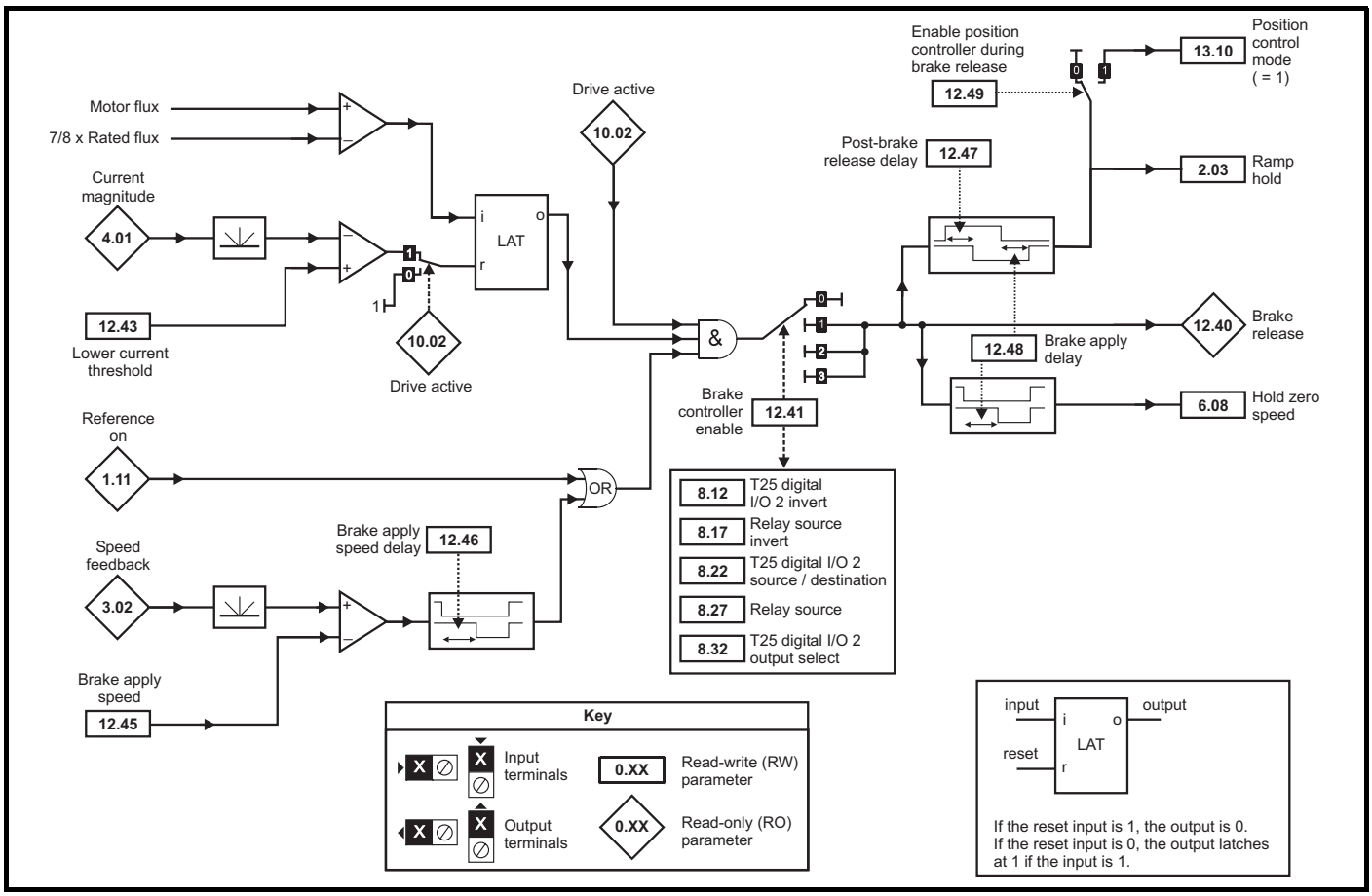
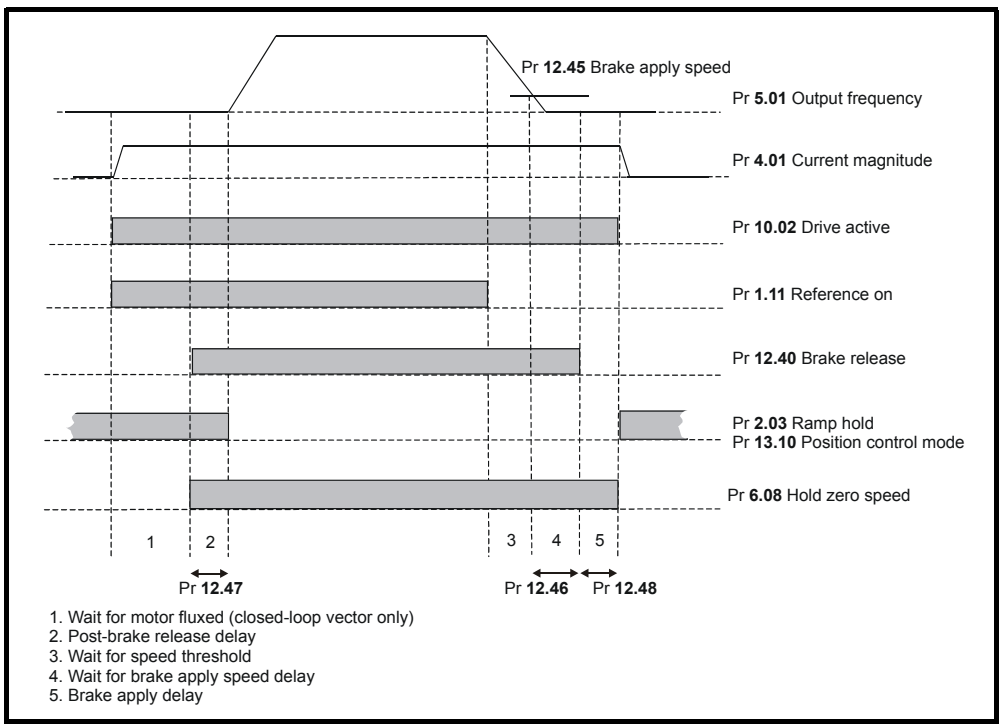


Figure 8-14 Brake sequence



WARNING

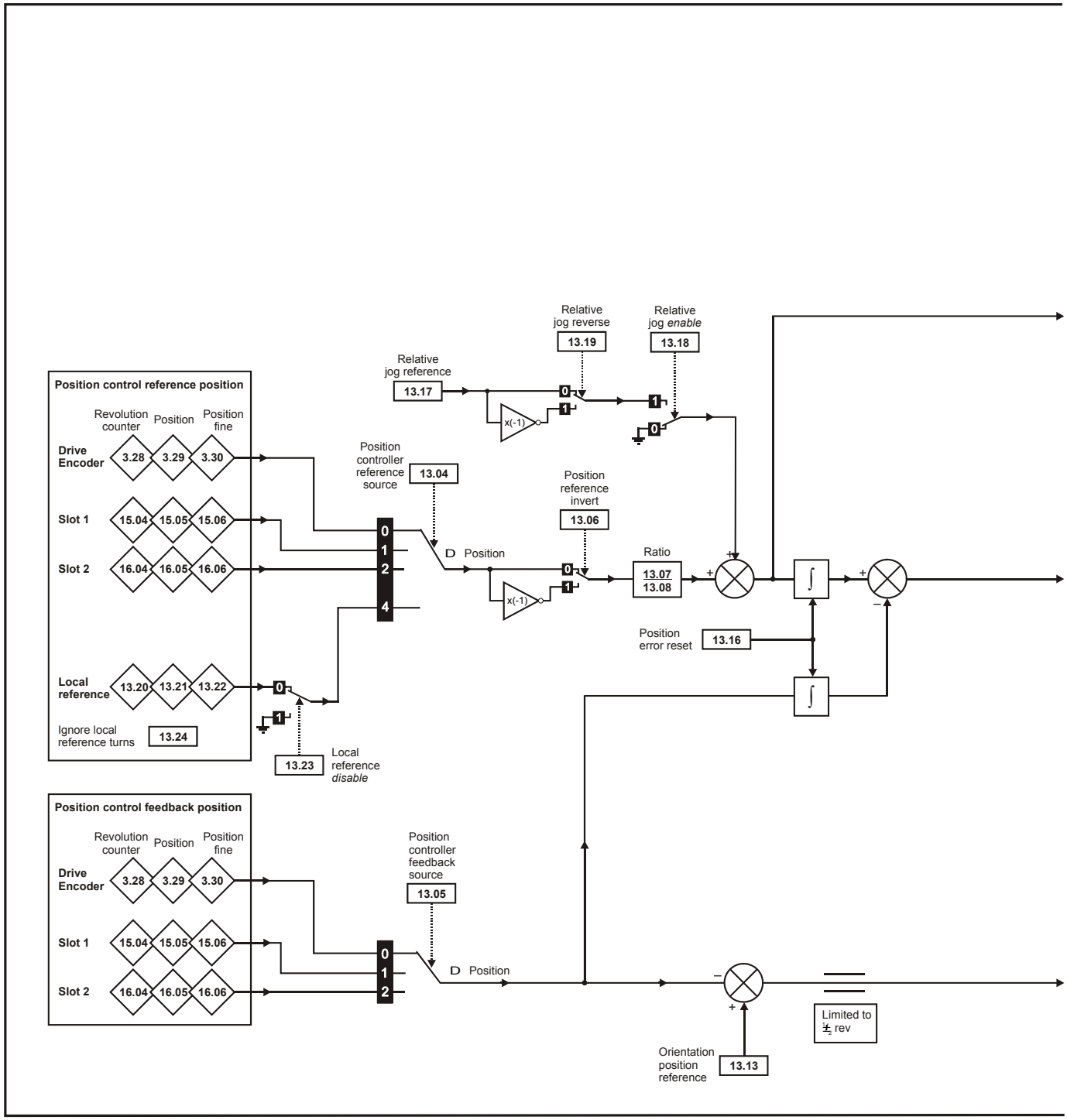
The control terminal relay can be selected as an output to release a brake. If a drive is set up in this manner and a drive replacement takes place, prior to programming the drive on initial power up, the brake may be released.
When drive terminals are programmed to non default settings the result of incorrect or delayed programming must be considered. The use of a Smartcard in boot mode or an SM-Applications module can ensure drive parameters are immediately programmed to avoid this situation.

Parameter		Range(⇳)	Default(⇨)	Type					
12.01	Threshold detector 1 output	OFF (0) or On (1)		RO	Bit		NC	PT	
12.02	Threshold detector 2 output	OFF (0) or On (1)		RO	Bit		NC	PT	
12.03	Threshold detector 1 source	Pr **0.00** to **21.51**	Pr **0.00**	RW	Uni			PT	US
12.04	Threshold detector 1 level	0.00 to 100.00 %	0.00	RW	Uni				US
12.05	Threshold detector 1 hysteresis	0.00 to 25.00 %	0.00	RW	Uni				US
12.06	Threshold detector 1 output invert	OFF (0) or On (1)	OFF (0)	RW	Bit				US
12.07	Threshold detector 1 destination	Pr **0.00** to **21.51**	Pr **0.00**	RW	Uni	DE		PT	US
12.08	Variable selector 1 source 1	Pr **0.00** to **21.51**	Pr **0.00**	RW	Uni			PT	US
12.09	Variable selector 1 source 2	Pr **0.00** to **21.51**	Pr **0.00**	RW	Uni			PT	US
12.10	Variable selector 1 mode	Select input 1 (0), select input 2 (1), add (2), subtract (3), multiply (4), divide (5), time constant (6), linear ramp (7), modulus (8), powers (9), sectional control (10), external rectifier monitor (11)	Select input 1 (0)	RW	Uni				US
12.11	Variable selector 1 destination	Pr **0.00** to **21.51**	Pr **0.00**	RW	Uni	DE		PT	US
12.12	Variable selector 1 output	±100.00 %		RO	Bi		NC	PT	
12.13	Variable selector 1 source 1 scaling	±4.000	1.000	RW	Bi				US
12.14	Variable selector 1 source 2 scaling	±4.000	1.000	RW	Bi				US
12.15	Variable selector 1 control	0.00 to 100.00 s	0.00	RW	Uni				US
12.23	Threshold detector 2 source	Pr **0.00** to **21.51**	Pr **0.00**	RW	Uni			PT	US
12.24	Threshold detector 2 level	0.00 to 100.00 %	0.00	RW	Uni				US
12.25	Threshold detector 2 hysteresis	0.00 to 25.00 %	0.00	RW	Uni				US
12.26	Threshold detector 2 output invert	OFF (0) or On (1)	OFF (0)	RW	Bit				US
12.27	Threshold detector 2 destination	Pr **0.00** to **21.51**	Pr **0.00**	RW	Uni	DE		PT	US
12.28	Variable selector 2 source 1	Pr **0.00** to **21.51**	Pr **0.00**	RW	Uni			PT	US
12.29	Variable selector 2 source 2	Pr **0.00** to **21.51**	Pr **0.00**	RW	Uni			PT	US
12.30	Variable selector 2 mode	Select input 1 (0), select input 2 (1), add (2), subtract (3), multiply (4), divide (5), time constant (6), linear ramp (7), modulus (8), powers (9), sectional control (10), external rectifier monitor (11)	Select input 1 (0)	RW	Uni				US
12.31	Variable selector 2 destination	Pr **0.00** to **21.51**	Pr **0.00**	RW	Uni	DE		PT	US
12.32	Variable selector 2 output	±100.00 %		RO	Bi		NC	PT	
12.33	Variable selector 2 source 1 scaling	±4.000	1.000	RW	Bi				US
12.34	Variable selector 2 source 2 scaling	±4.000	1.000	RW	Bi				US
12.35	Variable selector 2 control	0.00 to 100.00 s	0.00	RW	Uni				US
12.40	Brake release indicator	OFF (0) or On (1)		RO	Bit		NC	PT	
12.41	Brake controller enable	dis (0), rEL (1), d IO (2), USEr (3)	dis (0)	RW	Txt				US
12.43	Lower current threshold	0 to 200 %	10	RW	Uni				US
12.45	Brake apply frequency / speed	0 to 200 rpm	5	RW	Bit				US
12.46	Brake apply speed delay	0.0 to 25.0 s	1.0	RW	Uni				US
12.47	Post brake release delay	0.0 to 25.0 s	1.0	RW	Uni				US
12.48	Brake apply delay	0.0 to 25.0 s	1.0	RW	Uni				US
12.49	Enable position controller during brake release	OFF (0) or On (1)	OFF (0)	RW	Bit				US

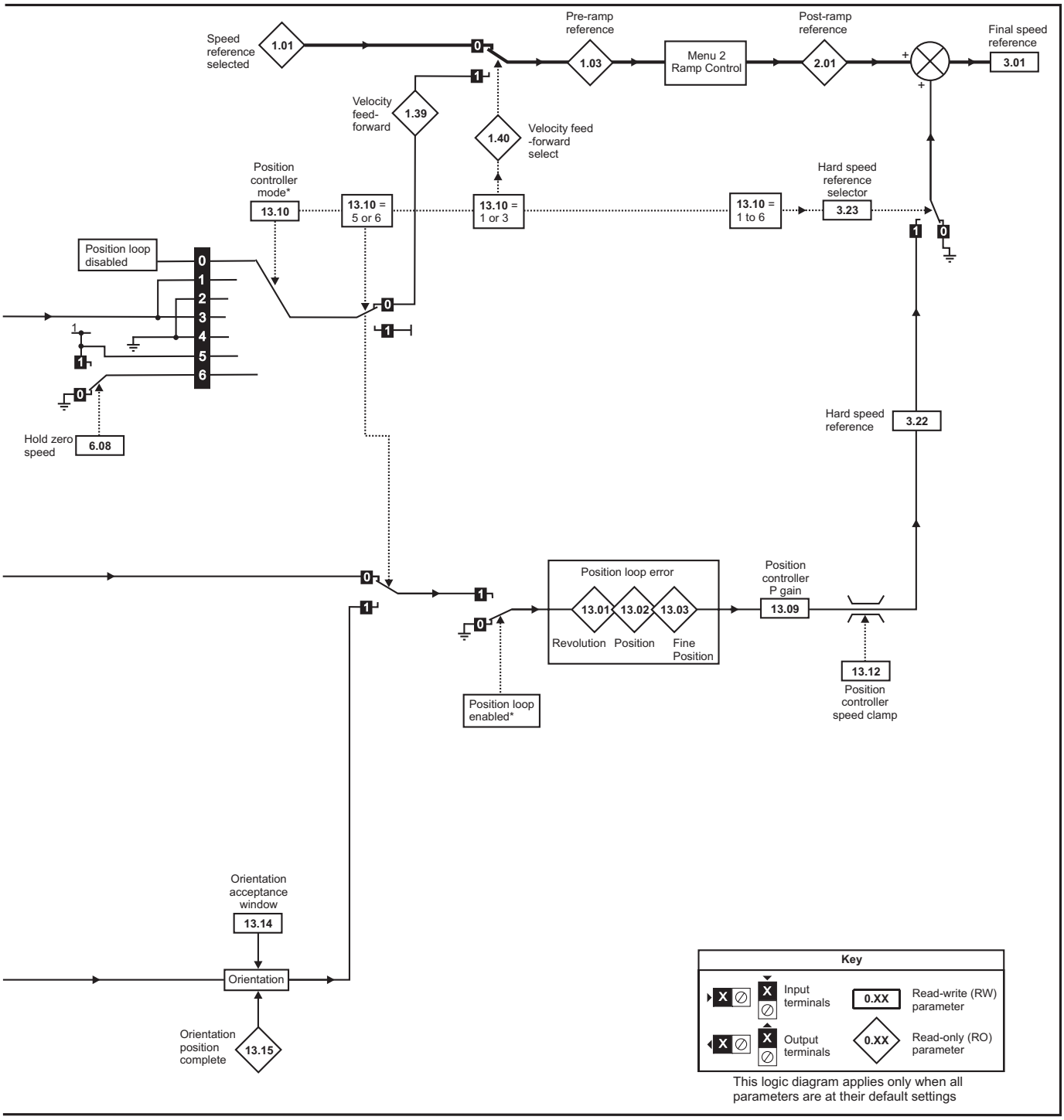
RW	Read / Write	RO	Read only	Uni	Unipolar	Bi	Bi-polar	Bit	Bit parameter	Txt	Text string		
FI	Filtered	DE	Destination	NC	Not copied	RA	Rating dependent	PT	Protected	US	User save	PS	Power down save

8.13 Menu 13: Position control

Figure 8-15 Menu 13 logic diagram



*For more information, refer to section 8.22.8 *Position modes* on page 132.



* The position controller is disabled and the error integrator is also reset under the following conditions:

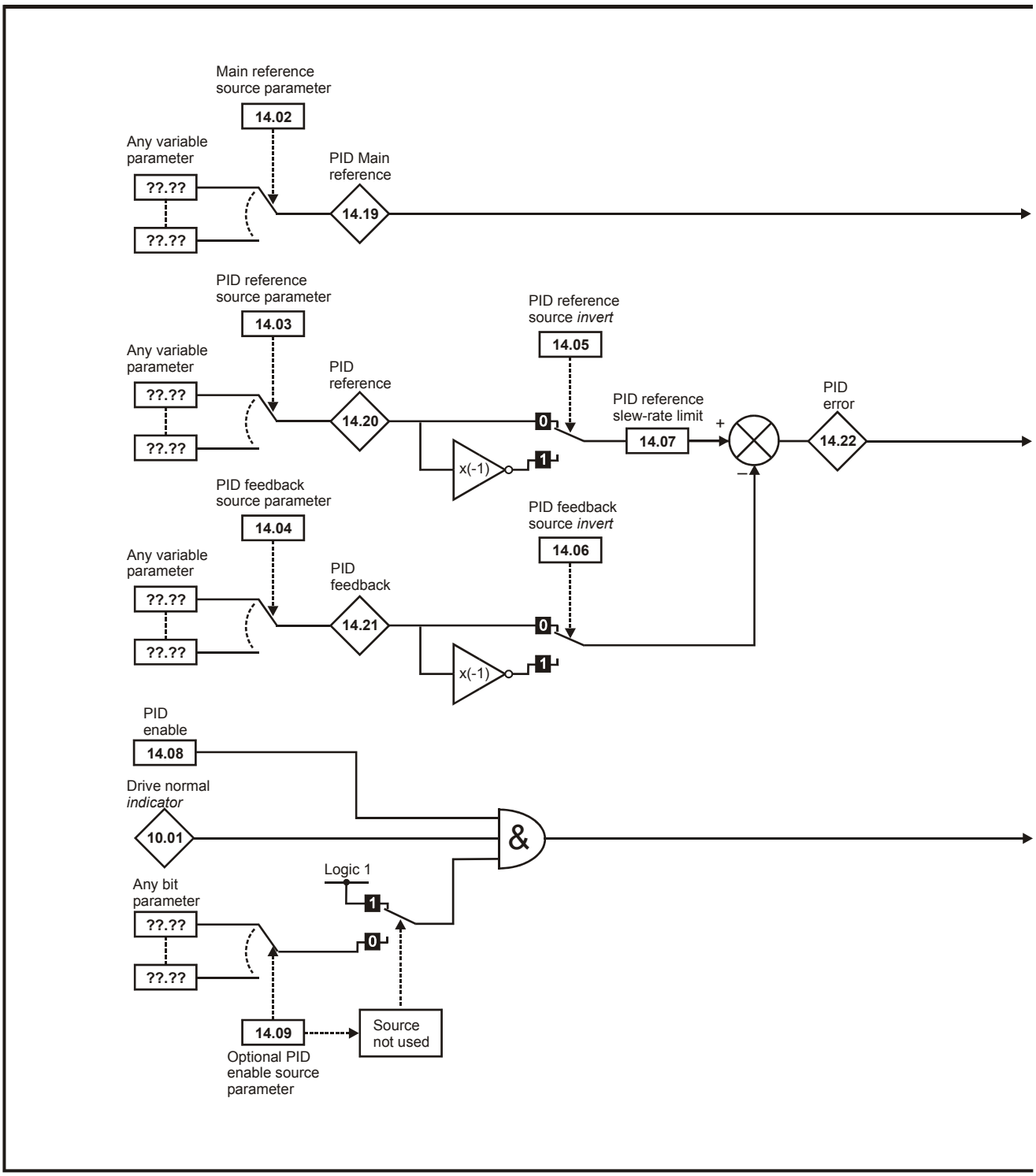
1. If the drive is disabled (i.e. inhibited, ready or tripped)
2. If the position controller mode (Pr **13.10**) is changed. The position controller is disabled transiently to reset the error integrator.
3. The absolute mode parameter (Pr **13.11**) is changed. The position controller is disabled transiently to reset the error integrator.
4. One of the position sources is invalid.
5. The position feedback initialised parameter (Pr **3.48**) is zero.

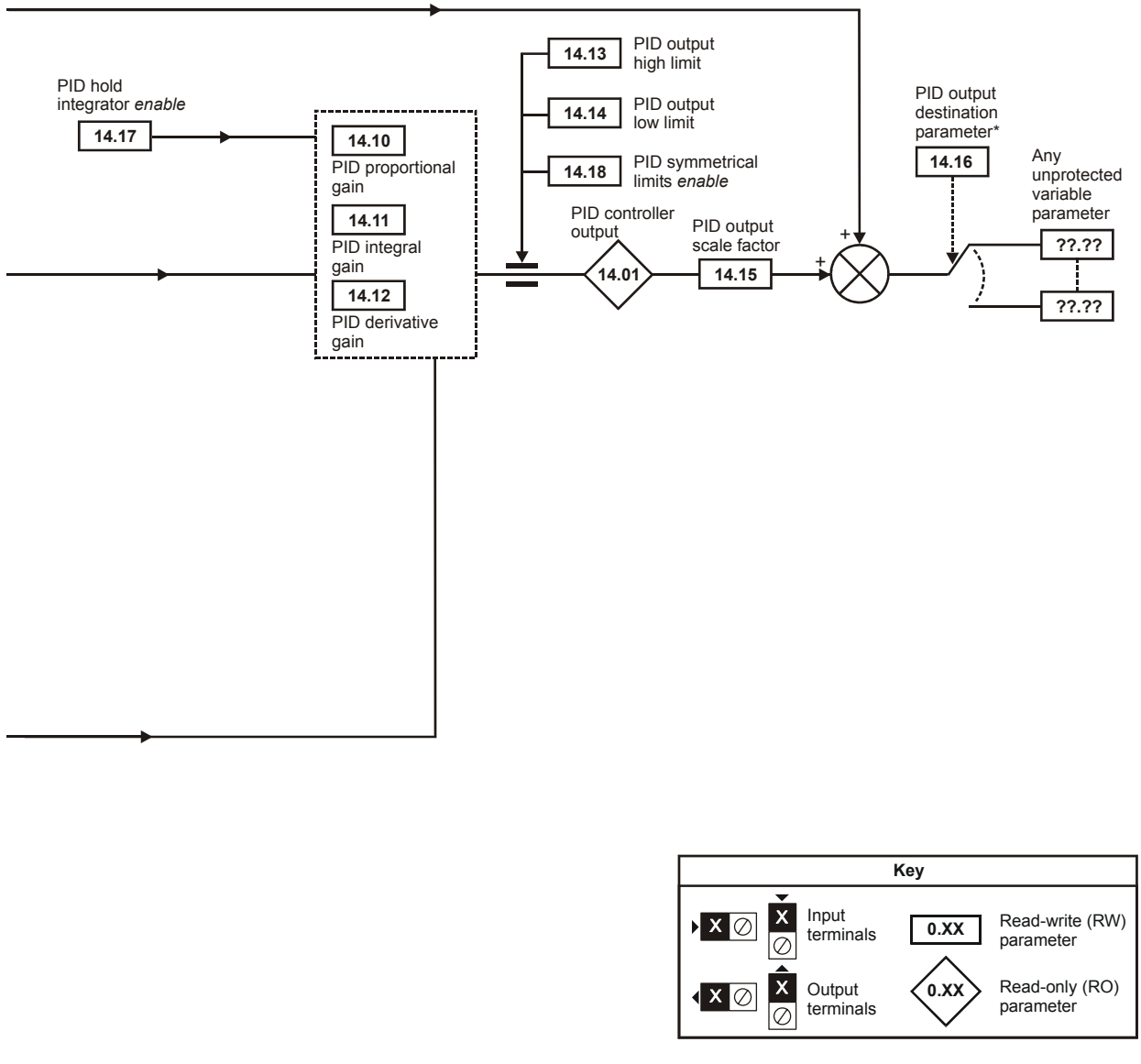
	Parameter	Range(⇳)	Default(⇨)	Type					
13.01	Revolutions error	-32,768 to +32,767		RO	Bi		NC	PT	
13.02	Position error	-32,768 to +32,767		RO	Uni		NC	PT	
13.03	Fine position error	-32,768 to +32,767		RO	Uni		NC	PT	
13.04	Position controller reference source	drv (0), Slot1 (1), Slot2 (2), LocAL (4)	drv (0)	RW	Uni				US
13.05	Position controller feedback source	drv (0), Slot1 (1), Slot2 (2)	drv (0)	RW	Uni				US
13.06	Position reference invert	OFF (0) or On (1)	OFF (0)	RW	Bit				US
13.07	Ratio numerator	0.000 to 4.000	1.000	RW	Uni				US
13.08	Ratio denominator	0.000 to 1.000	1.000	RW	Uni				US
13.09	Position controller P gain	0.00 to 100.00 rad $s^{-1}/_{rad}$	25.00	RW	Uni				US
13.10	Position controller mode	Position controller disabled (0) Rigid position control - feed fwd (1) Rigid position control (2) Non-rigid position control - feed fwd (3) Non-rigid position control (4) Orientation on stop (5) Orientation on stop and when drive enabled (6)	Position controller disabled (0)	RW	Uni				US
13.11	Absolute mode enable	OFF (0) or On (1)	OFF (0)	RW	Bit				US
13.12	Position controller speed clamp	0 to 250	150	RW	Uni				US
13.13	Orientation position reference	0 to 65,535	0	RW	Uni				US
13.14	Orientation acceptance window	0 to 4,096	256	RW	Uni				US
13.15	Orientation position complete	OFF (0) or On (1)		RO	Bit		NC	PT	
13.16	Position error reset	OFF (0) or On (1)	OFF (0)	RW	Bit		NC		
13.17	Relative jog reference	0.0 to 4,000.0 rpm	0.0	RW	Uni		NC		
13.18	Relative jog enable	OFF (0) or On (1)	OFF (0)	RW	Bit		NC		
13.19	Relative jog reverse	OFF (0) or On (1)	OFF (0)	RW	Bit		NC		
13.20	Local reference turns	0 to 65,535	0	RW	Uni		NC		
13.21	Local reference position	0 to 65,535	0	RW	Uni		NC		
13.22	Local reference fine position	0 to 65,535	0	RW	Uni		NC		
13.23	Local reference disable	OFF (0) or On (1)	OFF (0)	RW	Bit		NC		
13.24	Ignore local reference turns	OFF (0) or On (1)	OFF (0)	RW	Bit				US

RW	Read / Write	RO	Read only	Uni	Unipolar	Bi	Bi-polar	Bit	Bit parameter	Txt	Text string		
FI	Filtered	DE	Destination	NC	Not copied	RA	Rating dependent	PT	Protected	US	User save	PS	Power down save

8.14 Menu 14: User PID controller

Figure 8-16 Menu 14 Logic diagram





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.

Parameter		Range(⇳)	Default(⇨)	Type					
14.01	PID control output	±100.00 %		RO	Bi		NC	PT	
14.02	PID main reference source	Pr **0.00** to **21.51**	Pr **0.00**	RW	Uni			PT	US
14.03	PID reference source	Pr **0.00** to **21.51**	Pr **0.00**	RW	Uni			PT	US
14.04	PID feedback source	Pr **0.00** to **21.51**	Pr **0.00**	RW	Uni			PT	US
14.05	PID reference source invert	OFF (0) or On (1)	OFF (0)	RW	Bit				US
14.06	PID feedback source invert	OFF (0) or On (1)	OFF (0)	RW	Bit				US
14.07	PID reference slew-rate limit	0.0 to 3,200.0 s	0.0	RW	Uni				US
14.08	PID enable	OFF (0) or On (1)	OFF (0)	RW	Bit				US
14.09	PID optional enable source	Pr **0.00** to **21.51**	Pr **0.00**	RW	Uni			PT	US
14.10	PID proportional gain	0.000 to 4.000	1.000	RW	Uni				US
14.11	PID integral gain	0.000 to 4.000	0.500	RW	Uni				US
14.12	PID derivative gain	0.000 to 4.000	0.000	RW	Uni				US
14.13	PID upper limit	0.00 to 100.00 %	100.00	RW	Uni				US
14.14	PID lower limit	±100.00 %	-100.00	RW	Bi				US
14.15	PID output scaling factor	0.000 to 4.000	1.000	RW	Uni				US
14.16	PID output destination	Pr **0.00** to **21.51**	Pr **0.00**	RW	Uni	DE		PT	US
14.17	PID hold integrator enable	OFF (0) or On (1)	OFF (0)	RW	Bit		NC		
14.18	PID symmetrical limits enable	OFF (0) or On (1)	OFF (0)	RW	Bit				US
14.19	PID main reference	±100.00 %		RO	Bi		NC	PT	
14.20	PID reference	±100.00 %		RO	Bi		NC	PT	
14.21	PID feedback	±100.00 %		RO	Bi		NC	PT	
14.22	PID error	±100.00 %		RO	Bi		NC	PT	

RW	Read / Write	RO	Read only	Uni	Unipolar	Bi	Bi-polar	Bit	Bit parameter	Txt	Text string		
FI	Filtered	DE	Destination	NC	Not copied	RA	Rating dependent	PT	Protected	US	User save	PS	Power down save

8.15 Menus 15 and 16: Solutions Module set-up

Pr **15.01** and Pr **16.01** indicate the type of module that is installed in the corresponding slot.

Solutions Module ID	Module	Category
0	No module installed	
101	SM-Resolver	Feedback
102	SM-Universal Encoder Plus	
104	SM-Encoder 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/O 120V	
207	SM-I/O Lite	
208	SM-I/O 32	
401	SM-LON	Fieldbus
403	SM-PROFIBUS-DP	
404	SM-INTERBUS	
406	SM-CAN	
407	SM-DeviceNet	
408	SM-CANopen	
409	SM-SERCOS	
410	SM-Ethernet	
501	SM-SLM	SLM

Solutions Module software

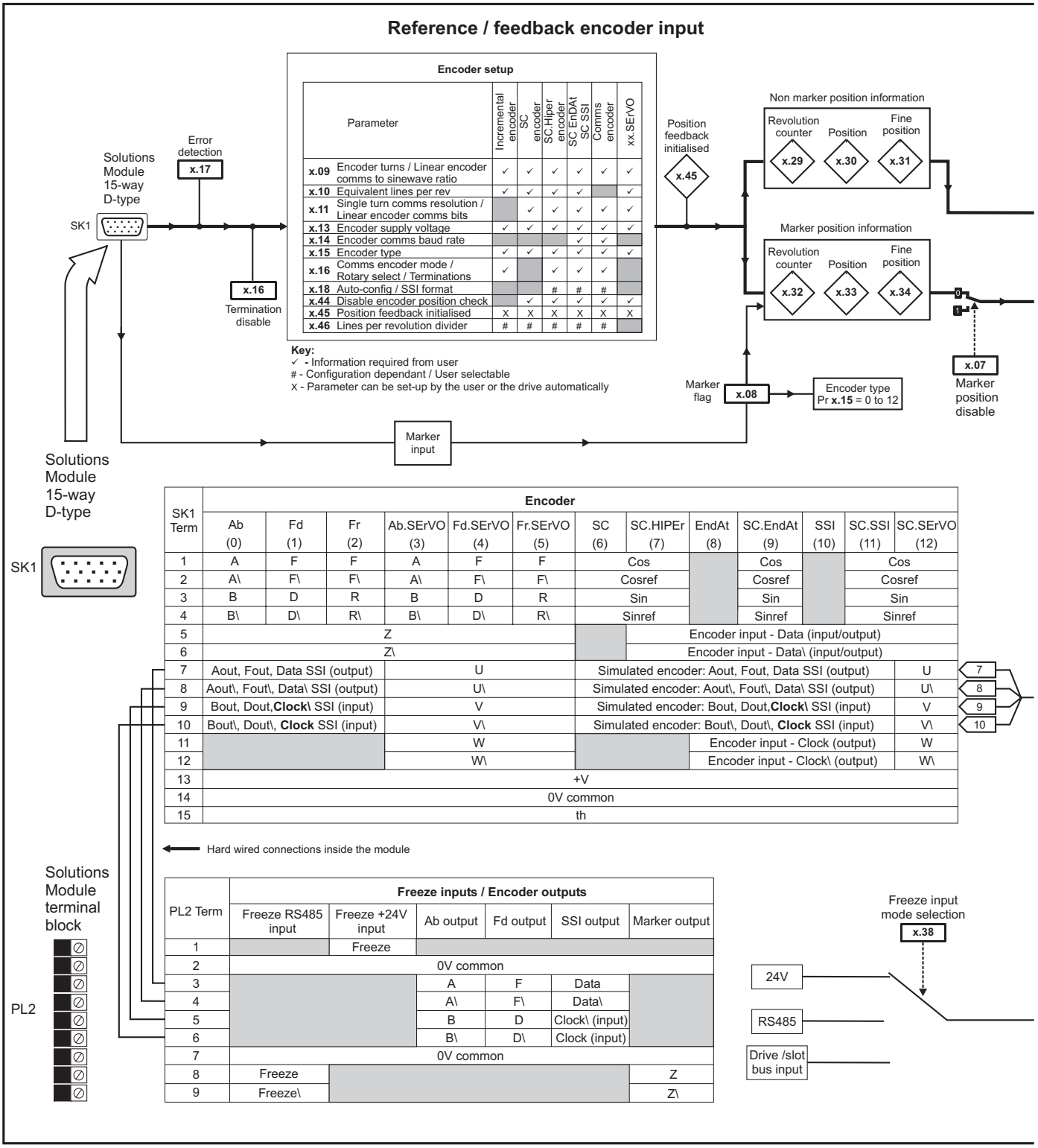
Most Solutions Modules contain software. The software version of the module can be checked by looking at Pr **x.02** and Pr **x.51**.

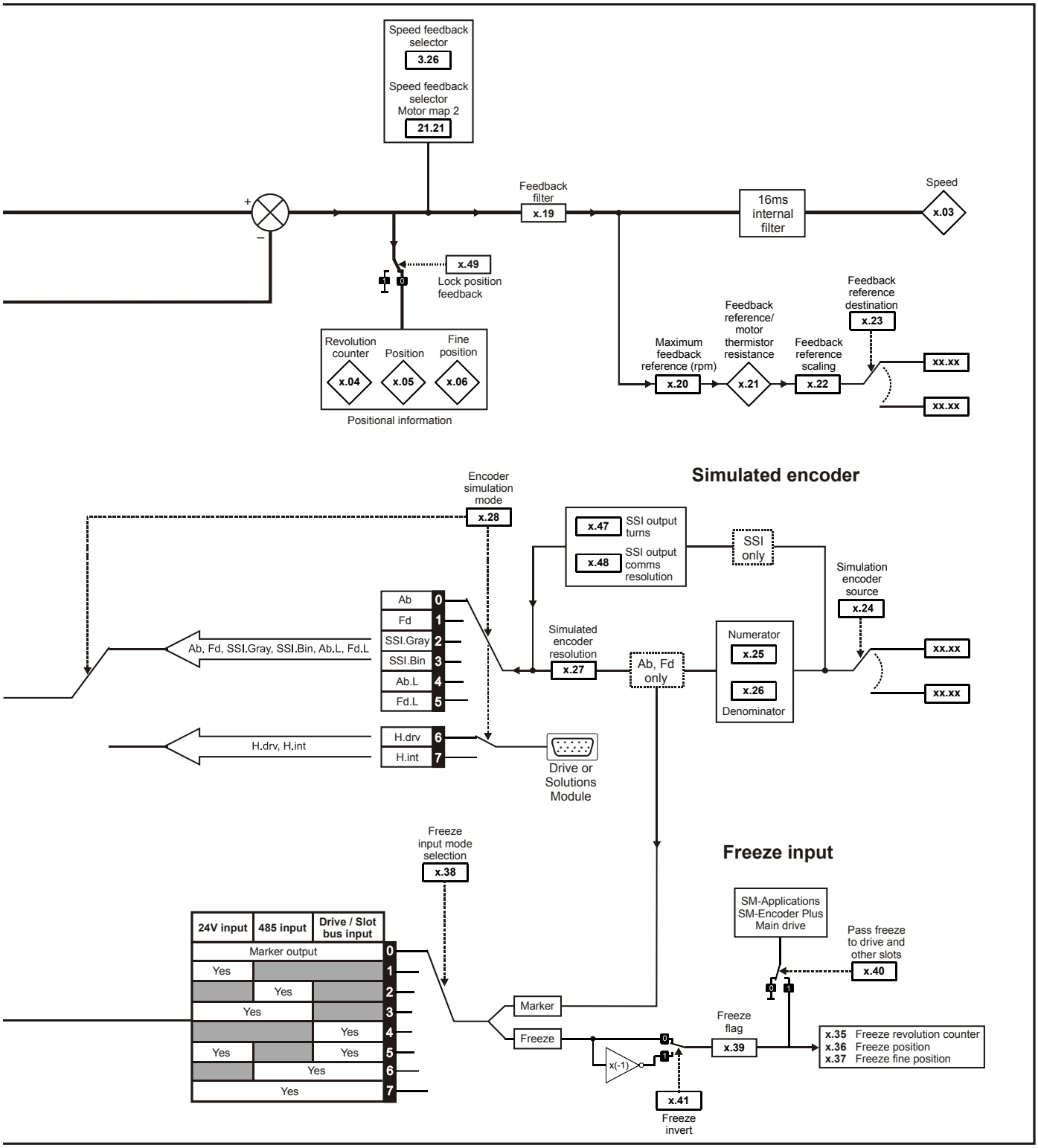
The software version takes the form of zz.yy.xx, where Pr **x.02** displays zz.yy and Pr **x.51** displays xx. I.e. for software version 01.01.00, Pr **x.02** would display 1.01 and Pr **x.51** would display 0

The SM-Resolver, SM-Encoder Plus and SM-I/O Plus modules do not contain any software.

8.15.1 Feedback module category

Figure 8-17 SM-Universal Encoder Plus logic diagram




Speed feedback selector
3.26
Speed feedback selector Motor map 2
21.21
Feedback filter
x.19
16ms internal filter
Speed
x.03
x.49
Lock position feedback
Revolution counter
Position
Fine position
x.04
x.05
x.06
Positional information
Feedback reference/ motor thermistor resistance
Maximum feedback reference (rpm)
Feedback reference scaling
Feedback reference destination
x.23
x.20
x.21
x.22
xx.xx
xx.xx
Simulated encoder
Encoder simulation mode
x.28
x.47
SSI output turns
x.48
SSI output comms resolution
SSI only
Simulation encoder source
x.24
Ab
Fd
SSI.Gray
SSI.Bin
Ab.L
Fd.L
Ab, Fd, SSI.Gray, SSI.Bin, Ab.L, Fd.L
Simulated encoder resolution
x.27
Ab, Fd only
Numerator
x.25
x.26
Denominator
H.drv
H.int
H.drv, H.int
Drive or Solutions Module
Freeze input
Freeze input mode selection
x.38
24V input
485 input
Drive / Slot bus input
Marker output
SM-Applications SM-Encoder Plus Main drive
Pass freeze to drive and other slots
x.40
Marker
Freeze
x(-1)
Freeze flag
x.39
x.35 Freeze revolution counter
x.36 Freeze position
x.37 Freeze fine position
x.41
Freeze invert

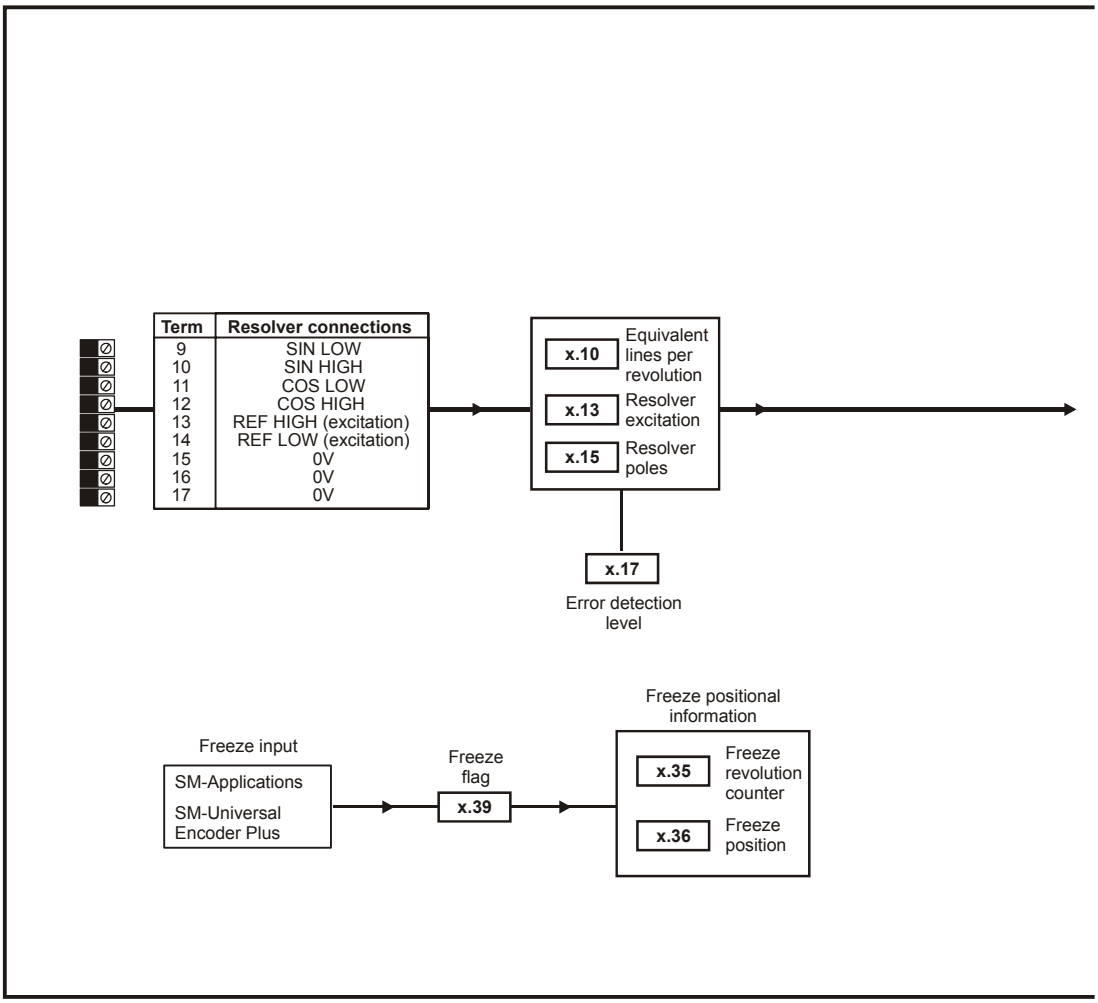
SM-Universal Encoder Plus parameters

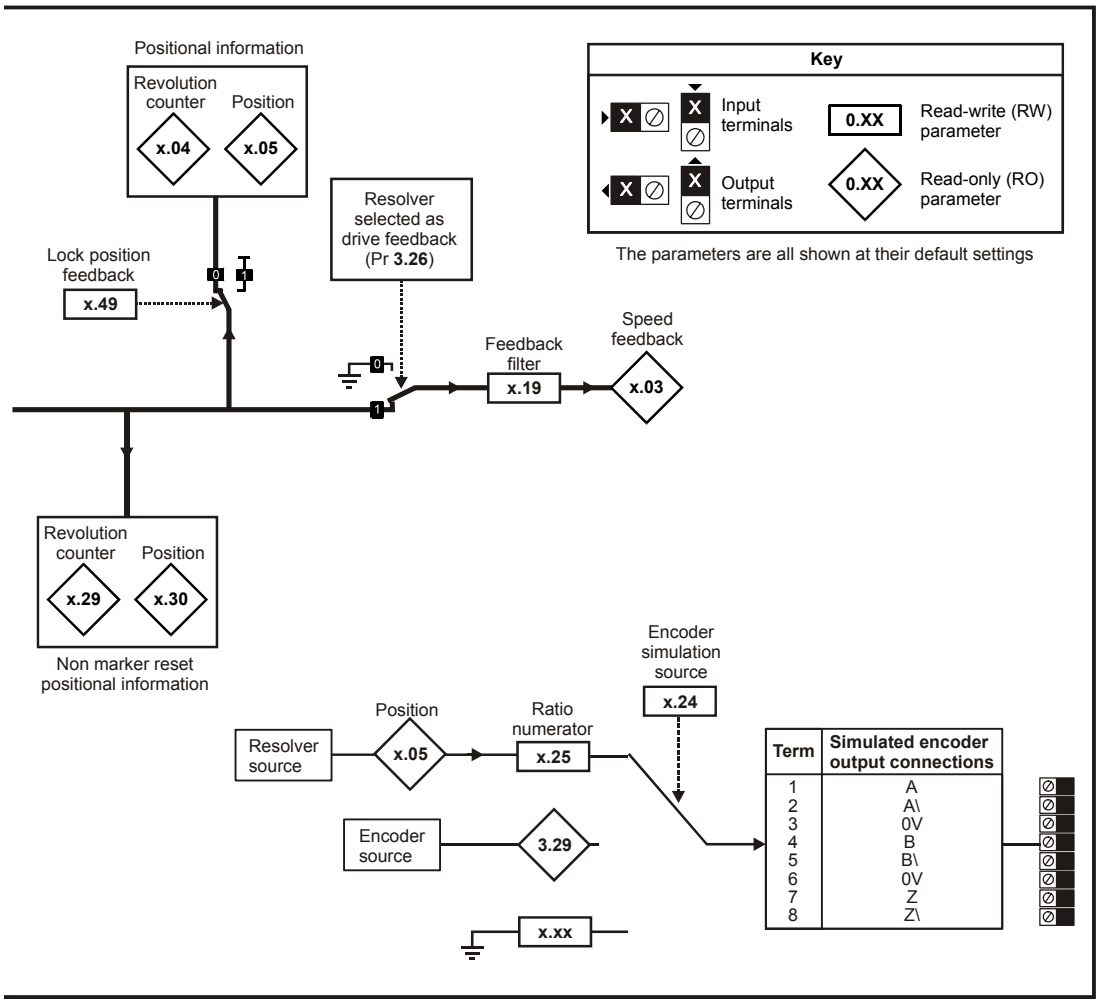
	Parameter	Range(⇳)	Default(⇨)	Type					
x.01	Solutions Module ID	0 to 599	102	RO	Uni			PT	US
x.02	Solutions Module software version	0.00 to 99.99		RO	Uni		NC	PT	
x.03	Speed	±40,000.0 rpm		RO	Bi	FI	NC	PT	
x.04	Revolution counter	0 to 65,535 revolutions		RO	Uni	FI	NC	PT	
x.05	Position	0 to 65,535 ($1/2^{16}$ths of a revolution)		RO	Uni	FI	NC	PT	
x.06	Fine position	0 to 65,535 ($1/2^{32}$nds of a revolution)		RO	Uni	FI	NC	PT	
x.07	Marker position reset disable	OFF (0) or On (1)	OFF (0)	RW	Bit				US
x.08	Marker flag	OFF (0) or On (1)	OFF (0)	RW	Bit		NC		
x.09	Encoder turns/ linear encoder comms to sine wave ratio	0 to 16 bits	16	RW	Uni				US
x.10	Equivalent lines per revolution	0 to 50,000	4096	RW	Uni				US
x.11	Single turn comms bits/ linear encoder comms bits	0 to 32 bits	0	RW	Uni				US
x.12	Motor thermistor check *enable*	OFF (0) or On (1)	OFF (0)	RW	Bit				US
x.13	Encoder supply voltage	5V (0), 8V (1), 15V (2)	5V (0)	RW	Uni				US
x.14	Encoder comms baud rate	100 (0), 200 (1), 300 (2), 400 (3), 500 (4), 1,000 (5), 1,500 (6), 2,000 (7)	300 (2)	RW	Txt				US
x.15	Encoder type	Ab (0), Fd (1), Fr (2), Ab.SErVO (3), Fd.SErVO (4), Fr.SErVO (5), SC (6), SC.HiPEr (7), EndAt (8), SC.EndAt (9), SSI (10), SC.SSI (11), SC.UVW (12)	Ab (0)	RW	Uni				US
x.16	Rotary encoder select/ comms only encoder mode/ terminations	0 to 2	1	RW	Uni				US
x.17	Error detection level	0 to 7	1	RW	Uni				US
x.18	Auto configuration/ SSI binary format select	OFF (0) or On (1)	OFF (0)	RW	Bit				US
x.19	Feedback filter	0 to 5 (0 to 16 ms)	0	RW	Uni				US
x.20	Maximum feedback reference	0.0 to 40,000.0 rpm	1500.0	RW	Uni				US
x.21	Feedback reference/ motor thermistor resistance	±100.0 %		RO	Bi		NC	PT	
x.22	Feedback reference scaling	0.000 to 4.000	1.000	RW	Uni				US
x.23	Feedback reference destination	Pr **0.00** to Pr **21.51**	Pr 0.00	RW	Uni	DE		PT	US
x.24	Encoder simulation source	Pr **0.00** to Pr **21.51**	Pr **0.00**	RW	Uni			PT	US
x.25	Encoder simulation ratio numerator	0.0000 to 3.0000	0.2500	RW	Uni				US
x.26	Encoder simulation ratio denominator	0.0000 to 3.0000	1.0000	RW	Uni				US
x.27	Encoder simulation resolution select	OFF (0) or On (1)	OFF (0)	RW	Bit		NC		
x.28	Encoder simulation mode	Ab (0), Fd (1), SSI.Gray (2), SSI.Bin (3), Ab.L (4), Fd.L (5), H-drv (6), H-int (7)	Ab (0)	RW	Txt				US
x.29	Non-marker reset revolution counter	0 to 65,535 revolutions		RO	Uni		NC	PT	
x.30	Non-marker reset position	0 to 65,535 ($1/2^{16}$ths of a revolution)		RO	Uni		NC	PT	
x.31	Non-marker reset fine position	0 to 65,535 ($1/2^{32}$nds of a revolution)		RO	Uni		NC	PT	
x.32	Marker revolution counter	0 to 65,535 revolutions		RO	Uni		NC	PT	
x.33	Marker position	0 to 65,535 ($1/2^{16}$ths of a revolution)		RO	Uni		NC	PT	
x.34	Marker fine position	0 to 65,535 ($1/2^{32}$nds of a revolution)		RO	Uni		NC	PT	
x.35	Freeze revolution counter	0 to 65,535 revolutions		RO	Uni		NC	PT	
x.36	Freeze position	0 to 65,535 ($1/2^{16}$ths of a revolution)		RO	Uni		NC	PT	
x.37	Freeze fine position	0 to 65,535 ($1/2^{32}$nds of a revolution)		RO	Uni		NC	PT	
x.38	Freeze input mode selection	Bit 0 (LSB) = 24V input Bit 1 = EIA485 input Bit 2 (MSB) = From another Solutions Module	1	RW	Uni				US
x.39	Freeze flag	OFF (0) or On (1)	OFF (0)	RW	Bit		NC		
x.40	Pass freeze to drive and other slots	OFF (0) or On (1)	OFF (0)	RW	Bit		NC		US
x.41	Freeze invert	OFF (0) or On (1)	OFF (0)	RW	Bit				US
x.42	Encoder comms transmit register/ Sin signal value	0 to 65,535	0	RW	Uni		NC		
x.43	Encoder comms receive register/ Cos signal value	0 to 65,535	0	RW	Uni		NC		
x.44	Disable encoder position check	OFF (0) or On (1)	OFF (0)	RW	Bit		NC		
x.45	Position feedback initialised	OFF (0) or On (1)		RO	Bit		NC	PT	
x.46	Lines per revolution divider	1 to 1024	1	RW	Uni				US
x.47	SSI output turns	0 to 16 bits	16	RW	Uni				US
x.48	SSI output comms resolution	0 to 32 bits	0	RW	Uni				US
x.49	Lock position feedback	OFF (0) or On (1)	OFF (0)	RW	Bit				
x.50	Solutions Module error status*	0 to 255		RO	Uni		NC	PT	
x.51	Solutions Module software sub-version	0 to 99		RO	Uni		NC	PT	

RW	Read / Write	RO	Read only	Uni	Unipolar	Bi	Bi-polar	Bit	Bit parameter	Txt	Text string		
FI	Filtered	DE	Destination	NC	Not copied	RA	Rating dependent	PT	Protected	US	User save	PS	Power down save

*See trip SLX.Er, *Feedback module category* on page 33.

Figure 8-18 SM-Resolver logic diagram





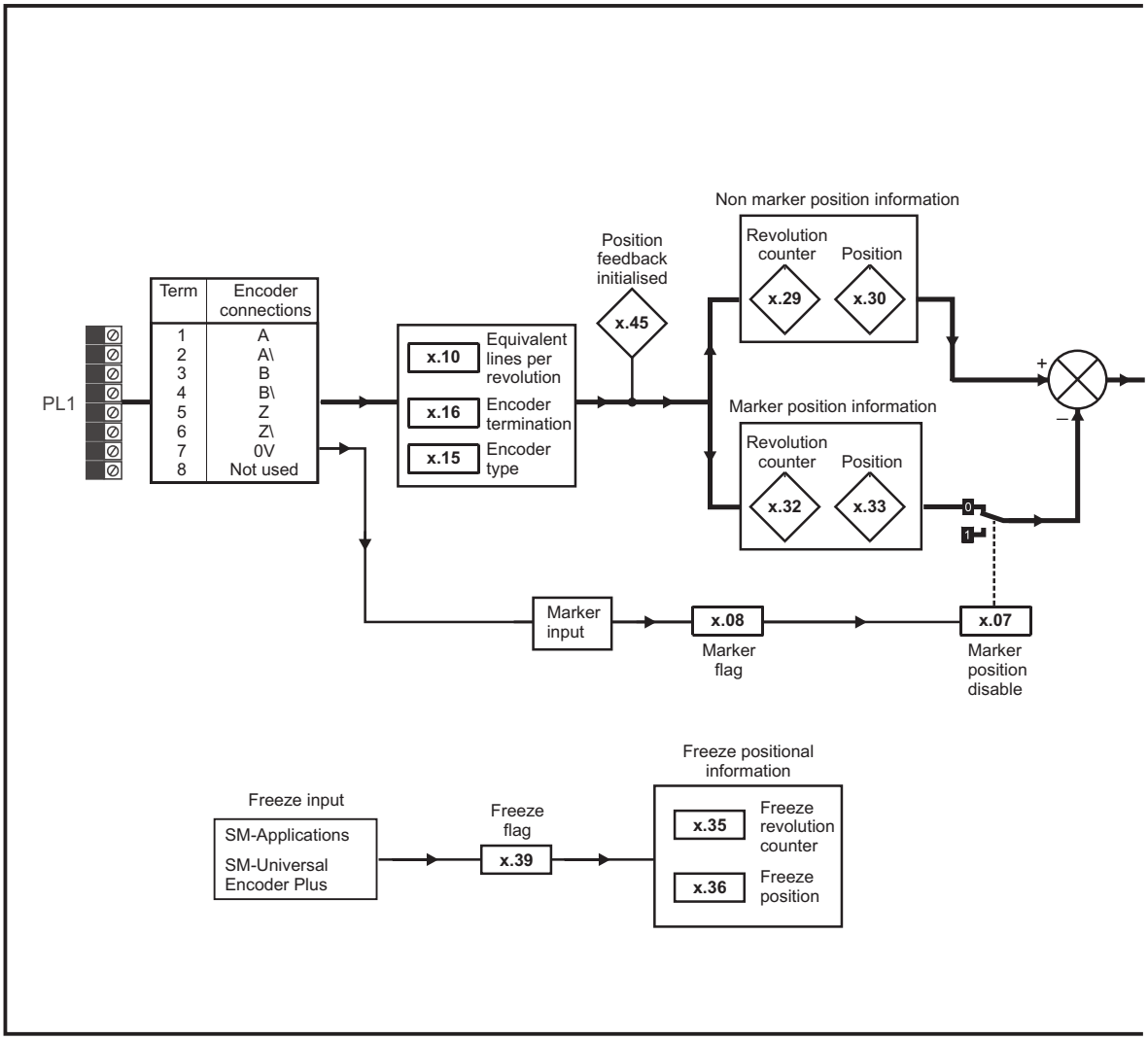
SM-Resolver parameters

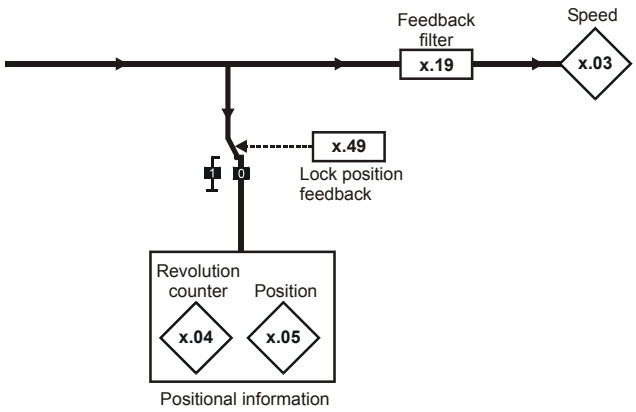
Parameter		Range(⇳)	Default(⇨)	Type					
x.01	Solutions Module ID	0 to 599	101	RO	Uni			PT	US
x.03	Speed	±40,000.0 rpm		RO	Bi	FI	NC	PT	
x.04	Revolution counter	0 to 65,535 revolutions		RO	Uni	FI	NC	PT	
x.05	Position	0 to 65,535 1/2^{16}ths of a revolution		RO	Uni	FI	NC	PT	
x.10	Equivalent lines per revolution	0 to 50,000	4096	RW	Uni				US
x.13	Resolver excitation	3:1 (0), 2:1 (1 or 2)	3:1 (0)	RW	Uni				US
x.15	Resolver poles	2 pole (0), 4 pole (1), 6 pole (2), 8 pole (3 to 11)	2 pole (0)	RW	Uni				US
x.17	Error detection level	Bit 0 (LSB) = Wire break detect Bit 1 = Phase error detect Bit 2 (MSB) = SSI power supply bit monitor Value is binary sum	1	RW	Uni				US
x.19	Feedback filter	0 (0), 1 (1), 2 (2), 4 (3), 8 (4), 16 (5) ms	0	RW	Txt				US
x.24	Encoder simulation source	Pr **0.00** to Pr **21.51**	Pr **0.00**	RW	Uni			PT	US
x.25	Encoder simulation ratio numerator	0.0000 to 3.0000	0.25	RW	Uni				US
x.29	Non-marker reset revolution counter	0 to 65,535 revolutions		RO	Uni		NC	PT	
x.30	Non-marker reset position	0 to 65,535 1/2^{16}ths of a revolution		RO	Uni		NC	PT	
x.35	Freeze revolution counter	0 to 65,535 revolutions		RO	Uni		NC	PT	
x.36	Freeze position	0 to 65,535 1/2^{16}ths of a revolution		RO	Uni		NC	PT	
x.39	Freeze flag	OFF (0) or On (1)	OFF (0)	RW	Bit		NC		
x.45	Position feedback initialized	OFF (0) or On (1)		RO	Bit		NC	PT	
x.49	Lock position feedback	OFF (0) or On (1)	OFF (0)	RW	Bit		NC		
x.50	Solutions Module error status*	0 to 255		RO	Uni		NC	PT	

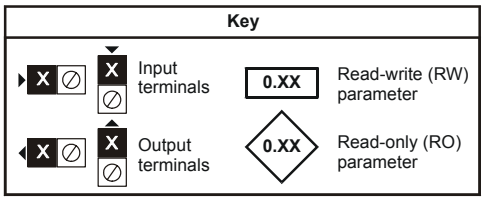
RW	Read / Write	RO	Read only	Uni	Unipolar	Bi	Bi-polar	Bit	Bit parameter	Txt	Text string		
FI	Filtered	DE	Destination	NC	Not copied	RA	Rating dependent	PT	Protected	US	User save	PS	Power down save

*See trip SLX.Er, *Feedback module category* on page 33.

Figure 8-19 SM-Encoder Plus logic diagram







The parameters are all shown at their default settings

SM-Encoder Plus parameters

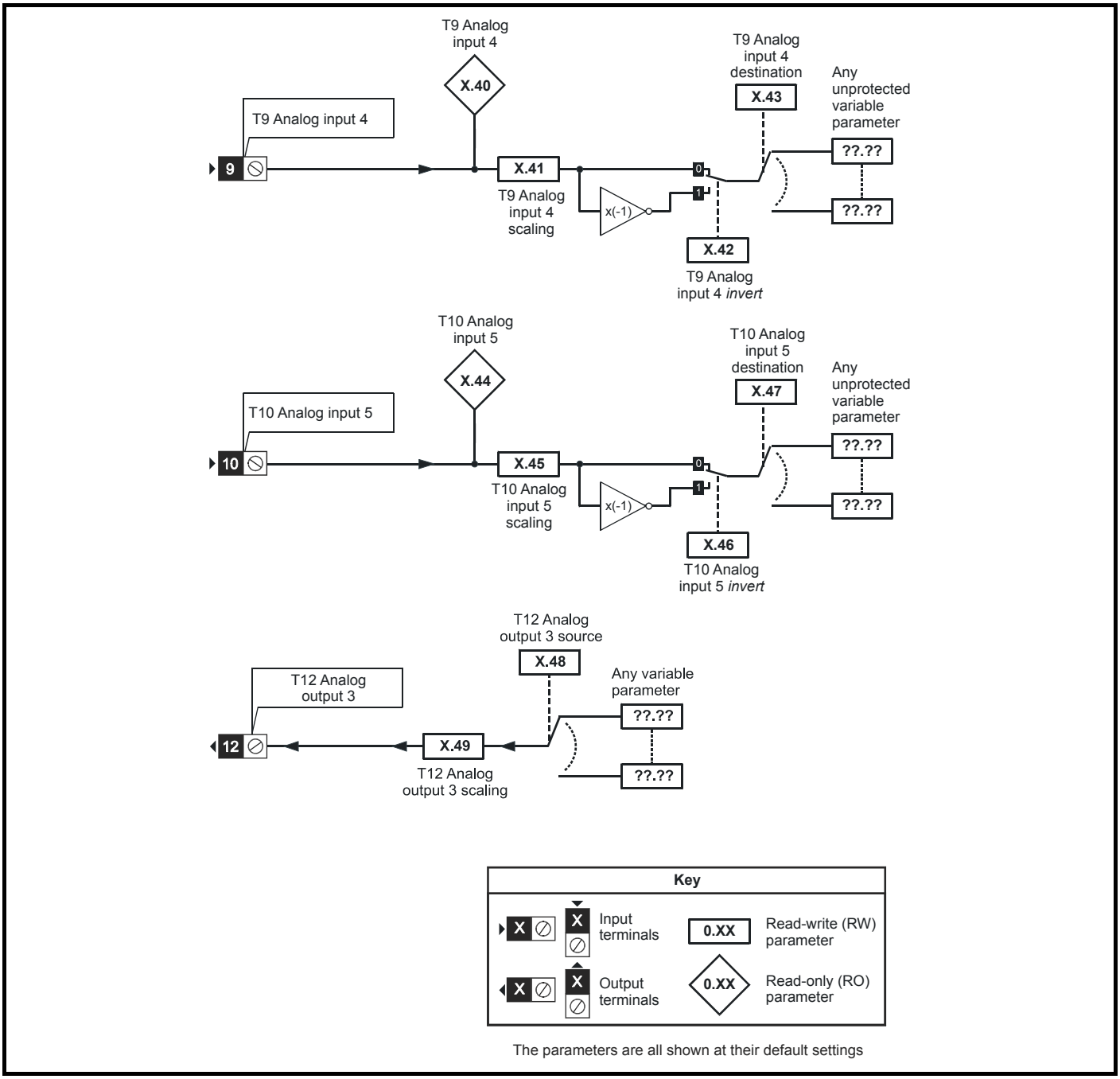
Parameter		Range(⇳)	Default(⇨)	Type					
x.01	Solutions Module ID	0 to 599	101	RO	Uni			PT	US
x.03	Speed	±40,000.0 rpm		RO	Bi	FI	NC	PT	
x.04	Revolution counter	0 to 65,535 revolutions		RO	Uni	FI	NC	PT	
x.05	Position	0 to 65,535 1/2^{16}ths of a revolution		RO	Uni	FI	NC	PT	
x.07	Marker position reset disable	OFF (0) or On (1)	OFF (0)	RW	Bit				US
x.08	Marker flag	OFF (0) or On (1)	OFF (0)	RW	Bit		NC		
x.10	Equivalent lines per revolution	0 to 50,000	4096	RW	Uni				US
x.15	Encoder type	Ab (0), Fd (1), Fr (2),	AB (0)	RW	Uni				US
x.16	Encoder termination	0 to 2	1	RW	Uni				US
x.19	Feedback filter	0 (0), 1 (1), 2 (2), 4 (3), 8 (4), 16 (5) ms	0	RW	Txt				US
x.29	Non-marker reset revolution counter	0 to 65,535 revolutions		RO	Uni		NC	PT	
x.30	Non-marker reset position	0 to 65,535 1/2^{16}ths of a revolution		RO	Uni		NC	PT	
x.32	Marker revolution counter	0 to 65,535 revolutions		RO	Uni		NC	PT	
x.33	Marker position	0 to 65,535 1/2^{16}ths of a revolution		RO	Uni		NC	PT	
x.35	Freeze revolution counter	0 to 65,535 revolutions		RO	Uni		NC	PT	
x.36	Freeze position	0 to 65,535 1/2^{16}ths of a revolution		RO	Uni		NC	PT	
x.39	Freeze flag	OFF (0) or On (1)	OFF (0)	RW	Bit		NC		
x.45	Position feedback initialized	OFF (0) or On (1)		RO	Bit		NC	PT	
x.49	Lock position feedback	OFF (0) or On (1)	OFF (0)	RW	Bit		NC		
x.50	Solutions Module error status*	0 to 255		RO	Uni		NC	PT	

RW	Read / Write	RO	Read only	Uni	Unipolar	Bi	Bi-polar	Bit	Bit parameter	Txt	Text string		
FI	Filtered	DE	Destination	NC	Not copied	RA	Rating dependent	PT	Protected	US	User save	PS	Power down save

*See trip SLX.Er, *Feedback module category* on page 33.

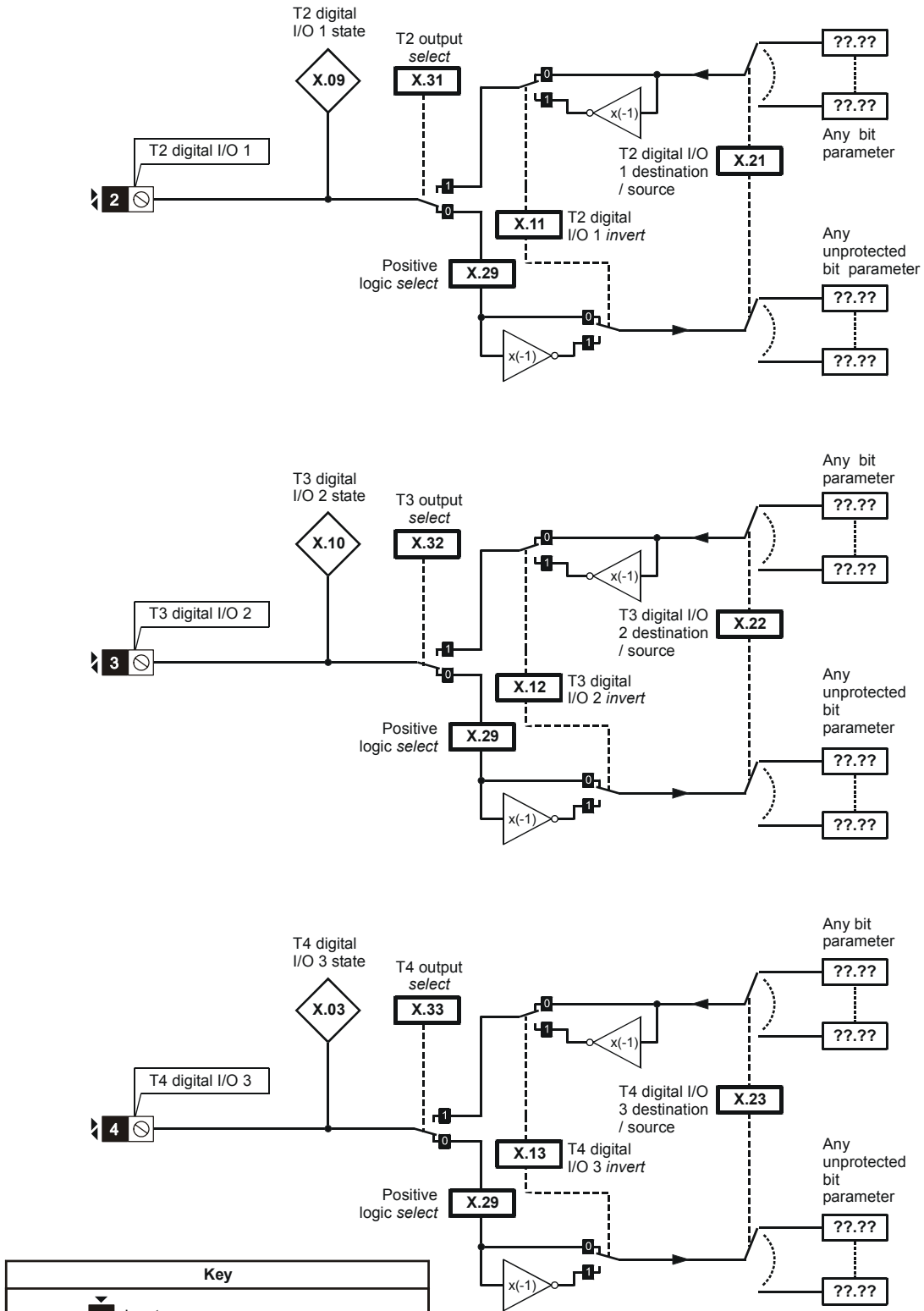
8.15.2 Automation module category

Figure 8-20 SM-I/O Plus analog logic diagram



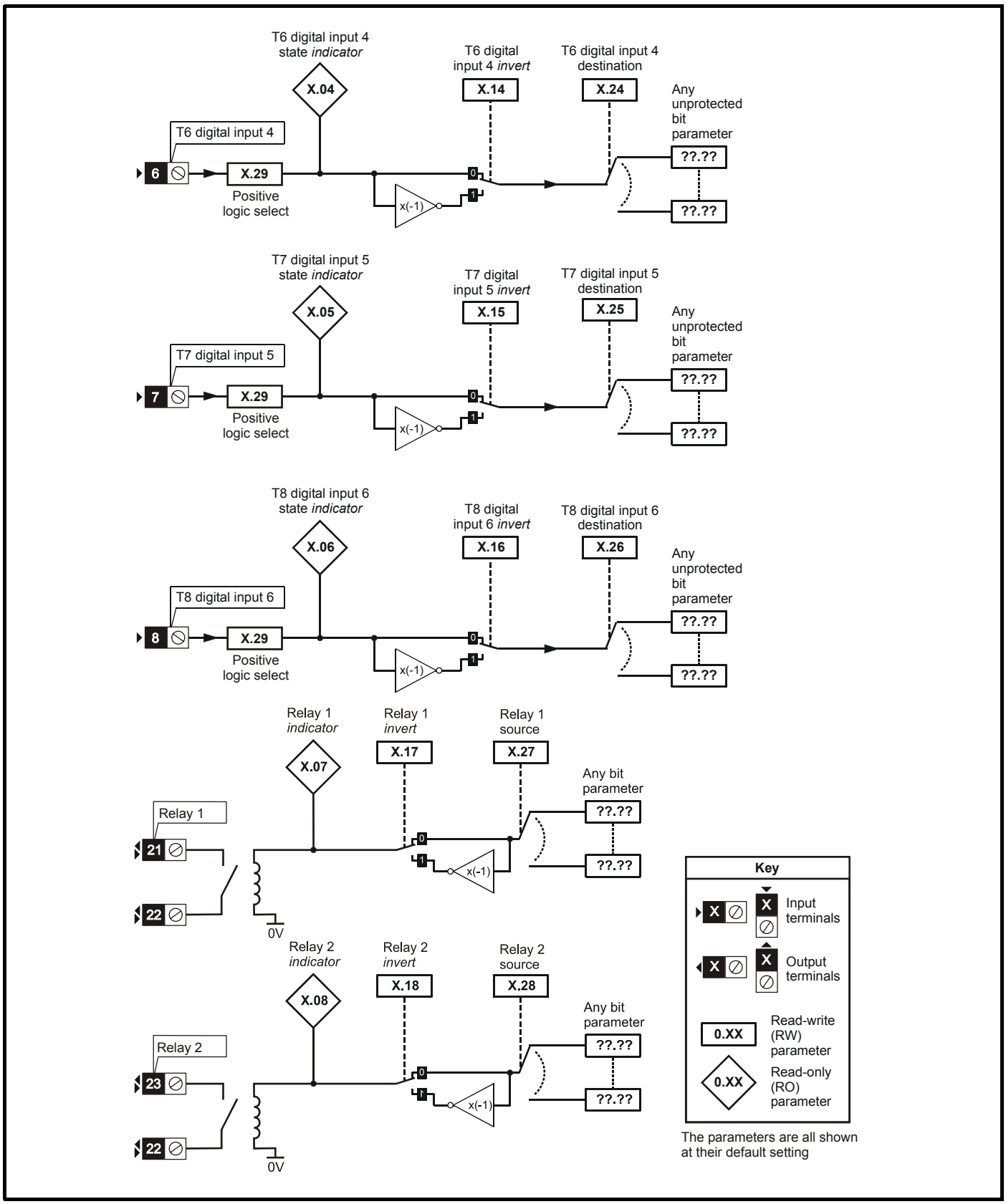
The parameters are all shown at their default settings

Figure 8-21 SM-I/O Plus digital logic diagram 1



The parameters are all shown at their default setting

Figure 8-22 SM-I/O Plus digital logic diagram 2



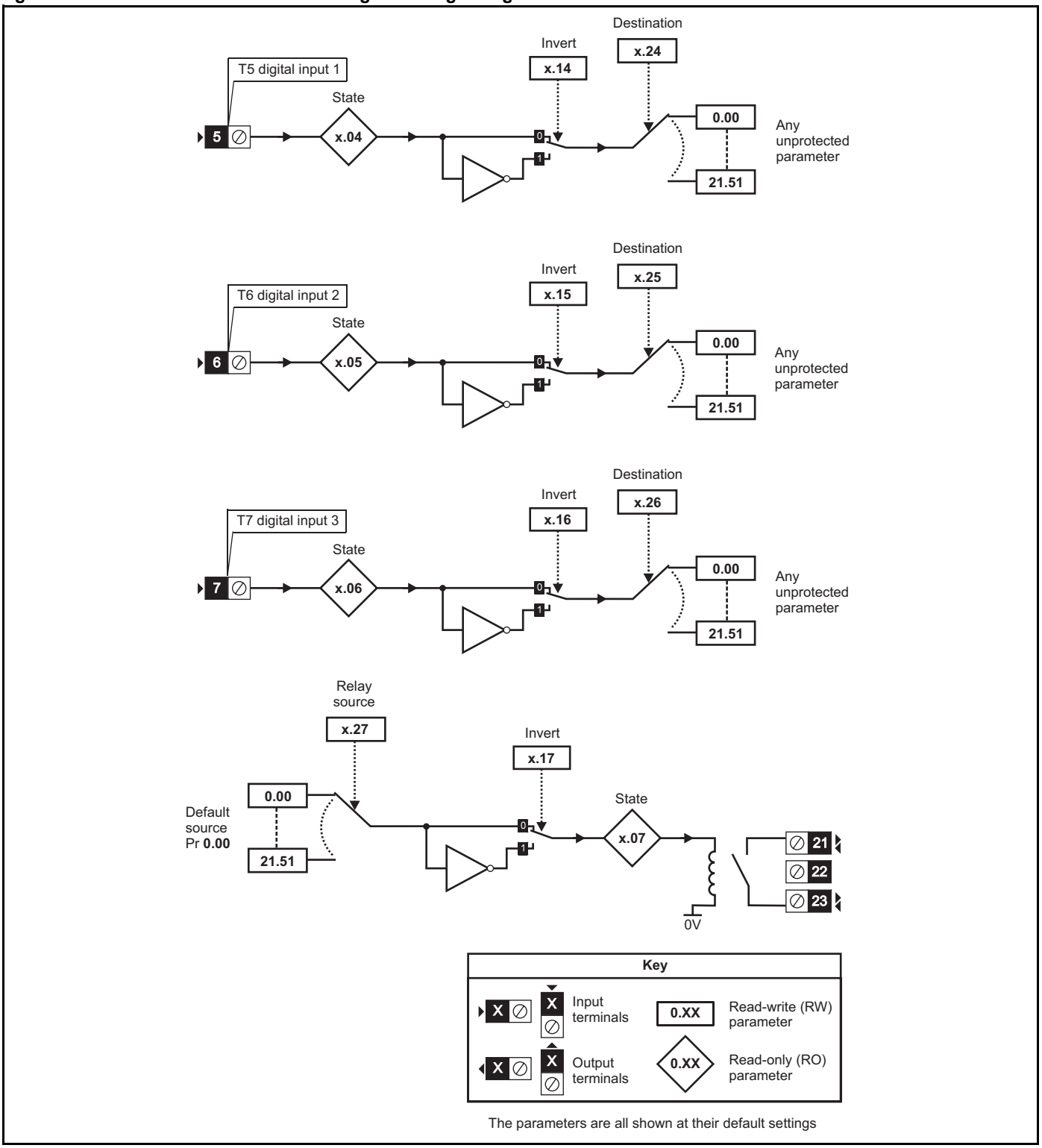
SM-I/O Plus parameters

Parameter		Range(⇳)	Default(⇨)	Type					
x.01	Solutions Module ID	0 to 599	201	RO	Uni			PT	US
x.03	T4 digital I/O 3 state	OFF (0) or On (1)		RO	Bit		NC	PT	
x.04	T6 digital input 4 state	OFF (0) or On (1)		RO	Bit		NC	PT	
x.05	T7 digital input 5 state	OFF (0) or On (1)		RO	Bit		NC	PT	
x.06	T8 digital input 6 state	OFF (0) or On (1)		RO	Bit		NC	PT	
x.07	Relay 1 state	OFF (0) or On (1)		RO	Bit		NC	PT	
x.08	Relay 2 state	OFF (0) or On (1)		RO	Bit		NC	PT	
x.09	T2 digital I/O 1 state	OFF (0) or On (1)		RO	Bit		NC	PT	
x.10	T3 digital I/O 2 state	OFF (0) or On (1)		RO	Bit		NC	PT	
x.11	T2 digital I/O 1 invert	OFF (0) or On (1)	OFF (0)	RW	Bit				US
x.12	T3 digital I/O 2 invert	OFF (0) or On (1)	OFF (0)	RW	Bit				US
x.13	T4 digital I/O 3 invert	OFF (0) or On (1)	OFF (0)	RW	Bit				US
x.14	T6 digital input 4 invert	OFF (0) or On (1)	OFF (0)	RW	Bit				US
x.15	T7 digital input 5 invert	OFF (0) or On (1)	OFF (0)	RW	Bit				US
x.16	T8 digital input 6 invert	OFF (0) or On (1)	OFF (0)	RW	Bit				US
x.17	Relay 1 invert	OFF (0) or On (1)	OFF (0)	RW	Bit				US
x.18	Relay 2 invert	OFF (0) or On (1)	OFF (0)	RW	Bit				US
x.20	Digital I/O read word	0 to 511		RO	Uni		NC	PT	
x.21	T2 digital I/O 1 source/ destination	Pr **0.00** to Pr	Pr **0.00**	RW	Uni	DE		PT	US
x.22	T3 digital I/O 2 source/ destination	Pr **0.00** to Pr	Pr **0.00**	RW	Uni	DE		PT	US
x.23	T4 digital I/O 3 source/ destination	Pr **0.00** to Pr	Pr **0.00**	RW	Uni	DE		PT	US
x.24	T6 digital input 4 destination	Pr **0.00** to Pr	Pr **0.00**	RW	Uni	DE		PT	US
x.25	T7 digital input 5 destination	Pr **0.00** to Pr	Pr **0.00**	RW	Uni	DE		PT	US
x.26	T8 digital input 6 destination	Pr **0.00** to Pr	Pr **0.00**	RW	Uni	DE		PT	US
x.27	Relay 1 source	Pr **0.00** to Pr	Pr **0.00**	RW	Uni			PT	US
x.28	Relay 2 source	Pr **0.00** to Pr	Pr **0.00**	RW	Uni			PT	US
x.29	Input polarity select	OFF (0) or On (1)	On (1) (positive logic)	RW	Bit			PT	US
x.31	T2 digital I/O 1 output select	OFF (0) or On (1)	OFF (0)	RW	Bit				US
x.32	T3 digital I/O 2 output select	OFF (0) or On (1)	OFF (0)	RW	Bit				US
x.33	T4 digital I/O 3 output select	OFF (0) or On (1)	OFF (0)	RW	Bit				US
x.40	Analog input 1	±100.0%		RO	Bi		NC	PT	
x.41	Analog input 1 scaling	0 to 4.000	1.000	RW	Uni				US
x.42	Analog input 1 invert	OFF (0) or On (1)	OFF (0)	RW	Bit				US
x.43	Analog input 1 destination	Pr **0.00** to Pr	Pr **0.00**	RW	Uni	DE		PT	US
x.44	Analog input 2	±100.0%		RO	Bi		NC	PT	
x.45	Analog input 2 scaling	0.000 to 4.000	1.000	RW	Uni				US
x.46	Analog input 2 invert	OFF (0) or On (1)	OFF (0)	RW	Bit				US
x.47	Analog input 2 destination	Pr **0.00** to Pr	Pr **0.00**	RW	Uni	DE		PT	US
x.48	Analog output 1 source	Pr **0.00** to Pr	Pr **0.00**	RW	Uni			PT	US
x.49	Analog output 1 scaling	0.000 to 4.000	1.000	RW	Uni				US
x.50	Solutions Module error status*	0 to 255		RO	Uni		NC	PT	

RW	Read / Write	RO	Read only	Uni	Unipolar	Bi	Bi-polar	Bit	Bit parameter	Txt	Text string		
FI	Filtered	DE	Destination	NC	Not copied	RA	Rating dependent	PT	Protected	US	User save	PS	Power down save

*See trip SLX.Er, *Automation (I/O Expansion) module category* on page 35.

Figure 8-23 SM-I/O Lite & SM-I/O Timer digital I/O logic diagram



The parameters are all shown at their default settings

Figure 8-24 SM-I/O Lite & SM-I/O Timer analog I/O logic diagram

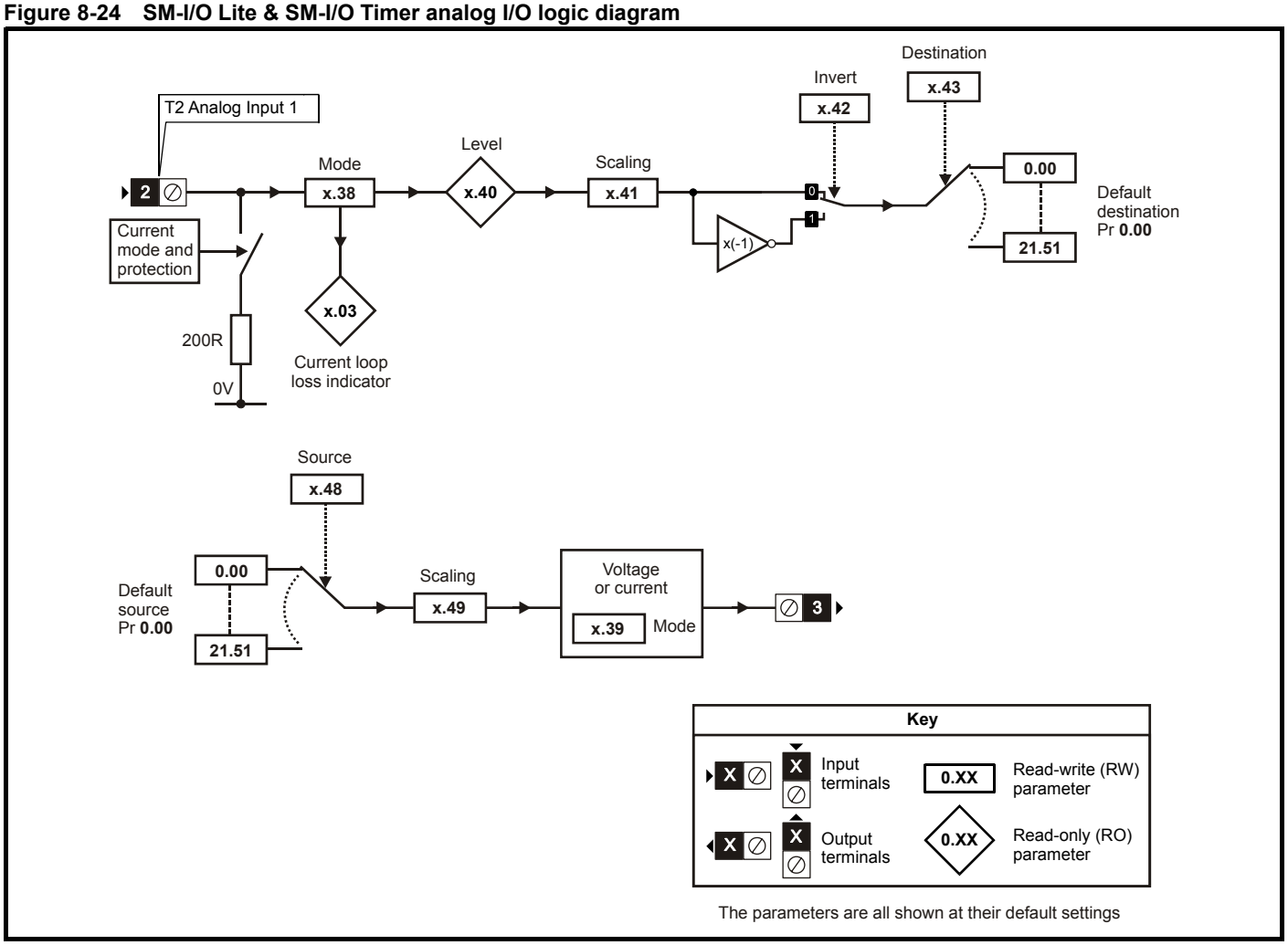
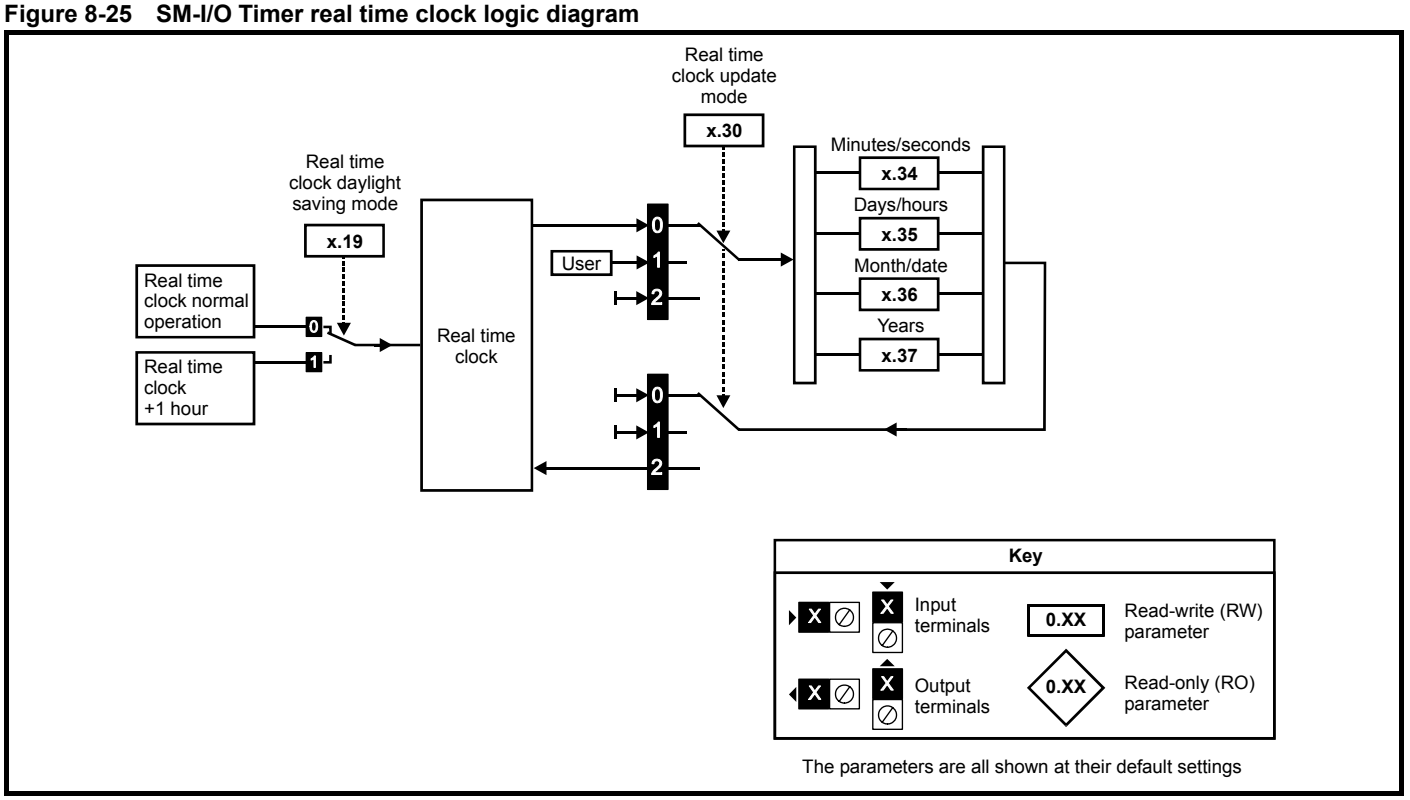


Figure 8-25 SM-I/O Timer real time clock logic diagram



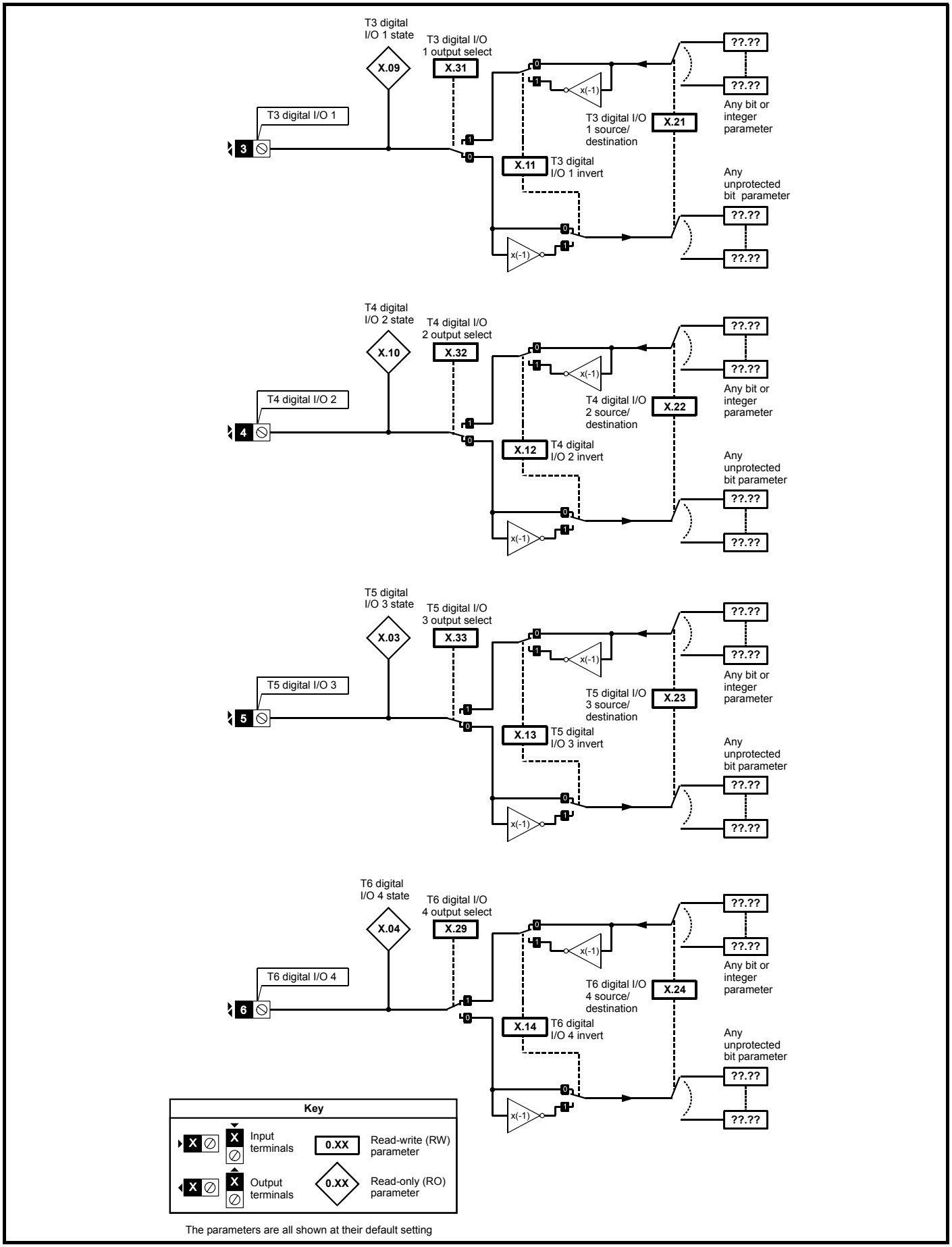
SM-I/O Timer & SM-I/O Lite parameters

Parameter		Range(⇳)	Default(⇨)	Type						SM-I/O	
										Lite	Timer
x.01	Solutions Module ID	0 to 599	SM-I/O Lite: 207	RO	Uni			PT	US	✓	✓
x.02	Solutions Module software version	0.00 to 99.99		RO	Uni		NC	PT		✓	✓
x.03	Current loop loss indicator	OFF (0) or On (1)		RO	Bit		NC	PT		✓	✓
x.04	T5 digital input 4 state	OFF (0) or On (1)		RO	Bit		NC	PT		✓	✓
x.05	T6 digital input 5 state	OFF (0) or On (1)		RO	Bit		NC	PT		✓	✓
x.06	T7 digital input 6 state	OFF (0) or On (1)		RO	Bit		NC	PT		✓	✓
x.07	Relay 1 state	OFF (0) or On (1)		RO	Bit		NC	PT		✓	✓
x.14	T5 digital input 4 invert	OFF (0) or On (1)	OFF (0)	RW	Bit				US	✓	✓
x.15	T6 digital input 5 invert	OFF (0) or On (1)	OFF (0)	RW	Bit				US	✓	✓
x.16	T7 digital input 6 invert	OFF (0) or On (1)	OFF (0)	RW	Bit				US	✓	✓
x.17	Relay 1 invert	OFF (0) or On (1)	OFF (0)	RW	Bit				US	✓	✓
x.20	Digital I/O read word	0 to 255		RO	Uni		NC	PT		✓	✓
x.24	T5 digital input 4 destination	Pr **0.00** to Pr	Pr **0.00**	RW	Uni	DE		PT	US	✓	✓
x.25	T6 digital input 5 destination	Pr **0.00** to Pr	Pr **0.00**	RW	Uni	DE		PT	US	✓	✓
x.26	T7 digital input 6 destination	Pr **0.00** to Pr	Pr **0.00**	RW	Uni	DE		PT	US	✓	✓
x.27	Relay 1 source	Pr **0.00** to Pr	Pr **0.00**	RW	Uni			PT	US	✓	✓
x.30	Real time clock update mode	0 to 2	0	RW	Uni						✓
x.34	Real time clock minutes/seconds	00.00 to 59.59	00.00	RW	Uni			PT			✓
x.35	Real time clock days/hours	1.00 to 7.23	0.00	RW	Uni			PT			✓
x.36	Real time clock month/date	00.00 to 12.31	00.00	RW	Uni			PT			✓
x.37	Real time clock years	2000 to 2099	2000	RW	Uni			PT			✓
x.38	Analog input 1 mode	0-20 (0), 20-0 (1), 4-20.tr (2), 20-4.tr (3), 4-20 (4), 20-4 (5), VOLt(6)	0-20 (0)	RW	Txt				US	✓	✓
x.39	Analog output mode	0-20 (0), 20-0 (1), 4-20 (2), 20-4 (3), VOLt (4)	0-20 (0)	RW	Txt				US	✓	✓
x.40	Analog input 1	±100.0%		RO	Bi		NC	PT		✓	✓
x.41	Analog input 1 scaling	0 to 4.000	1.000	RW	Uni				US	✓	✓
x.42	Analog input 1 invert	OFF (0) or On (1)	OFF (0)	RW	Bit				US	✓	✓
x.43	Analog input 1 destination	Pr **0.00** to Pr	Pr **0.00**	RW	Uni	DE		PT	US	✓	✓
x.48	Analog output 1 source	Pr **0.00** to Pr	Pr **0.00**	RW	Uni			PT	US	✓	✓
x.49	Analog output 1 scaling	0.000 to 4.000	1.000	RW	Uni				US	✓	✓
x.50	Solutions Module error status*	0 to 255		RO	Uni		NC	PT		✓	✓
x.51	Solutions Module software sub-version	0 to 99		RO	Uni		NC	PT		✓	✓

RW	Read / Write	RO	Read only	Uni	Unipolar	Bi	Bi-polar	Bit	Bit parameter	Txt	Text string		
FI	Filtered	DE	Destination	NC	Not copied	RA	Rating dependent	PT	Protected	US	User save	PS	Power down save

*See trip SLX.Er, *Automation (I/O Expansion) module category* on page 35.

Figure 8-26 SM-I/O PELV digital I/O logic diagram



The parameters are all shown at their default setting

Figure 8-27 SM-I/O PELV digital input logic diagram

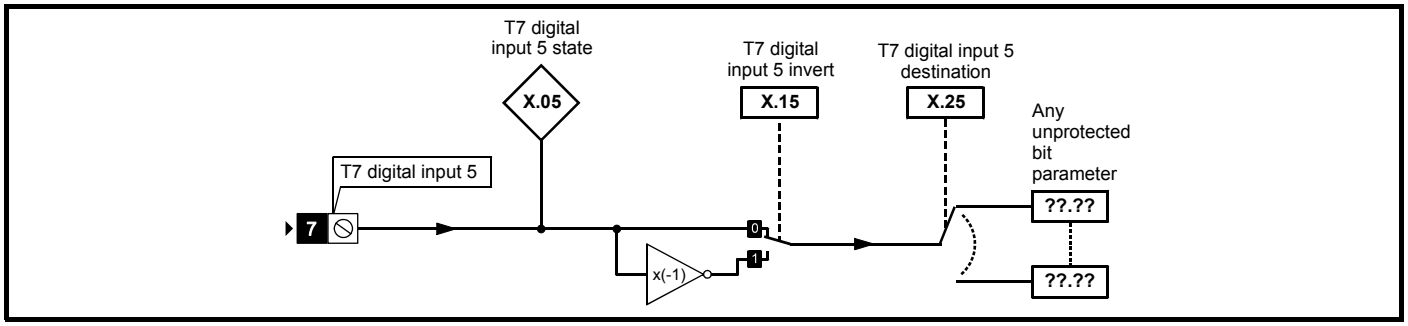
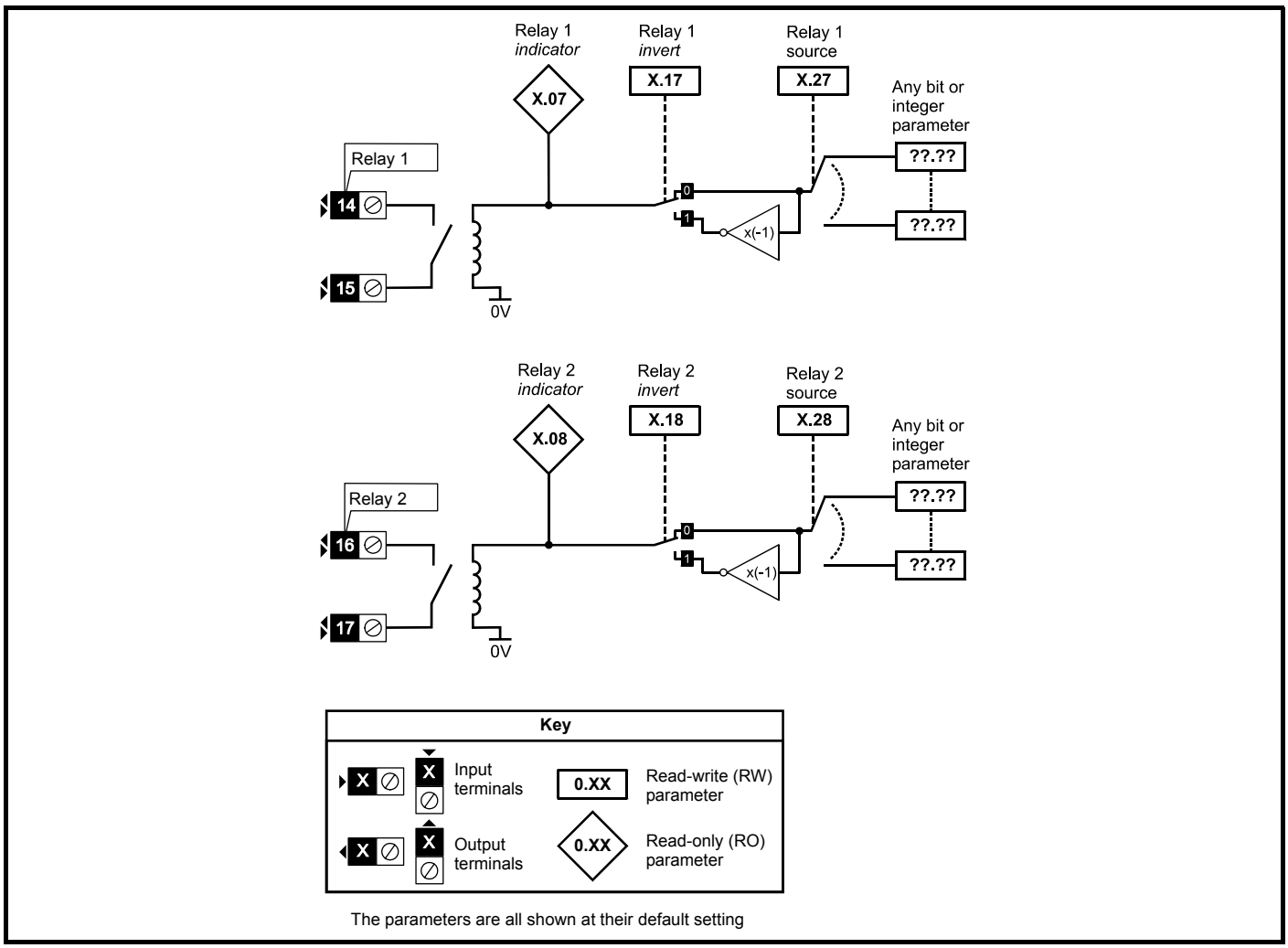


Figure 8-28 SM-I/O PELV relay logic diagram



The parameters are all shown at their default setting

Figure 8-29 SM-I/O PELV analog input logic diagram

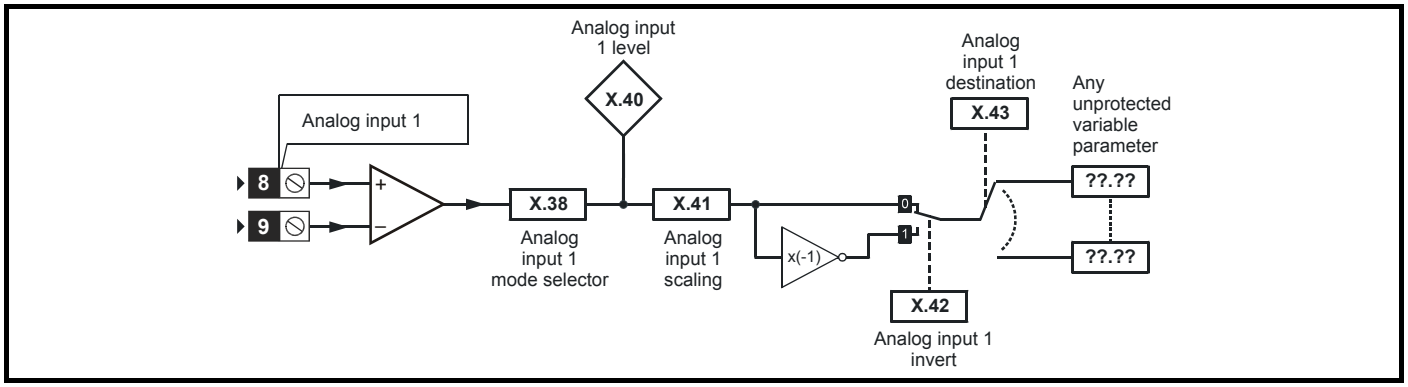
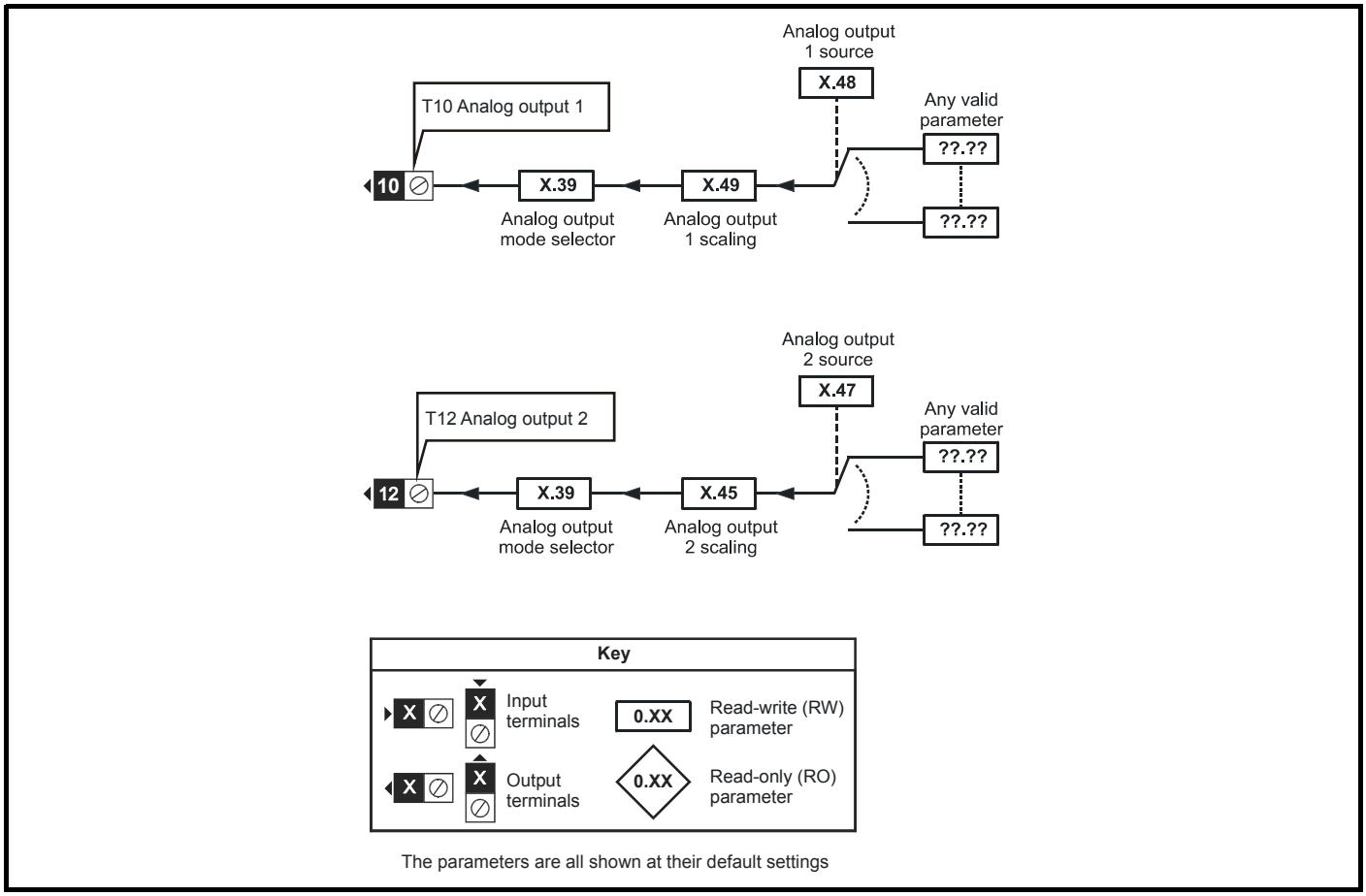


Figure 8-30 SM-I/O PELV analog output logic diagram



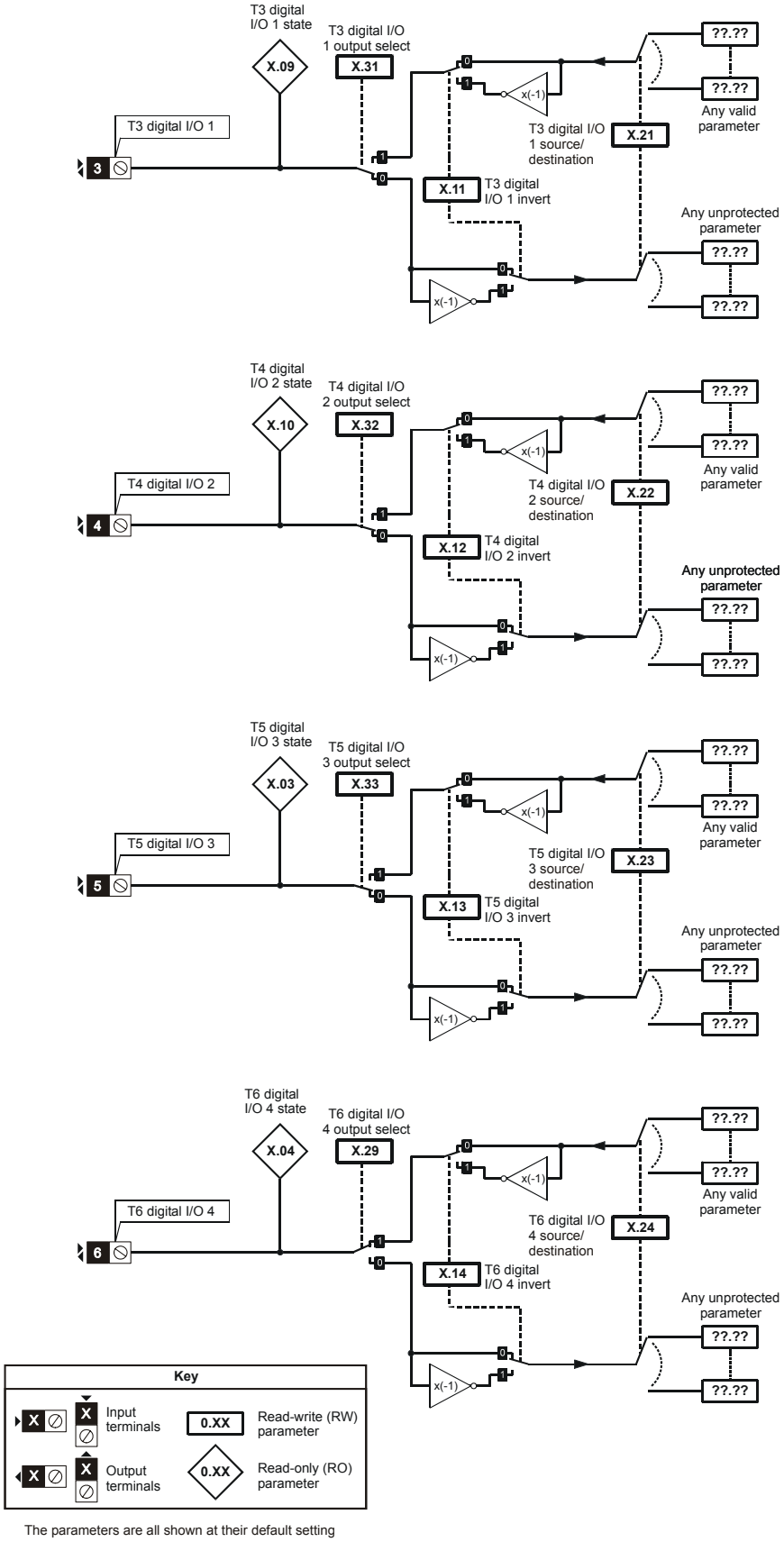
SM-I/O PELV parameters

Parameter		Range(⇳)	Default(⇨)	Type					
x.01	Solutions Module ID	0 to 599	204	RO	Uni			PT	US
x.02	Solutions Module software version	0.00 to 99.99		RO	Uni		NC	PT	
x.03	T5 digital I/O 3 state	OFF (0) or On (1)		RO	Bit		NC	PT	
x.04	T6 digital I/O 4 state	OFF (0) or On (1)		RO	Bit		NC	PT	
x.05	T7 digital input 5 state	OFF (0) or On (1)		RO	Bit		NC	PT	
x.07	Relay 1 state	OFF (0) or On (1)		RO	Bit		NC	PT	
x.08	Relay 2 state	OFF (0) or On (1)		RO	Bit		NC	PT	
x.09	T3 digital I/O 1 state	OFF (0) or On (1)		RO	Bit		NC	PT	
x.10	T4 digital I/O 2 state	OFF (0) or On (1)		RO	Bit		NC	PT	
x.11	T3 digital I/O 1 invert	OFF (0) or On (1)	OFF (0)	RW	Bit				US
x.12	T4 digital I/O 2 invert	OFF (0) or On (1)	OFF (0)	RW	Bit				US
x.13	T5 digital I/O 3 invert	OFF (0) or On (1)	OFF (0)	RW	Bit				US
x.14	T6 digital I/O 4 invert	OFF (0) or On (1)	OFF (0)	RW	Bit				US
x.15	T7 digital input 5 invert	OFF (0) or On (1)	OFF (0)	RW	Bit				US
x.16	Disable PELV User power supply absent trip	OFF (0) or On (1)	OFF (0)	RW	Bit				US
x.17	Relay 1 invert	OFF (0) or On (1)	OFF (0)	RW	Bit				US
x.18	Relay 2 invert	OFF (0) or On (1)	OFF (0)	RW	Bit				US
x.19	Freeze flag	OFF (0) or On (1)	OFF (0)	RW	Bit				US
x.20	Digital I/O read word	0 to 255		RO	Uni		NC	PT	
x.21	T3 digital I/O 1 source/destination	Pr **0.00** to Pr	Pr **0.00**	RW	Uni	DE		PT	US
x.22	T4 digital I/O 2 source/destination	Pr **0.00** to Pr	Pr **0.00**	RW	Uni	DE		PT	US
x.23	T5 digital I/O 3 source/destination	Pr **0.00** to Pr	Pr **0.00**	RW	Uni	DE		PT	US
x.24	T6 digital I/O 4 source/destination	Pr **0.00** to Pr	Pr **0.00**	RW	Uni	DE		PT	US
x.25	T7 digital input 5 destination	Pr **0.00** to Pr	Pr **0.00**	RW	Uni	DE		PT	US
x.27	Relay 1 source	Pr **0.00** to Pr	Pr **0.00**	RW	Uni			PT	US
x.28	Relay 2 source	Pr **0.00** to Pr	Pr **0.00**	RW	Uni			PT	US
x.29	T6 digital I/O 4 output select	OFF (0) or On (1)	On (1)	RW	Bit				US
x.31	T3 digital I/O 1 output select	OFF (0) or On (1)	OFF (0)	RW	Bit				US
x.32	T4 digital I/O 2 output select	OFF (0) or On (1)	OFF (0)	RW	Bit				US
x.33	T5 digital I/O 3 output select	OFF (0) or On (1)	OFF (0)	RW	Bit				US
x.38	Analog input 1 mode	0-20 (0), 20-0 (1), 4-20.tr (2), 20-4.tr (3), 4-20 (4), 20-4 (5)	0-20 (0)	RW	Txt				US
x.39	Analog output mode	0-20 (0), 20-0 (1), 4-20 (2), 20-4 (3)	0-20 (0)	RW	Txt				US
x.40	Analog input 1 level	0.0 to 100.0%		RO	Bi		NC	PT	
x.41	Analog input 1 scaling	0.000 to 4.000	1.000	RW	Uni				US
x.42	Analog input 1 invert	OFF (0) or On (1)	OFF (0)	RW	Bit				US
x.43	Analog input 1 destination	Pr **0.00** to Pr	Pr **0.00**	RW	Uni	DE		PT	US
x.45	Analog output 2 scaling	0.000 to 4.000	1.000	RW	Uni				US
x.47	Analog output 2 source	Pr **0.00** to Pr	Pr **0.00**	RW	Uni			PT	US
x.48	Analog output 1 source	Pr **0.00** to Pr	Pr **0.00**	RW	Uni			PT	US
x.49	Analog output 1 scaling	0.000 to 4.000	1.000	RW	Uni				US
x.50	Solutions Module error status*	0 to 255		RO	Uni		NC	PT	
x.51	Solutions Module software sub-version	0 to 99		RO	Uni		NC	PT	

RW	Read / Write	RO	Read only	Uni	Unipolar	Bi	Bi-polar	Bit	Bit parameter	Txt	Text string		
FI	Filtered	DE	Destination	NC	Not copied	RA	Rating dependent	PT	Protected	US	User save	PS	Power down save

*See trip SLX.Er, *Automation (I/O Expansion) module category* on page 35.

Figure 8-31 SM-I/O 24V Protected digital I/O logic diagram



The parameters are all shown at their default setting

Figure 8-32 SM-I/O 24V Protected digital I/O logic diagram

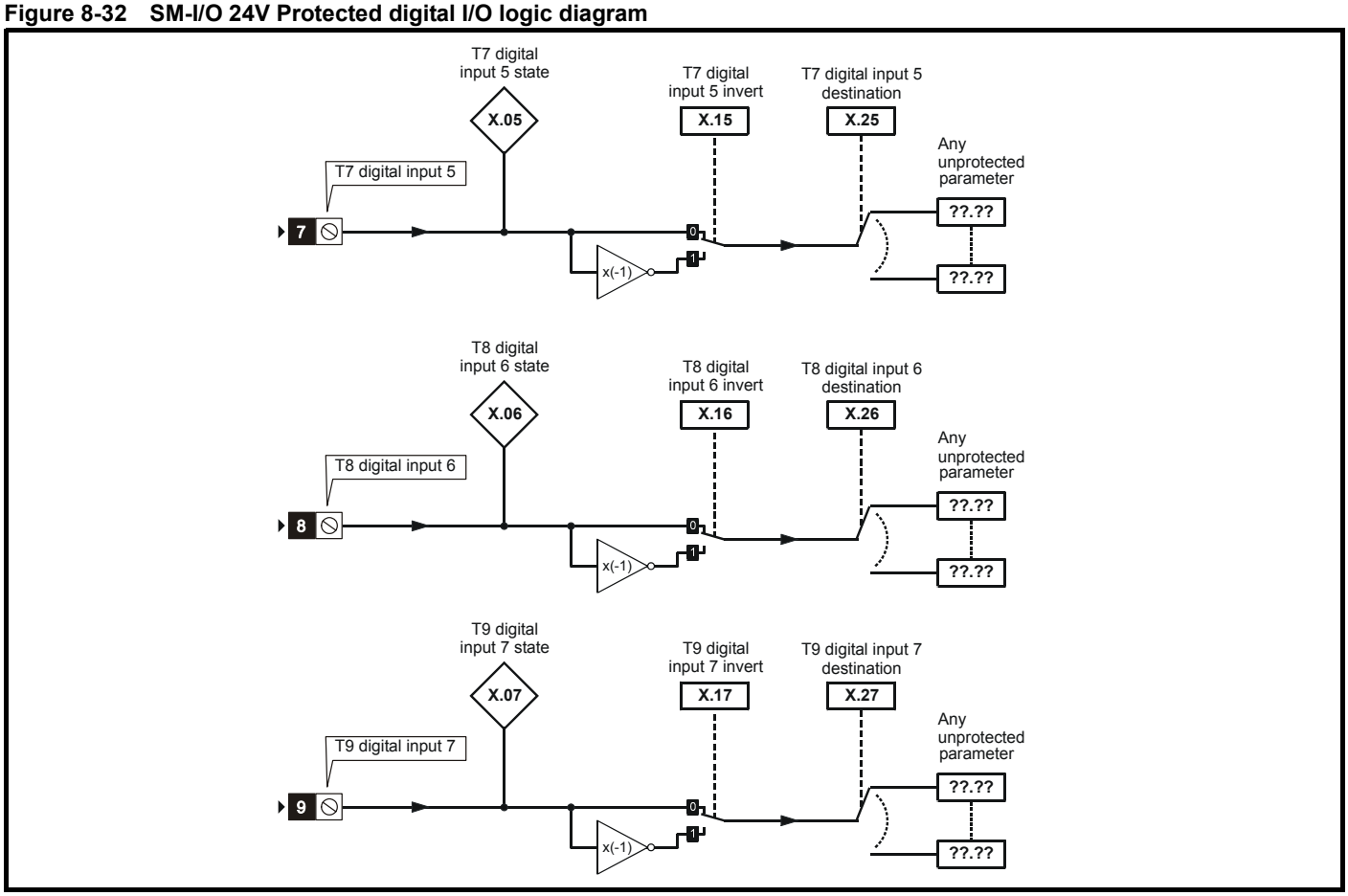


Figure 8-33 SM-I/O 24V Protected relay logic diagram

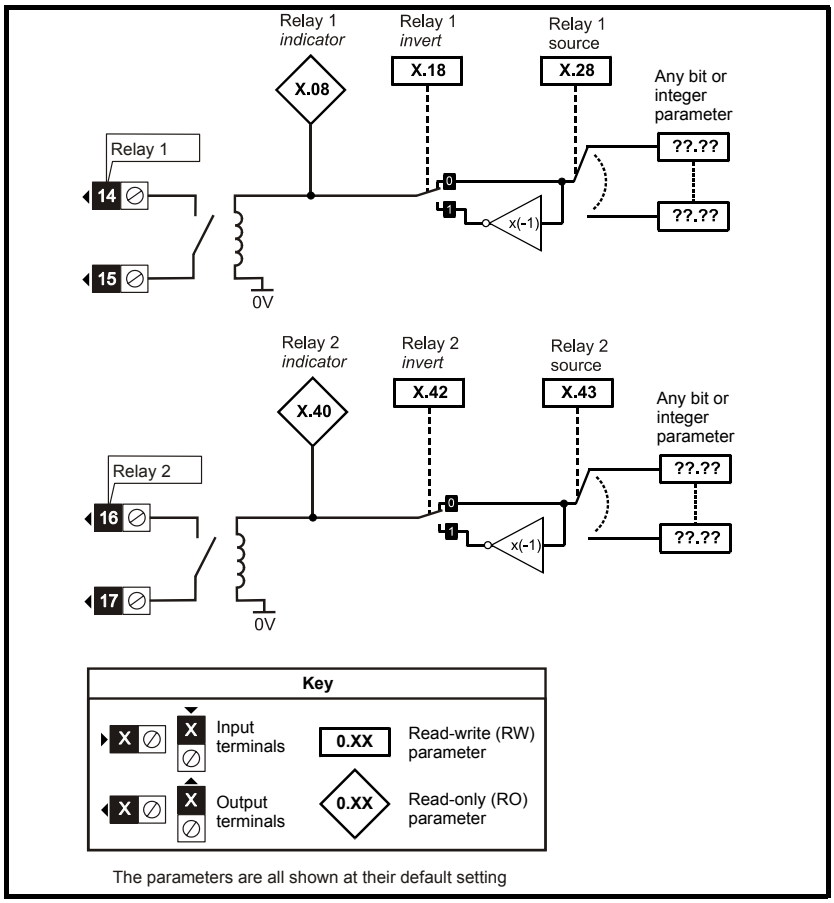
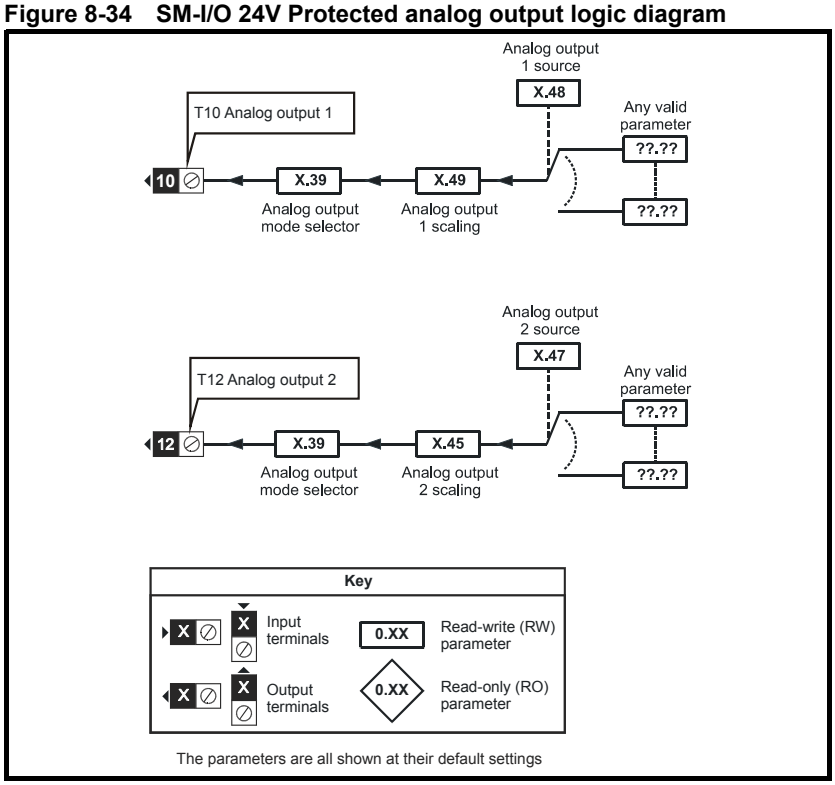


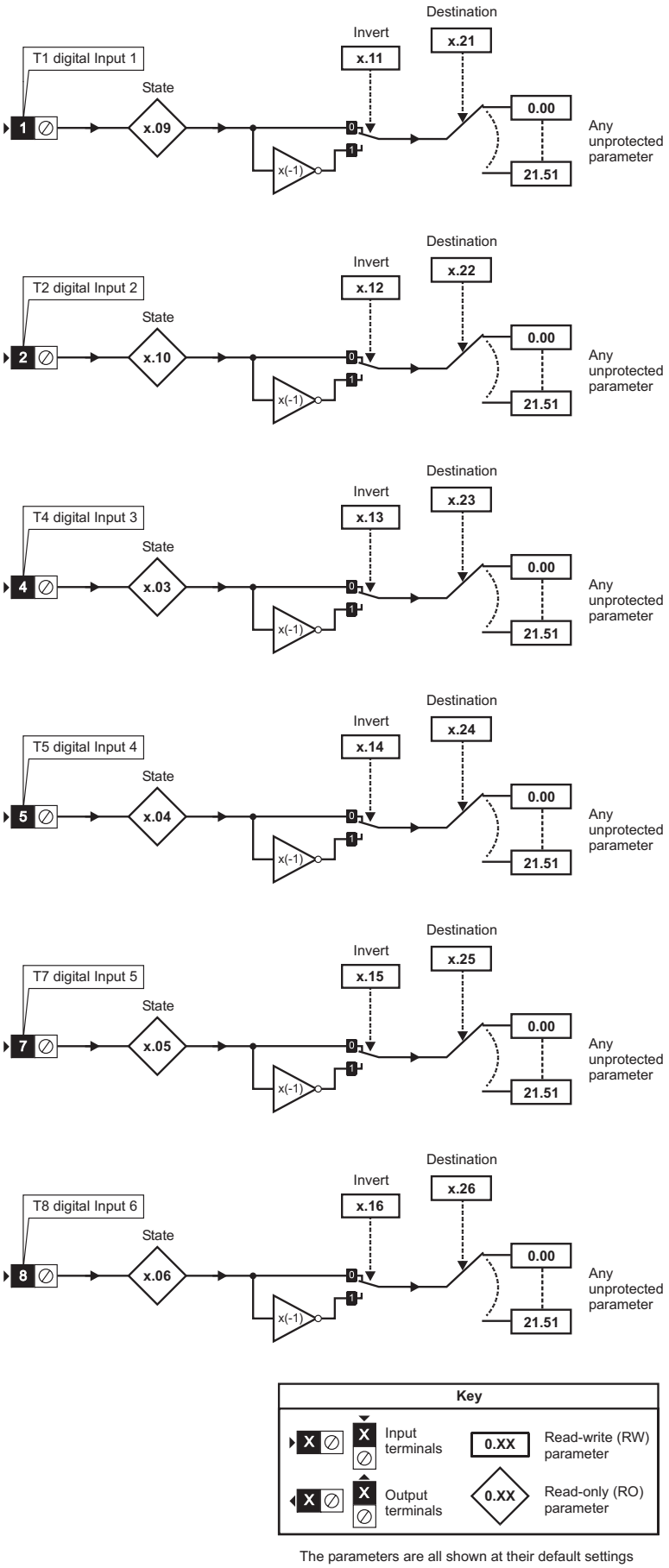
Figure 8-34 SM-I/O 24V Protected analog output logic diagram



SM-I/O 24V Protected parameters

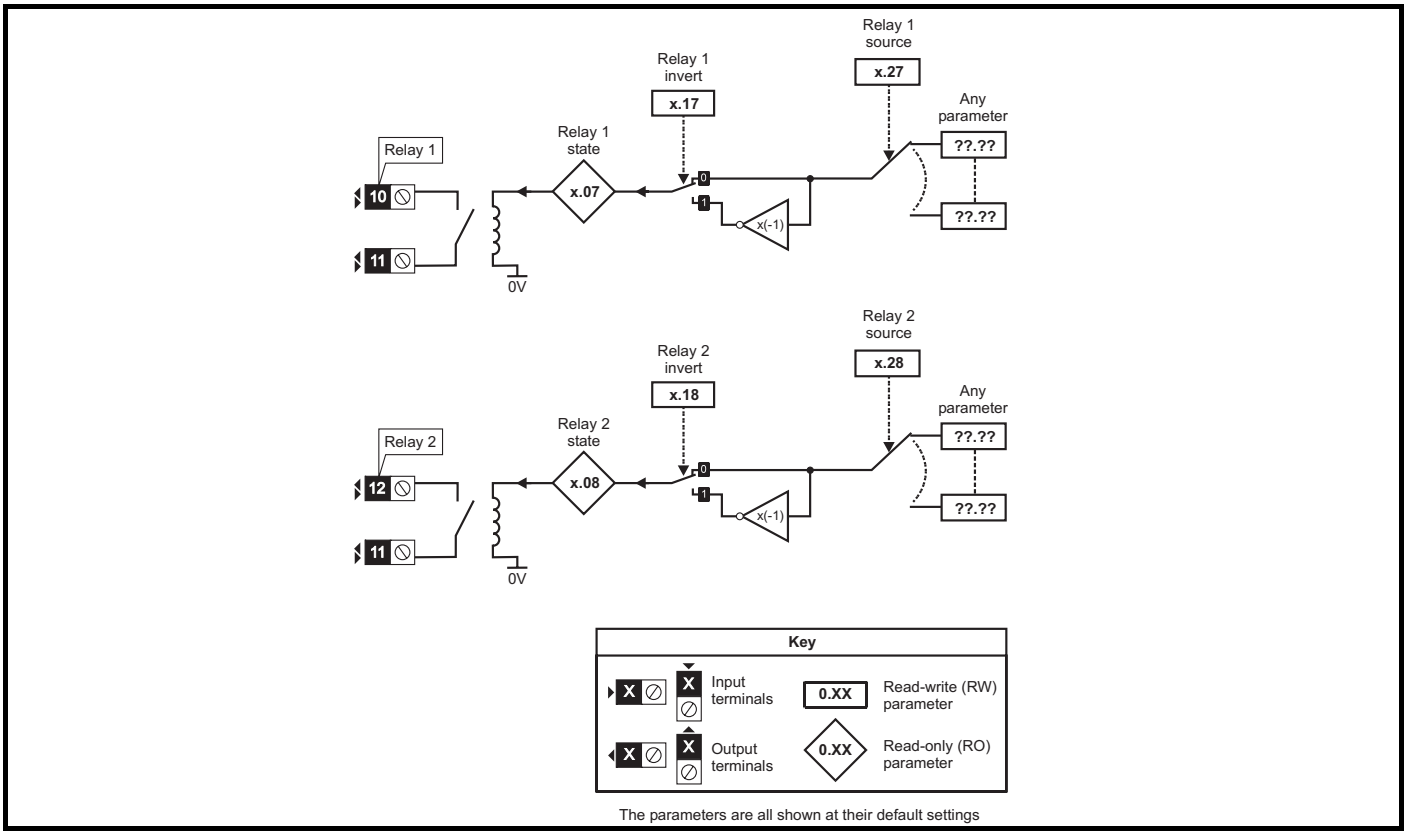
	Parameter	Range(⇳)	Default(⇨)	Type					
x.01	Solutions Module ID	0 to 599	205	RO	Uni			PT	US
x.02	Solutions Module Main Software Version	0.00 to 99.99		RO	Uni		NC	PT	
x.03	T5 digital I/O 3 state	OFF (0) or On (1)		RO	Bit		NC	PT	
x.04	T6 digital I/O 4 state	OFF (0) or On (1)		RO	Bit		NC	PT	
x.05	T7 digital input 5 state	OFF (0) or On (1)		RO	Bit		NC	PT	
x.06	T8 digital input 6 state	OFF (0) or On (1)		RO	Bit		NC	PT	
x.07	T9 digital input 7 state	OFF (0) or On (1)		RO	Bit		NC	PT	
x.08	Relay 1 state	OFF (0) or On (1)		RO	Bit		NC	PT	
x.09	T3 digital I/O 1 state	OFF (0) or On (1)		RO	Bit		NC	PT	
x.10	T4 digital I/O 2 state	OFF (0) or On (1)		RO	Bit		NC	PT	
x.11	T3 digital I/O 1 invert	OFF (0) or On (1)	OFF (0)	RW	Bit				US
x.12	T4 digital I/O 2 invert	OFF (0) or On (1)	OFF (0)	RW	Bit				US
x.13	T5 digital I/O 3 invert	OFF (0) or On (1)	OFF (0)	RW	Bit				US
x.14	T6 digital I/O 4 invert	OFF (0) or On (1)	OFF (0)	RW	Bit				US
x.15	T7 digital input 5 invert	OFF (0) or On (1)	OFF (0)	RW	Bit				US
x.16	T8 digital input 6 invert	OFF (0) or On (1)	OFF (0)	RW	Bit				US
x.17	T9 digital input 7 invert	OFF (0) or On (1)	OFF (0)	RW	Bit				US
x.18	Relay 1 invert	OFF (0) or On (1)	OFF (0)	RW	Bit				US
x.20	Digital I/O read word	0 to 255		RO	Uni		NC	PT	
x.21	T3 digital I/O 1 source/destination	Pr **0.00** to Pr	Pr **0.00**	RW	Uni	DE			US
x.22	T4 digital I/O 2 source/destination	Pr **0.00** to Pr	Pr **0.00**	RW	Uni	DE			US
x.23	T5 digital I/O 3 source/destination	Pr **0.00** to Pr	Pr **0.00**	RW	Uni	DE			US
x.24	T6 digital I/O 4 source/destination	Pr **0.00** to Pr	Pr **0.00**	RW	Uni	DE			US
x.25	T7 digital input 5 destination	Pr **0.00** to Pr	Pr **0.00**	RW	Uni	DE			US
x.26	T8 digital input 6 destination	Pr **0.00** to Pr	Pr **0.00**	RW	Uni	DE			US
x.27	T9 digital input 7 destination	Pr **0.00** to Pr	Pr **0.00**	RW	Uni	DE			US
x.28	Relay 1 source	Pr **0.00** to Pr	Pr **0.00**	RW	Uni				US
x.29	T6 digital I/O 4 output select	OFF (0) or On (1)	On (1)	RW	Bit				US
x.31	T3 digital I/O 1 output select	OFF (0) or On (1)	OFF (0)	RW	Bit				US
x.32	T4 digital I/O 2 output select	OFF (0) or On (1)	OFF (0)	RW	Bit				US
x.33	T5 digital I/O 3 output select	OFF (0) or On (1)	OFF (0)	RW	Bit				US
x.39	Analog output mode	0-20, 20-0, 4-20, 20-4	0-20	RW	Uni				US
x.40	Relay 2 state	0.0 or 100.0 %		RO	Bit		NC	PT	
x.42	Relay 2 invert	OFF (0) or On (1)	OFF (0)	RW	Bit				US
x.43	Relay 2 source	Pr **0.00** to Pr	Pr **0.00**	RW	Uni				US
x.45	Analog output 2 scaling	0.000 to 4.000	1.000	RW	Uni				US
x.47	Analog output 2 source	Pr **0.00** to Pr	Pr **0.00**	RW	Uni				US
x.48	Analog output 1 source	Pr **0.00** to Pr	Pr **0.00**	RW	Uni				US
x.49	Analog output 1 scaling	0.000 to 4.000	1.000	RW	Uni				US
x.50	Solutions Module error status	0 to 255		RO	Uni		NC	PT	
x.51	Solutions Module software sub-version	0 to 99		RO	Uni		NC	PT	

Figure 8-35 SM-I/O 120V digital input logic diagram



The parameters are all shown at their default settings

Figure 8-36 SM-I/O 120V relay diagram



The parameters are all shown at their default settings

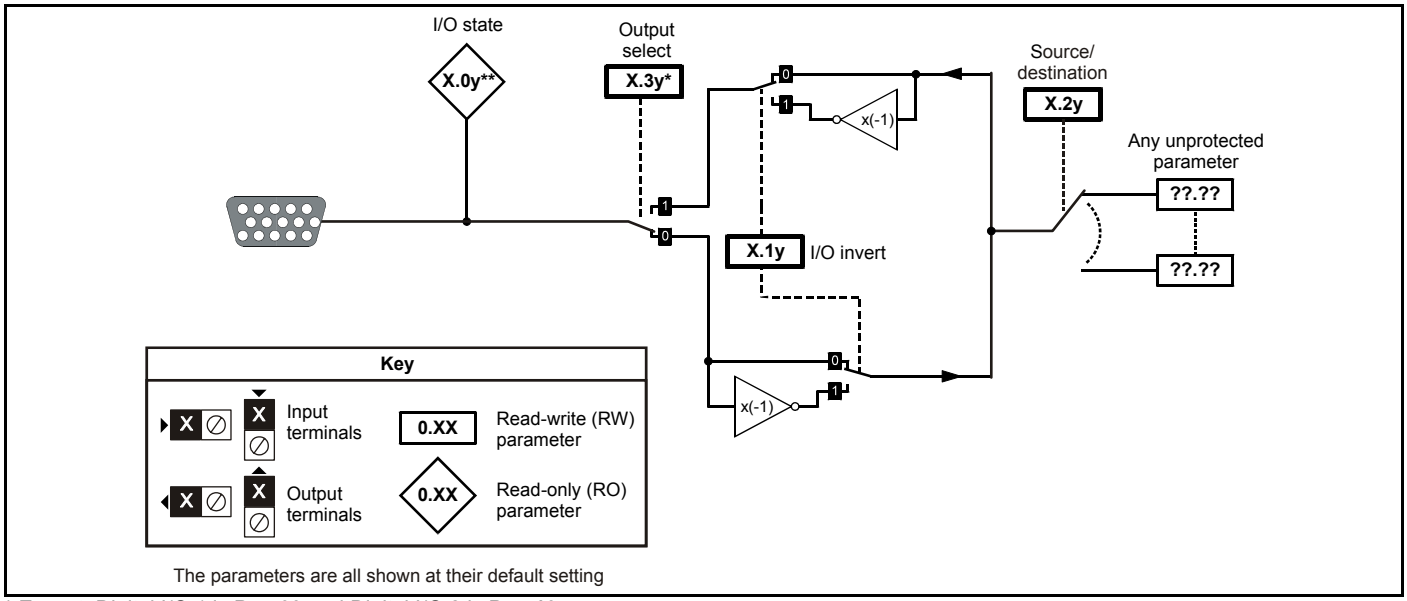
SM-I/O 120V parameters

Parameter		Range(⇳)	Default(⇨)	Type					
x.01	Solutions Module ID	0 to 599	206	RO	Uni			PT	US
x.02	Solutions Module software version	0.00 to 99.99		RO	Uni		NC	PT	
x.03	T4 digital input 3 state	OFF (0) or On (1)		RO	Bit		NC	PT	
x.04	T5 digital input 4 state	OFF (0) or On (1)		RO	Bit		NC	PT	
x.05	T7 digital input 5 state	OFF (0) or On (1)		RO	Bit		NC	PT	
x.06	T8 digital input 6 state	OFF (0) or On (1)		RO	Bit		NC	PT	
x.07	Relay 1 state	OFF (0) or On (1)		RO	Bit		NC	PT	
x.08	Relay 2 state	OFF (0) or On (1)		RO	Bit		NC	PT	
x.09	T1 digital input 1 state	OFF (0) or On (1)		RO	Bit		NC	PT	
x.10	T2 digital input 2 state	OFF (0) or On (1)		RO	Bit		NC	PT	
x.11	T1 digital input 1 invert	OFF (0) or On (1)	OFF (0)	RW	Bit				US
x.12	T2 digital input 2 invert	OFF (0) or On (1)	OFF (0)	RW	Bit				US
x.13	T4 digital input 3 invert	OFF (0) or On (1)	OFF (0)	RW	Bit				US
x.14	T5 digital input 4 invert	OFF (0) or On (1)	OFF (0)	RW	Bit				US
x.15	T7 digital input 5 invert	OFF (0) or On (1)	OFF (0)	RW	Bit				US
x.16	T8 digital input 6 invert	OFF (0) or On (1)	OFF (0)	RW	Bit				US
x.17	Relay 1 invert	OFF (0) or On (1)	OFF (0)	RW	Bit				US
x.18	Relay 2 invert	OFF (0) or On (1)	OFF (0)	RW	Bit				US
x.20	Digital I/O read word	0 to 255		RO	Uni		NC	PT	
x.21	T1 digital input 1 destination	Pr **0.00** to Pr **21.51**	Pr **0.00**	RW	Uni	DE		PT	US
x.22	T2 digital input 2 destination	Pr **0.00** to Pr **21.51**	Pr **0.00**	RW	Uni	DE		PT	US
x.23	T4 digital input 3 destination	Pr **0.00** to Pr **21.51**	Pr **0.00**	RW	Uni	DE		PT	US
x.24	T5 digital input 4 destination	Pr **0.00** to Pr **21.51**	Pr **0.00**	RW	Uni	DE		PT	US
x.25	T7 digital input 5 destination	Pr **0.00** to Pr **21.51**	Pr **0.00**	RW	Uni	DE		PT	US
x.26	T8 digital input 6 destination	Pr **0.00** to Pr **21.51**	Pr **0.00**	RW	Uni	DE		PT	US
x.27	Relay 1 source	Pr **0.00** to Pr **21.51**	Pr **0.00**	RW	Uni			PT	US
x.28	Relay 2 source	Pr **0.00** to Pr **21.51**	Pr **0.00**	RW	Uni			PT	US
x.50	Solutions Module error status*	0 to 255		RO	Uni		NC	PT	
x.51	Solutions Module software sub-version	0 to 99		RO	Uni		NC	PT	

RW	Read / Write	RO	Read only	Uni	Unipolar	Bi	Bi-polar	Bit	Bit parameter	Txt	Text string		
FI	Filtered	DE	Destination	NC	Not copied	RA	Rating dependent	PT	Protected	US	User save	PS	Power down save

*See trip SLX.Er, *Automation (I/O Expansion) module category* on page 35.

Figure 8-37 SM-I/O 32 logic diagram



* Except: Digital I/O 1 is Pr **x.09** and Digital I/O 2 is Pr **x.10**

** Except: Digital I/O 4 is Pr **x.29**

SM-I/O 32 parameters

Parameter		Range(⇳)	Default(⇨)	Type					
x.01	Solutions Module ID	0 to 599	208	RO	Uni			PT	US
x.02	Solutions Module software version	0.00 to 99.99		RO	Uni		NC	PT	
x.03	I/O 3 state	OFF (0) or On (1)		RO	Bit		NC	PT	
x.04	I/O 4 state	OFF (0) or On (1)		RO	Bit		NC	PT	
x.05	I/O 5 state	OFF (0) or On (1)		RO	Bit		NC	PT	
x.06	I/O 6 state	OFF (0) or On (1)		RO	Bit		NC	PT	
x.07	I/O 7 state	OFF (0) or On (1)		RO	Bit		NC	PT	
x.08	I/O 8 state	OFF (0) or On (1)		RO	Bit		NC	PT	
x.09	I/O 1 state	OFF (0) or On (1)		RO	Bit		NC	PT	
x.10	I/O 2 state	OFF (0) or On (1)		RO	Bit		NC	PT	
x.11	I/O 1 invert	OFF (0) or On (1)	OFF (0)	RW	Bit				US
x.12	I/O 2 invert	OFF (0) or On (1)	OFF (0)	RW	Bit				US
x.13	I/O 3 invert	OFF (0) or On (1)	OFF (0)	RW	Bit				US
x.14	I/O 4 invert	OFF (0) or On (1)	OFF (0)	RW	Bit				US
x.15	I/O 5 invert	OFF (0) or On (1)	OFF (0)	RW	Bit				US
x.16	I/O 6 invert	OFF (0) or On (1)	OFF (0)	RW	Bit				US
x.17	I/O 7 invert	OFF (0) or On (1)	OFF (0)	RW	Bit				US
x.18	I/O 8 invert	OFF (0) or On (1)	OFF (0)	RW	Bit				US
x.20	Digital I/O read word	0 to 255		RO	Uni		NC	PT	
x.21	I/O 1 source/destination	Pr **0.00** to Pr **21.51**	Pr **0.00**	RW	Uni			PT	US
x.22	I/O 2 source/destination	Pr **0.00** to Pr **21.51**	Pr **0.00**	RW	Uni			PT	US
x.23	I/O 3 source/destination	Pr **0.00** to Pr **21.51**	Pr **0.00**	RW	Uni			PT	US
x.24	I/O 4 source/destination	Pr **0.00** to Pr **21.51**	Pr **0.00**	RW	Uni			PT	US
x.25	I/O 5 source/destination	Pr **0.00** to Pr **21.51**	Pr **0.00**	RW	Uni			PT	US
x.26	I/O 6 source/destination	Pr **0.00** to Pr **21.51**	Pr **0.00**	RW	Uni			PT	US
x.27	I/O 7 source/destination	Pr **0.00** to Pr **21.51**	Pr **0.00**	RW	Uni			PT	US
x.28	I/O 8 source/destination	Pr **0.00** to Pr **21.51**	Pr **0.00**	RW	Uni			PT	US
x.29	Digital output 4 select	OFF (0) or On (1)	OFF (0)	RW	Bit			PT	US
x.31	Digital output 1 select	OFF (0) or On (1)	OFF (0)	RW	Bit			PT	US
x.32	Digital output 2 select	OFF (0) or On (1)	OFF (0)	RW	Bit			PT	US
x.33	Digital output 3 select	OFF (0) or On (1)	OFF (0)	RW	Bit			PT	US
x.43	Fast update method direction marker	Pr **0.00** to Pr **21.51**	Pr **0.00**	RW	Uni			PT	US
x.47	Fast update method read register	Pr **0.00** to Pr **21.51**	Pr **0.00**	RW	Uni			PT	US
x.48	Fast update method write register	Pr **0.00** to Pr **21.51**	Pr **0.00**	RW	Uni			PT	US
x.50	Solutions Module error status*	0 to 255		RO	Uni		NC	PT	
x.51	Solutions Module software sub-version	0 to 99		RO	Uni		NC	PT	

RW	Read / Write	RO	Read only	Uni	Unipolar	Bi	Bi-polar	Bit	Bit parameter	Txt	Text string		
FI	Filtered	DE	Destination	NC	Not copied	RA	Rating dependent	PT	Protected	US	User save	PS	Power down save

*See trip SLX.Er, *Automation (I/O Expansion) module category* on page 35.

8.15.3 Fieldbus module category

Fieldbus module parameters

Parameter		Range(⇳)	Default(⇨)	Type				
x.01	Solutions Module ID	0 to 599		RO	Uni			PT	US
x.02	Solutions Module software version	0.00 to 99.99		RO	Uni		NC	PT	
x.03	Fieldbus Node Address	65,535	65,535	RW	Uni				US
x.04	Fieldbus Baud Rate	-128 to +127	0	RW	Bi				US
x.05	Mode	65,535	4	RW	Uni				US
x.06	Fieldbus Diagnostic	±9,999		RO	Bi		NC	PT	
x.07	Trip Delay Time	0 to 3,000	200	RW	Uni				US
x.08	Little endianism select	OFF (0) or On (1)	On (1)	RW	Bit				US
x.09	Register control	OFF (0) or On (1)	OFF (0)	RW	Bit				US
x.10 to x.19	'I' data registers 0 - 9	-32,768 to +32,767		RW	Bi				
x.20 to x.29	'O' data registers 0 - 9	-32,768 to +32,767		RW	Bi				
x.30	Load Solutions Module defaults	OFF (0) or On (1)	OFF (0)	RW	Bit				US
x.31	Save Solutions Module parameters	OFF (0) or On (1)	OFF (0)	RW	Bit				US
x.32	Request to reinitialise	OFF (0) or On (1)	OFF (0)	RW	Bit				
x.33	Download from Fieldbus Solutions Module	OFF (0) or On (1)	OFF (0)	RW	Bit				
x.34	Compression	OFF (0) or On (1)	OFF (0)	RW	Bit				US
x.35	Serial number	-2,147,483,648 to 2,147,483,647		RO	Bi		NC	PT	
x.36 to x.37	Fieldbus specific	OFF (0) or On (1)	OFF (0)	RW	Bit				US
x.38	Fieldbus specific defined mode	0 to 255	0	RW	Uni				US
x.39	Cyclic input configuration	0 to 255	0	RW	Uni				US
x.40	Cyclic output configuration	0 to 255	0	RW	Uni				US
x.41 to x.43	Fieldbus specific	0 to 255	0	RW	Uni				US
x.44 to x.48	Fieldbus specific	0 to 255	0	RO	Uni			PT	
x.49	Mapping error status	0 to 255	0	RO	Uni			PT	
x.50	Solutions Module error status*	0 to 255		RO	Uni		NC	PT	

RW	Read / Write	RO	Read only	Uni	Unipolar	Bi	Bi-polar	Bit	Bit parameter	Txt	Text string		
FI	Filtered	DE	Destination	NC	Not copied	RA	Rating dependent	PT	Protected	US	User save	PS	Power down save

*See trip SLX.Er, *Fieldbus module category* on page 35.

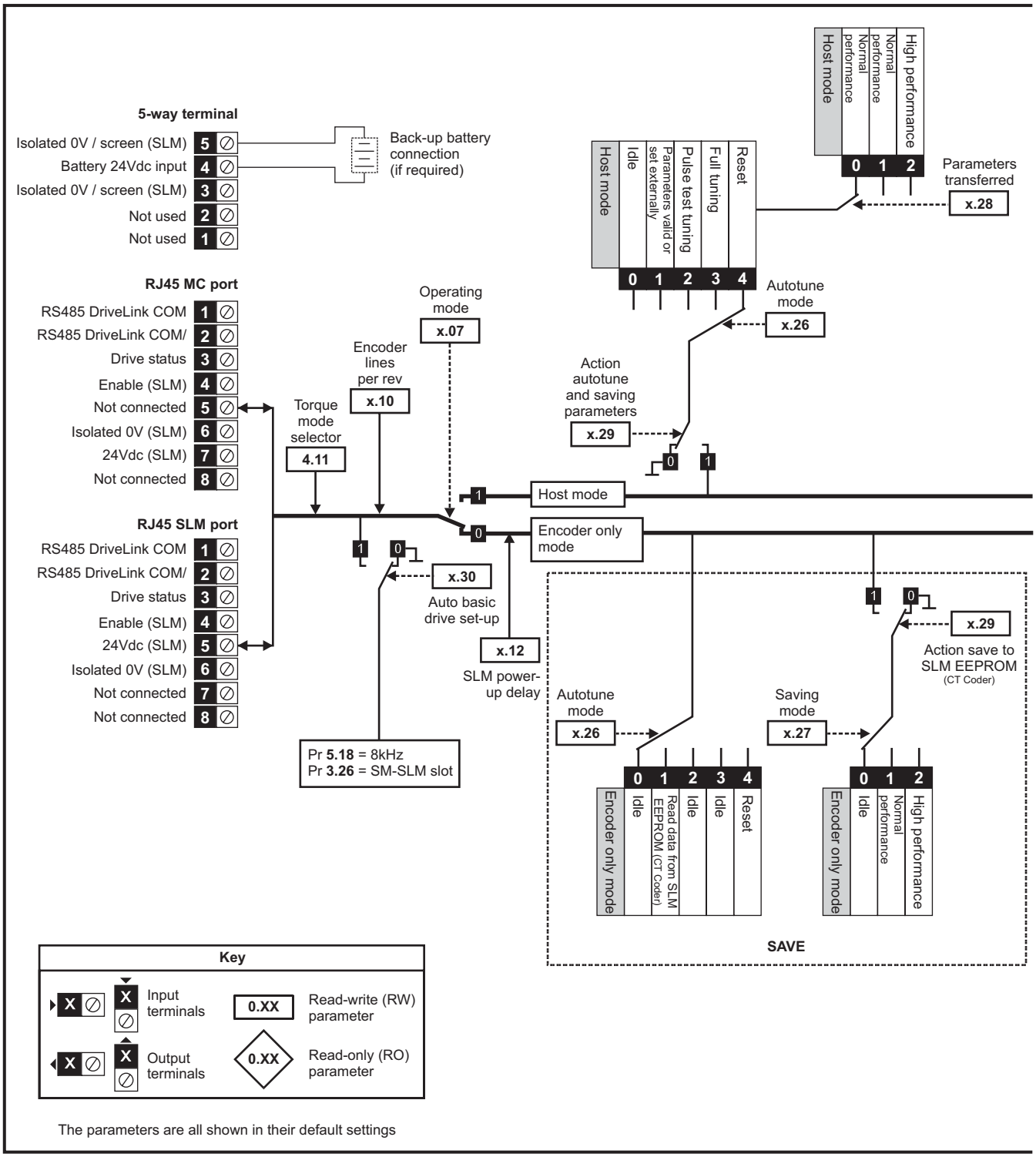
8.15.4 SM-LON

Parameter		Range(⇳)	Default(⇨)	Type					
x.01	Solutions Module ID	0 to 599	401	RO	Uni			PT	US
x.02	Solutions Module software version	0.00 to 99.99		RO	Uni		NC	PT	
x.03	Node ID	0 to 127	0	RW	Uni				
x.06	Option module diagnostic information	-9999 to 9999	0	RW	Uni				
x.07	Network loss trip	0 to 1	0	RW	Uni				
x.10	Subnet ID	0 to 255	0	RW	Uni				
x.11	Domain ID length	0 to 6	0	RW	Uni				
x.12	Domain ID byte 1	0 to 255	0	RW	Uni				
x.13	Domain ID byte 2	0 to 255	0	RW	Uni				
x.14	Domain ID byte 3	0 to 255	0	RW	Uni				
x.15	Domain ID byte 4	0 to 255	0	RW	Uni				
x.16	Domain ID byte 5	0 to 255	0	RW	Uni				
x.17	Domain ID byte 6	0 to 255	0	RW	Uni				
x.30	Load Option Defaults	Off (0) or On (1)	Off (0)	RW	Bit				
x.31	Save option parameters	Off (0) or On (1)	Off (0)	RW	Bit				
x.32	Request to re-initialise	Off (0) or On (1)	Off (0)	RW	Bit				
x.33	Restore parameters from option module	Off (0) or On (1)	Off (0)	RW	Bit				
x.34	Initialise drive reference selectors	Off (0) or On (1)	Off (0)	RW	Bit				
x.35	Option module serial number	-2147483648 to 2147483647		RO	Bi		NC	PT	
x.36	Transmit service pin message	Off (0) or On (1)	Off (0)	RW	Bit				
x.37	Wink active	Off (0) or On (1)	Off (0)	RW	Bit				
x.38	Unconfigure option module	0 to 1	0	RW	Uni				
x.39	Default configuration property storage	0 to 1	0	RW	Uni				
x.50	Module error status	0 to 255		RO	Uni		NC	PT	
x.51	Module software sub-version	0 to 99		RO	Uni		NC	PT	

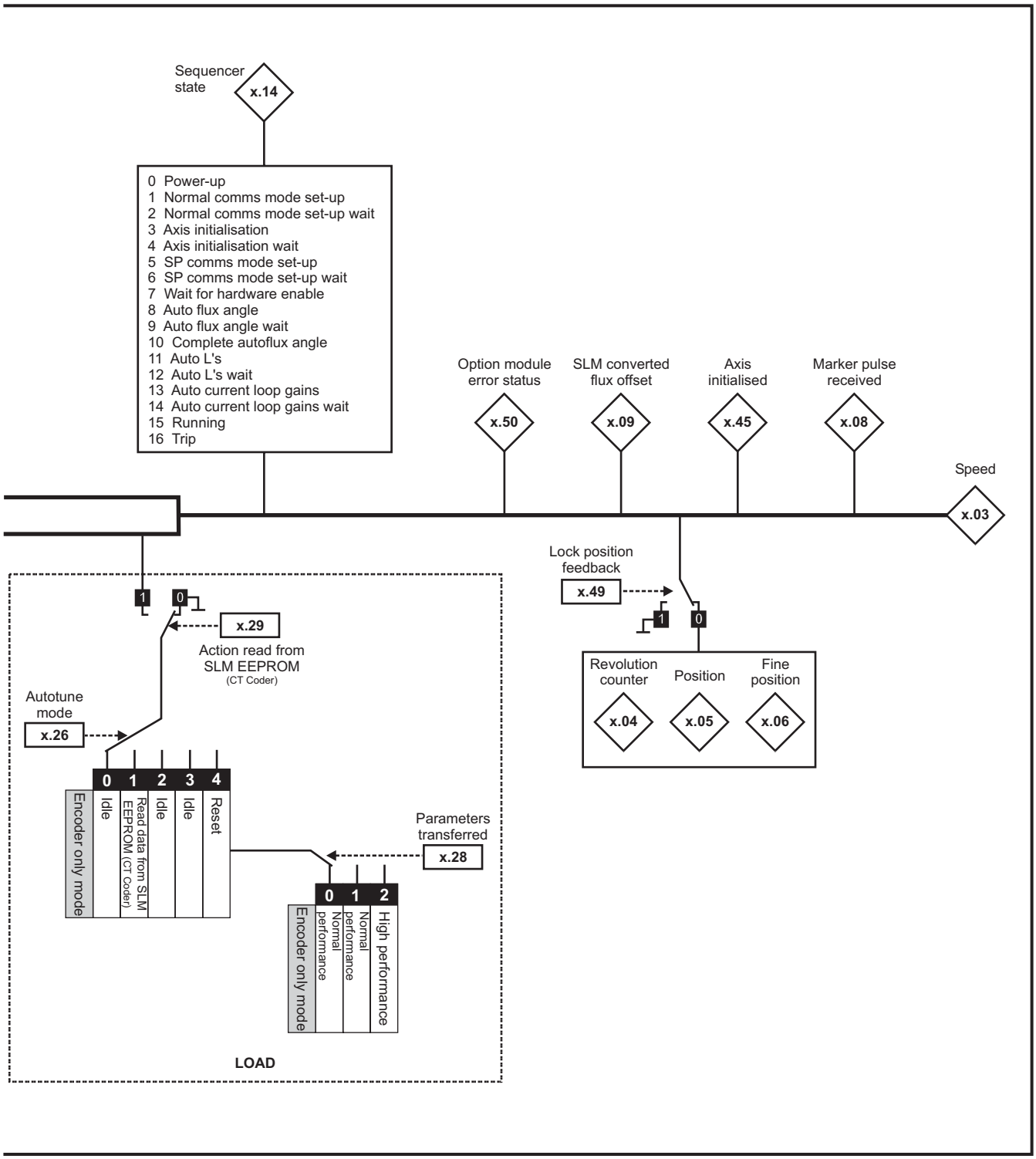
RW	Read / Write	RO	Read only	Uni	Unipolar	Bi	Bi-polar	Bit	Bit parameter	Txt	Text string		
FI	Filtered	DE	Destination	NC	Not copied	RA	Rating dependent	PT	Protected	US	User save	PS	Power down save

8.15.5 SLM module category

Figure 8-38 SM-SLM logic diagram



The parameters are all shown in their default settings


Sequencer state
x.14
0 Power-up
1 Normal comms mode set-up
2 Normal comms mode set-up wait
3 Axis initialisation
4 Axis initialisation wait
5 SP comms mode set-up
6 SP comms mode set-up wait
7 Wait for hardware enable
8 Auto flux angle
9 Auto flux angle wait
10 Complete autoflux angle
11 Auto L's
12 Auto L's wait
13 Auto current loop gains
14 Auto current loop gains wait
15 Running
16 Trip
Option module error status
x.50
SLM converted flux offset
x.09
Axis initialised
x.45
Marker pulse received
x.08
Speed
x.03
Lock position feedback
x.49
Revolution counter
x.04
Position
x.05
Fine position
x.06
x.29
Action read from SLM EEPROM
(CT Coder)
Autotune mode
x.26
0 1 2 3 4
Encoder only mode
Idle
Read data from SLM EEPROM (CT Coder)
Idle
Idle
Reset
Parameters transferred
x.28
0 1 2
Encoder only mode
Normal performance
Normal performance
High performance
LOAD

SM-SLM parameters

Parameter		Range(⇳)	Default(⇨)	Type					
x.01	Solutions Module ID	0 to 499		RO	Uni			PT	US
x.02	Solutions Module software version	0.0 to 99.99		RO	Uni		NC	PT	
x.03	Speed	±40,000.0 rpm		RO	Bi	FI	NC	PT	
x.04	Revolution counter	0 to 65,535 revolutions		RO	Uni	FI	NC	PT	
x.05	Position	0 to 65,535 ($1/2^{16}$ths of a revolution)		RO	Uni	FI	NC	PT	
x.06	Fine position	0 to 65,535 ($1/2^{32}$nds of a revolution)		RO	Uni	FI	NC	PT	
x.07	Operating mode	HoSt (0), Enc.Only (1)	HoSt (0)	RW	Txt				US
x.08	Marker pulse received indicator	OFF (0) or On (1)	OFF (0)	RO	Bit		NC		
x.09	SLM converted flux offset	0 to 65,535	0	RO	Uni				
x.10	Encoder lines per revolution	0 to 50,000	1024	RW	Uni				US
x.11	SLM software version	0.000 to 9.999	0.000	RO	Uni		NC	PT	
x.12	SLM power-up delay	0.000 (0), 0.250 (1), 0.500 (2), 0.750 (3), 1.000 (4), 1.250 (5), 1.500 (6) s	0.250 (1)	RW	Txt				US
x.13	Not used*								
x.14	Sequencer status	0 to 16		RO	Uni		NC	PT	
x.15	Not used*								
x.16	Not used*								
x.17	Not used*								
x.18	Not used*								
x.19	Feedback filter	0 (0), 1 (1), 2 (2), 4 (3), 8 (4), 16 (5) ms	0 (0)	RW	Txt				US
x.20	Not used*								
x.21	Not used*								
x.22	Not used*								
x.23	Not used*								
x.24	Not used*								
x.26	Autotune mode	0 to 4	0	RW	Uni				US
x.27	Saving mode	0 to 2	0	RW	Uni				US
x.28	Parameters transferred	0 to 2	0	RW	Uni				US
x.29	Action the tuning and saving parameters	OFF (0) or On (1)	OFF (0)	RW	Bit				US
x.30	Automatic basic drive set-up request	0 to 1	0	RW	Uni				US
x.32	Not used*								
x.33	Not used*								
x.34	Not used*								
x.35	Not used*								
x.36	Not used*								
x.37	Not used*								
x.38	Not used*								
x.39	Not used*								
x.40	Not used*								
x.41	Not used*								
x.42	Not used*								
x.43	Not used*								
x.44	Not used*								
x.45	Axis initialised	OFF (0) or On (1)		RO	Bit			PT	
x.46	Not used*								
x.47	Not used*								
x.48	Not used*								
x.49	Lock position feedback	OFF (0) or On (1)	OFF (0)	RW	Bit			PT	
x.50	Solutions Module error status**	0 to 255		RO	Uni		NC	PT	
x.51	Solutions Module software sub-version	0 to 99		RO	Uni		NC	PT	

RW	Read / Write	RO	Read only	Uni	Unipolar	Bi	Bi-polar	Bit	Bit parameter	Txt	Text string		
FI	Filtered	DE	Destination	NC	Not copied	RA	Rating dependent	PT	Protected	US	User save	PS	Power down save

* Some of the parameters which are not used will be introduced in scheduled product enhancement.

**See trip SLX.Er, *SLM module category* on page 36.

8.16 Menu 17: Motion processors

Menu 17 parameter functions are dependant on the Digitax ST variant.

8.16.1 Digitax ST Base

Menu 17 not available.

8.16.2 Digitax ST Indexer

Table 8-6 Digitax ST Indexer

Parameter		Range(⇳)	Default(⇨)	Type					
17.01	Solutions Module ID	0 to 599		RO	Uni			PT	US
17.02	Solutions Module software version	0.00 to 99.99		RO	Uni		NC	PT	
17.03	DPL program status	None (0), Stop (1), Run (2), Trip (3)		RO	Txt		NC	PT	
17.04	Available system resource	0 to 100		RO	Uni		NC	PT	
17.10	DPL Print Routing	SYPT: OFF (0), RS485: On (1)	SYPT: OFF (0)	RW	Bit				US
17.11	Clock tick time (ms)	0 to 200	10	RW	Uni				US
17.12	Motion engine sample rate	dISAbLEd (0), 0.25 ms (1), 0.5 ms (2), 1 ms (3), 2 ms (4), 4 ms (5), 8 ms (6)	dISAbLEd (0)	RW	Txt				US
17.13	Enable autorun	OFF (0) or On (1)	On (1)	RW	Bit				US
17.14	Global run time trip enable	OFF (0) or On (1)	OFF (0)	RW	Bit				US
17.15	Disable reset on trip cleared	OFF (0) or On (1)	OFF (0)	RW	Bit				US
17.16	Encoder data update rate	0 to 3	0	RW	Uni				US
17.17	Enable parameter over range trips	OFF (0) or On (1)	OFF (0)	RW	Bit				US
17.18	Watchdog enable	OFF (0) or On (1)	OFF (0)	RW	Bit				US
17.19	Save request	OFF (0) or On (1)	OFF (0)	RW	Bit		NC		
17.20	Enable power down save	OFF (0) or On (1)	OFF (0)	RW	Bit				US
17.21	Enable menu 20 save and restore	OFF (0) or On (1)	OFF (0)	RW	Bit				US
17.37	Reject download if drive enabled	OFF (0) or On (1)	OFF (0)	RW	Bit				US
17.38	Do not trip drive on APC run-time error	OFF (0) or On (1)	OFF (0)	RW	Bit				US
17.39	Inter-UT70 synchronization status	0 to 3	0	RO	Uni		NC		
17.40	Inter-UT70 master transfer mode	0 to 10	1	RW	Uni				US
17.42	Freeze main drive position	OFF (0) or On (1)	OFF (0)	RW	Bit				US
17.43	Freeze invert	OFF (0) or On (1)	OFF (0)	RW	Bit				US
17.44	Task priority level	0 to 255	0	RW	Uni				US
17.48	DPL line number in error	0 to 2,147,483,647	0	RO	Uni		NC	PT	
17.49	User program ID	-32,767 to +32,768	0	RO	Bi		NC	PT	
17.50	Solutions Module error status*	0 to 255		RO	Uni		NC	PT	
17.51	Solutions Module software sub-version	0 to 99		RO	Uni		NC	PT	

RW	Read / Write	RO	Read only	Uni	Unipolar	Bi	Bi-polar	Bit	Bit parameter	Txt	Text string		
FI	Filtered	DE	Destination	NC	Not copied	RA	Rating dependent	PT	Protected	US	User save	PS	Power down save

*See trip SLX.Er, *Automation (I/O Expansion) module category* on page 35.

8.16.3 Digitax ST Plus

Table 8-7 Digitax ST Plus

Parameter		Range(⇳)	Default(⇨)	Type					
17.01	Solutions Module ID	0 to 599		RO	Uni			PT	US
17.02	Solutions Module software version	0.00 to 99.99		RO	Uni		NC	PT	
17.03	DPL program status	None (0), Stop (1), Run (2), Trip (3)		RO	Txt		NC	PT	
17.04	Available system resource	0 to 100		RO	Uni		NC	PT	
17.05	RS485 address	0 to 255	11	RW	Uni				US
17.06	RS485 mode	0 to 255	1	RW	Uni				US
17.07	RS485 baud rate	300 (0), 600 (1), 1200 (2), 2400 (3), 4800 (4), 9600 (5), 19200 (6), 38400 (7), 57600 (8), 115200 (9) baud	4800 (4)	RW	Txt				US
17.08	RS485 Turnaround delay	0 to 255 ms	2	RW	Uni				US
17.09	RS485 Tx enable delay	0 to 1 ms	0	RW	Uni				US
17.10	DPL Print Routing	SYPT: OFF (0), RS485: On (1)	SYPT: OFF (0)	RW	Bit				US
17.11	Clock tick time (ms)	0 to 200	10	RW	Uni				US
17.12	Motion engine sample rate	dISAbLEd (0), 0.25 ms (1), 0.5 ms (2), 1 ms (3), 2 ms (4), 4 ms (5), 8 ms (6)	dISAbLEd (0)	RW	Txt				US
17.13	Enable autorun	OFF (0) or On (1)	On (1)	RW	Bit				US
17.14	Global run time trip enable	OFF (0) or On (1)	OFF (0)	RW	Bit				US
17.15	Disable reset on trip cleared	OFF (0) or On (1)	OFF (0)	RW	Bit				US
17.16	Encoder data update rate	0 to 3	0	RW	Uni				US
17.17	Enable parameter over range trips	OFF (0) or On (1)	OFF (0)	RW	Bit				US
17.18	Watchdog enable	OFF (0) or On (1)	OFF (0)	RW	Bit				US
17.19	Save request	OFF (0) or On (1)	OFF (0)	RW	Bit		NC		
17.20	Enable power down save	OFF (0) or On (1)	OFF (0)	RW	Bit				US
17.21	Enable menu 20 save and restore	OFF (0) or On (1)	OFF (0)	RW	Bit				US
17.22	CTNet Token Ring ID	0 to 255	0	RW	Uni				US
17.23	CTNet node address	0 to 255	0	RW	Uni				US
17.24	CTNet baud rate	5.000 (0), 2.500 (1), 1.250 (2), 0.625 (3)	2.500 (1)	RW	Txt				US
17.25	CTNet sync setup	0,000 to 9,999	0,000	RW	Uni				US
17.26	CTNet easy mode - first cyclic parameter destination node	0 to 25,503	0	RW	Uni				US
17.27	CTNet easy mode - first cyclic source parameter	0 to 9,999	0	RW	Uni				US
17.28	CTNet easy mode - second cyclic parameter destination node	0 to 25,503	0	RW	Uni				US
17.29	CTNet easy mode - second cyclic source parameter	0 to 9,999	0	RW	Uni				US
17.30	CTNet easy mode - third cyclic parameter destination node	0 to 25,503	0	RW	Uni				US
17.31	CTNet easy mode - third cyclic source parameter	0 to 9,999	0	RW	Uni				US
17.32	CTNet easy mode set-up - Transfer slot 1 destination parameter	0 to 9,999	0	RW	Uni				US
17.33	CTNet easy mode set-up - Transfer slot 2 destination parameter	0 to 9,999	0	RW	Uni				US
17.34	CTNet easy mode set-up - Transfer slot 3 destination parameter	0 to 9,999	0	RW	Uni				US
17.35	CTNet sync event task ID	Disabled (0), Event (1), Event1 (2), Event2 (3), Event3 (4)	Disabled (0)	RW	Txt				US
17.36	CTNet diagnostic parameter			RO	Uni		NC	PT	
17.37	Reject download if drive enabled	OFF (0) or On (1)	OFF (0)	RW	Bit				US
17.38	Do not trip drive on APC run-time error	OFF (0) or On (1)	OFF (0)	RW	Bit				US
17.39	Inter-UT70 synchronization status	0 to 3	0	RO	Uni		NC		
17.40	Inter-UT70 master transfer mode	0 to 10	1	RW	Uni				US
17.42	Freeze main drive position	OFF (0) or On (1)	OFF (0)	RW	Bit				US
17.43	Freeze invert	OFF (0) or On (1)	OFF (0)	RW	Bit				US
17.44	Task priority level	0 to 255	0	RW	Uni				US
17.48	DPL line number in error	0 to 2,147,483,647	0	RO	Uni		NC	PT	
17.49	User program ID	-32,767 to +32,768	0	RO	Bi		NC	PT	
17.50	Solutions Module error status*	0 to 255		RO	Uni		NC	PT	
17.51	Solutions Module software sub-version	0 to 99		RO	Uni		NC	PT	

RW	Read / Write	RO	Read only	Uni	Unipolar	Bi	Bi-polar	Bit	Bit parameter	Txt	Text string		
FI	Filtered	DE	Destination	NC	Not copied	RA	Rating dependent	PT	Protected	US	User save	PS	Power down save

*See trip SLX.Er, *Automation (I/O Expansion) module category* on page 35.

8.16.4 Digitax ST EZMotion

Table 8-8 Digitax ST EZMotion

Parameter		Range(⇳)	Default(⇨)	Type					
17.01	Option ID code	303	303	RO				PT	US
17.02	Option software version	OFF (0) or On (1)		RO	Bit		NC	PT	
17.13	EZ output 1 status	OFF (0) or On (1)		RO	Bit		NC	PT	
17.14	EZ output 2 status	OFF (0) or On (1)		RO	Bit		NC	PT	
17.17	EZ input 1 status	OFF (0) or On (1)		RO	Bit		NC	PT	
17.18	EZ input 2 status	OFF (0) or On (1)		RO	Bit		NC	PT	
17.19	EZ input 3 status	OFF (0) or On (1)		RO	Bit		NC	PT	
17.20	EZ input 4 status	OFF (0) or On (1)		RO	Bit		NC	PT	
17.48	System status	OFF (0) or On (1)		RO	Bit		NC	PT	
17.50	Solutions module error status	0 to 255		RO			NC	PT	
17.51	Option software sub-version	0 to 99		RO			NC	PT	

RW	Read / Write	RO	Read only	Uni	Unipolar	Bi	Bi-polar	Bit	Bit parameter	Txt	Text string		
FI	Filtered	DE	Destination	NC	Not copied	RA	Rating dependent	PT	Protected	US	User save	PS	Power down save

8.17 Menu 18: Application menu 1

Parameter		Range(⇳)	Default(⇨)	Type					
18.01	Application menu 1 power-down saved integer	-32,768 to +32,767	0	RW	Bi		NC		PS
18.02 to 18.10	Application menu 1 read-only integer	-32,768 to +32,767	0	RO	Bi		NC		
18.11 to 18.30	Application menu 1 read-write integer	-32,768 to +32,767	0	RW	Bi				US
18.31 to 18.50	Application menu 1 read-write bit	OFF (0) or On (1)	0	RW	Bit				US

8.18 Menu 19: Application menu 2

Parameter		Range(⇳)	Default(⇨)	Type					
19.01	Application menu 2 power-down saved integer	-32,768 to +32,767	0	RW	Bi		NC		PS
19.02 to 19.10	Application menu 2 read-only integer	-32,768 to +32,767	0	RO	Bi		NC		
19.11 to 19.30	Application menu 2 read-write integer	-32,768 to +32,767	0	RW	Bi				US
19.31 to 19.50	Application menu 2 read-write bit	OFF (0) or On (1)	0	RW	Bit				US

8.19 Menu 20: Application menu 3

Parameter		Range(⇳)	Default(⇨)	Type					
20.01 to 20.20	Application menu 3 read-write integer	-32,768 to +32,767	0	RW	Bi		NC		
20.21 to 20.40	Application menu 3 read-write long integer	-2^{31} to $2^{31}-1$	0	RW	Bi		NC		

Menu 20 parameters are transferred to the SMARTCARD when a 4yyy transfer is performed. See section 7.2.1 *Writing to the SMARTCARD* on page 36 for more information.

RW	Read / Write	RO	Read only	Uni	Unipolar	Bi	Bi-polar	Bit	Bit parameter	Txt	Text string		
FI	Filtered	DE	Destination	NC	Not copied	RA	Rating dependent	PT	Protected	US	User save	PS	Power down save

8.20 Menu 21: Second motor parameters

Parameter			Range(⇳)	Default(⇨)	Type					
21.01	Maximum reference clamp	{**0.02**}*	SPEED_LIMIT_MAX rpm	3,000.0	RW	Uni				US
21.02	Minimum reference clamp	{**0.01**}*	±SPEED_LIMIT_MAX rpm	0.0	RW	Bi			PT	US
21.03	Reference selector	{**0.05**}*	A1.A2 (0), A1.Pr (1), A2.Pr (2), Pr (3), PAd (4), Prc (5)	A1.A2 (0)	RW	Txt				US
21.04	Acceleration rate	{**0.03**}*	0.000 to 3,200.000 s/1000rpm	0.200	RW	Uni				US
21.05	Deceleration rate	{**0.04**}*	0.000 to 3,200.000 s/1000rpm	0.200	RW	Uni				US
21.07	Rated current	{**0.46**}*	0 to RATED_CURRENT_MAX A	Drive rated current (Pr **11.32**)	RW	Uni		RA		US
21.08	Rated load rpm		0.00 to 40,000.00 rpm	3,000.00	RW	Uni				US
21.09	Rated voltage	{**0.44**}*	0 to AC_VOLTAGE_SET_MAX V	200V rating drive: 230V 400V rating drive: EUR> 400V, USA> 460V	RW	Uni		RA		US
21.11	Number of motor poles	{**0.42**}*	Auto to 120 pole (0 to 60)	6 POLE (3)	RW	Txt				US
21.12	Stator resistance		Size 1 to 5: 0.000 to 65.000 Ω Size 6: 0.000 to 65.000 x 10 mΩ	0.0	RW	Uni		RA		US
21.14	Transient inductance (σL_s)		0.000 to 500.000mH	0.000	RW	Uni		RA		US
21.15	Motor 2 active		OFF (0) or On (1)		RO	Bit		NC	PT	
21.16	Thermal time constant	{**0.45**}*	0.0 to 3000.0	20.0	RW	Uni				US
21.17	Speed controller Kp gain	{**0.07**}*	0.000 to 6.5535 rad s^{-1}	0.0100	RW	Uni				US
21.18	Speed controller Ki gain	{**0.08**}*	0.00 to 655.35 s/rad s^{-1}	1.00	RW	Uni				US
21.19	Speed controller Kd gain	{**0.09**}*	0.00000 to 0.65535 s^{-1}/rad s^{-1}	0.00000	RW	Uni				US
21.20	Encoder phase angle	{**0.43**}*	0.0 to 359.9 ° electrical	0.0	RW	Uni				US
21.21	Speed feedback selector		drv (0), SLot1 (1), SLot2 (2), SLot3 (3)	drv (0)	RW	Txt				US
21.22	Current controller Kp gain	{**0.38**}*	0 to 30,000	200V: 75, 400V: 150,	RW	Uni				US
21.23	Current controller Ki gain	{**0.39**}*	0 to 30,000	200V: 1,000, 400V: 2,000,	RW	Uni				US
21.27	Motoring current limit		0 to MOTOR2_CURRENT_LIMIT_MAX %	300.0	RW	Uni		RA		US
21.28	Regen current limit		0 to MOTOR2_CURRENT_LIMIT_MAX %	300.0	RW	Uni		RA		US
21.29	Symmetrical current limit	{**0.06**}*	0 to MOTOR2_CURRENT_LIMIT_MAX %	300.0	RW	Uni		RA		US
21.30	Motor volts per 1,000 rpm, K_e		SV> 0 to 10,000 V	98	RW	Uni				US
21.31	Motor pole pitch		0.00 to 655.35 mm	0.00	RW	Uni				US

RW	Read / Write	RO	Read only	Uni	Unipolar	Bi	Bi-polar	Bit	Bit parameter	Txt	Text string		
FI	Filtered	DE	Destination	NC	Not copied	RA	Rating dependent	PT	Protected	US	User save	PS	Power down save

* The menu 0 references are only valid when the second motor map parameters have been made active by setting Pr **11.45** to 1. (The second motor map only becomes effective when the output stage of the drive is not enabled, i.e. inh, rdY, or trip states.)

When the second motor map parameters are active, the symbol 'Mot2' will appear in the lower left hand corner of the LCD display or the decimal point that is second from the right on the first row of the LED display is lit.

8.21 Menu 22: Additional Menu 0 set-up

Parameter		Range(⇳)	Default(⇨)	Type					
22.01	Parameter **0.31** set-up	Pr **1.00** to Pr **21.51**	Pr **11.33**	RW	Uni			PT	US
22.02	Parameter **0.32** set-up	Pr **1.00** to Pr **21.51**	Pr **11.32**	RW	Uni			PT	US
22.03	Parameter **0.33** set-up	Pr **1.00** to Pr **21.51**	Pr **0.00**	RW	Uni			PT	US
22.04	Parameter **0.34** set-up	Pr **1.00** to Pr **21.51**	Pr **11.30**	RW	Uni			PT	US
22.05	Parameter **0.35** set-up	Pr **1.00** to Pr **21.51**	Pr **11.24**	RW	Uni			PT	US
22.06	Parameter **0.36** set-up	Pr **1.00** to Pr **21.51**	Pr **11.25**	RW	Uni			PT	US
22.07	Parameter **0.37** set-up	Pr **1.00** to Pr **21.51**	Pr **11.23**	RW	Uni			PT	US
22.08	Parameter **0.38** set-up	Pr **1.00** to Pr **21.51**	Pr **4.13**	RW	Uni			PT	US
22.09	Parameter **0.39** set-up	Pr **1.00** to Pr **21.51**	Pr **4.14**	RW	Uni			PT	US
22.10	Parameter **0.40** set-up	Pr **1.00** to Pr **21.51**	Pr **5.12**	RW	Uni			PT	US
22.11	Parameter **0.41** set-up	Pr **1.00** to Pr **21.51**	Pr **5.18**	RW	Uni			PT	US
22.12	Parameter **0.42** set-up	Pr **1.00** to Pr **21.51**	Pr **5.11**	RW	Uni			PT	US
22.13	Parameter **0.43** set-up	Pr **1.00** to Pr **21.51**	Pr **3.25**	RW	Uni			PT	US
22.14	Parameter **0.44** set-up	Pr **1.00** to Pr **21.51**	Pr **5.09**	RW	Uni			PT	US
22.15	Parameter **0.45** set-up	Pr **1.00** to Pr **21.51**	Pr **4.15**	RW	Uni			PT	US
22.16	Parameter **0.46** set-up	Pr **1.00** to Pr **21.51**	Pr **5.09**	RW	Uni			PT	US
22.18	Parameter **0.48** set-up	Pr **1.00** to Pr **21.51**	Pr **11.31**	RW	Uni			PT	US
22.19	Parameter **0.49** set-up	Pr **1.00** to Pr **21.51**	Pr **11.44**	RW	Uni			PT	US
22.20	Parameter **0.50** set-up	Pr **1.00** to Pr **21.51**	Pr **11.29**	RW	Uni			PT	US
22.21	Parameter **0.51** set-up	Pr **1.00** to Pr **21.51**	Pr **10.37**	RW	Uni			PT	US
22.22	Parameter **0.52** set-up	Pr **1.00** to Pr **21.51**	Pr **0.00**	RW	Uni			PT	US
22.23	Parameter **0.53** set-up	Pr **1.00** to Pr **21.51**	Pr **0.00**	RW	Uni			PT	US
22.24	Parameter **0.54** set-up	Pr **1.00** to Pr **21.51**	Pr **0.00**	RW	Uni			PT	US
22.25	Parameter **0.55** set-up	Pr **1.00** to Pr **21.51**	Pr **0.00**	RW	Uni			PT	US
22.26	Parameter **0.56** set-up	Pr **1.00** to Pr **21.51**	Pr **0.00**	RW	Uni			PT	US
22.27	Parameter **0.57** set-up	Pr **1.00** to Pr **21.51**	Pr **0.00**	RW	Uni			PT	US
22.28	Parameter **0.58** set-up	Pr **1.00** to Pr **21.51**	Pr **0.00**	RW	Uni			PT	US
22.29	Parameter **0.59** set-up	Pr **1.00** to Pr **21.51**	Pr **0.00**	RW	Uni			PT	US

RW	Read / Write	RO	Read only	Uni	Unipolar	Bi	Bi-polar	Bit	Bit parameter	Txt	Text string		
FI	Filtered	DE	Destination	NC	Not copied	RA	Rating dependent	PT	Protected	US	User save	PS	Power down save

8.22 Advanced features

This section gives information on some of the advanced functions of the drive. For additional information see the *Advanced User Guide*.

Reference modes	Pr **1.14**, Pr **1.15** and Pr **8.39**
Braking modes	Pr **2.04** and Pr **2.08**
S ramps	Pr **2.06** and Pr **2.07**
Torque modes	Pr **4.08** and Pr **4.11**
Stop modes	Pr **6.01** and Pr **6.08**
Main loss modes	Pr **6.03**, Pr **6.48**, Pr **4.13** and Pr **4.14**
Start/stop logic modes	Pr **6.04** and Pr **6.40**
Position loop modes	Pr **13.10**
Fast disable	Pr **6.29**

8.22.1 Reference modes

1.14	**Reference selector**								
RW	Txt					NC		US	
⇳	A1.A2 (0), A1.Pr (2), A2.Pr (2), Pr (3), PAd (4), Prc (5)				⇨	A1.A2 (0)			

Table 8-9 Active reference

Pr 1.14	Pr 1.15	Digital Input T28		Digital Input T29		Pr 1.49	Pr 1.50	Active Reference
		State	Function	State	Function			
A1.A2 (0)	0 or 1	0	Local Remote		Jog forward**	1	1	Analog input 1
		1				2	1	Analog input 2
	2 to 8		No function			1 or 2	2 to 8	Preset reference 2 to 8
	9 *	0	Local Remote			1	1	Analog input 1
		1				2	1	Analog input 2
			No function			1 or 2	2 to 8	Preset reference 2 to 8
A1.Pr (1)	0	0	Preset select bit 0	0	Preset select bit 1	1	1	Analog input 1
		1					2	Preset reference 2
		0		1			3	Preset reference 3
		1					4	Preset reference 4
	1		No function		No function		1	Analog input 1
	2 to 8						2 to 8	Preset reference 2 to 8
	9 *						1	Analog input 1
							2 to 8	Preset reference 2 to 8
A2.Pr (2)	0	0	Preset select bit 0	0	Preset select bit 1	2	1	Analog input 2
		1					2	Preset reference 2
		0		1			3	Preset reference 3
		1					4	Preset reference 4
	1		No function		No function		1	Analog input 2
	2 to 8						2 to 8	Preset reference 2 to 8
	9 *						1	Analog input 2
							2 to 8	Preset reference 2 to 8
Pr (3)	0	0	Preset select bit 0	0	Preset select bit 1	3	1	Preset reference 1
		1					2	Preset reference 2
		0		1			3	Preset reference 3
		1					4	Preset reference 4
	1 to 8		No function		No function		1 to 8	Preset reference 1 to 8
	9 *						1 to 8	Preset reference 1 to 8
PAd (4)			No function		No function	4		Keypad reference
Prc (5)			No function		No function	5		Precision reference

* Setting Pr **1.15** to 9 enables the Preset reference scan timer. With the scan timer enabled the preset references are selected automatically in turn. Pr **1.16** defines the time between each change.

** Jog forward can only be selected when the drive is in either the ready (rdy), inhibit (inh) or trip states.

1.15	**Preset reference selector**								
RW	Uni					NC		US	
⇳	0 to 9				⇨	0			

8.39	**T28 and T29 auto-selection disable**								
RW	Bit							US	
⇳	OFF (0) or On (1)				⇨	OFF (0)			

If Pr **8.39** is set to OFF (0), then the setting of Pr **1.14** automatically changes the operation of digital inputs T28 and T29 by configuring the destination parameters Pr **8.25** and Pr **8.26**. To allow Pr **8.25** and Pr **8.26** to be changed manually by the user, the automatic set-up must be disabled by setting Pr **8.39** to 1.

If Pr **8.39** is 0 and Pr **1.14** is changed, then a drive reset is required before the function of terminal T28 or T29 will become active.

Preset references
Preset references 1 to 8 are contained in Pr **1.21** to Pr **1.28**.

Keypad reference
If Keypad reference is selected the drive sequencer is controlled directly by the keypad keys and the keypad reference parameter (Pr **1.17**) is selected. The sequencing bits, Pr **6.30** to Pr **6.34**, and Pr **6.37** have no effect and jog is disabled.

Precision reference
If Precision reference is selected the speed reference is given Pr **1.18** and Pr **1.19**.

8.22.2 Braking Modes

2.04		Ramp mode select								
RW		Txt							US	
OL	⇳	FASt (0), Std (1), Std.hV (2)				⇨	Std (1)			
CL		FASt (0), Std (1)								

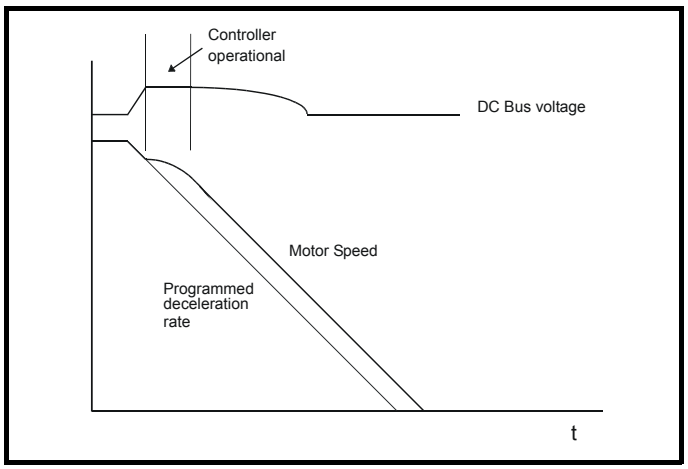
This parameter does not affect the acceleration ramp, as the ramp output always rises at the programmed acceleration rate subject to the current limits. It is possible in under some unusual circumstances in open-loop mode (i.e. highly inductive supply) for the motor to reach a low speed in standard ramp mode, but not completely stop. It is also possible if the drive attempts to stop the motor with an overhauling load in any mode that the motor will not stop when standard ramp mode or fast ramp mode is used. If the drive is in the deceleration state the rate of fall of the frequency or speed is monitored. If this does not fall for 10 seconds the drive forces the frequency or the speed reference to zero. This only applies when the drive is in the deceleration state and not when the reference is simply set to zero.

0: Fast ramp

Fast ramp is used where the deceleration follows the programmed deceleration rate subject to current limits.

1: Standard ramp

Standard ramp is used. During deceleration, if the voltage rises to the standard ramp level (Pr **2.08**) it causes a controller to operate, the output of which changes the demanded load current in the motor. As the controller regulates the DC bus voltage, the motor deceleration increases as the speed approaches zero speed. When the motor deceleration rate reaches the programmed deceleration rate the controller ceases to operate and the drive continues to decelerate at the programmed rate. If the standard ramp voltage (Pr **2.08**) is set lower than the nominal DC Bus level the drive will not decelerate the motor, but it will coast to rest. The output of the ramp controller (when active) is a current demand that is fed to the torque producing current controller modes. The gain of these controllers can be modified with Pr **4.13** and Pr **4.14**.



2: Standard ramp with motor voltage boost

This mode is the same as normal standard ramp mode except that the motor voltage is boosted by 20%. This increases the losses in the motor giving faster deceleration.

2.08		Standard ramp voltage								
RW	Uni			RA					US	
⇳	0 to DC_VOLTAGE_SET_MAX V					⇨	200V drive: 375 400V drive: EUR> 750 USA> 775			

This voltage is used as the control level for standard ramp mode. If this parameter is set too low the machine will coast to rest, and if it is set too high and no braking resistor is used the drive may give an over-volt 'OV' trip. The minimum level should be greater than the voltage produced on the DC Bus by the highest supply voltage. Normally the DC Bus voltage will be approximately the rms supply line voltage x √2.

WARNING

Care should be taken in the setting of this parameter. It is recommended that the setting should be at least 50V higher than the maximum expected level of the DC Bus voltage. If this is not done, the motor may fail to decelerate on a STOP command.

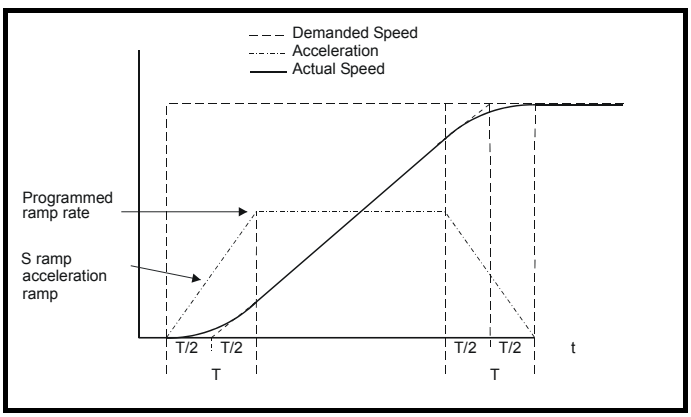
8.22.3 S ramps

2.06		S ramp enable								
RW	Bit								US	
⇳	OFF (0) or On (1)					⇨	OFF (0)			

Setting this parameter enables the S ramp function. S ramp is disabled during deceleration using standard ramp. When the motor is accelerated again after decelerating in standard ramp the acceleration ramp used by the S ramp function is reset to zero.

2.07		S ramp acceleration limit								
RW	Uni								US	
⇳	0.000 to 100.000 s^2/1000rpm					⇨	0.030			

This parameter defines the maximum rate of change of acceleration/ deceleration. The default values have been chosen such that for the default ramps and maximum speed, the curved parts of the S will be 25% of the original ramp if S ramp is enabled.



Since the ramp rate is defined in s/100Hz or s/1000rpm and the S ramp parameter is defined in s^2/100Hz or s^2/1000rpm, the time T for the 'curved' part of the S can be determined from:

T = S ramp rate of change / Ramp rate

Enabling S ramp increases the total ramp time by the period T since an additional T/2 is added to each end of the ramp in producing the S.

8.22.4 Torque modes

4.08	Torque reference								
RW	Bi							US	
⇳	±USER_CURRENT_MAX %				⇨	0.00			

Parameter for main torque reference. The normal update rate for the torque reference is 4ms. However if analog inputs 2 or 3 on the drive are used as the source of the reference, the drive is in closed-loop vector or servo mode and the analog inputs are in voltage mode with zero offset, the sample time is reduced to 250µs.

4.11	Torque mode selector								
RW	Uni							US	
⇳	0 to 4				⇨	0			

When this parameter is set to 1, 2 or 3 the ramps are not active while the drive is in the run state. When the drive is taken out of the run state, but not disabled, the appropriate stopping mode is used. It is recommended that coast stopping or stopping without ramps are used. However, if ramp stop mode is used the ramp output is pre-loaded with the actual speed at the changeover point to avoid unwanted jumps in the speed reference.

0: Speed control mode

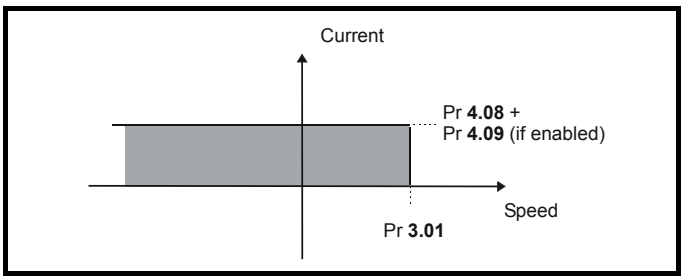
The torque demand is equal to the speed loop output.

1: Torque control

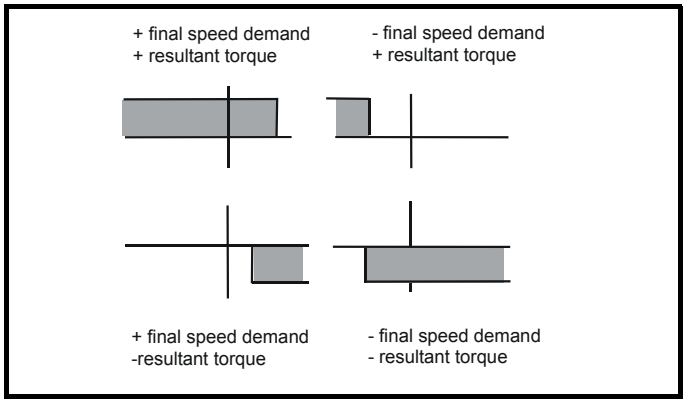
The torque demand is given by the sum of the torque reference and the torque offset, if enabled. The speed is not limited in any way, however, the drive will trip at the overspeed threshold if runaway occurs.

2: Torque control with speed override

The output of the speed loop defines the torque demand, but is limited between 0 and the resultant torque reference (Pr **4.08** and Pr **4.09** (if enabled)). The effect is to produce an operating area as shown below if the final speed demand and the resultant torque reference are both positive. The speed controller will try and accelerate the machine to the final speed demand level with a torque demand defined by the resultant torque reference. However, the speed cannot exceed the reference because the required torque would be negative, and so it would be clamped to zero.



Depending on the sign of the final speed demand and the resultant torque the four areas of operation shown below are possible.



This mode of operation can be used where torque control is required, but the maximum speed must be limited by the drive.

3: Coiler/uncoiler mode

Positive final speed demand:

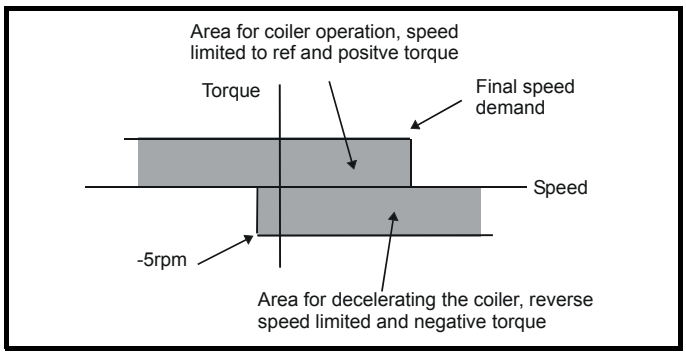
A positive resultant torque will give torque control with a positive speed limit defined by the final speed demand. A negative resultant torque will give torque control with a negative speed limit of -5rpm.

Negative final speed demand:

A negative resultant torque will give torque control with a negative speed limit defined by the final speed demand. A positive resultant torque will give torque control with a positive speed limit of +5rpm.

Example of coiler operation:

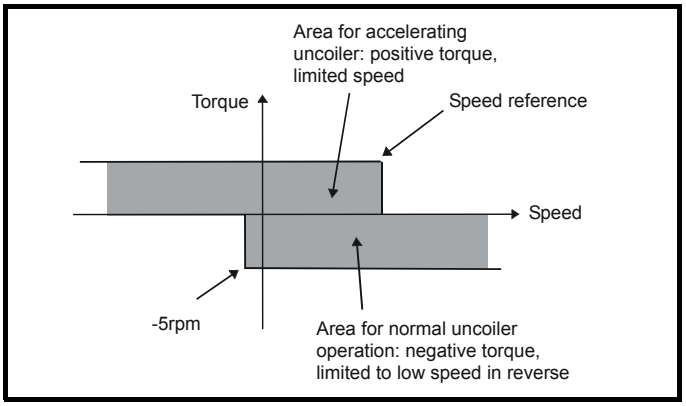
This is an example of a coiler operating in the positive direction. The final speed demand is set to a positive value just above the coiler reference speed. If the resultant torque demand is positive the coiler operates with a limited speed, so that if the material breaks the speed does not exceed a level just above the reference. It is also possible to decelerate the coiler with a negative resultant torque demand. The coiler will decelerate down to -5rpm until a stop is applied. The operating area is shown in the following diagram.



Example of uncoiler operation:

This is an example for an uncoiler operating in the positive direction. The final speed demand should be set to a level just above the maximum normal speed. When the resultant torque demand is negative the uncoiler will apply tension and try and rotate at 5rpm in reverse, and so take up any slack. The uncoiler can operate at any positive speed applying tension. If it is necessary to accelerate the uncoiler a positive resultant torque demand is used. The speed will be limited to the final speed demand. The operating area is the same as that for the coiler and

is shown below:



4: Speed control with torque feed-forward

The drive operates under speed control, but a torque value may be added to the output of the speed controller. This can be used to improve the regulation of systems where the speed loop gains need to be low for stability.

8.22.5 Stop modes

6.01	Stop mode									
RW	Txt								US	
⇳	COASt (0), rP (1), no.rP (2)					⇨	no.rP (2)			

Only one stopping phases exists and the ready state is entered as soon as the single stopping action is complete.

Stopping Mode	Action
0: Coast	Inhibits the inverter
1: Ramp	Stop with ramp
2: No ramp	Stop with no ramp

The motor can be stopped with position orientation after stopping. This mode is selected with the position controller mode parameter (Pr **13.10**). When this mode is selected Pr **6.01** has no effect.

6.08	Hold zero speed									
RW	Bit								US	
⇳	OFF (0) or On (1)					⇨	On (1)			

When this bit is set the drive remains active even when the run command has been removed and the motor has reached standstill.

8.22.6 Line power supply loss modes

6.03	Line power supply loss mode									
RW	Txt								US	
⇳	diS (0), StoP (1), ridE.th (2)					⇨	diS (0)			

0: diS

There is no line power supply loss detection and the drive operates normally only as long as the DC Bus voltage remains within specification (i.e. >Vuu). Once the voltage falls below Vuu an under-voltage 'UV' trip occurs. This will reset itself if the voltage rises above Vuu Restart, as stated in the table below.

1: StoP

The speed reference is set to zero and the ramps are disabled allowing the drive to decelerate the motor to a stop under current limit. If the line power supply is re-applied while the motor is stopping any run signal is ignored until the motor has stopped. If the current limit value is set very low level the drive may trip UV before the motor has stopped.

2: ridE.th

The drive detects line power supply loss when the DC Bus voltage falls below Vml_1. The drive then enters a mode where a closed-loop controller attempts to hold the DC Bus level at Vml_1. This causes the motor to decelerate at a rate that increases as the speed falls. If the line power supply is re-applied it will force the DC Bus voltage above the detection threshold Vml_3 and the drive will continue to operate normally. The output of the line power supply loss controller is a current demand that is fed into the current control system and therefore the gain Pr **4.13** and Pr **4.14** must be set up for optimum control. See parameters Pr **4.13** and Pr **4.14** for set-up details.

The following table shows the voltage levels used by drives with each voltage rating.

Voltage level	200V drive	400V drive
Vuu	175	330
Vml_1	205*	410*
Vml_2	Vml_1 - 10V	Vml_1 - 20V
Vml_3	Vml_1 + 10V	Vml_1 + 15V
Vuu Restart	215	425

* Vml_1 is defined by Pr **6.48**. The values in the table above are the default values.

6.48	Line power supply loss ride through detection level								
RW	Uni					RA		US	
⇳	0 to DC_VOLTAGE_SET_MAX V				⇨	200V drive: 205 400V drive: 410			

The line power supply loss detection level can be adjusted using this parameter. If the value is reduced below the default value, the default value is used by the drive. If the level is set too high, so that the line power supply loss detection becomes active under normal operating conditions, the motor will coast to a stop.

4.13	Current loop P gain								
RW	Uni							US	
⇳	0 to 30,000				⇨	200V drive: 75 400V drive: 150			

4.14	Current loop I gain								
RW	Uni							US	
⇳	0 to 30,000				⇨	200V drive: 1,000 400V drive: 2,000			

The Kp and Ki gains are used in the voltage based current controller. The default values give satisfactory operation with most motors. However it may be necessary to change the gains to improve the performance. The proportional gain (Pr **4.13**) is the most critical value in controlling the performance. Either the value can be set by auto-tuning (see Pr **5.12**) or it can be set by the user so that

Pr **4.13** = Kp = (L / T) x (I_{fs} / V_{fs}) x (256 / 5)

Where:

T is the sample time of the current controllers. The drive compensates for any change of sample time, and so it should be assumed that the sample time is equivalent to the lowest sample rate of 167μs.

L is the motor inductance. For a servo motor this is half the phase to phase inductance that is normally specified by the manufacturer. For an induction motor this is the per phase transient inductance (σL_s). This is the inductance value stored in Pr **5.24** after the autotune test

is carried out. If σL_s cannot be measured it can be calculated from the steady state per-phase equivalent circuit of the motor as follows:

$$\sigma L_s = L_s - \left(\frac{L_m^2}{L_r}\right)$$

I_{fs} is the peak full scale current feedback = $K_C \times \sqrt{2} / 0.45$. Where K_C is defined in Pr **11.32**.

V_{fs} is the maximum DC bus voltage.

Therefore:

Pr **4.13** = Kp = (L / 167µs) x (K_C x √2 / 0.45 / V_{fs}) x (256 / 5)

= K x L x K_C

Where:

K = [√2 / (0.45 x V_{fs} x 167µs)] x (256 / 5)

Drive voltage rating	Vfs	K
200V	415V	2322
400V	830V	1161

This set-up will give a step response with minimum overshoot after a step change of current reference. The approximate performance of the current controllers will be as given below. The proportional gain can be increased by a factor of 1.5 giving a similar increase in bandwidth, however, this gives at step response with approximately 12.5% overshoot.

Switching frequency kHz	Current control sample time µs	Gain bandwidth Hz	Phase delay µs
3	167	TBA	1160
4	125	TBA	875
6	83	TBA	581
8	125	TBA	625
12	83	TBA	415

The integral gain (Pr **4.14**) is less critical and should be set so that

Pr **4.14** = Ki = Kp x 256 x T / τ_m

Where:

τ_m is the motor time constant (L / R).

R is the per phase stator resistance of the motor (i.e. half the resistance measured between two phases).

Therefore

Pr **4.14** = Ki = (K x L x K_C) x 256 x 167µs x R / L

= 0.0427 x K x R x K_C

The above equation gives a conservative value of integral gain. In some applications where it is necessary for the reference frame used by the drive to dynamically follow the flux very closely (i.e. high speed closed-loop induction motor applications) the integral gain may need to have a significantly higher value.

8.22.7 Start / stop logic modes

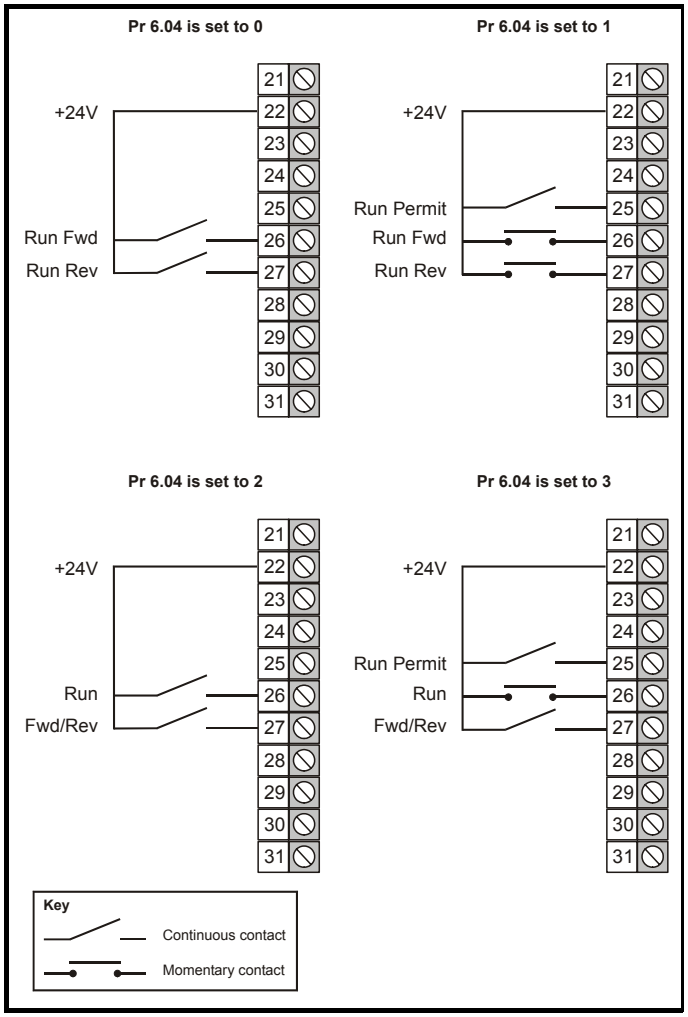
6.04	Start / stop logic select									
RW	Uni								US	
⇳	0 to 4					⇨	0			

This parameter is provided to allow the user to select several predefined digital input routing macros to control the sequencer. When a value between 0 and 3 is selected the drive processor continuously updates the destination parameters for digital I/O T25, T26 and T27, and the enable sequencer latching bit (Pr **6.40**). When a value of 4 is selected the destination parameters for these digital I/O and Pr **6.40** can be modified by the user.

If Pr **6.04** is changed then a drive reset is required before the function of T25, T26 or T27 will become active.

Pr 6.04	T25	T26	T27	Pr 6.40
0	No Function	Pr **6.30** (Run Forward)	Pr **6.32** (Run Reverse)	0 (Non Latching)
1	Pr **6.39** (Run Permit)	Pr **6.30** (Run Forward)	Pr **6.32** (Run Reverse)	1 (Latching)
2	No Function	Pr **6.34** (Run)	Pr **6.33** (Fwd/Rev)	0 (Non Latching)
3	Pr **6.39** (Run Permit)	Pr **6.34** (Run)	Pr **6.33** (Fwd/Rev)	1 (Latching)
4	User programmable	User programmable	User programmable	User programmable

Figure 8-39 Digital input connections when Pr 6.04 is set to 0 to 3



6.40	Enable sequencer latching									
RW	Bit								US	
⇳	OFF (0) or On (1)					⇨	OFF (0)			

This parameter enables sequencer latching. When sequencer latching is used, a digital input must be used as a run permit or not stop input. The digital input should write to Pr **6.39**. The run permit or not stop input must be made active to allow the drive to run. Making the run permit or not stop input inactive resets the latch and stops the drive.

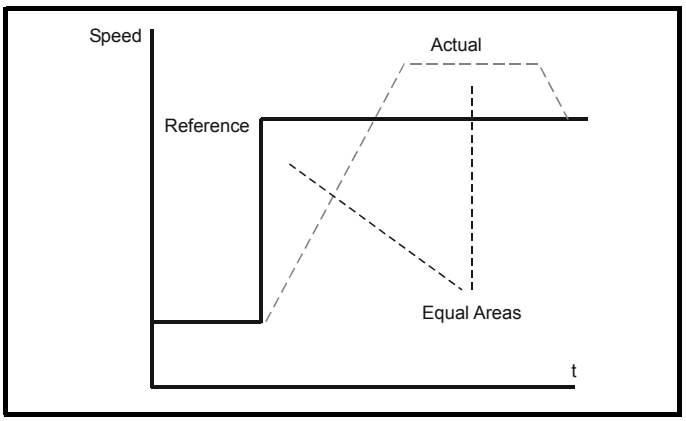
8.22.8 Position modes

13.10	Position controller mode								
RW	Uni							US	
⇳	0 to 6				⇨	0			

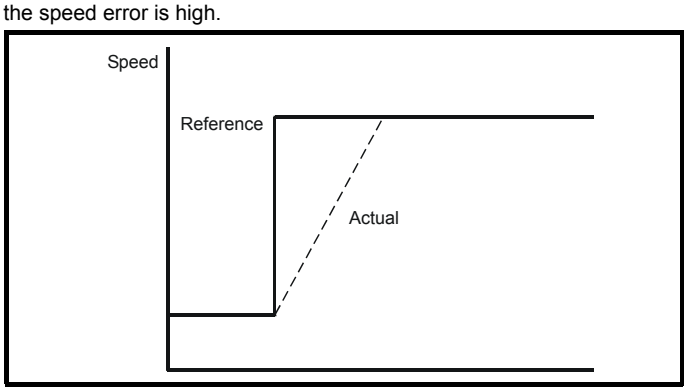
This parameter is used to set the position controller mode as shown in the table below.

Parameter value	Mode	Feed forward active
0	Position controller disabled	
1	Rigid position control	✓
2	Rigid position control	
3	Non-rigid position control	✓
4	Non-rigid position control	
5	Orientation on stop	
6	Orientation on stop and when drive enabled	

Rigid position control
In rigid position control the position error is always accumulated. This means that, if for example, the slave shaft is slowed down due to excessive load, the target position will eventually be recovered by running at a higher speed when the load is removed.



Non-rigid position control
In non-rigid position control the position loop is only active when the 'At Speed' condition is met (see Pr **3.06**). This allows slippage to occur while the speed error is high.



Velocity feed forward
The position controller can generate a velocity feed forwards value from the speed of the reference encoder. The feed-forwards value is passed to menu, and so ramps may be included if required. Because the position controller only has a proportional gain, it is necessary to use velocity feed-forwards to prevent a constant position error that would be proportional to the speed of the reference position.

If for any reason the user wishes to provide the velocity feed forward from a source other than the reference position, the feed forward system can be made inactive, i.e. Pr **13.10** = 2 or 4. The external feed forward can be provided via Menu 1 from any of the frequency/speed references. However, if the feed forward level is not correct a constant position error will exist.

Relative jogging
If relative jogging is enabled the feedback position can be made to move relative the reference position at the speed defined by Pr **13.17**.

Orientation
If Pr **13.10** is 5 the drive orientates the motor following a stop command. If hold zero speed is enabled (Pr **6.08** = 1) the drive remains in position control when orientation is complete and hold the orientation position. If hold zero speed is not enabled the drive is disabled when orientation is complete.

If Pr **13.10** is 6 the drive orientates the motor following a stop command and whenever the drive is enabled provided that hold zero speed is enabled (Pr **6.08** = 1). This ensures that the spindle is always in the same position following the drive being enabled.

When orientating from a stop command the drive goes through the following sequence:

1. The motor is decelerated or accelerated to the speed limit programmed in Pr **13.12**, using ramps if these are enabled, in the direction the motor was previously running.
2. When the ramp output reaches the speed set in Pr **13.12**, ramps are disabled and the motor continues to rotate until the position is found to be close to the target position (i.e. within 1/32 of a revolution). At this point the speed demand is set to 0 and the position loop is closed.
3. When the position is within the window defined by Pr **13.14**, the orientation complete indication is given in Pr **13.15**.

The stop mode selected by Pr **6.01** has no effect if orientation is enabled.

8.22.9 Fast Disable

6.29	Hardware enable								
RO	Bit					NC	PT		
⇳	OFF (0) or On (1)				⇨				

This bit is a duplicate of parameter Pr **8.09** and reflects the state of the enable input. With software V01.10.00 and later, if the destination of one of the drive digital I/O (Pr **8.21** to Pr **8.26**) is set to Pr **6.29** and the I/O is set as an input, the state of the input does not affect the value of this parameter as it is protected, however, it does provide a fast disable function.

The SAFE TORQUE OFF input to the drive (T31) disables the drive in hardware by removing the gate drive signals from the inverter IGBTs and also disables the drive via the software system. When the drive is disabled by de-activating the SAFE TORQUE OFF input (T31) there can be a delay of up to 20ms (typically 8ms) before the drive is disabled. However, if a digital I/O is set up to provide the fast disable function it is possible to disable the drive within 600μs of de-activating the input. To do this an enable signal should be given to both the SAFE TORQUE OFF input (T31) and to the digital I/O selected for the fast disable function. The state of the digital I/O including the effect of its associated invert parameter is ANDed with the SAFE TORQUE OFF (T31) to enable the drive.

WARNING

If the safety function of the SAFE TORQUE OFF input is required then there must not be a direct connection between the SAFE TORQUE OFF input (T31) and any other digital I/O on the drive. If the safety function of the SAFE TORQUE OFF input and the fast disable function is required then the drive should be given two separate independent enable signals. A safety related enable from a safe source connected to the SAFE TORQUE OFF input on the drive. A second enable connected to the digital I/O on the drive selected for the fast disable function. The circuit must be arranged so that a fault which causes the fast input to be forced high cannot cause the SAFE TORQUE OFF input to be forced high, including the case where a component such as a blocking diode has failed.

8 Diagnostics

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.

The display on the drive gives various information about the status of the drive. These fall into three categories:

- Trip indications
- Alarm indications
- Status indications

Table 8-1 Trip indications

Trip	Diagnosis
br.th	**Braking resistor thermistor temperature monitoring fail**
10	If no brake resistor is installed, set Pr **0.51** (or Pr **10.37**) to 8 to disable this trip. If a brake resistor is installed: Ensure that the braking resistor thermistor is connected correctly Ensure that the fan in the drive is working correctly Replace the braking resistor
C.Acc	**SMARTCARD trip: SMARTCARD Read / Write fail**
185	Check SMARTCARD is installed / located correctly Ensure SMARTCARD is not writing data to data location 500 to 999 Replace SMARTCARD
C.boot	**SMARTCARD trip: The menu 0 parameter modification cannot be saved to the SMARTCARD because the necessary file has not been created on the SMARTCARD**
177	A write to a menu 0 parameter has been initiated via the keypad with Pr **11.42** set to auto(3) or boot(4), but the necessary file on the SMARTCARD has not bee created Ensure that Pr **11.42** is correctly set and reset the drive to create the necessary file on the SMARTCARD Re-attempt the parameter write to the menu 0 parameter
C.bUSY	**SMARTCARD trip: SMARTCARD can not perform the required function as it is being accessed by a Solutions Module**
178	Wait for the Solutions Module to finish accessing the SMARTCARD and then re-attempt the required function
C.Chg	**SMARTCARD trip: Data location already contains data**
179	Erase data in data location Write data to an alternative data location
C.cPr	**SMARTCARD trip: The values stored in the drive and the values in the data block on the SMARTCARD are different**
188	Press the red reset button
C.dAt	**SMARTCARD trip: Data location specified does not contain any data**
183	Ensure data block number is correct
C.Err	**SMARTCARD trip: SMARTCARD data is corrupted**
182	Ensure the card is located correctly Erase data and retry Replace SMARTCARD
C.Full	**SMARTCARD trip: SMARTCARD full**
184	Delete a data block or use different SMARTCARD
cL2	**Analog input 2 current loss (current mode)**
28	Check analog input 2 (terminal 7) current signal is present (4-20mA, 20-4mA)
cL3	**Analog input 3 current loss (current mode)**
29	Check analog input 3 (terminal 8) current signal is present (4-20mA, 20-4mA)
CL.bit	**Trip initiated from the control word (Pr 6.42)**
35	Disable the control word by setting Pr **6.43** to 0 or check setting of Pr **6.42**
C.OPtn	**SMARTCARD trip: Solutions Modules installed are different between source drive and destination drive**
180	Ensure correct Solutions Modules are installed Ensure Solutions Modules are in the same Solutions Module slot Press the red reset button
C.Prod	**SMARTCARD trip: The data blocks on the SMARTCARD are not compatible with this product**
175	Erase all data on the SMARTCARD by setting Pr **xx.00** to 9999 and pressing the red reset button Replace SMARTCARD

Trip	Diagnosis
C.rdo	**SMARTCARD trip: SMARTCARD has the Read Only bit set**
181	Enter 9777 in Pr **xx.00** to allow SMARTCARD Read / Write access Ensure card is not writing to data locations 500 to 999
C.rtg	**SMARTCARD trip: The voltage and/or current rating of the source and destination drives are different**
186	Drive rating dependent parameters (parameters with the RA coding) are 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 SMARTCARDs when the rating of the destination drive is different from the source drive and the file is a parameter file. Drive rating dependent parameters will be transferred if only the current rating is different and the file is a differences from default type file. Press the red reset button Drive rating parameters are:

Parameter	Function
2.08	Standard ramp voltage
4.05/**6**/**7**, **21.27**/**8**/**9**	Current limits
4.24	User current maximum scaling
5.07, **21.07**	Motor rated current
5.09, **21.09**	Motor rated voltage
5.17, **21.12**	Stator resistance
5.18	Switching frequency
5.23, **21.13**	Voltage offset
5.24, **21.14**	Transient inductance
6.48	Line power supply loss ride through detection level

186	The above parameters will be set to their default values.
C.TyP	**SMARTCARD trip: SMARTCARD parameter set not compatible with drive**
187	Press the reset button Ensure destination drive type is the same as the source parameter file drive type
dESt	**Two or more parameters are writing to the same destination parameter**
199	Set Pr **xx.00** = 12001 check all visible parameters in the menus for duplication
EEF	**EEPROM data corrupted - Drive mode becomes open loop and serial comms will timeout with remote keypad on the drive RS485 comms port.**
31	This trip can only be cleared by loading default parameters and saving parameters
Enc1	**Drive encoder trip: Encoder power supply overload**
189	Check encoder power supply wiring and encoder current requirement Maximum current = 200mA @ 15V, or 300mA @ 8V and 5V
Enc2	**Drive encoder trip: Wire break (Drive encoder terminals 1 & 2, 3 & 4, 5 & 6)**
190	Check cable continuity Check wiring of feedback signals is correct Check encoder power is set correctly Replace feedback device If wire break detection on the main drive encoder input is not required, set Pr **3.40** = 0 to disable the Enc2 trip
Enc3	**Drive encoder trip: Phase offset incorrect While running**
191	Check the encoder signal for noise Check encoder shielding Check the integrity of the encoder mechanical mounting Repeat the offset measurement test
Enc4	**Drive encoder trip: Feedback device comms failure**
192	Ensure encoder power supply is correct Ensure baud rate is correct Check encoder wiring Replace feedback device
Enc5	**Drive encoder trip: Checksum or CRC error**
193	Check the encoder signal for noise Check the encoder cable shielding With EnDat encoders, check the comms resolution and/or carry out the auto-configuration Pr **3.41**
Enc6	**Drive encoder trip: Encoder has indicated an error**
194	Replace feedback device With SSI encoders, check the wiring and encoder supply setting

Trip	Diagnosis
Enc7	**Drive encoder trip: Initialisation failed**
195	Re-set the drive Check the correct encoder type is entered into Pr **3.38** Check encoder wiring Check encoder power supply is set correctly Carry out the auto-configuration Pr **3.41** Replace feedback device
Enc8	**Drive encoder trip: Auto configuration on power up has been requested and failed**
196	Change the setting of Pr **3.41** to 0 and manually enter the drive encoder turns (Pr **3.33**) and the equivalent number of lines per revolution (Pr **3.34**) Check the comms resolution
Enc9	**Drive encoder trip: Position feedback selected is selected from a Solutions Module slot which does not have a speed / position feedback Solutions Module installed**
197	Check setting of Pr **3.26** (or Pr **21.21** if the second motor parameters have been enabled)
Enc10	**Drive encoder trip: Servo mode phasing failure because encoder phase angle (Pr 3.25 or Pr 21.20) is incorrect**
198	Check the encoder wiring. Perform an autotune to measure the encoder phase angle or manually enter the correct phase angle into Pr **3.25** (or Pr **21.20**). Spurious Enc10 trips can be seen in very dynamic applications. This trip can be disabled by setting the overspeed threshold in Pr **3.08** to a value greater than zero. Caution should be used in setting the over speed threshold level as a value which is too large may mean that an encoder fault will not be detected.
Enc11	**Drive encoder trip: A failure has occurred during the alignment of the analog signals of a SINCOS encoder with the digital count derived from the sine and cosine waveforms and the comms position (if applicable). This fault is usually due to noise on the sine and cosine signals.**
161	Check encoder cable shield. Examine sine and cosine signals for noise.
Enc12	**Drive encoder trip: Hiperface encoder - The encoder type could not be identified during auto-configuration**
162	Check encoder type can be auto-configured. Check encoder wiring. Enter parameters manually.
Enc13	**Drive encoder trip: EnDat encoder - The number of encoder turns read from the encoder during auto-configuration is not a power of 2**
163	Select a different type of encoder.
Enc14	**Drive encoder trip: EnDat encoder - The number of comms bits defining the encoder position within a turn read from the encoder during auto-configuration is too large.**
164	Select a different type of encoder. Faulty encoder.
Enc15	**Drive encoder trip: The number of periods per revolution calculated from encoder data during auto-configuration is either less than 2 or greater than 50,000.**
165	Linear motor pole pitch / encoder ppr set up is incorrect or out of parameter range i.e. Pr **5.36** = 0 or Pr **21.31** = 0. Faulty encoder.
Enc16	**Drive encoder trip: EnDat encoder - The number of comms bits per period for a linear encoder exceeds 255.**
166	Select a different type of encoder. Faulty encoder.
Enc17	**Drive encoder trip: The periods per revolution obtained during auto-configuration for a rotary SINCOS encoder is not a power of two.**
167	Select a different type of encoder. Faulty encoder.
ENP.Er	**Data error from electronic nameplate stored in selected position feedback device**
176	Replace feedback device
Et	**External trip from input on terminal 31**
6	Check terminal 31 signal Check value of Pr **10.32** Enter 12001 in Pr **xx.00** and check for parameter controlling Pr **10.32** Ensure Pr **10.32** or Pr **10.38** (=6) are not being controlled by serial comms
HF01	**Data processing error: CPU address error**
	Hardware fault - return drive to supplier

Trip	Diagnosis
HF02	**Data processing error: DMAC address error**
	Hardware fault - return drive to supplier
HF03	**Data processing error: Illegal instruction**
	Hardware fault - return drive to supplier
HF04	**Data processing error: Illegal slot instruction**
	Hardware fault - return drive to supplier
HF05	**Data processing error: Undefined exception**
	Hardware fault - return drive to supplier
HF06	**Data processing error: Reserved exception**
	Hardware fault - return drive to supplier
HF07	**Data processing error: Watchdog failure**
	Hardware fault - return drive to supplier
HF08	**Data processing error: Level 4 crash**
	Hardware fault - return drive to supplier
HF09	**Data processing error: Heap overflow**
	Hardware fault - return drive to supplier
HF10	**Data processing error: Router error**
	Hardware fault - return drive to supplier
HF11	**Data processing error: Access to EEPROM failed**
	Hardware fault - return drive to supplier
HF12	**Data processing error: Main program stack overflow**
	Hardware fault - return drive to supplier
HF13	**Data processing error: Software incompatible with hardware**
	Hardware or software fault - return drive to supplier
HF17	**Multi-module system thermistor short circuit or open circuit**
217	Hardware fault - return drive to supplier
HF18	**Multi-module system interconnect cable error**
218	Hardware fault - return drive to supplier
HF19	**Temperature feedback multiplexing failure**
219	Hardware fault - return drive to supplier
HF20	**Power stage recognition: serial code error**
220	Hardware fault - return drive to supplier
HF21	**Power stage recognition: unrecognised frame size**
221	Hardware fault - return drive to supplier
HF22	**Power stage recognition: multi module frame size mismatch**
222	Hardware fault - return drive to supplier
HF23	**Power stage recognition: multi module voltage rating mismatch**
223	Hardware fault - return drive to supplier
HF24	**Power stage recognition: unrecognised drive size**
224	Hardware fault - return drive to supplier
HF25	**Current feedback offset error**
225	Hardware fault - return drive to supplier
HF26	**Soft start relay failed to close, soft start monitor failed or braking IGBT short circuit at power up**
226	Hardware fault - return drive to supplier
HF27	**Power stage thermistor 1 fault**
227	Hardware fault - return drive to supplier

Trip	Diagnosis
HF29	**Control board thermistor fault**
229	Hardware fault - return drive to supplier
HF30	**DCCT wire break trip from power module**
230	Hardware fault - return drive to supplier
It.AC	**Output current overload timed out (I^2t) - accumulator value can be seen in Pr 4.19**
20	Ensure the load is not jammed / sticking Check the load on the motor has not changed If seen during an autotune in servo mode, ensure that the motor rated current Pr **0.46** (Pr **5.07**) or Pr **21.07** is current rating of the drive Tune the rated speed parameter Check feedback device signal for noise Check the feedback device mechanical coupling
It.br	**Braking resistor overload timed out (I^2t) – accumulator value can be seen in Pr 10.39**
19	Ensure the values entered in Pr **10.30** and Pr **10.31** are correct Increase the power rating of the braking resistor and change Pr **10.30** and Pr **10.31** If an external thermal protection device is being used and the braking resistor software overload is not required, set Pr **10.30** or Pr **10.31** to 0 to disable the trip
L.SYnC	**Drive failed to synchronize to the supply voltage in Regen mode**
O.CtL	**Drive control board over temperature**
23	Check enclosure / drive fans are still functioning correctly Check enclosure ventilation paths Check enclosure door filters Check ambient temperature Reduce drive switching frequency
O.ht1	**Power device over temperature based on thermal model**
21	Reduce drive switching frequency Reduce duty cycle Decrease acceleration / deceleration rates Reduce motor load
O.ht2	**Heatsink over temperature**
22	Check enclosure / drive fans are still functioning correctly Check enclosure ventilation paths Check enclosure door filters Increase ventilation Decrease acceleration / deceleration rates Reduce drive switching frequency Reduce duty cycle Reduce motor load
O.ht3	**Drive over-temperature based on thermal model**
27	The drive will attempt to stop the motor before tripping. If the motor does not stop in 10s the drive trips immediately. Check enclosure / drive fans are still functioning correctly Check enclosure ventilation paths Check enclosure door filters Increase ventilation Decrease acceleration / deceleration rates Reduce duty cycle Reduce motor load
OI.AC	**Instantaneous output over current detected**
3	Acceleration /deceleration rate is too short. If seen during autotune reduce voltage boost Pr **5.15** Check for short circuit on output cabling Check integrity of motor insulation Check feedback device wiring Check feedback device mechanical coupling Check feedback signals are free from noise Is motor cable length within limits Reduce the values in speed loop gain parameters – Pr **3.10**, Pr **3.11** and Pr **3.12** Has offset measurement test been completed? Reduce the values in current loop gain parameters - Pr **4.13** and Pr **4.14**

Trip	Diagnosis
OI.br	**Braking transistor over-current detected: short circuit protection for the braking transistor activated**
4	Check braking resistor wiring Check braking resistor value is greater than or equal to the minimum resistance value Check braking resistor insulation
O.Ld1	**Digital output overload: total current drawn from 24V supply and digital outputs exceeds 200mA**
26	Check total load on digital outputs (terminals 24,25,26)and +24V rail (terminal 22)
O.SPd	**Motor speed has exceeded the over speed threshold**
7	Increase the over speed trip threshold in Pr **3.08** Reduce the speed loop P gain (Pr **3.10**) to reduce the speed overshoot
OV	**DC bus voltage has exceeded the peak level or the maximum continuous level for 15 seconds**
2	Increase deceleration ramp (Pr **0.04**) Decrease braking resistor value (staying above the minimum value) Check nominal AC supply level Check for supply disturbances which could cause the DC bus to rise – voltage overshoot after supply recovery from a notch induced by DC drives. Check motor insulation **Drive voltage rating** **Peak voltage** **Maximum continuous voltage level (15s)** 200 415 400 400 830 800 If the drive is operating in low voltage DC mode the overvoltage trip level is 1.45 x Pr **6.46**.
PAd	**Keypad has been removed when the drive is receiving the speed reference from the keypad**
34	Instal keypad and reset Change speed reference selector to select speed reference from another source
PH	**AC voltage input phase loss or large supply imbalance detected**
32	Ensure all three phases are present and balanced Check input voltage levels are correct (at full load) **NOTE** Load level must be between 50 and 100% for the drive to trip under phase loss conditions. The drive will attempt to stop the motor before this trip is initiated.
PS	**Internal power supply fault**
5	Remove any Solutions Modules and reset Hardware fault - return drive to supplier
PS.10V	**10V user power supply current greater than 10mA**
8	Check wiring to terminal 4 Reduce load on terminal 4
PS.24V	**24V internal power supply overload**
9	The total user load of the drive and Solutions Modules has exceeded the internal 24V power supply limit. The user load consists of the drive's digital outputs, the SM-I/O Plus digital outputs, the drive's main encoder supply and the SM-Universal Encoder Plus encoder supply. • Reduce load and reset • Provide an external 24V >50W power supply • Remove any Solutions Modules and reset
PSAVE.Er	**Power down save parameters in the EEPROM are corrupt**
37	Indicates that the power was removed when power down save parameters were being saved. The drive will revert back to the power down parameter set that was last saved successfully. Perform a user save (Pr **xx.00** to 1000 or 1001 and reset the drive) or power down the drive normally to ensure this trip does or occur the next time the drive is powered up.
SAVE.Er	**User save parameters in the EEPROM are corrupt**
36	Indicates that the power was removed when user parameters were being saved. The drive will revert back to the user parameter set that was last saved successfully. Perform a user save (Pr **xx.00** to 1000 or 1001 and reset the drive) to ensure this trip does or occur the next time the drive is powered up.
SCL	**Drive RS485 serial comms loss to remote keypad**
30	Re-instal the cable between the drive and keypad Check cable for damage Replace cable Replace keypad

Trip	Diagnosis
SLX.dF	**Solutions Module slot X trip: Solutions Module type installed in slot X changed**
204,209	Save parameters and reset
SLX.Er	**Solutions Module slot X trip: Solutions Module in slot X has detected a fault**
202,207,212	**Feedback module category** Check value in Pr **15**/**16.50**. The following table lists the possible error codes for the SM-Universal Encoder Plus, SM-Encoder Plus and SM-Resolver. See the *Diagnostics* section in the relevant Solutions Module User Guide for more information.

Error code	Module	Trip Description	Diagnostic
0	All	No trip	No fault detected
1	SM-Universal Encoder Plus	Encoder power supply overload	Check encoder power supply wiring and encoder current requirement Maximum current = 200mA @ 15V, or 300mA @ 8V and 5V
	SM-Resolver	Excitation output short circuit	Check the excitation output wiring.
2	SM-Universal Encoder Plus & SM-Resolver	Wire break	Check cable continuity Check wiring of feedback signals is correct Check supply voltage or excitation output level Replace feedback device
3	SM-Universal Encoder Plus	Phase offset incorrect while running	Check the encoder signal for noise Check encoder shielding Check the integrity of the encoder mechanical mounting Repeat the offset measurement test
4	SM-Universal Encoder Plus	Feedback device communications failure	Ensure encoder power supply is correct Ensure baud rate is correct Check encoder wiring Replace feedback device
5	SM-Universal Encoder Plus	Checksum or CRC error	Check the encoder signal for noise Check the encoder cable shielding
6	SM-Universal Encoder Plus	Encoder has indicated an error	Replace encoder
7	SM-Universal Encoder Plus	Initialisation failed	Check the correct encoder type is entered into Pr **15**/**16**/**17.15** Check encoder wiring Check supply voltage level Replace feedback device
8	SM-Universal Encoder Plus	Auto configuration on power up has been requested and failed	Change the setting of Pr **15**/**16**/**17.18** and manually enter the number of turns (Pr **15**/**16**/**17.09**) and the equivalent number of lines per revolution (Pr **15**/**16**/**17.10**)
9	SM-Universal Encoder Plus	Motor thermistor trip	Check motor temperature Check thermistor continuity
10	SM-Universal Encoder Plus	Motor thermistor short circuit	Check motor thermistor wiring Replace motor / motor thermistor
11	SM-Universal Encoder Plus	Failure of the sincos analog position alignment during encoder initialisation	Check encoder cable shield. Examine sine and cosine signals for noise.
	SM-Resolver	Poles not compatible with motor	Check that the correct number of resolver poles has been set in Pr **15**/**16**/**17.15**.
12	SM-Universal Encoder Plus	Encoder type could not be identified during auto-configuration	Check encoder type can be auto-configured. Check encoder wiring. Enter parameters manually.
13	SM-Universal Encoder Plus	Number of encoder turns read from the encoder during auto-configuration is not a power of 2	Select a different type of encoder.
14	SM-Universal Encoder Plus	Number of comms bits defining the encoder position within a turn read from the encoder during auto-configuration is too large.	Select a different type of encoder. Faulty encoder.
15	SM-Universal Encoder Plus	The number of periods per revolution calculated from encoder data during auto-configuration is either <2 or >50,000.	Linear motor pole pitch / encoder ppr set up is incorrect or out of parameter range i.e. Pr **5.36** = 0 or Pr **21.31** = 0. Faulty encoder.
16	SM-Universal Encoder Plus	The number of comms bits per period for a linear encoder exceeds 255.	Select a different type of encoder. Faulty encoder.
74	All	Solutions Module has overheated	Check ambient temperature Check enclosure ventilation

Trip	Diagnosis
SLX.Er	**Solutions Module slot X trip: Solutions Module in slot X or Digitax ST Plus/Indexer has detected a fault**
202,207,212	**Automation (Applications) module category** Check value in Pr **17.50**. The following table lists the possible error codes for the Digitax ST Plus and Digitax ST Indexer. See the *Diagnostics* section in the Advanced User Guide for more information.

Error Code	Trip Description
39	User program stack overflow
40	Unknown error - please contact supplier
41	Parameter does not exist
42	Attempt to write to a read-only parameter
43	Attempt to read from a write-only parameter
44	Parameter value out of range
45	Invalid synchronisation modes
46	Unused
47	Synchronisation lost with CTSync Master
48	RS485 not in user mode
49	Invalid RS485 configuration
50	Maths error - divide by zero or overflow
51	Array index out of range
52	Control word user trip
53	DPL program incompatible with target
54	DPL task overrun
55	Unused
56	Invalid timer unit configuration
57	Function block does not exist
58	Flash PLC Storage corrupt
59	Drive rejected application module as Sync master
60	CTNet hardware failure. Please contact your supplier
61	CTNet invalid configuration
62	CTNet invalid baud-rate
63	CTNet invalid node ID
64	Digital Output overload
65	Invalid function block parameter(s)
66	User heap too large
67	RAM file does not exist or a non-RAM file id has been specified
68	The RAM file specified is not associated to an array
69	Failed to update drive parameter database cache in Flash memory
70	User program downloaded while drive enabled
71	Failed to change drive mode
72	Invalid CTNet buffer operation
73	Fast parameter initialisation failure
74	Over-temperature
75	Hardware unavailable
76	Module type cannot be resolved. Module is not recognised.
77	Inter-option module comms error with module in slot 1
78	Inter-option module comms error with module in slot 2
79	Inter-option module comms error with module in slot 3
80	Inter-option module comms error with module unknown slot
81	APC internal error
82	Communications to drive faulty

Trip	Diagnosis
SLX.Er	**Solutions Module slot X trip: Solutions Module in slot X has detected a fault**
202,207,212	**Automation (I/O Expansion) module category** Check value in Pr **15/16.50**. The following table lists the possible error codes for the SM-I/O Plus, SM-I/O Lite, SM-I/O Timer, SM-I/O PELV, SM-I/O 120V and SM-I/O 24V Protected. See the *Diagnostics* section in the relevant Solutions Module User Guide for more information.

Error code	Module	Reason for fault
0	All	No errors
1	All	Digital output overload
2	SM-I/O Lite, SM-I/O Timer	Analog input 1 current input too high (>22mA) or too low (<3mA)
	SM-I/O PELV, SM-I/O 24V Protected	Digital input overload
3	SM-I/O PELV, SM-I/O 24V Protected	Analog input 1 current input too low (<3mA)
	SM-I/O 24V Protected	Communications error
4	SM-I/O PELV	User power supply absent
5	SM-I/O Timer	Real time clock communication error
74	All	Module over temperature

Trip	Diagnosis
SLX.Er	**Solutions Module slot X trip: Solutions Module in slot X has detected a fault**
202,207,212	**Fieldbus module category** Check value in Pr **15**/**16.50**. The following table lists the possible error codes for the Fieldbus modules. See the *Diagnostics* section in the relevant Solutions Module User Guide for more information.

Error code	Module	Trip Description
0	All	No trip
52	SM-PROFIBUS-DP, SM-Interbus, SM-DeviceNet, SM-CANOpen	User control word trip
61	SM-PROFIBUS-DP, SM-Interbus, SM-DeviceNet, SM-CANOpen, SM-SERCOS	Configuration error
64	SM-DeviceNet	Expected packet rate timeout
65	SM-PROFIBUS-DP, SM-Interbus, SM-DeviceNet, SM-CANOpen, SM-SERCOS	Network loss
66	SM-PROFIBUS-DP	Critical link failure
	SM-CAN, SM-DeviceNet, SM-CANOpen	Bus off error
69	SM-CAN	No acknowledgement
70	All (except SM-Ethernet)	Flash transfer error
	SM-Ethernet	No valid menu data available for the module from the drive
74	All	Solutions module over temperature
75	SM-Ethernet	The drive is not responding
76	SM-Ethernet	The Modbus connection has timed out
80	All (except SM-SERCOS)	Inter-option communications error
81	All (except SM-SERCOS)	Communications error to slot 1
82	All (except SM-SERCOS)	Communications error to slot 2
83	All (except SM-SERCOS)	Communications error to slot 3
84	SM-Ethernet	Memory allocation error
85	SM-Ethernet	File system error
86	SM-Ethernet	Configuration file error
87	SM-Ethernet	Language file error
98	All	Internal watchdog error
99	All	Internal software error

<table>
<tr><th>Trip</th><th>Diagnosis</th></tr>
<tr><td>SLX.Er</td><td>Solutions Module slot X trip: Solutions Module in slot X has detected a fault</td></tr>
<tr><td>202,207,212</td><td>SLM module category
Check value in Pr 15/16.50. The following table lists the possible error codes for the SM-SLM. See the Diagnostics section in the SM-SLM User Guide for more information.
<table>
<tr><th>Error Code</th><th>Trip Description</th></tr>
<tr><td>0</td><td>No fault detected</td></tr>
<tr><td>1</td><td>Power supply overloaded</td></tr>
<tr><td>2</td><td>SLM version is too low</td></tr>
<tr><td>3</td><td>DriveLink error</td></tr>
<tr><td>4</td><td>Incorrect switching frequency selected</td></tr>
<tr><td>5</td><td>Feedback source selection incorrect</td></tr>
<tr><td>6</td><td>Encoder error</td></tr>
<tr><td>7</td><td>Motor object number of instances error</td></tr>
<tr><td>8</td><td>Motor object list version error</td></tr>
<tr><td>9</td><td>Performance object number of instances error</td></tr>
<tr><td>10</td><td>Parameter channel error</td></tr>
<tr><td>11</td><td>Drive operating mode incompatible</td></tr>
<tr><td>12</td><td>Error writing to the SLM EEPROM</td></tr>
<tr><td>13</td><td>Motor object type incorrect</td></tr>
<tr><td>14</td><td>Digitax ST object error</td></tr>
<tr><td>15</td><td>Encoder object CRC error</td></tr>
<tr><td>16</td><td>Motor object CRC error</td></tr>
<tr><td>17</td><td>Performance object CRC error</td></tr>
<tr><td>18</td><td>Digitax ST object CRC error</td></tr>
<tr><td>19</td><td>Sequencer timeout</td></tr>
<tr><td>74</td><td>Solutions module over temperature</td></tr>
</table></td></tr>
<tr><td>SLX.HF</td><td>Solutions Module slot X trip: Solutions Module X hardware fault</td></tr>
<tr><td>200,205,210</td><td>Ensure Solutions Module is installed correctly
Return Solutions Module to supplier</td></tr>
<tr><td>SLX.nF</td><td>Solutions Module slot X trip: Solutions Module has been removed</td></tr>
<tr><td>203,208,213</td><td>Ensure Solutions Module is installed correctly
Re-instal Solutions Module
Save parameters and reset drive</td></tr>
<tr><td>SL.rtd</td><td>Solutions Module trip: Drive mode has changed and Solutions Module parameter routing is now incorrect</td></tr>
<tr><td>215</td><td>Press reset.
If the trip persists, contact the supplier of the drive.</td></tr>
<tr><td>SLX.tO</td><td>Solutions Module slot X trip: Solutions Module watchdog timeout</td></tr>
<tr><td>201,206,211</td><td>Press reset.
If the trip persists, contact the supplier of the drive.</td></tr>
<tr><td>t010</td><td>User trip defined in 2nd processor Solutions Module code</td></tr>
<tr><td>10</td><td>SM-Applications program must be interrogated to find the cause of this trip</td></tr>
<tr><td>t038</td><td>User trip defined in 2nd processor Solutions Module code</td></tr>
<tr><td>38</td><td>SM-Applications program must be interrogated to find the cause of this trip</td></tr>
<tr><td>t040 to t089</td><td>User trip defined in 2nd processor Solutions Module code</td></tr>
<tr><td>40 to 89</td><td>SM-Applications program must be interrogated to find the cause of this trip</td></tr>
<tr><td>t099</td><td>User trip defined in 2nd processor Solutions Module code</td></tr>
<tr><td>99</td><td>SM-Applications program must be interrogated to find the cause of this trip</td></tr>
<tr><td>t101</td><td>User trip defined in 2nd processor Solutions Module code</td></tr>
<tr><td>101</td><td>SM-Applications program must be interrogated to find the cause of this trip</td></tr>
<tr><td>t112 to t160</td><td>User trip defined in 2nd processor Solutions Module code</td></tr>
<tr><td>112 to 160</td><td>SM-Applications program must be interrogated to find the cause of this trip</td></tr>
</table>

Trip	Diagnosis
t168 to t175	**User trip defined in 2nd processor Solutions Module code**
168 to 175	SM-Applications program must be interrogated to find the cause of this trip
t216	**User trip defined in 2nd processor Solutions Module code**
216	SM-Applications program must be interrogated to find the cause of this trip
th	**Motor thermistor trip**
24	Check motor temperature Check thermistor continuity Set Pr **7.15** = VOLt and reset the drive to disable this function
thS	**Motor thermistor short circuit**
25	Check motor thermistor wiring Replace motor / motor thermistor Set Pr **7.15** = VOLt and reset the drive to disable this function
tunE*	**Autotune stopped before completion**
18	The drive has tripped out during the autotune The red stop key has been pressed during the autotune The SAFE TORQUE OFF signal (terminal 31) was active during the autotune procedure
tunE1*	**The position feedback did not change or required speed could not be reached during the inertia test (see Pr 5.12)**
11	Ensure the motor is free to turn i.e. brake was released. Check feedback device wiring is correct Check feedback parameters are set correctly Check encoder coupling to motor
tunE2*	**Position feedback direction incorrect or motor could not be stopped during the inertia test (see Pr 5.12)**
12	Check motor cable wiring is correct. Check feedback device wiring is correct Swap any two motor phases (closed loop vector only)
tunE3*	**Drive encoder commutation signals connected incorrectly or measured inertia out of range (see Pr 5.12)**
13	Check motor cable wiring is correct. Check feedback device U,V and W commutation signal wiring is correct
tunE4*	**Drive encoder U commutation signal fail during an autotune**
14	Check feedback device U phase commutation wires continuity Replace encoder
tunE5*	**Drive encoder V commutation signal fail during an autotune**
15	Check feedback device V phase commutation wires continuity Replace encoder
tunE6*	**Drive encoder W commutation signal fail during an autotune**
16	Check feedback device W phase commutation wires continuity Replace encoder
tunE7*	**Motor number of poles set incorrectly**
17	Check lines per revolution for feedback device Check the number of poles in Pr **5.11** is set correctly
UP ACC	**Onboard PLC program: cannot access Onboard PLC program file on drive**
98	Disable drive - write access is not allowed when the drive is enabled Another source is already accessing Onboard PLC program - retry once other action is complete
UP div0	**Onboard PLC program attempted divide by zero**
90	Check program
UP OFL	**Onboard PLC program variables and function block calls using more than the allowed RAM space (stack overflow)**
95	Check program
UP ovr	**Onboard PLC program attempted out of range parameter write**
94	Check program
UP PAr	**Onboard PLC program attempted access to a non-existent parameter**
91	Check program
UP ro	**Onboard PLC program attempted write to a read-only parameter**
92	Check program
UP So	**Onboard PLC program attempted read of a write-only parameter**
93	Check program

Trip	Diagnosis
UP udF	**Onboard PLC program un-defined trip**
97	Check program
UP uSEr	**Onboard PLC program requested a trip**
96	Check program
UV	**DC bus under voltage threshold reached**
1	Check AC supply voltage level **Drive voltage rating (Vac)** / **Under voltage threshold (Vdc)** / **UV reset voltage (Vdc)** 200 / 175 / 215V 400 / 350 / 425V

*If a tunE through tunE trip occurs, then after the drive is reset the drive cannot be made to run unless it is disabled via the SAFE TORQUE OFF input (terminal 31), drive enable parameter (Pr **6.15**) or the control word (Pr **6.42** and Pr **6.43**).

Table 8-2 Serial communications look-up table

No.	Trip	No.	Trip	No.	Trip
1	UV	40 to 89	t040 to t089	182	C.Err
2	OV	90	UP div0	183	C.dAt
3	Ol.AC	91	UP PAr	184	C.FULL
4	Ol.br	92	UP ro	185	C.Acc
5	PS	93	UP So	186	C.rtg
6	Et	94	UP ovr	187	C.TyP
7	O.SPd	95	UP OFL	188	C.cPr
8	PS.10V	96	UP uSEr	189	EnC1
9	PS.24V	97	UP udF	190	EnC2
10	br.th	98	UP ACC	191	EnC3
11	tunE1	99	t099	192	EnC4
12	tunE2	100		193	EnC5
13	tunE3	101	t101	194	EnC6
15	tunE5	103	Olbr.P	196	EnC8
16	tunE6	104	OlAC.P	197	EnC9
17	tunE7	105	Oht2.P	198	EnC10
18	tunE	106	OV.P	199	DESt
19	It.br	107	PH.P	200	SL1.HF
20	It.AC	108	PS.P	201	SL1.tO
21	O.ht1	109	OldC.P	202	SL1.Er
24	th	112 to 160	t112 to t160	205	SL2.HF
25	thS	161	Enc11	206	SL2.tO
26	O.Ld1	162	Enc12	207	SL2.Er
27	O.ht3	163	Enc13	208	SL2.nF
28	cL2	164	Enc14	209	SL2.dF
29	cL3	165	Enc15	210	SL3.HF
30	SCL	166	Enc16	211	SL3.tO
31	EEF	167	Enc17	212	SL3.Er
32	PH	168 to 174	t168 to t174	213	SL3.nF
33	rS	175	C.Prod	214	SL3.dF
34	PAd	176	EnP.Er	215	SL.rtd
35	CL.bit	177	C.boot	216	t216
36	SAVE.Er	178	C.bUSY	217 to 232	HF17 to HF32
37	PSAVE.Er	179	C.Chg		
38	t038	180	C.OPtn		
39	L.SYnC	181	C.RdO		

The trips can be grouped into the following categories. It should be noted that a trip can only occur when the drive is not tripped or is already tripped but with a trip with a lower priority number.

Table 8-3 Trip categories

Priority	Category	Trips	Comments
1	Hardware faults	HF01 to HF16	These indicate serious internal problems and cannot be reset. The drive is inactive after one of these trips and the display shows **HFxx**. The Drive OK relay opens and the serial comms will not function.
2	Non-resetable trips	HF17 to HF32, SL1.HF, SL2.HF	Cannot be reset. Requires the drive to be powered down.
3	EEF trip	EEF	Cannot be reset unless a code to load defaults is first entered in Pr **xx.00** or Pr **11.43**.
4	SMARTCARD trips	C.boot, C.Busy, C.Chg, C.OPtn, C.RdO, C.Err, C.dat, C.FULL, C.Acc, C.rtg, C.TyP, C.cpr	Can be reset after 1.0s SMARTCARD trips have priority 5 during power-up
4	supply trips	PS.24V	Can be reset after 1.0s
5	Autotune	tunE, tunE1 to tunE	Can be reset after 1.0s, but the drive cannot be made to run unless it is disabled via the SAFE TORQUE OFF input (terminal 31), *Drive enable* (Pr **6.15**) or the *Control word* (Pr **6.42** and Pr **6.43**).
5	Normal trips with extended reset	OI.AC, OI.Br, OIAC.P, OIBr.P, OIdC.P	Can be reset after 10.0s
5	Normal trips	All other trips not included in this table	Can be reset after 1.0s
5	Non-important trips	th, thS, Old1, cL2, cL3, SCL	If Pr **10.37** is 1 or 3 the drive will stop before tripping
5	Phase loss	PH	The drive attempts to stop before tripping
5	Drive over-heat based on thermal model	O.ht3	The drive attempts to stop before tripping, but if it does not stop within 10s the drive will automatically trip
6	Self-resetting trips	UV	Under voltage trip cannot be reset by the user, but is automatically reset by the drive when the supply voltage is with specification

Although the UV trip operates in a similar way to all other trips, all drive functions can still operate but the drive cannot be enabled. The following differences apply to the UV trip:

1. Power-down save user parameters are saved when UV trip is activated except when the main high voltage supply is not active (i.e. operating in Low Voltage DC Supply Mode, Pr **6.44** = 1).
2. The UV trip is self-resetting when the DC bus voltage rises above the drive restart voltage level. If another trip is active instead of UV at this point, the trip is not reset.
3. The drive can change between using the main high voltage supply and low voltage DC supply only when the drive is in the under voltage condition (Pr **10.16** = 1). The UV trip can only be seen as active if another trip is not active in the under voltage condition.
4. When the drive is first powered up a UV trip is initiated if the supply voltage is below the restart voltage level and another trip is not active. This does not cause save power down save parameters to be saved at this point.

8.1 Alarm indications

In any mode an alarm flashes alternately with the data displayed when one of the following conditions occur. If action is not taken to eliminate any alarm except "Autotune", "Lt" 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 8-4 Alarm indications

Lower display	Description
br.rS	Braking resistor overload
Braking resistor I^2t accumulator (Pr **10.39**) in the drive has reached 75.0% of the value at which the drive will trip and the braking IGBT is active.	
Hot	Heatsink or control board or inverter IGBT over temperature alarms are active
• The drive heatsink temperature has reached a threshold and the drive will trip O.ht2 if the temperature continues to rise (see the O.ht2 trip). Or • The ambient temperature around the control PCB is approaching the over temperature threshold (see the O.CtL trip).	
OVLd	Motor overload
The motor I^2t 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 >100%	
Auto tune	Autotune in progress
The autotune procedure has been initialised. 'Auto' and 'tunE' will flash alternatively on the display.	
Lt	Limit switch is active
Indicates that a limit switch is active and that it is causing the motor to be stopped (i.e. forward limit switch with forward reference etc.)	
PLC	Onboard PLC program is running
An Onboard PLC program is installed and running. The lower display will flash 'PLC' once every 10s.	

8.2 Status indications

Table 8-5 Status indications

Upper display	Description	Drive output stage
ACUU	AC Supply loss The drive has detected that the AC supply has been lost and is attempting to maintain the DC bus voltage by decelerating the motor.	Enabled
dc	DC applied to the motor The drive is applying DC injection braking.	Enabled
dEC	Decelerating The drive is decelerating the motor.	Enabled
inh	Inhibit The drive is inhibited and cannot be run. The drive enable signal is not applied to terminal 31 or Pr **6.15** is set to 0.	Disabled
POS	Positioning The drive is positioning/orientating the motor shaft.	Enabled
rdY	Ready The drive is ready to be run.	Disabled
run	Running The drive is running.	Enabled
SCAn	Scanning Regen> The drive is enabled and is synchronising to the line.	Enabled
StoP	Stop or holding zero speed The drive is holding zero speed.Regen> The drive is enabled but the AC voltage is too low, or the DC bus voltage is still rising or falling.	Enabled
triP	Trip condition The drive has tripped and is no longer controlling the motor. The trip code appears on the lower display.	Disabled

Table 8-6 Solutions Module and SMARTCARD status indications at power-up

Lower display	Description
boot	A parameter set is being transferred from the SMARTCARD to the drive during power-up. For further information, refer to the *User Guide*.
cArd	The drive is writing a parameter set to the SMARTCARD during power-up. For further information, refer to the *User Guide*.
loAding	The drive is writing information to a Solutions Module.

Index

0475-0001-01