EMERSON
Industrial Automation

Advanced user Guide

Commander SX

IP66/Nema 4X
variable speed drive

Part Number : 3854 en - 03.2008 / b

CONTROL TECHNIQUES

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Commander SX
IP66/Nema 4X variable speed drive

NOTE

CONTROL TECHNIQUES reserves the right to modify the characteristics of its products at any time in order to incorporate the latest technological developments. The information contained in this document may therefore be changed without notice.

WARNING

For the user's own safety, this variable speed drive must be connected to an approved earth (⏚ terminal).

If accidentally starting the installation is likely to cause a risk to personnel or the machines being driven, it is essential to supply the equipment via a circuit-breaking device (power contactor) which can be controlled via an external safety system (emergency stop, detection of errors on the installation).

The variable speed drive is fitted with safety devices which, in the event of a fault, control stopping and thus stop the motor. The motor itself can become jammed for mechanical reasons. Voltage fluctuations, and in particular power cuts, may also cause the motor to stop.

The removal of the causes of the shutdown can lead to restarting, which may be dangerous for certain machines or installations. In such cases, it is essential that the user takes appropriate precautions against the motor restarting after an unscheduled stop.

The variable speed drive is designed to be able to supply a motor and the driven machine above its rated speed.
If the motor or the machine are not mechanically designed to withstand such speeds, the user may be exposed to serious danger resulting from their mechanical deterioration.
Before programming a high speed, it is important that the user checks that the installation can withstand it.

The variable speed drive which is the subject of this manual is designed to be integrated in an installation or an electrical machine, and can under no circumstances be considered to be a safety device. It is therefore the responsibility of the machine manufacturer, the designer of the installation or the user to take all necessary precautions to ensure that the system complies with current standards, and to provide any devices required to ensure the safety of equipment and personnel.

Using the drive for hoisting: when using this application, it is essential to follow the special instructions in an application-specific manual which is available on request. It is the responsibility of the user to obtain this manual from his usual CONTROL TECHNIQUES contact.

CONTROL TECHNIQUES declines all responsibility in the event of the above recommendations not being observed.

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Manual corresponding to software versions higher than or equal to 3.10
This generation of drives requires the use of a SX SOFT parameter-setting software version higher than or equal to V3.00, or the KEYPAD-LCD console version higher than or equal to V3.10

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Safety Information

Warnings, Cautions and Notes

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

Caution :
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.

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 User Guide.

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, commissioning and maintenance must be carried out by personnel who have the necessary training and experience. They must read this safety information and this User Guide carefully.
The STOP and SECURE INPUT (Option) 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 SECURE INPUT (Option) 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 SECURE INPUT (Option) 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.**

Environmental limits
Instructions in this User Guide 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.

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 earth (ground) connections.
This User Guide contains instruction for achieving compliance with specific EMC standards.
Within the European Union, all machinery in which this product is used must comply with the following directives:
98/37/EC: Safety of machinery.
89/336/EEC: Electromagnetic Compatibility.

Motor
Ensure the motor is installed in accordance with the manufacturer's recommendations. Ensure the motor shaft is not exposed.
Standard squirrel cage induction motors are designed for single speed operation. If it is intended to use the capability of the drive to run a motor at speeds above its designed maximum, it is strongly recommended that the manufacturer is consulted first.
Low speeds may cause the motor to overheat because the cooling fan becomes less effective. The motor should be fitted with a protection thermistor. If necessary, an electric forced vent fan should be used.
The values of the motor parameters set in the drive affect the protection of the motor. The default values in the drive should not be relied upon.
It is essential that the correct value is entered in parameter 06 motor rated current. This affects the thermal protection of the motor.

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] Independent approval by CETIM has been given for sizes 1 to 3.

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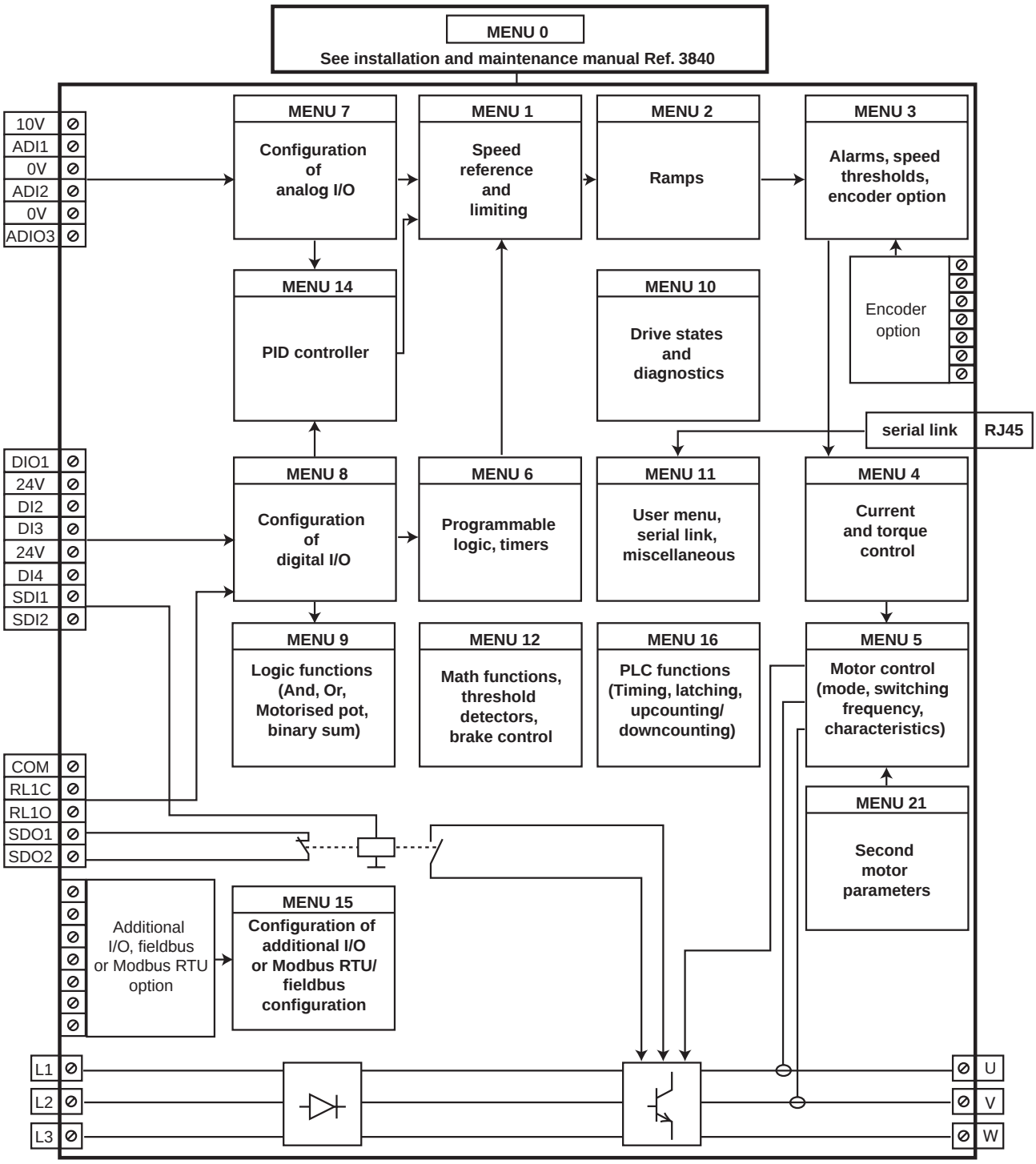
FOREWORD

CAUTION

- **This is the technical manual complementing installation and maintenance manual ref. 3840.**
- **Before setting the drive parameters, it is essential to have strictly observed all instructions relating to installation, connection and commissioning of the drive contained in document ref. 3840**

MENU ORGANISATION



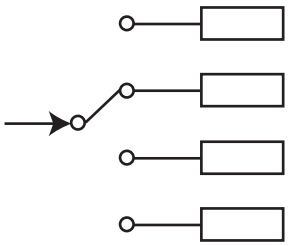
Explanation of symbols used in this document.

1.06 : A shadowed number in bold refers to a parameter.

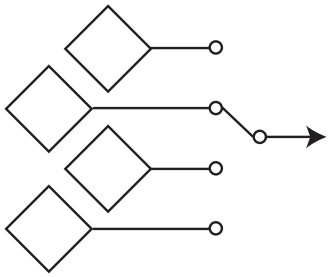
ADI1 / ⊘ : Refers to a drive input or output terminal.

1.21 : Parameters which appear in a rectangle or identified R-W are parameters with Read and Write access. They can be designated as an assignment destination for connection to:
- digital inputs for bit parameters
- analog inputs for non-bit parameters
- outputs of internal functions (comparators, logical or arithmetical operations, etc.)

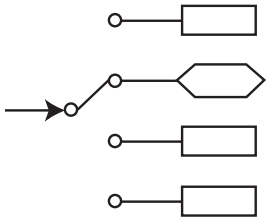
Parameters identified R-W/P cannot be assigned.



1.01 : Parameters which appear in a diamond or identified RO/P are parameters with Read Only access which are write-protected. They are used to provide information concerning operation of the drive and can be designated as an assignment source for connection to:
- digital outputs for bit parameters
- analog outputs for non-bit parameters
- inputs of internal functions (comparators, logical or arithmetical operations, etc.)



1.36 : Parameters which appear in a hexagon or identified by R-A are parameters which can only be assigned to:
- digital inputs for bit parameters
- analog inputs for non-bit parameters



0 (Disabled) (OFF): The values of "bit" parameters can correspond to a value 0, 1, 2, etc. via the serial link, to a mnemonic of up to 32 characters using the LCD console, or to a mnemonic of 4 characters maximum using the drive display. These values and labels are given for each parameter concerned.

: Indicates a parameter used when the drive is configured in open loop Flux Vector Control mode or U/F.

: Indicates a parameter used when the drive is configured in closed loop Flux Vector Control mode.

Notes

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CONTENTS

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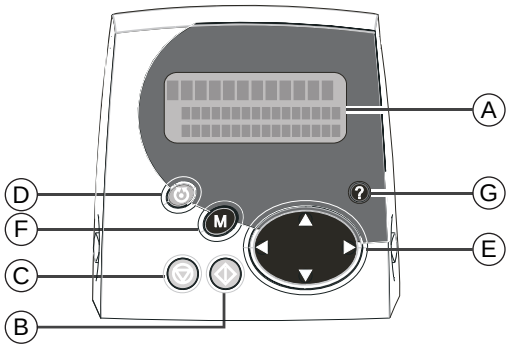
PARAMETER SETTING USING THE LCD KEYPAD

1 - PARAMETER SETTING USING THE LCD KEYPAD

1.1 - Presentation



Ref.	Function
Ⓐ	Backlit LCD with a 3-line display for indicating: - The drive operating status and its main data - The main adjustment parameters via a "simplified parameter setting" menu (menu 0) - All drive parameters via 21 menus for "advanced parameter setting" (access via a code)
Ⓑ	Green key for run command if control via the keypad is enabled (see 6.43).
Ⓒ	Red button for drive reset (RESET) and stop command.
Ⓓ	Blue button for change of direction of rotation if control via the keypad is enabled (see 6.43).
Ⓔ	Navigation button (, , ,) for moving through the various menus and changing the contents of parameters.
Ⓕ	M button for saving and changing the mode (display, read, set parameters).
Ⓖ	? button not used.

• The drives use an algorithm which is adjusted by parameters. The performance levels obtained depend on the parameter setting. Inappropriate settings may have serious consequences for personnel and machinery.

• The drive parameters must only be set by appropriately qualified and experienced personnel.

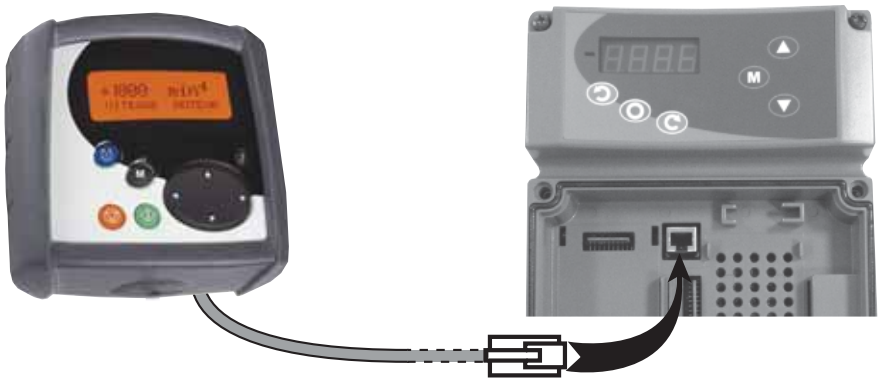
• Before powering up the drive, check that the power connections (mains supply and motor) are correct, and that any moving parts are mechanically protected.

• Before setting the drive parameters, all instructions relating to installation and connection of the drive contained in the installation document must have been followed to the letter (see manual supplied with the drive).

• Users of the drive should take particular care to avoid starting it accidentally.

1.2 - Connection to the drive

The parameter-setting keypad connects to the **Commander SX** with a male/male RJ45 - RJ45 shielded cable.



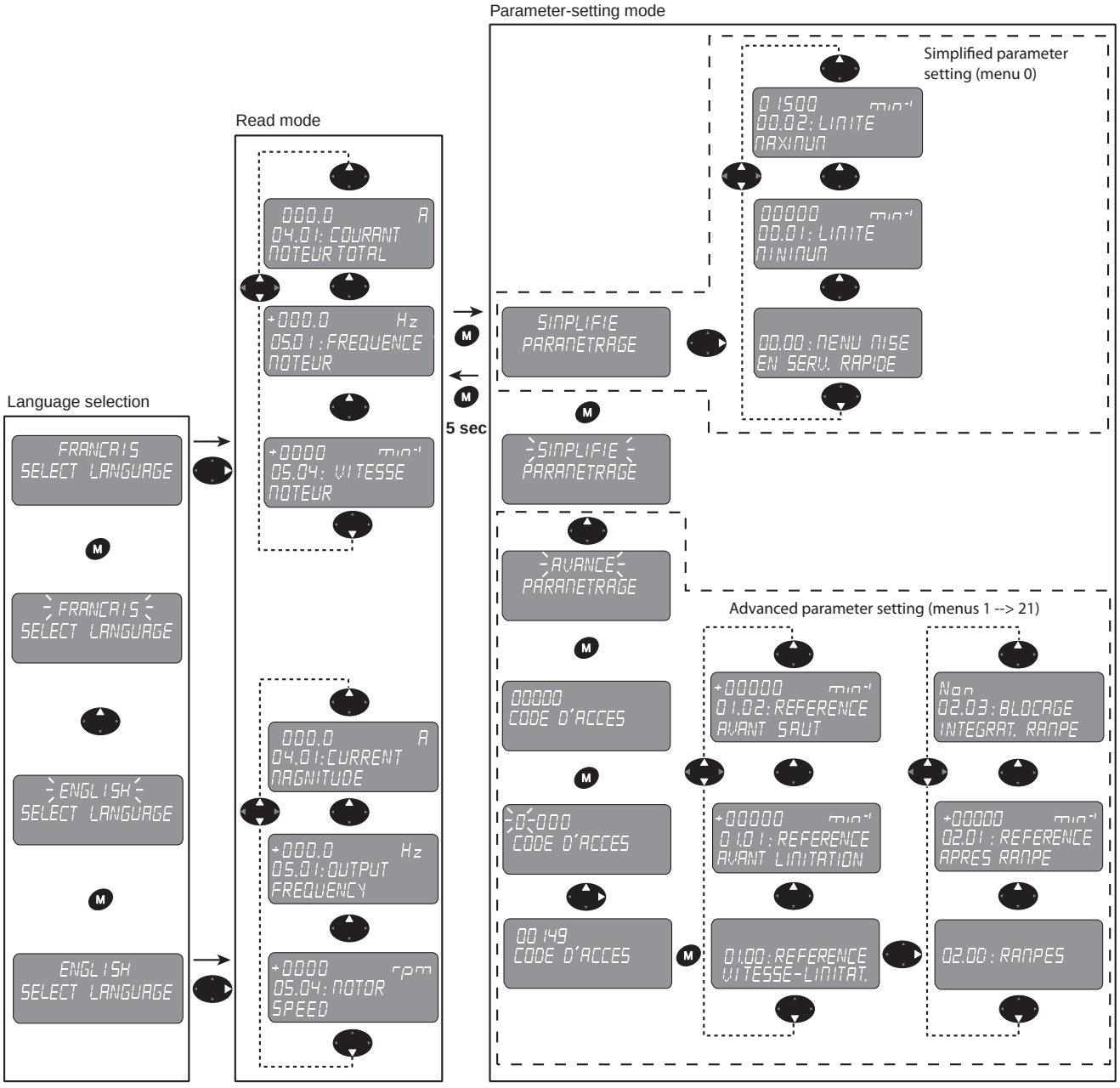
The drive automatically detects the presence of the LCD keypad.

1.3 - Architecture

On power-up, the keypad offers a choice of languages (factory setting: French). Press the key to access read mode. Then press the M key to access parameter-setting mode; there are 2 parameter-setting levels:
- "Simplified" parameter setting (user menu, known as menu 0)
- "Advanced" parameter setting (menus 1 to 21), protected by an access code (factory setting = 149)

To return from parameter-setting mode to read mode, simply hold down the M button for a few seconds.

Basic architecture



1.3.1 - Read mode

Read mode is used to display the status of the drive and its main measurement points when stopped or during operation.

1.3.1.1 - List of displayed parameters

Name	Address	Unit
MOTOR SPEED	5.04	rpm
MOTOR FREQUENCY	5.01	Hz
TOTAL MOTOR CURRENT	4.01	A
ACTIVE CURRENT	4.02	A
OUTPUT VOLTAGE	5.02	V
DC BUS VOLTAGE	5.05	V
ANALOG INPUT 1	7.01	%
ANALOG INPUT 2	7.02	%
ANALOG/DIG./PTC INPUT 3	7.03	%
DIGITAL IN/OUT 1 to 4 STATE + SDI	8.01 to 8.07	-
RELAY + BRAKE OUTPUT	8.07 and 12.40	-
SELECTED REFERENCE	1.49	-
SELECTED PRESET REFERENCE	1.50	-
SPEED REFERENCE SELECTED	1.01	rpm
POST-RAMP REFERENCE	2.01	rpm
RUN COUNTER: YEARS/DAYS, Hr/Min	6.22 and 6.23	-
ENERGY METER: MWh, KWh	6.24 and 6.25	-
TRIP -2 to TRIP -10	10.21 to 10.29	-
Drive SOFTWARE VERSION	11.29	-
LCD KEYPAD VERSION	-	-
MAX DRIVE CURRENT RATING	11.32	-
LAST PRESET CONFIG.	11.48	-

• Configuration of A1.A2:

Name	Address	Unit
ANALOG REFERENCE 2	1.37	rpm
ANALOG REFERENCE 1	1.36	rpm

• Configuration of A1.Pr and A2.Pr:

Name	Address	Unit
ANALOG REFERENCE 1	1.36	rpm

• Configuration of E.Pot:

Name	Address	Unit
MOTORISED POT. REFERENCE	9.03	%

• Configuration of Torq:

Name	Address	Unit
ANALOG REFERENCE 1	1.36	rpm
TORQUE REFERENCE	4.08	%

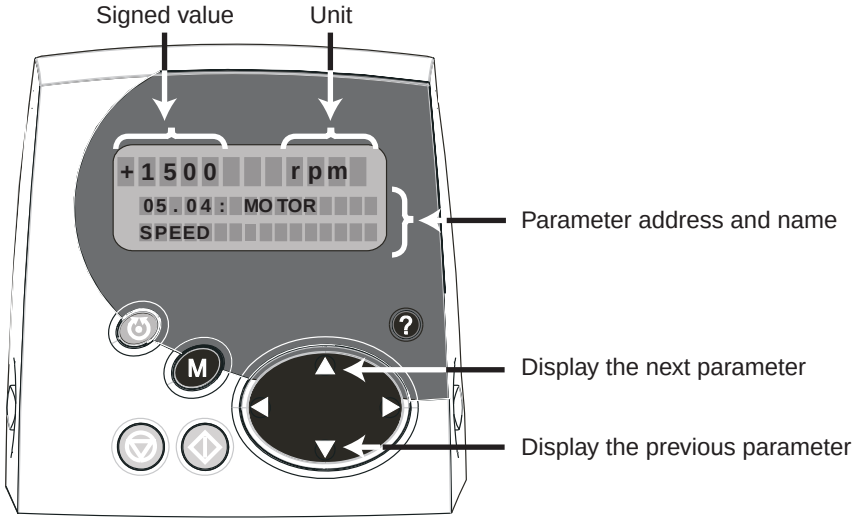
• Configuration of PID and PUMP:

Name	Address	Unit
PID REFERENCE	14.20	%
PID FEEDBACK	14.21	%
PID MAIN REFERENCE	14.19	%
PID ERROR	14.22	%
PID OUTPUT VALUE	14.01	%

• Configuration of PAD:

Name	Address	Unit
REFERENCE VIA KEYPAD	1.17	rpm

1.3.1.2 - Basic display



1.3.2 - Simplified parameter setting mode (menu 0)

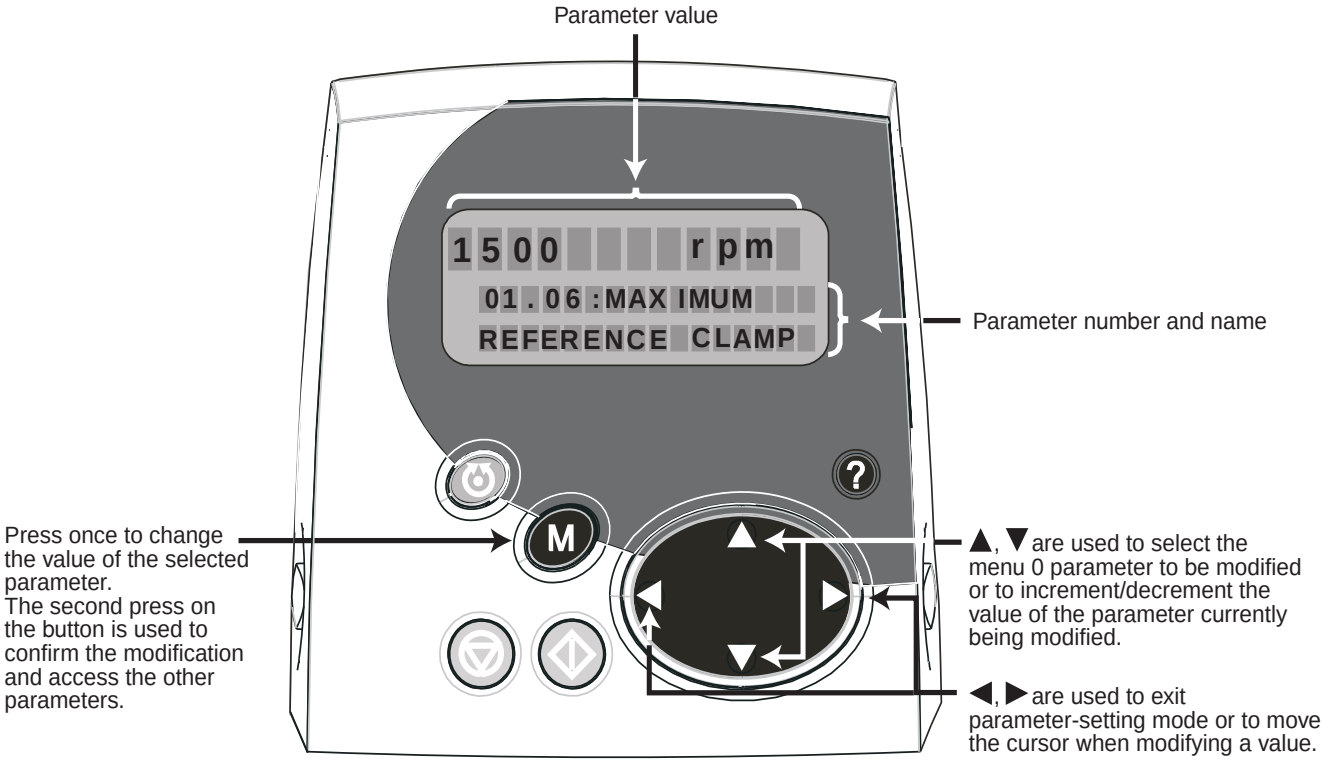
A user menu, known as menu 0, contains the most useful parameters. Each parameter in menu 0 is the image of a parameter contained in another menu in advanced parameter-setting mode.

1.3.3 - Advanced parameter setting mode (menus 1 to 21)

Advanced parameter setting mode provides access to all the drive parameters. The parameters are arranged in menus.

The drive has 21 menus (menu 1 to menu 21).
A parameter is indicated by XX.YY, where the first two figures (XX) refer to the menu and the next two figures (YY) refer to the parameter number in the menu.
The change from simplified parameter setting mode to advanced parameter setting mode is protected by an access code (factory setting: 149).

1.4 - Commissioning using simplified parameter setting mode



2 - MENU 0 CORRESPONDENCE AND AUTOMATIC PARAMETER SETTING

This section describes the interactions between menu 0 (user menu) and the advanced menus (menus 1 to 21).
On the one hand, each parameter in menu 0 (01 to 80) is in fact the image (address) of a parameter in the advanced menus (e.g. parameter 02 corresponds to parameter 1.06 in menu 1).
On the other hand, when a preset configuration is selected by parameter 05, the drive automatically assigns parameters 11 to 24 of menu 0 to adapt the drive to the application, and also then internally sets a list of parameters (different depending on the selected preset configuration).
It is therefore useful to know these internal settings in cases where the user starts parameter setting via menu 0, and ends with the advanced menus.
Refer to the installation and commissioning manual ref. 3840 for commissioning using menu 0.

WARNING:
The purpose of the preset configurations in menu 0 is to adapt the drive to the application as closely as possible. However, if the user changes the structure of the selected preset configuration by adding settings via the advanced menus, the 05 parameter changes to "OPEn" (unrestricted parameter setting).

2.1 - Parameters 01 to 10

Parameter	Name	Address
01	Minimum reference clamp	1.07
02	Maximum reference clamp	1.06
03	Acceleration rate	2.11
04	Deceleration rate	2.21
05	Preset configuration select	11.46
06	Motor rated current	5.07
07	Motor rated speed	5.08
08	Motor rated voltage	5.09
09	Rated power factor (cos φ)	5.10
10	Quick setup menu access	11.44

2.2 - Parameters 11 to 24: preset configurations

2.2.1 - Configuration 0: 05 = A1.A2

Parameter	Name	Address
11	ADI1 mode	7.06
12	ADI2 mode	7.11
13 to **24**	Not used	

• Internal setting

Parameter	Name	Value
1.14	Reference selector	0
6.04	Start/stop logic select	0
7.06	ADI1 mode	6
7.08	ADI1 input scaling	100
7.09	ADI1 input invert	0
7.10	ADI1 input destination	1.36
7.11	ADI2 mode	4
7.12	ADI2 input scaling	100
7.13	ADI2 input invert	0
7.14	ADI2 input destination	1.37
7.15	ADIO3 mode	10
7.16	ADIO3 scaling	100
7.17	ADIO3 input invert	0
7.18	ADIO3 input destination/output source	5.04
8.10	Secure disable select	1
8.11	DIO1 input or output invert	0
8.12	DI2 input invert	0
8.13	DI3 input invert	0
8.14	DI4 input invert	0
8.17	Output relay invert	0
8.21	DIO1 input destination/output source	10.03
8.22	DI2 input destination	6.30
8.23	DI3 input destination	6.32
8.24	DI4 input destination	1.41
8.27	Output relay source	10.01
8.31	DIO1 input or output select	1

2.2.2 - Configuration 1: 05 = A1.Pr

Parameter	Name	Address
11	ADI1 mode	7.06
12	Preset reference 2	1.22
13	Preset reference 3	1.23
14	Preset reference 4	1.24
15 to 24	Not used	

• Internal setting

Parameter	Name	Value
1.14	Reference selector	1
1.15	Preset selector	0
6.04	Start/stop logic select	0
6.43	Run/Stop source	0
7.06	ADI1 mode	6
7.09	ADI1 input invert	0
7.10	ADI1 input destination	1.36
7.11	ADI2 mode	7
7.13	ADI2 input invert	0
7.14	ADI2 input destination	1.46
7.15	ADIO3 mode	10
7.17	ADIO3 input invert	0
7.18	ADIO3 input destination/output source	5.04
7.33	AIO3 feature	0
8.10	Secure disable select	1
8.11	DIO1 input or output invert	0
8.12	DI2 input invert	0
8.13	DI3 input invert	0
8.14	DI4 input invert	0
8.17	Output relay invert	0
8.21	DIO1 input destination/output source	10.03
8.22	DI2 input destination	6.30
8.23	DI3 input destination	6.32
8.24	DI4 input destination	1.45
8.27	Output relay source	10.01
8.31	DIO1 input or output select	1
8.41	DIO1 feature	0

2.2.3 - Configuration 2: 05 = A2.Pr

Parameter	Name	Address
11	ADI1 mode	7.06
12	Preset reference 2	1.22
13	Preset reference 3	1.23
14	Preset reference 4	1.24
15 to 24	Not used	

• Internal setting

Parameter	Name	Value
1.14	Reference selector	1
1.15	Preset selector	0
6.04	Start/stop logic select	0
6.43	Run/Stop source	0
7.06	ADI1 mode	4
7.09	ADI1 input invert	0
7.10	ADI1 input destination	1.36
7.11	ADI2 mode	7
7.13	ADI2 input invert	0
7.14	ADI2 input destination	1.46
7.15	ADIO3 mode	10
7.17	ADIO3 input invert	0
7.18	ADIO3 input destination/output source	5.04
7.33	ADIO3 feature	0
8.10	Secure disable select	1
8.11	DIO1 input or output invert	0
8.12	DI2 input invert	0
8.13	DI3 input invert	0
8.14	DI4 input invert	0
8.17	Output relay invert	0
8.21	DIO1 input destination/output source	10.03
8.22	DI2 input destination	6.30
8.23	DI3 input destination	6.32
8.24	DI4 input destination	1.45
8.27	Output relay source	10.01
8.31	DIO1 input or output select	1
8.41	DIO1 feature	0

2.2.4 - Configuration 3: 05 = 4Pr

Parameter	Name	Address
11	Preset reference 1	1.21
12	Preset reference 2	1.22
13	Preset reference 3	1.23
14	Preset reference 4	1.24
15 to 24	Not used	

• Internal setting

Parameter	Name	Value
1.14	Reference selector	3
1.15	Preset selector	0
6.04	Start/stop logic select	0
6.43	Run/Stop source	0
7.06	ADI1 mode	7
7.09	ADI1 input invert	0
7.10	ADI1 input destination	1.46
7.11	ADI2 mode	8
7.13	ADI2 input invert	0
7.15	ADIO3 mode	10
7.17	ADIO3 input invert	0
7.18	ADIO3 input destination/output source	5.04
7.33	ADIO3 feature	0
8.10	Secure disable select	1
8.11	DIO1 input or output invert	0
8.12	DI2 input invert	0
8.13	DI3 input invert	0
8.14	DI4 input invert	0
8.17	Output relay invert	0
8.21	DIO1 input destination/output source	10.03
8.22	DI2 input destination	6.30
8.23	DI3 input destination	6.32
8.24	DI4 input destination	1.45
8.27	Output relay source	10.01
8.41	DIO1 feature	0

2.2.5 - Configuration 4: 05 = 8Pr

Parameter	Name	Address
11	Preset reference 1	1.21
12	Preset reference 2	1.22
13	Preset reference 3	1.23
14	Preset reference 4	1.24
15	Preset reference 5	1.25
16	Preset reference 6	1.26
17	Preset reference 7	1.27
18	Preset reference 8	1.28
19 to 24	Not used	

• Internal setting

Parameter	Name	Value
1.14	Reference selector	3
1.15	Preset selector	0
6.04	Start/stop logic select	0
6.43	Run/Stop source	0
7.06	ADI1 mode	7
7.09	ADI1 input invert	0
7.10	ADI1 input destination	1.46
7.11	ADI2 mode	7
7.13	ADI2 input invert	0
7.14	ADI2 input destination	1.47
7.15	ADIO3 mode	10
7.17	ADIO3 input invert	0
7.18	ADIO3 input destination/output source	5.04
7.33	ADIO3 feature	0
8.10	Secure disable select	1
8.11	DIO1 input or output invert	0
8.12	DI2 input invert	0
8.13	DI3 input invert	0
8.14	DI4 input invert	0
8.17	Output relay invert	0
8.21	DIO1 input destination/output source	10.03
8.22	DI2 input destination	6.30
8.23	DI3 input destination	6.32
8.24	DI4 input destination	1.45
8.27	Output relay source	10.01
8.31	DIO1 input or output select	1
8.41	DIO1 feature	0

2.2.6 - Configuration 5: 05 = E.Pot

Parameter	Name	Address
11	ADI1 mode	7.06
12	Manual motorised pot reset	9.28
13	Automatic motorised pot reset	9.21
14	Motorised pot bipolar select	9.22
15	Motorised pot rate	9.23
16	Motorised pot scale factor	9.24
17	Motorised pot reference	9.03
18 to 24	Not used	

• Internal setting

Parameter	Name	Value
1.09	Reference offset validation	1
1.14	Reference selector	1
6.04	Start/stop logic select	0
6.43	Run/Stop source	0
7.06	ADI1 mode	6
7.09	ADI1 input invert	0
7.10	ADI1 input destination	1.36
7.11	ADI2 mode	7
7.13	ADI2 input invert	0
7.14	ADI2 input destination	9.26
7.15	ADIO3 mode	10
7.17	ADIO3 input invert	0
7.18	ADIO3 input destination/output source	5.04
7.33	ADIO3 feature	0
8.10	Secure disable select	1
8.11	DIO1 input or output invert	0
8.12	DI2 input invert	0
8.13	DI3 input invert	0
8.14	DI4 input invert	0
8.17	Output relay invert	0
8.21	DIO1 input destination/output source	10.03
8.22	DI2 input destination	6.30
8.23	DI3 input destination	6.32
8.24	DI4 input destination	9.27
8.27	Output relay source	10.01
8.31	DIO1 input or output select	1
8.41	DIO1 feature	0
9.25	Motorised pot destination	1.04

2.2.7 - Configuration 6: 05 = TorQ

Parameter	Name	Address
11	ADI1 mode	7.06
12	ADI2 mode	7.11
13 to 18	Not used	
19	ADI2 scaling	7.12
20 to 24	Not used	

• Internal setting

Parameter	Name	Value
1.14	Reference selector	1
6.04	Start/stop logic select	0
6.43	Run/Stop source	0
7.06	ADI1 mode	6
7.09	ADI1 input invert	0
7.10	ADI1 input destination	1.36
7.11	ADI2 mode	6
7.13	ADI2 input invert	0
7.14	ADI2 input destination	4.08
7.15	ADIO3 mode	10
7.17	ADIO3 input invert	0
7.18	ADIO3 input destination/output source	5.04
7.33	ADIO3 feature	0
8.10	Secure disable select	1
8.12	DI2 input invert	0
8.13	DI3 input invert	0
8.14	DI4 input invert	0
8.17	Output relay invert	0
8.21	DIO1 input destination/output source	10.03
8.22	DI2 input destination	6.30
8.23	DI3 input destination	6.32
8.24	DI4 input destination	4.11
8.27	Output relay source	10.01
8.31	DIO1 input or output select	1
8.41	DIO1 feature	0

2.2.8 - Configuration 7: 05 = Pid

Parameter	Name	Address
11	ADI1 mode	7.06
12	ADI2 mode	7.11
13	PID proportional gain	14.10
14	PID integral gain	14.11
15	PID derivative gain	14.12
16	PID upper limit	14.13
17	PID lower limit	14.14
18	PID output scaling	14.15
19	ADI2 input scaling	7.12
20	ADIO3 input scaling	7.16
21	PID reference	14.20
22	PID feedback	14.21
23	PID main reference	14.19
24	PID output	14.01

• Internal setting

Parameter	Name	Value
1.14	Reference selector	1
6.04	Start/stop logic select	0
6.43	Run/Stop source	0
7.06	ADI1 mode	6
7.09	ADI1 input invert	0
7.10	ADI1 input destination	1.27
7.11	ADI2 mode	2
7.13	ADI2 input invert	0
7.14	ADI2 input destination	1.28
7.15	ADIO3 mode	6
7.17	ADIO3 input invert	0
7.18	ADIO3 input destination/output source	1.26
7.33	ADIO3 feature	4
8.10	Secure disable select	1
8.11	DIO1 input or output invert	0
8.12	DI2 input invert	0
8.13	DI3 input invert	0
8.14	DI4 input invert	0
8.17	Output relay invert	0
8.21	DIO1 input destination/output source	10.04
8.22	DI2 input destination	6.30
8.23	DI3 input destination	6.32
8.24	DI4 input destination	14.08
8.27	Output relay source	10.01
8.31	DIO1 input or output select	1
8.41	DIO1 feature	2
14.02	PID main reference source	1.26
14.03	PID reference source	1.27
14.04	PID feedback source	1.28
14.16	PID output destination	1.36

2.2.9 - Configuration 8: 05 = Pump

Parameter	Name	Address
11	ADI1 mode	7.06
12	ADI2 mode	7.11
13	PID proportional gain	14.10
14	PID integral gain	14.11
15	Stop on Vmin enable	14.56
16	Draining threshold	12.04
17	Draining time delay	16.05
18	Digital reference	14.51
19	Customer unit scaling coefficient	14.53
20	Reference input in customer units	14.54
21	Sensor input in customer units	14.55
22	Motor speed	5.04
23 and 24	Not used	

• Internal setting

Parameter	Name	Value
5.09	Motor rated voltage	400
7.06	ADI1 mode	6
7.10	ADI1 input destination	1.23
7.11	ADI2 mode	2
7.14	ADI2 input destination	1.24
7.15	ADIO3 mode	10
7.18	ADIO3 input destination/output source	10.90
7.33	ADIO3 feature	4
7.62	Block scaling	105
7.64	Scaling block destination	12.24
7.68	Scaling block source	12.12
8.11	DIO1 input or output invert	1
8.14	DI4 input invert	0
8.21	DIO1 input destination/output source	10.63
8.22	DI2 input destination	9.30
8.23	DI3 input destination	12.10
8.24	DI4 input destination	1.42
8.31	DIO1 input or output select	0
8.41	DIO1 feature	9
9.04	Logic function 1 source 1	12.01
9.06	Logic function 1 source 2	8.02
9.14	Logic function 2 source 1	9.01
9.16	Logic function 2 source 2	8.04
9.33	Binary sum destination	0
9.34	Binary sum output offset	0
9.64	Logic function 3 source 1	12.02
9.65	Logic function 3 source 1 invert	1
9.66	Logic function 3 source 2	14.56
9.74	Logic function 4 source 1	9.61
9.75	Logic function 4 source 1 invert	1
9.76	Logic function 4 source 2	14.56
9.78	Logic function 4 output invert	1

Parameter	Name	Value
11.01	Parameter 46 set-up	6.22
11.02	Parameter 47 set-up	6.23
11.03	Parameter 48 set-up	7.62
11.04	Parameter 49 set-up	10.20
11.05	Parameter 50 set-up	10.21
11.06	Parameter 51 set-up	10.22
11.07	Parameter 52 set-up	10.23
11.08	Parameter 53 set-up	10.24
11.09	Parameter 54 set-up	10.25
11.10	Parameter 55 set-up	10.26
11.11	Parameter 56 set-up	10.27
11.12	Parameter 57 set-up	10.28
11.13	Parameter 58 set-up	10.29
11.44	Quick setup menu access	1
12.03	Comparator 1 source	1.24
12.04	Comparator 1 threshold	200
12.05	Comparator 1 hysteresis	20
12.06	Comparator 1 output invert	1
12.08	Function 1 variable 1 source	1.23
12.09	Function 1 variable 2 source	1.22
12.11	Function 1 output destination	1.21
12.23	Comparator 2 source	1.24
12.25	Comparator 2 hysteresis	10
12.28	Function 2 variable 1 source	14.51
12.29	Function 2 variable 2 source	1.06
12.30	Function block 2 select	4
12.31	Function 2 output destination	1.22
12.33	Function 2 variable 1 scale	10
12.63	Comparator 3 source	9.32
12.64	Comparator 3 threshold	64
12.65	Comparator 3 hysteresis	0
12.67	Comparator 3 output destination	6.30
14.02	PID main reference source	1.21
14.03	PID reference source	1.21
14.04	PID feedback source	1.24
14.08	PID enable	1
14.09	PID option enable source	8.04
14.10	PID proportional gain	15000
14.11	PID integral gain	2000
14.16	PID output destination	1.36
14.53	Customer unit coefficient	1
14.56	Stop on V min enable	1
16.02	Timer relay 1 input source	9.02
16.05	Timer relay 1 value	100
16.09	Timer relay 1 output destination	10.61
16.12	Timer relay 2 input source	9.71
16.13	Timer relay 2 type	1
16.15	Timer relay 2 value	100
16.19	Timer relay 2 output destination	9.29

2.2.10 - Configuration 9: 05 = A.CtP

Parameter	Name	Address
11 to 24	Not used	

• Internal setting

Parameter	Name	Value
1.14	Reference selector	1
6.04	Start/stop logic select	0
6.43	Run/Stop source	0
7.09	ADI1 input invert	0
7.10	ADI1 input destination	1.36
7.11	ADI2 mode	8
7.13	ADI2 input invert	0
7.14	ADI2 input destination	0
7.15	ADIO3 mode	10
7.17	ADIO3 input invert	0
7.18	ADIO3 input destination/output source	5.04
7.33	ADIO3 feature	4
8.10	Secure disable select	1
8.11	DIO1 input or output invert	0
8.12	DI2 input invert	0
8.13	DI3 input invert	0
8.14	DI4 input invert	1
8.17	Output relay invert	0
8.21	DIO1 input destination/output source	10.03
8.22	DI2 input destination	6.30
8.23	DI3 input destination	6.32
8.24	DI4 input destination	9.30
8.27	Output relay source	10.01
8.31	DIO1 input or output select	1
8.41	DIO1 feature	9
9.33	Binary sum destination	7.06
9.34	Binary sum output offset	4

2.2.11 - Configuration 10: 05 = HoiS

Parameter	Name	Address
11	Not used	
12	Preset reference 2 (PR2)	1.22
13 to 24	Not used	

• Internal setting

Parameter	Name	Value
1.10	Bipolar reference select	1
1.14	Reference selector	1
2.51	Ramp hold condition	1
6.04	Start/stop logic select	0
6.43	Run/Stop source	0
7.06	ADI1 mode	6
7.09	ADI1 input invert	0
7.10	ADI1 input destination	1.36
7.11	ADI2 mode	8
7.13	ADI2 input invert	0
7.14	ADI2 input destination	0
7.15	ADIO3 mode	7
7.17	ADIO3 input invert	0
7.18	ADIO3 input destination/output source	1.45
7.33	ADIO3 feature	4
8.10	Secure disable select	1
8.11	DIO1 input or output invert	0
8.12	DI2 input invert	0
8.13	DI3 input invert	0
8.14	DI4 input invert	0
8.17	Output relay invert	0
8.21	DIO1 input destination/output source	12.51
8.22	DI2 input destination	6.30
8.23	DI3 input destination	6.32
8.24	DI4 input destination	0
8.27	Output relay source	10.01
8.31	DIO1 input or output select	0
8.41	DIO1 feature	9
9.04	Logic function 1 source 1	8.04
9.05	Logic function 1 source 1 invert	1
9.06	Logic function 1 source 2	9.02
9.07	Logic function 1 source 2 invert	1
9.08	Logic function 1 output invert	0
9.10	Logic function 1 output destination	2.03
9.14	Logic function 2 source 1	1.45
9.16	Logic function 2 source 2	10.07

2.2.12 - Configuration 11: 05 = Pad

Parameter	Name	Address
11	Power-up keypad reference	1.51
12	Power-up keypad reference (Preset 1)	1.21
13	Enable FWD key	6.11
14	Enable Stop key	6.12
15	Enable REV key	6.13
16 to 24	Not used	

• Internal setting

Parameter	Name	Value
1.14	Reference selector	4
6.11	Enable local control FWD key	1
6.12	Enable local control Stop key	1
6.13	Enable keypad REV key	0
6.43	Run/Stop source	2
7.11	ADI2 mode	8
7.15	ADIO3 mode	10
7.18	ADIO3 input destination/output source	5.04
7.33	ADIO3 feature	0
8.10	Secure disable select	0
8.17	Output relay invert	0
8.22	DI2 input destination	0
8.23	DI3 input destination	6.39
8.24	DI4 input destination	6.13
8.27	Output relay source	10.01
8.81	DIRF input destination	0
8.83	DIRR input destination	0

2.2.13 - Configuration 12: 05 = HuAC

Parameter	Name	Address
11	Not used	
12	ADI2 mode	7.11
13 to 24	Not used	

• Internal setting

Parameter	Name	Value
1.14	Reference selector	0
6.04	Start/stop logic select	0
7.06	ADI1 mode	7
7.09	ADI1 input invert	0
7.10	ADI1 input destination	1.41
7.11	ADI2 mode	4
7.13	ADI2 input invert	0
7.14	ADI2 input destination	1.37
7.15	ADIO3 mode	10
7.17	ADIO3 input invert	0
7.18	ADIO3 input destination/output source	5.04
7.33	ADIO3 feature	4
8.10	Secure disable select	0
8.11	DIO1 input or output invert	0
8.12	DI2 input invert	0
8.13	DI3 input invert	0
8.14	DI4 input invert	0
8.17	Output relay invert	0
8.21	DIO1 input destination/output source	10.02
8.24	DI4 input destination	1.42
8.27	Output relay source	10.01
8.31	DIO1 input or output select	1
8.41	DIO1 feature	9
9.04	Logic function 1 source 1	8.04
9.06	Logic function 1 source 2	10.01
9.10	Logic function 1 output destination	9.30
9.33	Binary sum destination	6.43
9.34	Binary sum offset	0
9.64	Logic function 3 source 1	1.41
9.65	Logic function 3 source 1 invert	1
9.66	Logic function 3 source 2	8.04
9.67	Logic function 3 source 2 invert	1
9.68	Logic function 3 output invert	1
12.08	Function 1 variable 1 source	1.17
12.10	Function block 1 select	0
12.11	Function 1 output destination	1.21
12.13	Function 1 variable 1 scale	1000
12.15	Function 1 associated parameter	0
16.02	Timer relay 1 input source	9.61
16.03	Timer relay 1 type	0
16.04	Timer relay 1 unit of time	0
16.05	Timer relay 1 value	5
16.09	Timer relay 1 output destination	6.15

2.3 - Parameter 25 to 35

Parameter	Name	Address
25	Operating mode	11.31

• If 25 = OP.LP (0 or 1)

Parameter	Name	Address
26	Open loop mode select	5.14
• If 26 = r.run (0) or r.no (1) or r.FSt (3) or r.On (4) or SqrE (5)		
27 to 30	Not used	
31	Current loop P gain	4.13
32	Current loop I gain	4.14
33 to 35	Not used	
• If 26 = UtoF (2)		
27 and 28	Not used	
29	Boost	5.15
30	Dynamic V to F	5.13
31 to 35	Not used	

• If 25 = cL.LP (2) or SrvO (3)

Parameter	Name	Address
26	Encoder type	3.38
27	Encoder lines per revolution	3.34
28	Drive encoder filter	3.42
29	Speed loop P gain Kp1	3.10
30	Speed loop I gain Ki1	3.11
31	Current loop P gain	4.13
32	Current loop I gain	4.14
33	Ramp bypass	2.02
34 and 35	Not used	

2.4 - Parameters 36 to 80

Parameter	Name	Address
36	Brake controller enable	12.41
37	Upper current threshold	12.42
38	Lower current threshold	12.43
39	Brake release frequency	12.44
40	Brake apply frequency	12.45
41	Brake apply/magnetisation delay	12.46
42	Post-brake release delay	12.47
43	Brake apply delay	12.48
44	Not used	12.49
45	Not used	
46 *	Start/stop logic select	6.04
47 *	Secure disable select	8.10
48 *	ADIO3 mode	7.15
49 *	ADIO3 feature	7.33
50 *	DIO1 feature	8.41
51 *	Jog reference	1.05
52 *	Bipolar reference enable	1.10
53 *	Skip (critical speed)	1.29
54 *	Skip reference band	1.30
55 *	Deceleration ramp mode select	2.04
56 *	S ramp enable	2.06
57 *	Stop mode	6.01
58 *	Mains loss mode	6.03
59	Catch a spinning motor	6.09
60	Maximum switching frequency	5.18
61	Motor rated frequency	5.06
62	Number of motor poles	5.11
63	Autotune	5.12
64	Parameter cloning	11.42
65	Factory setting	11.43
66	User security code	11.30
67	Parameter displayed at power-up	11.22
68	Selection of load display	4.21
69	Speed display unit	5.34
70	Parameter scaling	11.21
71	Last trip	10.20
72	Penultimate trip	10.21
73	ADI1 input level	7.01
74	ADI2 input level	7.02
75	ADIO3 input or output level	7.03
76	Pre-offset reference	1.60
77	Pre-ramp reference	1.03
78	Current magnitude	4.01
79	Motor speed	5.04
80	DC bus voltage	5.05

(*) For preset configuration 05 = Pump, the addresses for 46 to 58 are different.
See section 2.2.9 - Internal setting.

3 - MENU 1: SPEED REFERENCE: Selection, limiting and filters

3.1 - List of parameters in Menu 1

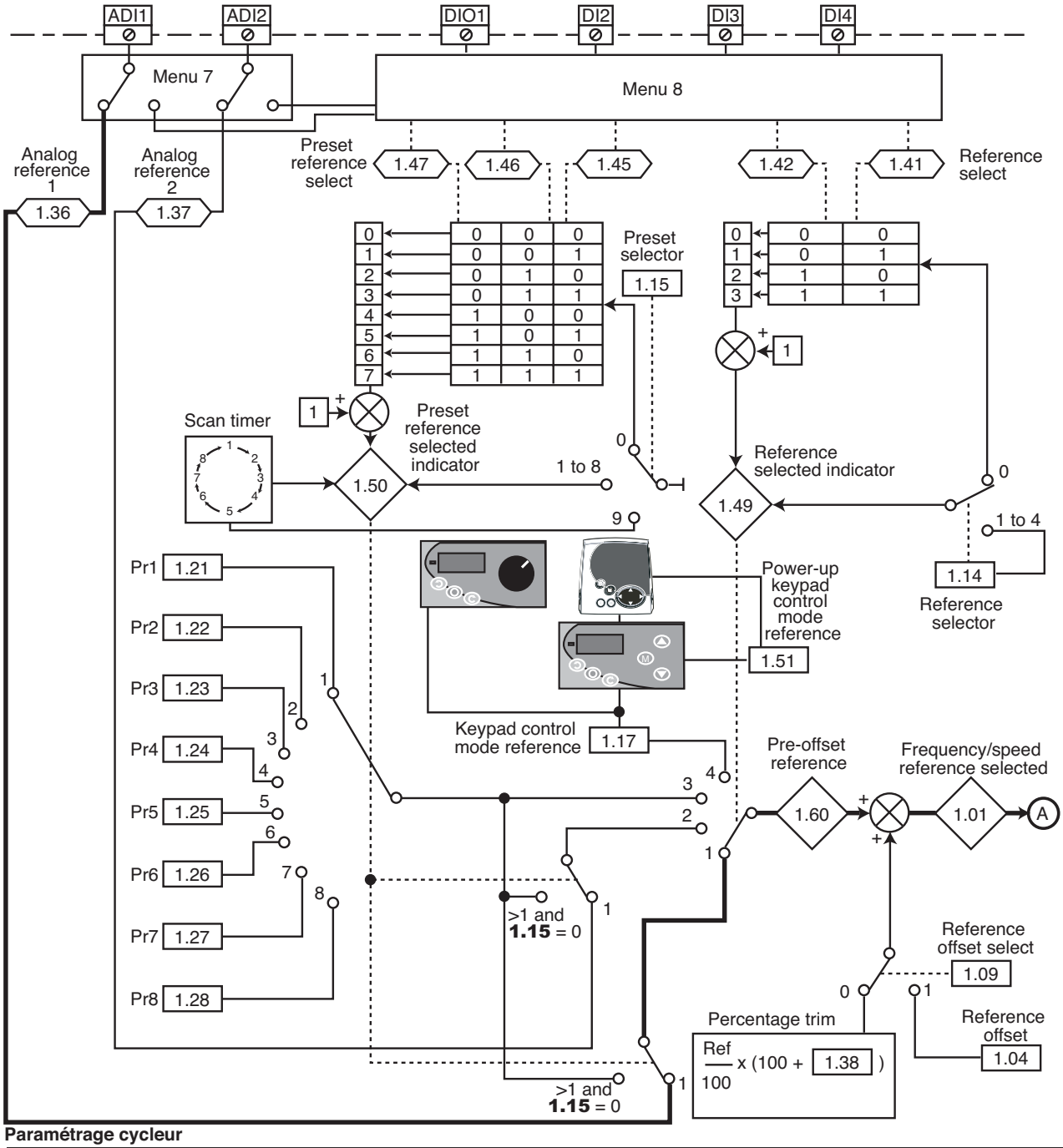
Parameter	Name	Type	Adjustment range	Factory setting	User setting
1.01	Speed reference selected	RO/P	± 1.06	-	-
1.02	Pre-skip filter reference	RO/P	± 1.06 or 1.07 to 1.06	-	-
1.03	Pre-ramp reference	RO/P	± 1.06 or 1.07 to 1.06	-	-
1.04	Reference offset	R-W	± 1.06	0	
1.05	Jog reference	R-W	0 to 1.06 rpm	45 rpm	
1.06	Maximum reference clamp	R-W	0 to 32000 rpm	Eur: 1500 rpm USA: 1800 rpm	
1.07	Minimum reference clamp	R-W	0 to 1.06	0	
1.08	Not used				
1.09	Reference offset validation	R-W	0 or 1	0	
1.10	Bipolar reference select	R-W	0 or 1	0	
1.11	Reference enable indicator	RO/P	0 or 1	-	-
1.12	Reverse select indicator	RO/P	0 or 1	-	-
1.13	Jog select indicator	RO/P	0 or 1	-	-
1.14	Reference selector	R-W	0 to 4	0	
1.15	Preset selector	R-W	0 to 9	0	
1.16	Preset reference timer	R-W	0 to 9999 s	0	
1.17	Keypad reference	R-W	1.07 to 1.06 (1.10 = 0)	0	-
1.18 to 1.20	Not used				
1.21 to 1.28	Preset 1 to Preset 8	R-W	± 1.06	0	
1.29	Skip reference 1	R-W	0 to 1.06 rpm	0	
1.30	Skip reference band 1	R-W	0 to 300 rpm	15 rpm	
1.31	Skip reference 2	R-W	0 to 1.06 rpm	0	
1.32	Skip reference band 2	R-W	0 to 300 rpm	15 rpm	
1.33 and 1.34	Not used				
1.35	Reference in skip zone	RO/P	0 or 1	-	-
1.36	Analog reference 1	R-A	1.07 to 1.06 (1.10 = 0) ± 1.06 (1.10 = 1)	-	-
1.37	Analog reference 2	R-A	1.07 to 1.06 (1.10 = 0) ± 1.06 (1.10 = 1)	-	-
1.38	Percentage trim	R-W	± 100.0%	0	
1.39 and 1.40	Not used				
1.41 and 1.42	Reference selector	R-A	0 or 1	-	-
1.43 and 1.44	Not used				
1.45 to 1.47	Preset reference select	R-A	0 or 1	-	-
1.48	Reference timer reset	R-W	0 or 1	0	

Parameter	Name	Type	Adjustment range	Factory setting	User setting
1.49	Selected reference indicator	RO/P	1 to 4	-	-
1.50	Selected preset reference indicator	RO/P	1 to 8	-	-
1.51	Power-up keypad reference	R-W	0 to 2	0	
1.52 to 1.59	Not used				
1.60	Pre-offset reference	RO	± 1.06	-	-
1.61 to 1.68	Not used				
1.69	Number of preset references timed	R-W	1 to 8	8	
1.70	Scan time selection	R-W	0 or 1	0	
1.71	Preset 1 time	R-W	0 to 9999 s	0	
1.72	Preset 2 time	R-W	0 to 9999 s	0	
1.73	Preset 3 time	R-W	0 to 9999 s	0	
1.74	Preset 4 time	R-W	0 to 9999 s	0	
1.75	Preset 5 time	R-W	0 to 9999 s	0	
1.76	Preset 6 time	R-W	0 to 9999 s	0	
1.77	Preset 7 time	R-W	0 to 9999 s	0	
1.78	Preset 8 time	R-W	0 to 9999 s	0	

Notes

3.2 - Menu 1 diagram

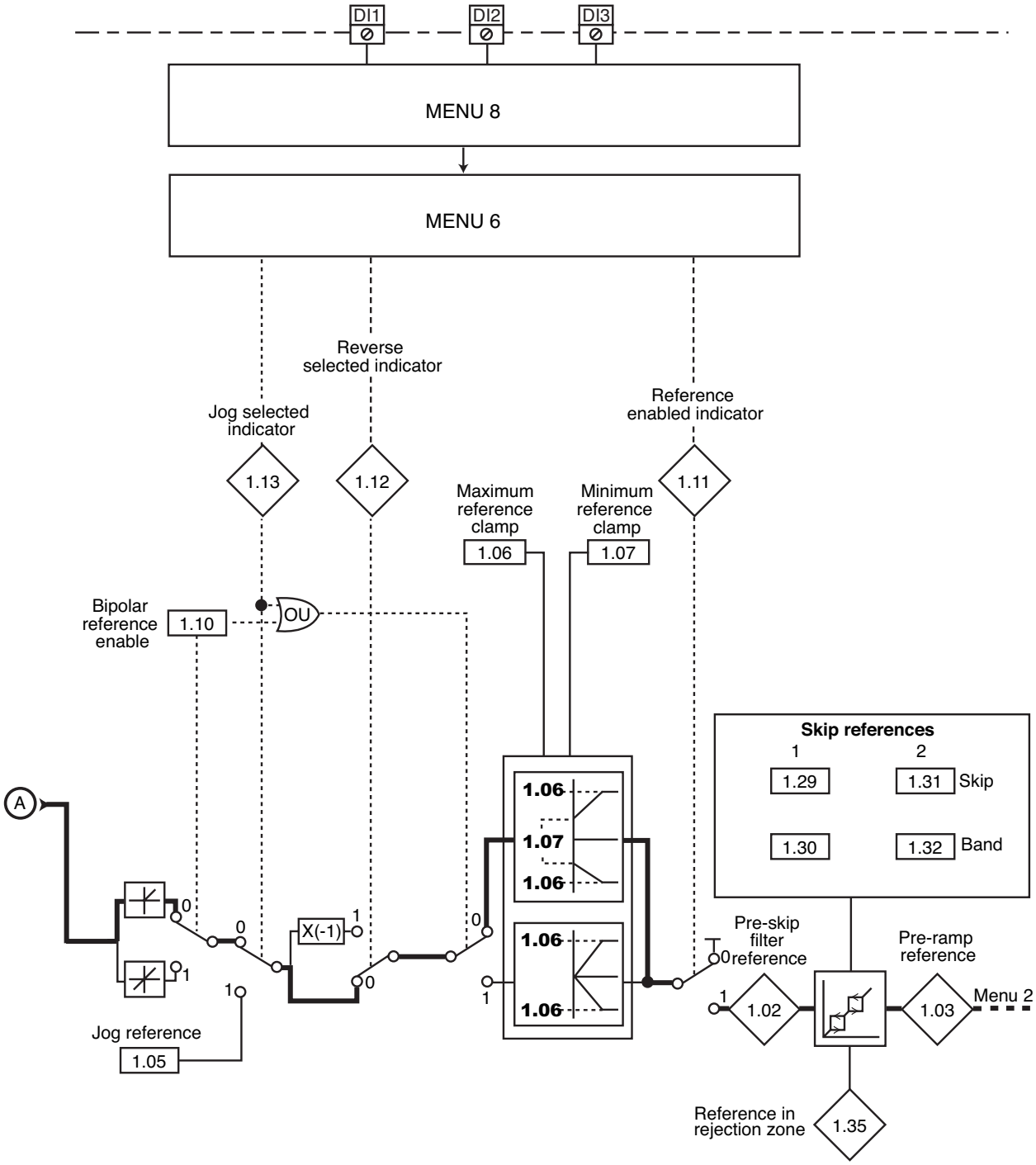
3.2.1 - Selection of reference (speed)



Paramétrage cycleur

1.16	Preset reference selector timer	1.73	Preset 3 scan timer time
1.48	Reference timer reset flag	1.74	Preset 4 scan timer time
1.69	Number of scanned references	1.75	Preset 5 scan timer time
1.70	Scan time selection	1.76	Preset 6 scan timer time
1.71	Preset 1 scan timer time	1.77	Preset 7 scan timer time
1.72	Preset 2 scan timer time	1.78	Preset 8 scan timer time

3.2.2 - Limiting and filters



3.3 - Explanation of parameters in menu 1

1.01 : Speed reference selected

Adjustment range : ± 1.06
Indicates the reference value.

1.02 : Pre-skip filter reference

Adjustment range : ± 1.06 or 1.07 to 1.06
Reference after limiting but before the skips.

1.03 : Pre-ramp reference

Adjustment range : ± 1.06 or 1.07 to 1.06
Indicates the reference after the skips but before the acceleration or deceleration ramps.

1.04 : Reference offset
Adjustment range : ± 1.06
Factory setting : 0
This reference is added to (positive value) or subtracted from (negative value) the selected reference if 1.09 equals 1 (OFFS). It can be used to correct the selected main reference to obtain an accurate setting.

1.05 : Jog reference
Adjustment range : 0 to 1.06 rpm
Factory setting : 45 rpm
Operating speed when the jog input has been selected.

1.06 : Maximum reference clamp
Adjustment range : 0 to 32000 rpm
Factory setting : **Eur = 1500 rpm**
USA = 1800 rpm

• Before setting the maximum reference clamp, check that the motor and the driven machine can withstand it.
Maximum speed in both directions of rotation.

1.07 : Minimum reference clamp
Adjustment range : 0 to 1.06
Factory setting : 0
In unipolar mode, defines the minimum speed.
WARNING:
• This parameter is inactive during jog operation.
• If the value of 1.06 is lower than that of 1.07, the value of 1.07 is automatically changed to the new value of 1.06.

1.08 : Not used

1.09 : Reference offset validation
Adjustment range : 0 or 1
Factory setting : 0
0 (Ref x 01.38) (ProP): A value proportional to this reference is added to the main reference. The percentage is adjusted using the parameter 1.38.
1 (Ref + 01.04) (OFFS): A fixed value set in 1.04 is added to the main reference.

1.10 : Bipolar reference select
Adjustment range : 0 or 1
Factory setting : 0
0 (+ only ref) (PoS): All negative references are treated as invalid.
1 (+ and - ref) (nEg): Used for changing the direction of rotation by the reference polarity. May come from the preset references.
Note: The drive analog inputs are unipolar.

1.11 : Reference enable indicator

Adjustment range : 0 or 1
Used to control enabling of the run command.
0 (Disabled) (StoP): Stop.
1 (Enabled) (run): Run.

1.12 : Reverse select indicator

Adjustment range : 0 or 1
Used to control enabling of the direction of rotation.
0 (Forward) (Fd): Forward.
1 (Reverse) (rS): Reverse.

1.13 : Jog select indicator

Adjustment range : 0 or 1
Used to control enabling of the jog command.
0 (Disabled) (OFF): Jog operation not enabled.
1 (Enabled) (Jog): Jog operation enabled.

1.14 : Reference selector
Adjustment range : 0 to 4
Factory setting : 0
0 (Term. inputs) (SEL): The speed reference is selected by combining the digital inputs assigned to parameters 1.41 and 1.42.
1 (Analog 1) (Ana1): The speed reference comes from analog input 1.
2 (Analog 2) (Ana2): The speed reference comes from analog input 2.
3 (Preset) (Pr): The speed reference comes from the preset references.
4 (Keypad) (Pad): The speed reference comes from the local control or the LCD keypad.

1.15 : Preset selector
Adjustment range : 0 to 9
Factory setting : 0
This parameter is used to select the preset references. It works as follows:
0 (Term. inputs) (SEL): Is used to select the reference by combining the digital inputs assigned to parameters 1.45 to 1.47.
1 (Preset 1) (Pr1): Preset reference 1
2 (Preset 2) (Pr2): Preset reference 2
3 (Preset 3) (Pr3): Preset reference 3
4 (Preset 4) (Pr4): Preset reference 4
5 (Preset 5) (Pr5): Preset reference 5
6 (Preset 6) (Pr6): Preset reference 6
7 (Preset 7) (Pr7): Preset reference 7
8 (Preset 8) (Pr8): Preset reference 8
9 (Timer) (Cycl): The reference is selected automatically by a scan timer.

1.16 : Preset reference selector timer
Adjustment range : 0 to 9999 s
Factory setting : 0
When 1.15 = 9 (timer), is used to set the time between each reference where the scan time is identical between each preset reference (1.70 is set to 0).

1.17 : Keypad reference
Adjustment range : 1.07 to 1.06 (1.10 = 0)
Factory setting : 0
Indicates the reference value coming from the local control or the LCD console.

1.18 to 1.20 : Not used

1.21 to 1.28 : Preset references 1 to 8
Adjustment range : ± 1.06
Factory setting : 0
In order, 1.21 to 1.28 are used to define preset references Preset 1 to Preset 8.

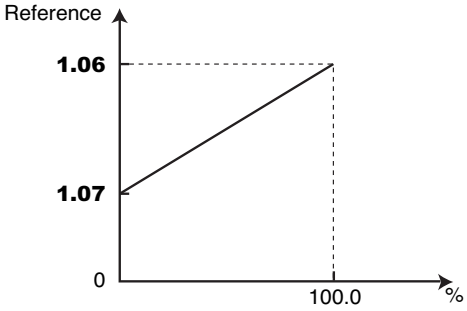
1.29 and 1.31 :Skip references 1 and 2
Adjustment range : 0 to 1.06 rpm
Factory setting : 0
Two skips are available to avoid a machine running at critical speeds. When one of these parameters is at 0, the function is deactivated.

1.30 and 1.32 :Skip reference bands 1 and 2
Adjustment range : 0 to 300 rpm
Factory setting : 15 rpm
Define the skip band around the avoided speed. The total skip will therefore equal the threshold set ± skip band. When the reference is within the window determined in this way, the drive will not allow operation in this zone.

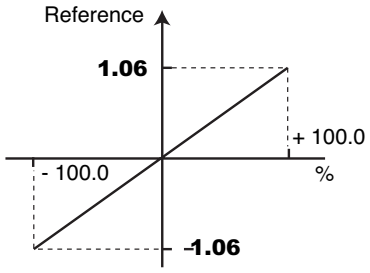
1.33 and 1.34 :Not used

1.35 : Reference in skip zone
Adjustment range : 0 or 1
0 (Out) (OFF): The selected reference is not within one of the skip reference zones.
1 (In) (On): The selected reference is within one of the skip reference zones. In this case, the motor speed does not correspond to the requested reference.

1.36 and 1.37 :Analog references 1 and 2
Adjustment range : 1.07 to 1.06 (1.10 = 0)
± 1.06 (1.10 = 1)
The analog inputs assigned to these parameters are automatically scaled so that 100.0% of the input corresponds to the maximum reference (1.06). Similarly the 0% input level will correspond to the minimum reference 1.07 or 0 according to 1.10.
Unipolar mode (1.10 =0)



Bipolar mode (1.10 = 1), requires an Additional I/O option



1.38 : Percentage trim
Adjustment range : ± 100.0%
Factory setting : 0
An offset proportional to the selected reference can be added to this reference.
The multiplication coefficient is determined by the analog input assigned to 1.38.

$$\text{Final ref} = \frac{\text{selected reference x } (\mathbf{1.38} + 100)}{100}$$

1.39 and 1.40 :Not used

1.41 and 1.42 :Reference selector
Adjustment range : 0 or 1
0 (OFF)
1 (On)
Used to assign the digital inputs to selection of the speed reference.

1.41	1.42	Selected reference
0	0	Analog input 1
1	0	Analog input 2
0	1	Preset references
1	1	Reference via keypad

1.43 and 1.44 :Not used

1.45 to 1.47 : Preset reference selector
Adjustment range : 0 or 1
0 (OFF)
1 (On)
Used to assign the digital inputs to selection of the preset references.

1.45	1.46	1.47	Selected reference	1.50
0	0	0	Preset reference 1 (Preset 1)	1
1	0	0	Preset reference 2 (Preset 2)	2
0	1	0	Preset reference 3 (Preset 3)	3
1	1	0	Preset reference 4 (Preset 4)	4
0	0	1	Preset reference 5 (Preset 5)	5
1	0	1	Preset reference 6 (Preset 6)	6
0	1	1	Preset reference 7 (Preset 7)	7
1	1	1	Preset reference 8 (Preset 8)	8

1.48 : Reference timer reset
Adjustment range : 0 or 1
Factory setting : 0
0 (OFF): Reset inactive.
1 (On): The preset reference scan timer is reset to zero. In this case, the reference is once again Pr 1.
Can be used to control cycle starting via a digital input.

1.49 : Selected reference indicator
Adjustment range : 0 to 4
0 (Term. inputs) (SEL):
1 (Analog 1) (Ana1): Analog input 1 reference is selected.
2 (Analog 2) (Ana2): Analog input 2 reference is selected.
3 (Preset) (Pr): The preset references are selected.
4 (Keypad) (Pad):
Indicates which reference has been selected.

1.50 : Selected preset reference indicator
Adjustment range : 1 to 8
0 (Term. inputs) (SEL): Is used to select the reference by combining the digital inputs assigned to parameters 1.45 to 1.47.
1 (Preset 1) (Pr1): Preset reference 1 selected.
2 (Preset 2) (Pr2): Preset reference 2 selected.
3 (Preset 3) (Pr3): Preset reference 3 selected.
4 (Preset 4) (Pr4): Preset reference 4 selected.
5 (Preset 5) (Pr5): Preset reference 5 selected.
6 (Preset 6) (Pr6): Preset reference 6 selected.
7 (Preset 7) (Pr7): Preset reference 7 selected.
8 (Preset 8) (Pr8): Preset reference 8 selected.
Indicates the selected preset reference.

1.51 : Power-up keypad reference
Adjustment range : 0 to 2
Factory setting : 0
0 (Reset to 0) (rSet): On power-up, the keypad reference is reset to zero.
1 (Last value) (Prec): On power-up, the keypad reference retains the value it had before power-down.
2 (Preset 1) (Pr1): On power-up, the keypad reference takes the value of preset reference 1 (1.21).

1.52 to 1.59 : Not used

1.60 : Pre-offset reference
Adjustment range : ± 1.06
Indicates the value of the selected reference before offset.

1.61 to 1.68 : Not used

1.69 : Number of preset references timed
Adjustment range : 1 to 8
Factory setting : 8
Used to configure the number of preset references integrated in the scan timer.
For example, if 1.69 = 3, the scan timer will perform a cycle Pr 1 --> Pr 2 --> Pr 3 --> Pr 1 etc.

1.70 : Scan time selection
Adjustment range : 0 or 1
Factory setting : 0
0 (Same) (Iden): The time between each preset reference is the same for all references.
1 (Different) (diFF): The time between each preset reference is different.

1.71 : Preset 1 scan timer time
Adjustment range : 0 to 9999 s
Factory setting : 0
If 1.70 is set to 1, determines the time during which the drive remains at reference Pr. 1.

1.72 : Preset 2 scan timer time
Adjustment range : 0 to 9999 s
Factory setting : 0
If 1.70 is set to 1, determines the time during which the drive remains at reference Pr. 2.

1.73 **: Preset 3 scan timer time**
Adjustment range : 0 to 9999 s
Factory setting : 0
If 1.70 is set to 1, determines the time during which the drive remains at reference Pr. 3.

1.74 **: Preset 4 scan timer time**
Adjustment range : 0 to 9999 s
Factory setting : 0
If 1.70 is set to 1, determines the time during which the drive remains at reference Pr. 4.

1.75 **: Preset 5 scan timer time**
Adjustment range : 0 to 9999 s
Factory setting : 0
If 1.70 is set to 1, determines the time during which the drive remains at reference Pr. 5.

1.76 **: Preset 6 scan timer time**
Adjustment range : 0 to 9999 s
Factory setting : 0
If 1.70 is set to 1, determines the time during which the drive remains at reference Pr. 6.

1.77 **: Preset 7 scan timer time**
Adjustment range : 0 to 9999 s
Factory setting : 0
If 1.70 is set to 1, determines the time during which the drive remains at reference Pr. 7.

1.78 **: Preset 8 scan timer time**
Adjustment range : 0 to 9999 s
Factory setting : 0
If 1.70 is set to 1, determines the time during which the drive remains at reference Pr. 8.

Notes

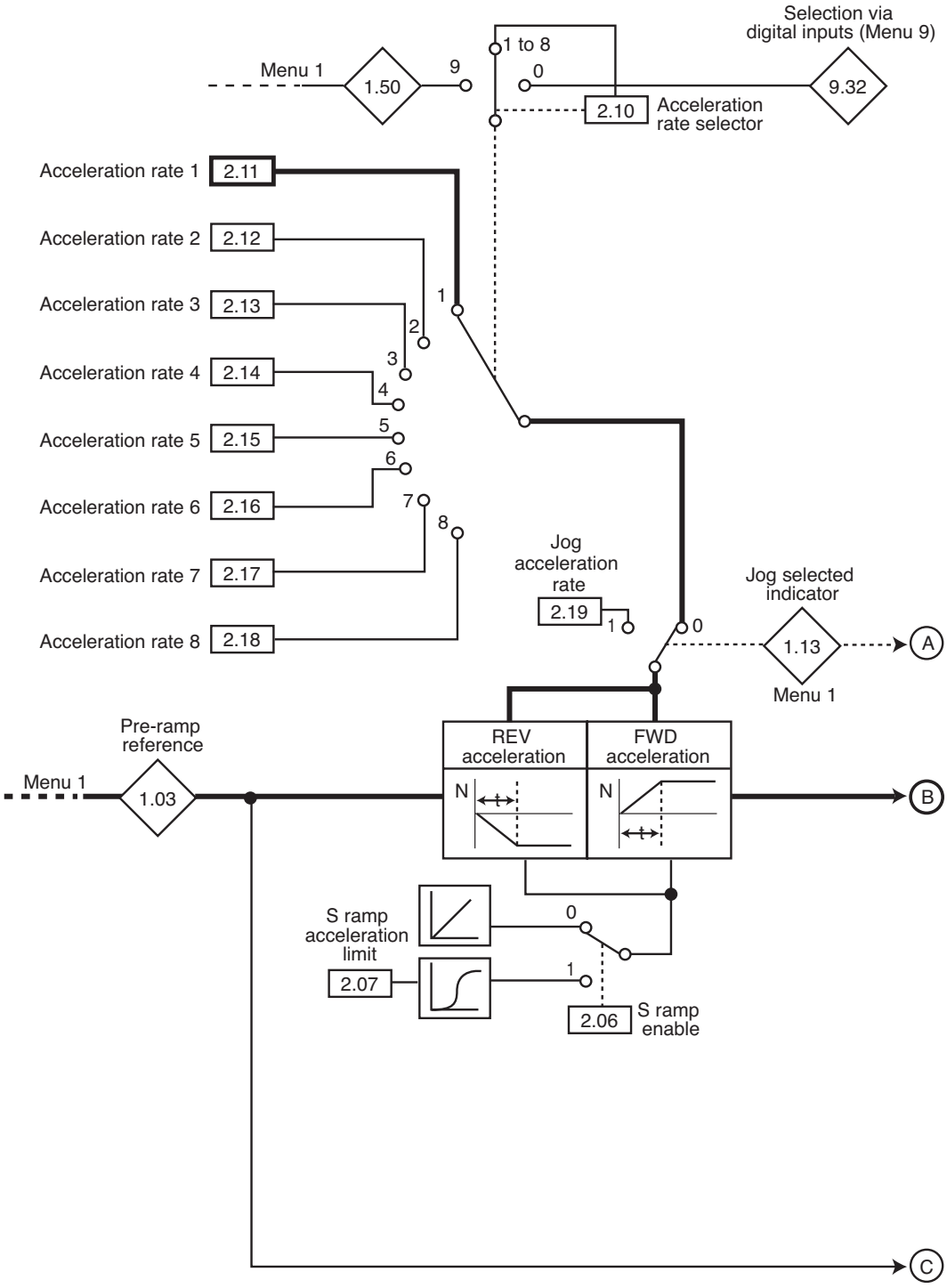
4 - MENU 2: RAMPS

4.1 - List of parameters in Menu 2

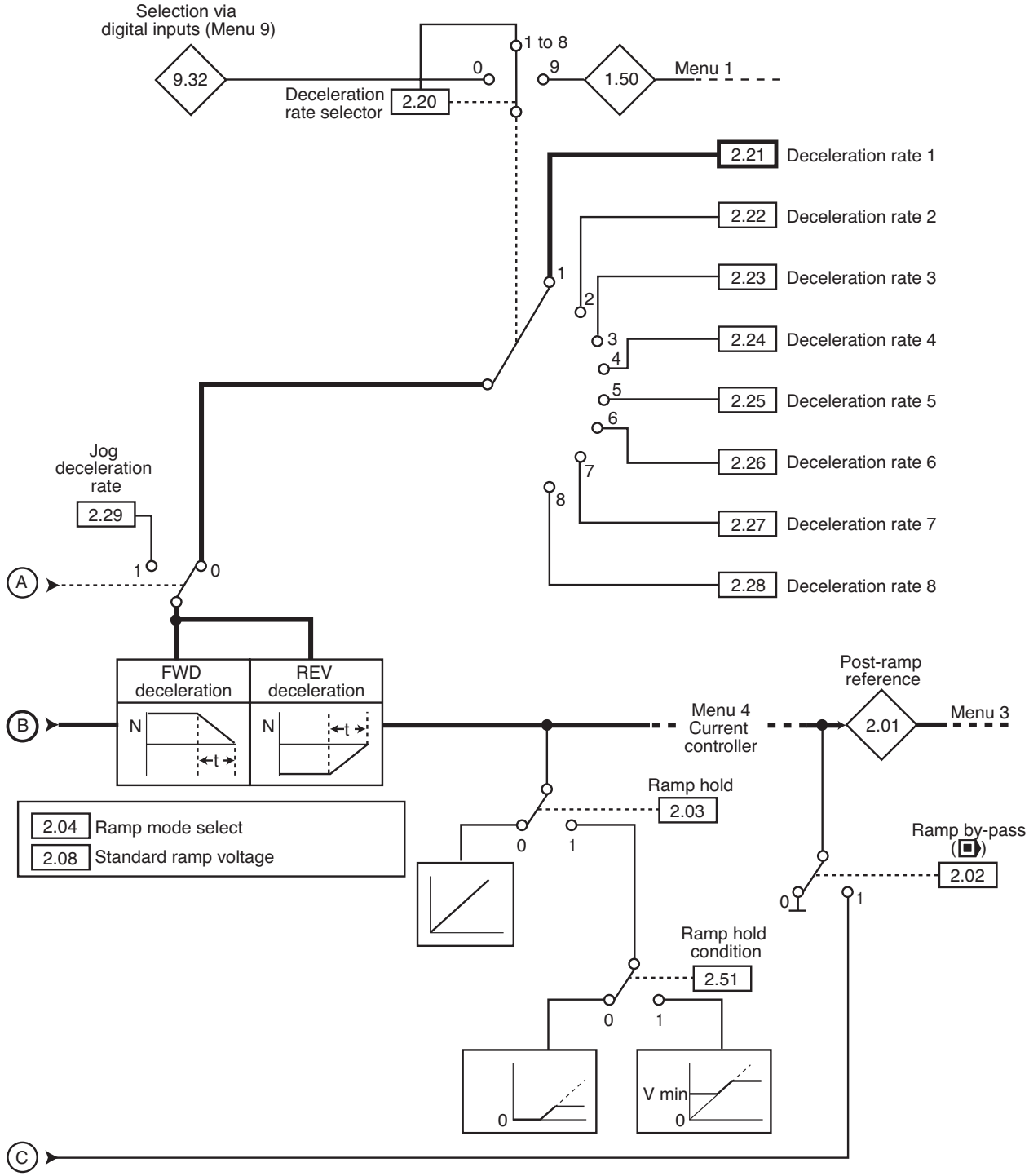
Parameter	Name	Type	Adjustment range	Factory setting	User setting
2.01	Post-ramp reference	RO/P	If 1.10 = 0 and 2.02 = 0: 0 to 1.06 If 1.10 = 0 and 2.02 = 1: 1.07 to 1.06 If 1.10 = 1: ± 1.06	-	-
2.02	Ramp bypass (▣)	R-W	0 or 1	0	
2.03	Ramp hold	R-W	0 or 1	0	
2.04	Deceleration ramp mode select	R-W	0 to 3	1	
2.05	Not used				
2.06	S ramp enable	R-W	0 or 1	0	
2.07	S ramp acceleration limit	R-W	2 to 10	10	
2.08	Standard ramp voltage	R-W	T = 0 to 800 V	Eur: 690V USA: 750V	
2.09	Not used				
2.10	Acceleration rate selector	R-W	0 to 9	1	
2.11 to 2.18	Acceleration rate 1 to Acceleration rate 8	R-W	0.1 to 600.0 s/1000 rpm	3.0 s/1000 rpm	
2.19	Jog acceleration rate	R-W	0.1 to 600.0 s/1000 rpm	0.2 s/1000 rpm	
2.20	Deceleration rate selector	R-W	0 to 9	1	
2.21 to 2.28	Deceleration rate 1 to Deceleration rate 8	R-W	0.1 to 600.0 s/1000 rpm	5.0 s/1000 rpm	
2.29	Jog deceleration rate	R-W	0.1 to 600.0 s/1000 rpm	0.2 s/1000 rpm	
2.30 to 2.50	Not used				
2.51	Ramp hold condition	R-W	0 or 1	0	

4.2 - Menu 2 diagrams

4.2.1 - Acceleration ramps



4.2.2 - Deceleration ramps



4.3 - Explanation of parameters in menu 2

2.01 **: Post-ramp reference**

Adjustment range : • If 1.10 = 0 and 2.02 = 0: 0 to 1.06
• If 1.10 = 0 and 2.02 = 1: 1.07 to 1.06
• If 1.10 = 1: ± 1.06

Measurement of the post-ramp reference. Used for diagnostics.

2.02 **: Ramp bypass (▣)**

Adjustment range : 0 or 1
Factory setting : 0
0 (Off) (no): Active ramps.
1 (On) (raMP): Ramps short-circuited.

2.03 **: Ramp hold**

Adjustment range : 0 or 1
Factory setting : 0
0 (Off) (raMP): Ramp freed.
1 (On) (StoP): The ramp is held and acceleration (or deceleration) is therefore interrupted.
WARNING:
The ramp hold function is disabled if a stop command is given.

2.04 **: Deceleration ramp mode select**

Adjustment range : 0 to 3
Factory setting : 1
0 (Fast) (Fst): Deceleration ramp imposed. If the deceleration ramp that has been configured is too fast in relation to the inertia of the load, the DC bus voltage exceeds its maximum value (set in 2.08) and the drive trips on "OU" overvoltage.
WARNING:
Select mode 2.04 = 0 (Fst) when a braking resistor is used.
1 (Standard) (Std): Standard deceleration ramp with automatic extension of the ramp time in order to avoid causing a DC bus overvoltage trip on the drive (threshold set in 2.08).
2 (Standard+) (StdH): The drive allows the motor voltage to be increased up to 1.2 times the rated voltage set in 5.09 (motor rated voltage), to avoid reaching the maximum DC bus voltage threshold (threshold set in 2.08). However, if this is not sufficient, the standard deceleration ramp time is extended, to avoid causing a DC bus overvoltage trip on the drive.
For the same amount of energy, mode 2 enables faster deceleration than mode 1.
3 (Fast+) (FstH): Same as mode 2, but the ramp is imposed. If the configured ramp is too fast, the drive goes into OU trip state.
WARNING:
In mode 2 and 3, the motor must be capable of tolerating additional losses relating to the increase in voltage at its terminals.

2.05 **: Not used**

2.06 **: S ramp enable**

Adjustment range : 0 or 1
Factory setting : 0
0 (Off) (Lin): The ramp is linear.
1 (On) (S-rP): A curved part (defined in 2.07) at the start and end of the ramp avoids load swinging (S ramp).
WARNING:
The S ramp is deactivated during controlled decelerations (2.04 = 1 or 2).

2.07 **: S ramp acceleration limit**

Adjustment range : 2 to 10
Factory setting : 10
Used to modify the ramp curve by the same value at the start and end of the ramp.
The value 4 represents a time for the curved part of 25% of the total ramp and 10 represents a time for the curved part of 10%.

2.08 **: Standard ramp voltage**

Adjustment range : 0 to 800 V
Factory setting : Eur: 690 V, USA: 750 V
This threshold is used when the drive is configured in standard deceleration mode (2.04 = 1 or 2).
If this threshold is too low, the machine will stop in freewheel mode. If this threshold is too high and there are no resistors connected, the drive will trip due to DC bus overvoltage ("OU" trip).
The minimum value of this parameter must be 50 V higher than the DC bus voltage obtained with the maximum supply voltage (U bus = U supply x √2).

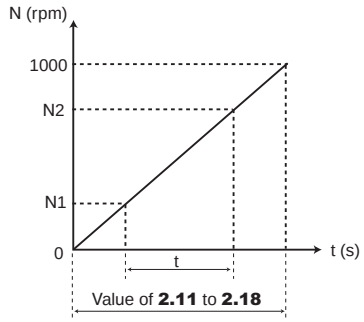
2.09 **: Not used**

2.10 **: Acceleration rate selector**

Adjustment range : 0 to 9
Factory setting : 1
This parameter is used to select the acceleration ramp as follows:
0 (Term. inputs) (SEL): Selection of the acceleration ramp via digital input. The choice of ramp comes from the binary sum in menu 9 (9.32).
1 (Acceler.1) (Acc1): Acceleration ramp 1
2 (Acceler.2) (Acc2): Acceleration ramp 2
3 (Acceler.3) (Acc3): Acceleration ramp 3
4 (Acceler.4) (Acc4): Acceleration ramp 4
5 (Acceler.5) (Acc5): Acceleration ramp 5
6 (Acceler.6) (Acc6): Acceleration ramp 6
7 (Acceler.7) (Acc7): Acceleration ramp 7
8 (Acceler.8) (Acc8): Acceleration ramp 8
9 (To preset) (rP.Pr): The ramp is automatically associated with the corresponding preset speed.

2.11 to **2.18** **: Acceleration rates 1 to 8**
Adjustment range : 0.1 to 600.0 s/1000 rpm
Factory setting : 3 s/1000 rpm
Sets the time for acceleration from 0 to 1000 rpm.

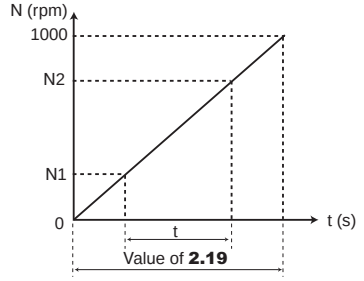
$$2.11 \text{ to } 2.18 = \frac{t(s) \times 1000 \text{ rpm}}{(N2 - N1) \text{ rpm}}$$



2.11: Acceleration rate 1 (main ramp in factory settings)
2.12: Acceleration rate 2
2.13: Acceleration rate 3
2.14: Acceleration rate 4
2.15: Acceleration rate 5
2.16: Acceleration rate 6
2.17: Acceleration rate 7
2.18: Acceleration rate 8

2.19 **: Jog acceleration rate**
Adjustment range : 0.1 to 600.0 s/1000 rpm
Factory setting : 0.2 s/1000 rpm
Sets the time for acceleration from 0 to 1000 rpm.

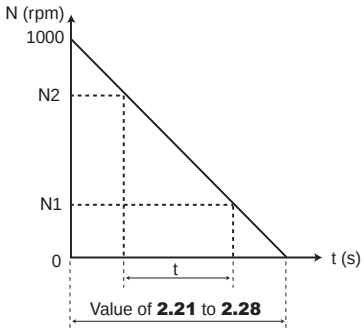
$$2.19 = \frac{t(s) \times 1000 \text{ rpm}}{(N2 - N1) \text{ rpm}}$$



2.20 **: Deceleration rate selector**
Adjustment range : 0 to 9
Factory setting : 1
This parameter is used to select the deceleration ramp as follows:
0 (Term. inputs) (SEL): Selection of the deceleration ramp via digital input. The choice of ramp comes from the binary sum in menu 9 (9.32).
1 (Deceler.1) (Dec1): Deceleration ramp 1
2 (Deceler.2) (Dec2): Deceleration ramp 2
3 (Deceler.3) (Dec3): Deceleration ramp 3
4 (Deceler.4) (Dec4): Deceleration ramp 4
5 (Deceler.5) (Dec5): Deceleration ramp 5
6 (Deceler.6) (Dec6): Deceleration ramp 6
7 (Deceler.7) (Dec7): Deceleration ramp 7
8 (Deceler.8) (Dec8): Deceleration ramp 8
9 (To preset) (rP.Pr): The ramp is automatically associated with the corresponding preset speed.

2.21 to **2.28** **: Deceleration rates 1 to 8**
Adjustment range : 0.1 to 600.0 s/1000 rpm
Factory setting : 5.0 s/1000 rpm
Sets the time for deceleration from 1000 rpm to 0.

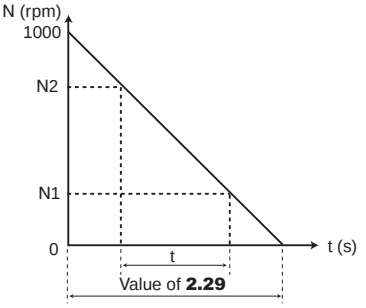
$$2.21 \text{ to } 2.28 = \frac{t(s) \times 1000 \text{ rpm}}{(N2 - N1) \text{ rpm}}$$



2.21: Deceleration rate 1 (main ramp in factory settings)
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

2.29 **: Jog deceleration rate**
Adjustment range : 0.1 to 600.0 s/1000 rpm
Factory setting : 0.2 s/1000 rpm
Sets the time for deceleration from 1000 rpm to 0.

$$2.29 = \frac{t(s) \times 1000 \text{ rpm}}{(N2 - N1) \text{ rpm}}$$



2.30 **to** **2.50** **: Not used**

2.51 **: Ramp hold condition**
Adjustment range : 0 or 1
Factory setting : 0
0 (ALL) (ALL): When 2.03 **= 1, the ramp is always held.**
1 (> V MIN) (S.Min): When 2.03 = 1, the ramp is freed between 0 and V min (1.07).

Notes

5 - MENU 3: FREQUENCY THRESHOLDS - ENCODER OPTION

5.1 - List of parameters in Menu 3

Parameter	Name		Type	Adjustment range	Factory setting	User setting
3.01	Final speed demand	▣	RO/P	± 2 x 1.06 rpm	-	
3.02	Motor speed		RO/P	± 2 x 1.06 rpm		-
3.03	Speed error	▣	RO/P	± 2 x 1.06 rpm		-
3.04	Speed control output	▣	RO/P	± 300.0%	-	-
3.05	Zero speed threshold		R-W	0 to 500 rpm	30 rpm	
3.06	At speed lower limit		R-W	0 to 500 rpm	30 rpm	
3.07 to 3.09	Not used					
3.10	Speed loop proportional gain (Kp1)	▣	R-W	0 to 32000	200	
3.11	Speed loop integral gain (Ki1)	▣	R-W	0 to 32000	100	
3.12	Speed loop differential gain (Kd1)	▣	R-W	0 to 32000	0	
3.13	Speed loop proportional gain (Kp2)	▣	R-W	0 to 32000	200	
3.14	Speed loop integral gain (Ki2)	▣	R-W	0 to 32000	100	
3.15	Speed loop differential gain (Kd2)	▣	R-W	0 to 32000	0	
3.16	Speed gain select	▣	R-W	0 or 1	0	
3.17	Speed gain setup	▣	R-W	0 to 2	0	
3.18	Total inertia	▣	R-W	0.001 to 32.000 Kkgm^2	0.001 Kkgm^2	
3.19	Not used					
3.20	Bandwidth	▣	R-W	0.1 to 255.0 Hz	10.0 Hz	
3.21	Damping factor	▣	R-W	0 to 10.0	1.0	
3.22	Hard speed reference	▣	R-W	0 to 2 x 1.06 rpm	0	
3.23	Hard speed reference selector	▣	R-W	0 or 1	0	
3.24	Not used					
3.25	Encoder phase angle	▣	R-W	0 to 359.9°	0	
3.26 to 3.28	Not used					
3.29	Drive encoder position	▣	RO/P	-32768 to +32767	-	-
3.30 to 3.33	Not used					
3.34	Encoder lines per revolution		R-W	0 to 32000 lpr	1024 lpr	
3.35 to 3.37	Not used					
3.38	Encoder type		R-W	0 to 8	If 11.31 = 0 to 2: 0 If 11.31 = 3: 3	
3.39 to 3.41	Not used					
3.42	Drive encoder filter	▣	R-W	0 to 10	3.0	
3.43	Maximum frequency input encoder reference		R-W	0 to 32000	5000	
3.44	Frequency input reference scale		R-W	0 to 2.0000	1.0000	
3.45	Frequency input reference	▣	RO/P	0 to 100%	-	-
		▣	RO/P	± 100%	-	-
3.46	Frequency input reference destination		R-W/P	0.00 to 21.51	0.00	

: Function not available

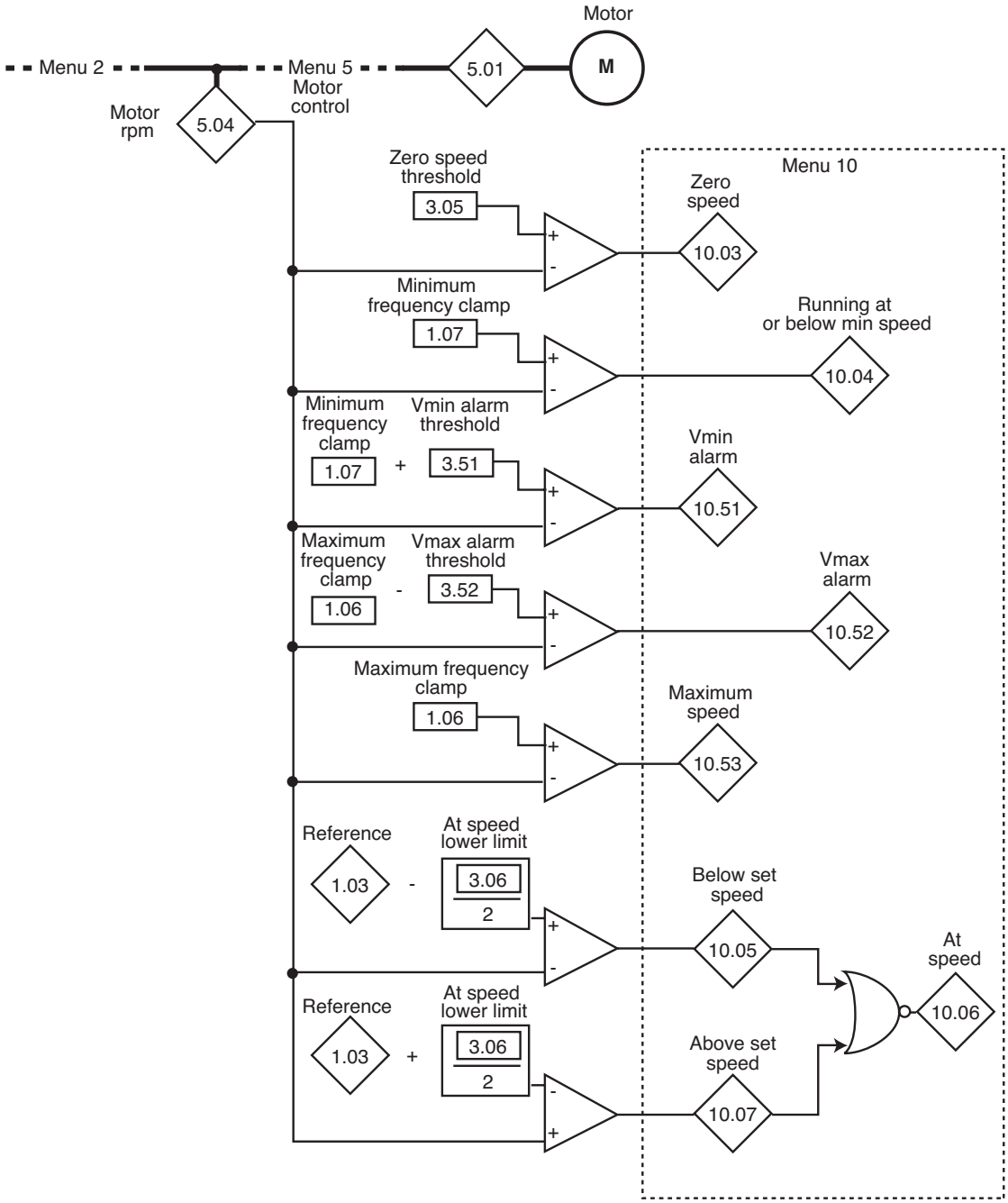
Commander SX
IP66/Nema 4X variable speed drive
MENU 3: FREQUENCY THRESHOLDS - ENCODER OPTION

Parameter	Name		Type	Adjustment range	Factory setting	User setting
3.47 to 3.50	Not used					
3.51	Vmin alarm threshold		R-W	0 to 500 rpm	90 rpm	
3.52	V max alarm threshold		R-W	0 to 500 rpm	90 rpm	
3.53 to 3.60	Not used					
3.61	Frequency input source		R-W/P	0.00 to 21.51	0.00	
3.62	Input frequency		RO/P	0 to 5000 Hz	-	-
3.63	Maximum frequency output reference		R-W	0 to 1000.0 Hz	20.0 Hz	
3.64	Frequency output reference scale		R-W	0 to 32.00	1.00	
3.65	Frequency output reference		RO/P	0 to 100%	-	-
3.66	Not used					
3.67	Frequency input select	■	R-W	0 or 1	0	
3.68	Minimum frequency threshold		R-W	1.0 to 10.0 Hz	1.0 Hz	
3.69 and 3.70	Not used					
3.71	Frequency output reference source		R-W/P	0.00 to 21.51	0.00	
3.72	Frequency output period		RO/P	0.001 to 2.000 s	-	-
3.73	Frequency output signal		RO/P	0 or 1	-	-

Notes

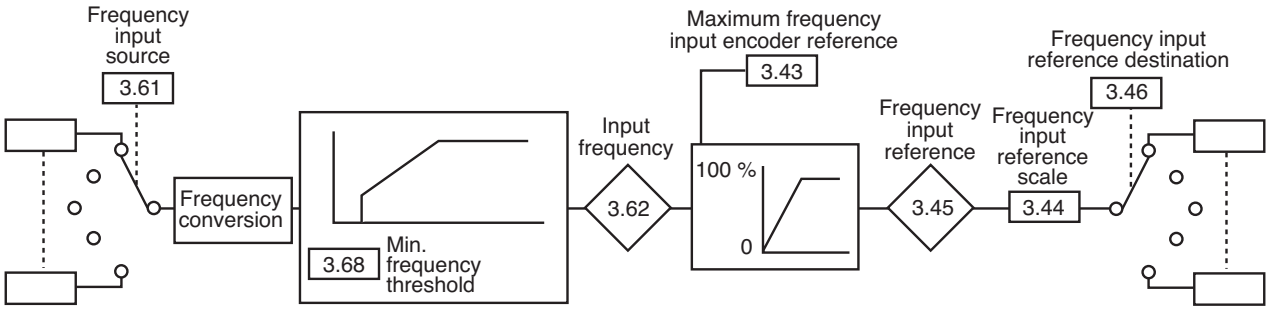
5.2 - Menu 3 diagram

5.2.1 - Basic version

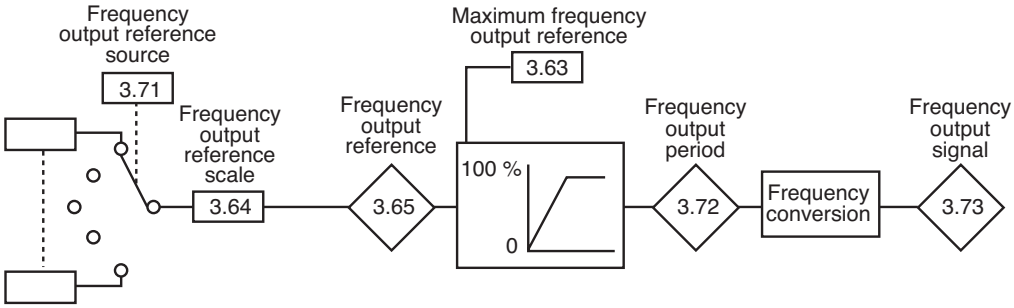


Basic version (continued)

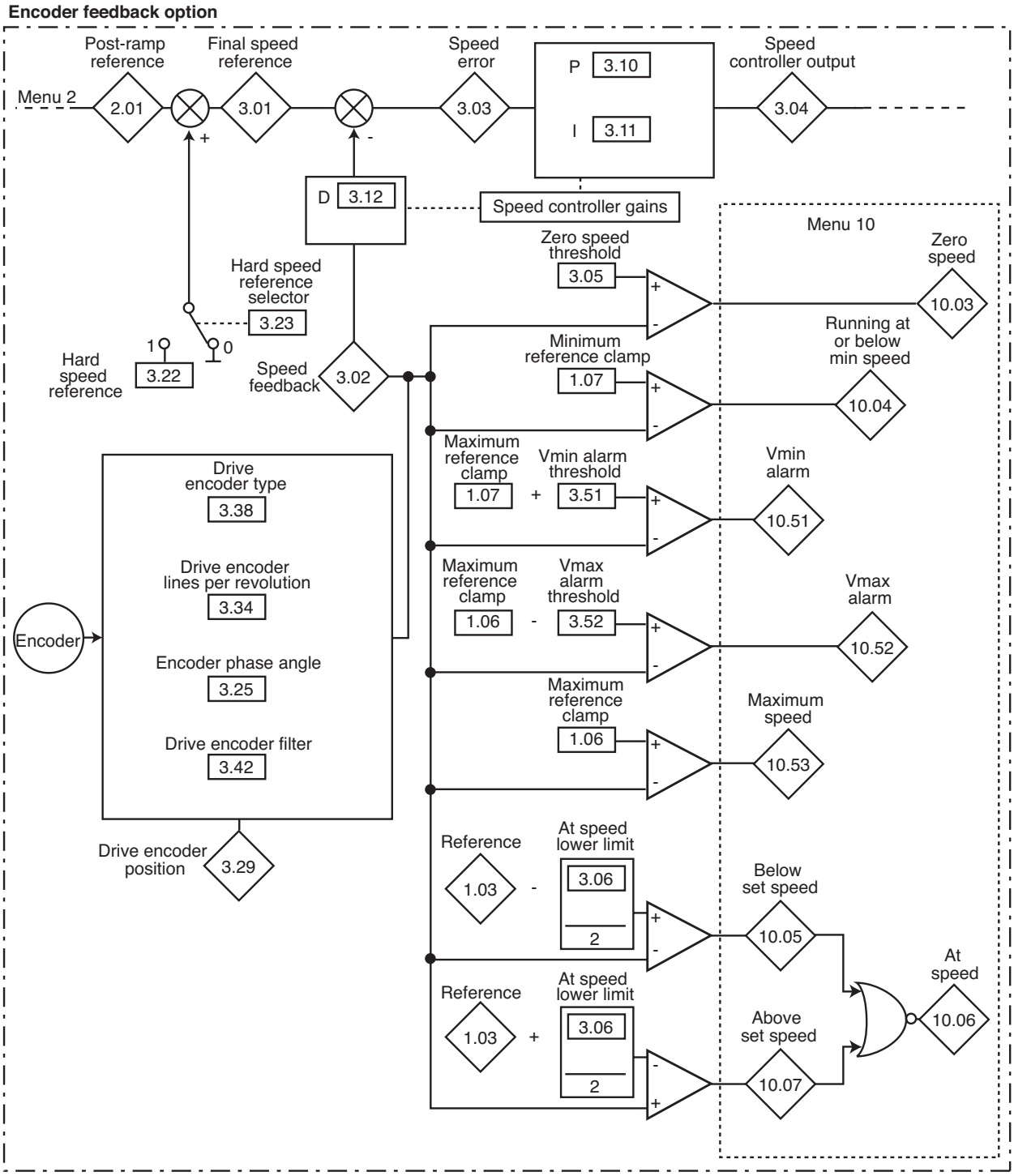
Frequency input



Frequency output

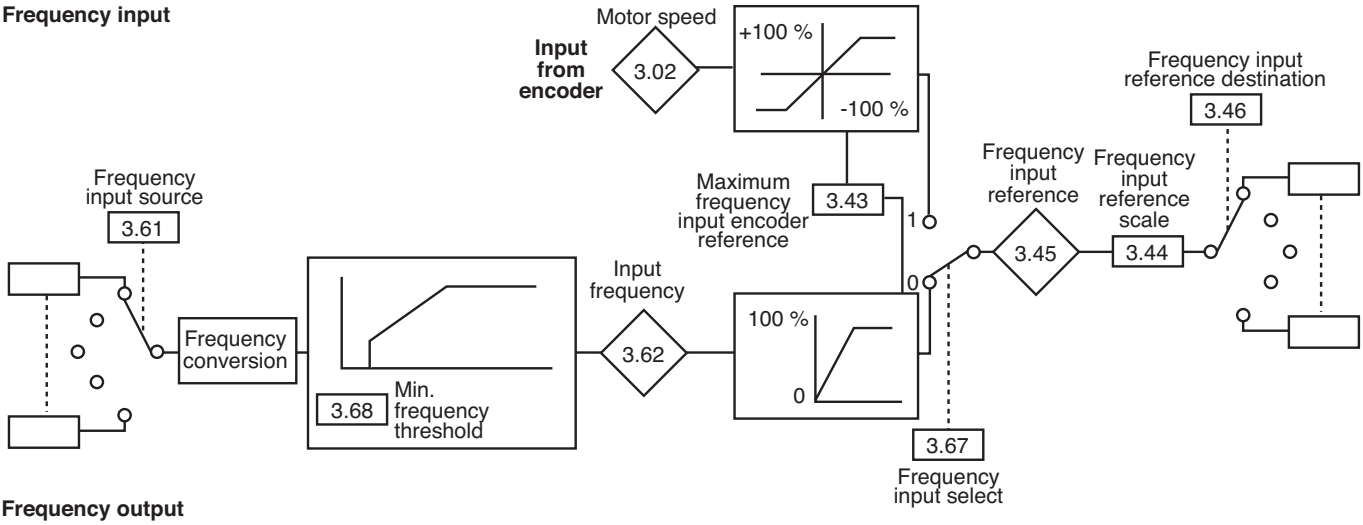


5.2.2 - With encoder option

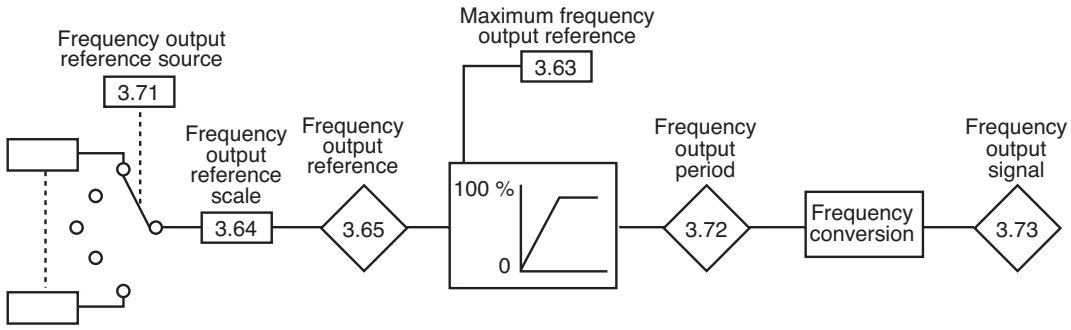


With encoder option (continued)

Frequency input



Frequency output



5.3 - Explanation of parameters in menu 3

Parameters marked with the symbol ▣ can only be accessed when an encoder feedback option is present.

3.01 : Final speed demand (▣)

Adjustment range : ± 2 x 1.06 rpm
Represents the sum of the post ramp reference and the hard speed reference if this has been enabled.

3.02 : Motor speed

Adjustment range : ± 2 x 1.06 rpm
Actual speed from the encoder.

3.03 : Speed error (▣)

Adjustment range : ± 2 x 1.06 rpm
Difference between the final speed reference and the speed feedback.

3.04 : Speed control output (▣)

Adjustment range : ± 300.0%
The speed control output produces a torque reference to be used in determining the value of the active current.

3.05 : Zero speed threshold
Adjustment range : 0 to 500 rpm
Factory setting : 30 rpm
If the motor speed 2.01 is at or below the level defined by this parameter, the zero speed alarm 10.03 will be at 1, otherwise it will be at 0.

3.06 : At speed lower limit
Adjustment range : 0 to 500 rpm
Factory setting : 30 rpm
Defines the window within which the "At speed" alarm is activated.
10.06 is at 1 when the post-ramp reference equals the reference ± (3.06/2).

3.07 to 3.09 : Not used

3.10 : Speed loop proportional gain Kp1 (▣)
Adjustment range : 0 to 32000
Factory setting : 200
Adjusts the stability of the motor speed in the event of sudden variations in the reference.
Increase the proportional gain until vibration occurs in the motor, then reduce the value by 20 to 30%, checking that the motor remains stable in the event of sudden variations in speed, both at no load and on load.

3.11 : Speed loop integral gain Ki1 (▣)
Adjustment range : 0 to 32000
Factory setting : 100
Adjusts the stability of the motor speed on load impact.
Increase the integral gain so that the same speed is obtained on load and at no load in the event of load impact.
WARNING: Do not configure a zero value in this parameter (may cause difficulties when the motor stops).

3.12 : Speed loop differential gain Kd1 (▣)
Adjustment range : 0 to 32000
Factory setting : 0
Adjusts the stability of the motor speed in the event of load shedding or sudden variations in the reference.
Reduces overshoots.
In general, leave the setting at 0.
Function not available.

3.13 : Speed loop proportional gain Kp2 (▣)
Adjustment range : 0 to 32000
Factory setting : 200
Adjusts the stability of the motor speed in the event of sudden variations in the reference.
The drive uses Kp1 (3.10) or Kp2 (3.13) depending on the value of 3.16.

3.14 : Speed loop integral gain Ki2 (▣)
Adjustment range : 0 to 32000
Factory setting : 100
Adjusts the stability of the motor speed on load impact.
The drive uses Ki1 (3.11) or Ki2 (3.14) depending on the value of 3.16.

3.15 : Speed loop differential gain Kd2 (▣)
Adjustment range : 0 to 32000
Factory setting : 0
Adjusts the stability of the motor speed in the event of load shedding or sudden variations in the reference.
The drive takes account of Kd1 (3.12) or Kd2 (3.15) depending on the value of 3.16.
Function not available.

3.16 : Speed gain select (▣)
Adjustment range : 0 or 1
Factory setting : 0
This parameter can be modified when the drive is disabled or enabled.
0 (Gain No1) (gai.1): Selection of gains Kp1 (3.10**), Ki1 (**3.11**) and Kd1 (**3.12**).**
1 (Gain No2) (gai.2): Selection of gains Kp2 (3.13), Ki2 (3.14) and Kd2 (3.15).

3.17 : Speed loop setup (▣)
Adjustment range : 0 to 2
Factory setting : 0
0 (USER SETUP) (User): The speed loop operates with the gains entered by the user.
1 (AUTO) (Auto): The speed loop operates with the gains calculated from the total inertia entered in 3.18, the bandwidth entered in 3.20 and the damping factor entered in 3.21.
2 (16 TIME) (Pr.16): For applications with very high inertia for which a very high proportional gain is necessary, this mode causes the proportional gain configured in 3.10 or 3.13 to be multiplied by 16.
Function not available.

3.18 : Total inertia (▣)
Adjustment range : 0.001 to 32.000 Kkgm^2
Factory setting : 0.001 Kkgm^2
Corresponds to the total inertia applied to the motor (motor inertia + load inertia).
This parameter is used for automatic calculation of the gains (see 3.17), and to provide a torque correction during acceleration if necessary.

3.19 : Not used

3.20 : Bandwidth (▣)
Adjustment range : 0.1 to 255.0 Hz
Factory setting : 10.0 Hz
Used to set the bandwidth taken into account with speed loop operating mode 1 (see 3.17).

3.21 : Damping factor (▣)
Adjustment range : 0 to 10.0
Factory setting : 1.0
Used to set the damping factor taken into account with speed loop operating mode 1 (see 3.17).

3.22 : Hard speed reference (▣)
Adjustment range : 0 to 2 x 1.06 rpm
Factory setting : 0
This hard speed reference is an additional reference which is not affected by the ramps.
Function not available.

3.23 : Hard speed reference selector (▣)
Adjustment range : 0 or 1
Factory setting : 0
0 (Off) (OFF): Hard speed reference selector inactive.
1 (On) (On): Used to add an unramped speed reference to the main reference.
Function not available.

3.24 : Not used

3.25 : Encoder phase angle (▣)
Adjustment range : 0 to 359.9°
Factory setting : 0
Indicates the result of the phasing test. It is stored when the drive is powered down and will be modified automatically only after a new phasing test.
⚠ • The phase angle, where it is known, can be entered manually. Any incorrect value can cause the motor to rotate in the wrong direction or trip the drive.

3.26 to 3.28 : Not used

3.29 : Drive encoder position (▣)
Adjustment range : -32768 to +32767
Indicates the position of the encoder in relation to the line it was on at power-up.

3.30 to 3.33 : Not used

3.34 : Encoder lines per revolution
Adjustment range : 0 to 32000 lpr
Factory setting : 1024 lpr
Used to configure the number of lines per encoder revolution. Converts the encoder input into a speed.

3.35 to 3.37 : Not used

3.38 : Encoder type
Adjustment range : 0 to 8
Factory setting : 0 if 11.31 = 0 to 2
3 if 11.31 = 3
0 (INCREMENTAL) (Incr.) : Quadrature incremental encoder
1 (Increm. FD) (Fd): Incremental encoder with Frequency/ Direction output
2 (Increm. FW/RV) (Fr): Incremental encoder with FWD/REV outputs
3 (Increm. UVW) (CoMM): Incremental encoder with commutation channels
4 (HALL EFFECT) (haLL): Hall effect sensor
5 (SENSORLESS 1) (tyP1): Sensorless mode 1
6 (SENSORLESS 2) (tyP2): Sensorless mode 2
7 (SENSORLESS 3) (tyP3): Sensorless mode 3
8 (SENSORLESS 4) (tyP4): Sensorless mode 4

3.39 to 3.41 : Not used

3.42 : Drive encoder filter (▣)
Adjustment range : 0 to 10
Factory setting : 3.0
This parameter is used to insert a sliding window filter in the encoder speed feedback, such that:
time constant = $2^{3.42}$ ms.
This is particularly useful for attenuating the current demand when the load has high inertia and high gain is necessary on the speed loop. If the filter is not enabled under these conditions, it is possible for the speed loop output to change continuously from one current limit to another, disabling the integral function of the speed loop.
The filter is inactive if 3.42 = 0.

3.43 : Maximum frequency input encoder reference
Adjustment range : 0 to 32000
Factory setting : 5000
Adjusts the input frequency which should correspond to 100% of the destination numerical value.

3.44 : Frequency input reference scale
Adjustment range : 0 to 2.0000
Factory setting : 1.0000
Used for scaling the numerical reference to be converted into pulses.

3.45 : Frequency input reference
Adjustment range : 0 to 100% (▣); ± 100% (▣)
Indicates the value of the numerical reference resulting from conversion of the pulse signal.

3.46 : Frequency input reference destination
Adjustment range : 0.00 to 21.51
Factory setting : 0.00
Used to select the destination of the numerical reference resulting from conversion of the pulse signal. Only "non-bit" type parameters can be programmed. If an unsuitable parameter is selected, 3.46 will be frozen at 0.

3.47 to 3.50 : Not used

3.51 : Vmin alarm threshold
Adjustment range : 0 to 500 rpm
Factory setting : 90 rpm
Triggers an alarm 10.51 when the motor speed is such that:
- (5.04) < Vmin (1.07 or 21.02) + 3.51 in open loop mode,
- (3.02) < Vmin (1.07 or 21.02) + 3.51 in closed loop mode.

3.52 : Vmax alarm threshold
Adjustment range : 0 to 500 rpm
Factory setting : 90 rpm
Triggers an alarm 10.52 when the motor speed is such that:
- (5.04) > Vmax (1.06 or 21.01) - 3.52 in open loop mode,
- (3.02) > Vmax (1.06 or 21.01) - 3.52 in closed loop mode.

3.53 to 3.60 : Not used

3.61 : Frequency input source
Adjustment range : 0.00 to 21.51
Factory setting : 0.00
Used to select the source of pulses. Only "bit" type parameters can be programmed. If an unsuitable parameter is selected, 3.61 will be frozen at 0.
Note: Only use inputs ADI1, ADI2, DIO1, DI2 and DI3 as the frequency input source. The maximum input frequency should be 5 kHz. If the input frequency is more than 5 kHz, use an encoder feedback option, and set 3.67 to 1 (EnCd).

3.62 : Input frequency
Adjustment range : 0 to 5000 Hz
Drive encoder frequency which will be converted to a numerical reference.
Application example:
Pulses from an inductive sensor connected on a digital input are converted to a reference which is assigned to the speed reference.

3.63 : Maximum frequency output reference
Adjustment range : 0 to 1000.0 Hz
Factory setting : 20.0 Hz
Adjusts the pulse frequency which should correspond to 100% of the original numerical reference.
Note: Set 3.63 above 0.5 Hz, since the drive output is inactive below this value.

3.64 : Frequency output reference scale
Adjustment range : 0 to 32.00
Factory setting : 1.00
Used for scaling the reference from the drive encoder.

3.65 : Frequency output reference
Adjustment range : 0 to 100%
Indicates the value of the analog reference.

3.66 : Not used

3.67 : Frequency input select ( )
Adjustment range : 0 or 1
Factory setting : 0
0 (Digital in) (Freq): An analog reference is generated from a frequency signal.
1 (Encoder) (Encd): The encoder signal is used to generate an analog reference (e.g. speed reference).

3.68 : Minimum frequency threshold
Adjustment range : 1.0 to 10.0 Hz
Factory setting : 1.0 Hz
This parameter is used to define a minimum signal absence detection time for the frequency input. Used to adapt detection to the period of the signal.
This minimum time = 1/(3.68).

3.69 and 3.70 :Not used

3.71 : Frequency output reference source
Adjustment range : 0.00 to 21.51
Factory setting : 0.00
Used to select the source of the numerical reference which will be converted into pulses.

3.72 : Frequency output period
Adjustment range : 0.001 to 2.000 s
Frequency output period resulting from conversion of the numerical reference.
Application example:
A potentiometer connected to an analog input generates a reference which is converted into pulses whose period is proportional to the reference. The pulses are assigned to the run command.

3.73 : Frequency output signal
Adjustment range : 0 or 1
0 (Off) (OFF)
1 (On) (On)
Used to assign the drive output to a digital output if necessary, e.g. DIO1.
Note: There is no counting above 2 seconds.

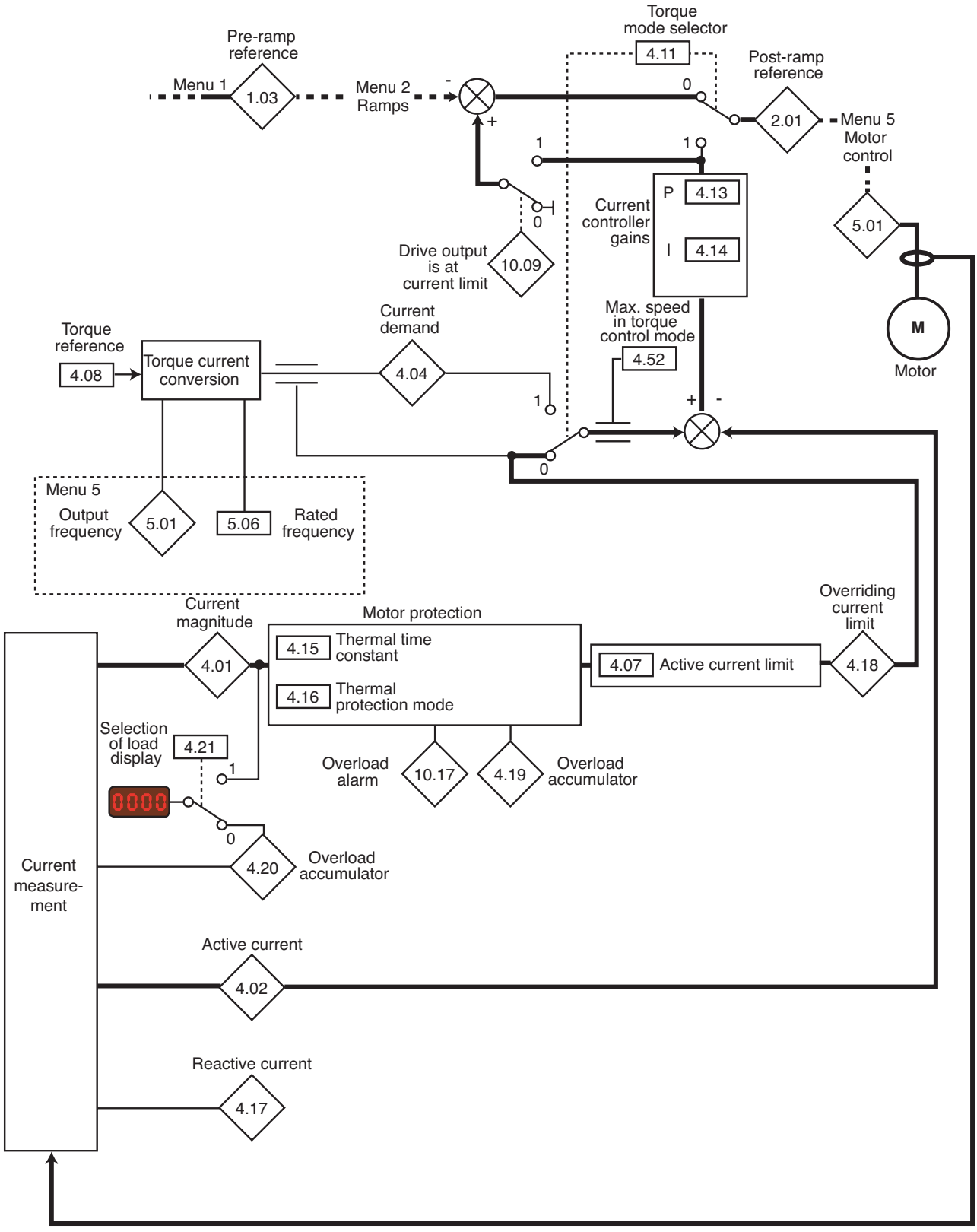
6 - MENU 4: CURRENT AND TORQUE CONTROL

6.1 - List of parameters in Menu 4

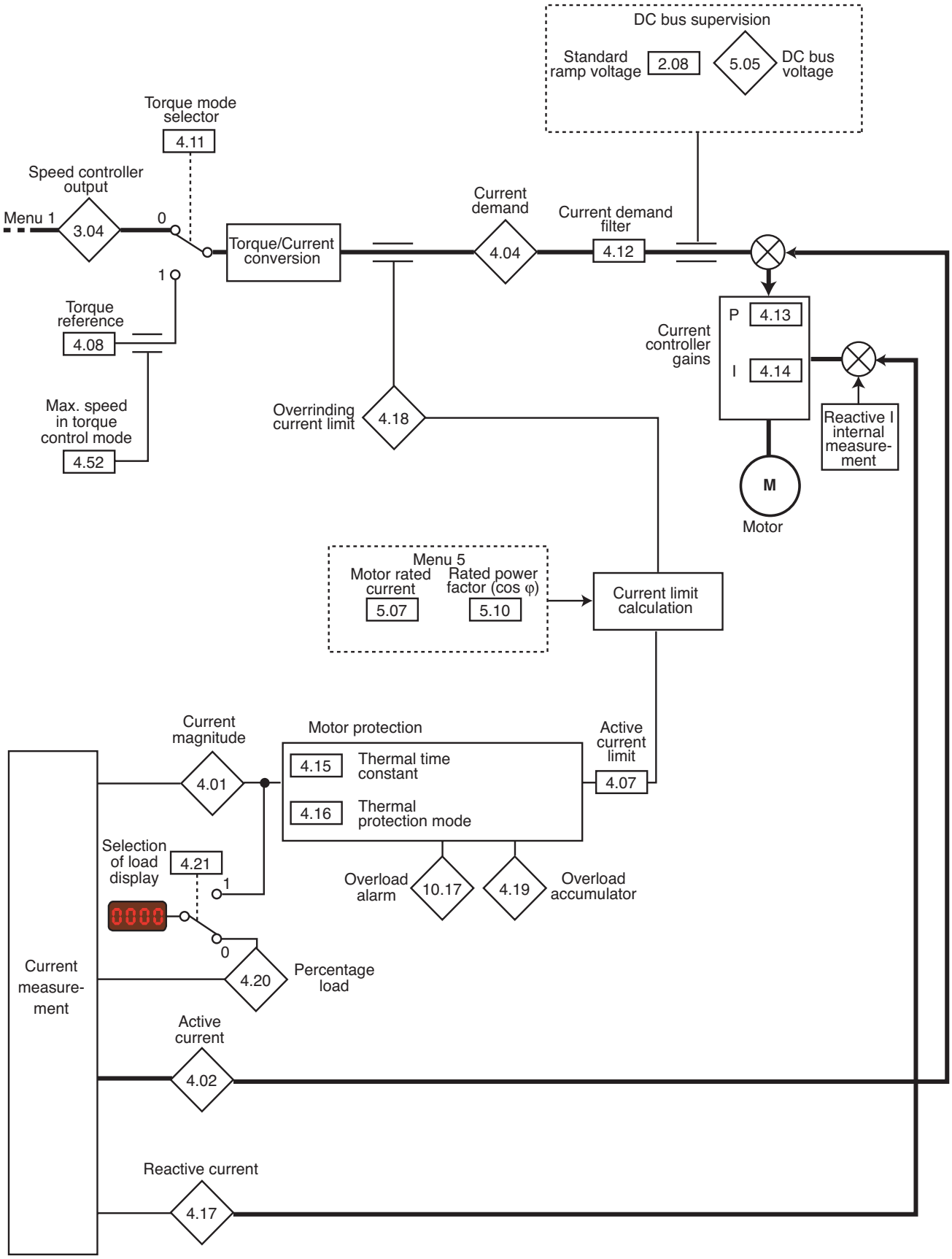
Parameter	Name		Type	Adjustment range	Factory setting	User setting
4.01	Current magnitude		RO/P	0 to max. current drive (A)	-	-
4.02	Active current		RO/P	± max. drive current	-	-
4.03	Not used					
4.04	Current demand		RO/P	± active current limit (% active In)	-	-
4.05 and 4.06	Not used					
4.07	Symmetrical current limit		R-W	0 to + 300.0% (% active In)	165.0%	
4.08	Torque reference		R-W	± 300.0% (% active In)	0	
4.09 and 4.10	Not used					
4.11	Torque mode selector		R-W	0 or 1	0	
4.12	Current demand filter	■	R-W	0 to 10 ms	0	
4.13	Current loop proportional gain		R-W	0 to 999	20	
4.14	Current loop integral gain		R-W	0 to 250	40	
4.15	Thermal time constant		R-W	0 to 250 s	89 s	
4.16	Thermal protection mode		R-W	0 or 1	0	
4.17	Reactive current		RO/P	± 9999	-	-
4.18	Overriding current limit		RO/P	0 to + 300% (% active In)	-	-
4.19	Overload accumulator		RO/P	0 to 100.0%	-	-
4.20	Percentage load		RO/P	± active current limit (% active In)	-	-
4.21	Selection of load display		R-W	0 or 1	0	
4.22 to 4.51	Not used					
4.52	Max. speed in torque control mode		R-W	0 to 32000 rpm	1500 rpm	

6.2 - Menu 4 diagram

6.2.1 - Basic version



6.2.2 - With encoder option



6.3 - Explanation of parameters in menu 4

4.01 **: Current magnitude**

Adjustment range : 0 to max. drive current (A)
Reading of the rms current in each drive output phase.
This is the result of the vectorial sum of the reactive current and the active current.

4.02 **: Active current**

Adjustment range : ± max. drive current
Reading of the active current delivered by the drive.
The active current gives a fairly precise image of the motor torque between 10 Hz and 50 Hz.
A negative value indicates operation in generator mode with driving load whereas a positive value indicates operation in motor mode.

4.03 **: Not used**

4.04 **: Current demand**

Adjustment range : ± active current limit (% active In)
The current demand is the result of conversion of the torque reference 4.08 corrected by the active current limit 4.07.

4.05 and 4.06 **:Not used**

4.07 **: Active current limit**
Adjustment range : 0 to +300.0% (% active In)*
Factory setting : 165.0%
Determines the active current limit that applies in both motor and generator mode in both directions of rotation.
With frequency control (4.11 = 0), the output frequency will automatically be adjusted in order to adhere to the current limit.
The current limit is an active current limit whereas the maximum current permitted by the drive is a total current.
The maximum value of 4.07 can therefore take the following value:

$$\text{Max. active I} = \frac{\sqrt{\text{Max. total I}^2 - \text{Reactive I}^2}}{\text{Active In}} \times 100\%$$

Max. total I = 150% drive In
Active In = motor In x cos φ

$$\text{Reactive current} = \sqrt{\text{Motor In}^2 - \text{Active In}^2}$$

* : The maximum value of 4.07 depends on the value of 11.32, 5.07 and 5.10, such that:
- For an induction motor (11.31 = 0, 1 or 2)

$$\frac{(\mathbf{11.32} \times 2{,}22)}{(\mathbf{5.07} \times \mathbf{5.10})} \times 100$$

- For a synchronous motor (11.31 = 3)

$$\frac{(\mathbf{11.32} \times 2{,}22)}{\mathbf{5.07}} \times 100$$

4.08 **: Torque reference**
Adjustment range : ± 300.0% (% active In)
Factory setting : 0
Main torque reference when the drive is configured for torque control.
Give a positive reference for the torque to be applied clockwise and conversely, a negative reference for the torque to be applied counter-clockwise.

4.09 and 4.10 **:Not used**

4.11 **: Torque mode selector**
Adjustment range : 0 or 1
Factory setting : 0
0 (Speed) (SPd): Speed control with current limiting by parameter 4.07**.**
1 (Torque) (trq): Torque control. The speed reference is no longer active and the torque reference can be given by analog reference 2 (if it is programmed on the torque reference, parameter 4.08). The output frequency is adjusted so that the active current measured by the drive equals the reference.

• With torque control (4.11 **= 1), the machine races if the resistive torque drops to zero. It is therefore essential to make sure that parameter** 1.06**, which limits the maximum speed, is set so as to ensure the safety of equipment and personnel.**
When racing occurs, the maximum speed reached is 1.06 **+ 30%.**

4.12 **: Current demand filter ( )**
Adjustment range : 0 to 10 ms
Factory setting : 0
This filter is used to introduce a time constant aimed at reducing any noise generated by the speed loop, such that: time constant = $2^{4.12}$ ms.

4.13 **: Current loop proportional gain**

4.14 **: Current loop integral gain**
Adjustment range : 4.13 = 0 to 999, 4.14 = 0 to 250
Factory setting : 4.13 = 20
4.14 = 40
Due to a certain number of internal drive factors, oscillations may occur in the following cases:
- Frequency control with current limiting around the rated frequency and on load impacts
- Torque control on machines with a low load and around the rated speed
- On a mains supply break or on a controlled deceleration ramp when control via the DC bus is requested.
To reduce these oscillations, we recommend that you first:
- increase the proportional gain 4.13
- then reduce the integral gain 4.14.

4.15 : Thermal time constant
Adjustment range : 0 to 250 s
Factory setting : 89 s
This parameter is used to define the motor thermal protection. If known, the thermal time constant of the motor should be entered directly in 4.15. Otherwise it should be calculated as a function of the maximum time for which the motor can tolerate 150% I_N.

$$4.15 = \frac{\text{Maximum duration at 150 \% } I_N}{0.674}$$

Note: When 7.11 = 8 (ADI2 configured as a PTC input), it is possible to deactivate the motor thermal protection (itAC motor overload trip) by setting 4.15 = 0.

4.16 : Thermal protection mode
Adjustment range : 0 or 1
Factory setting : 0
0 (Trip) (deF): The drive will trip when the threshold defined in parameter 4.15 is reached.
1 (Curr. limit) (Auto): The limiting current will automatically be reduced below 100% I_N when the threshold defined in parameter 4.15 is reached.

4.17 : Reactive current
Adjustment range : ± 9999
Reactive current reading.

4.18 : Overriding current limit
Adjustment range : 0 to +300% (% max. active In)
Depending on the system operation, indicates the rms current limit in real time.

4.19 : Overload accumulator
Adjustment range : 0 to 100.0%
The accumulator increases according to the formula

$$4.19 = \frac{\mathbf{4.01}^2 \left(1-e^{-t/\mathbf{4.15}}\right)}{(\mathbf{5.07} \times 1{,}05)^2} \times 100\ \%$$

When 4.19 reaches 100%, the drive goes into "It Ac" trip state or causes the limiting current to be reduced.

4.20 : Percentage load
Adjustment range : ± active current limit (% active In)
This parameter indicates the drive load level. A positive value indicates operation in motor mode whereas a negative value indicates operation in generator mode (driving load).

4.21 : Selection of load display
Adjustment range : 0 or 1
Factory setting : 0
This parameter is used to obtain an indication of the load or the total current on the display.

4.21	LCD display	LED display	Functions
0	**As % Inom**	**Ld**	**Display of the drive load level** 4.20.
1	In Amps	A	Display of the total motor

4.22 to **4.51** **: Not used**

4.52 : Max. speed in torque control mode
Adjustment range : 0 to 32000 rpm
Factory setting : 1500 rpm
In torque control mode, this parameter is used to set the speed at which the drive reverts to speed regulation, in order to avoid reaching an excessive rotation speed. The maximum speed taken into account corresponds to the value of parameter 4.52 + 20%.
Note: Parameter 1.06 Maximum reference clamp is always active.

Notes

7 - MENU 5: MOTOR CONTROL

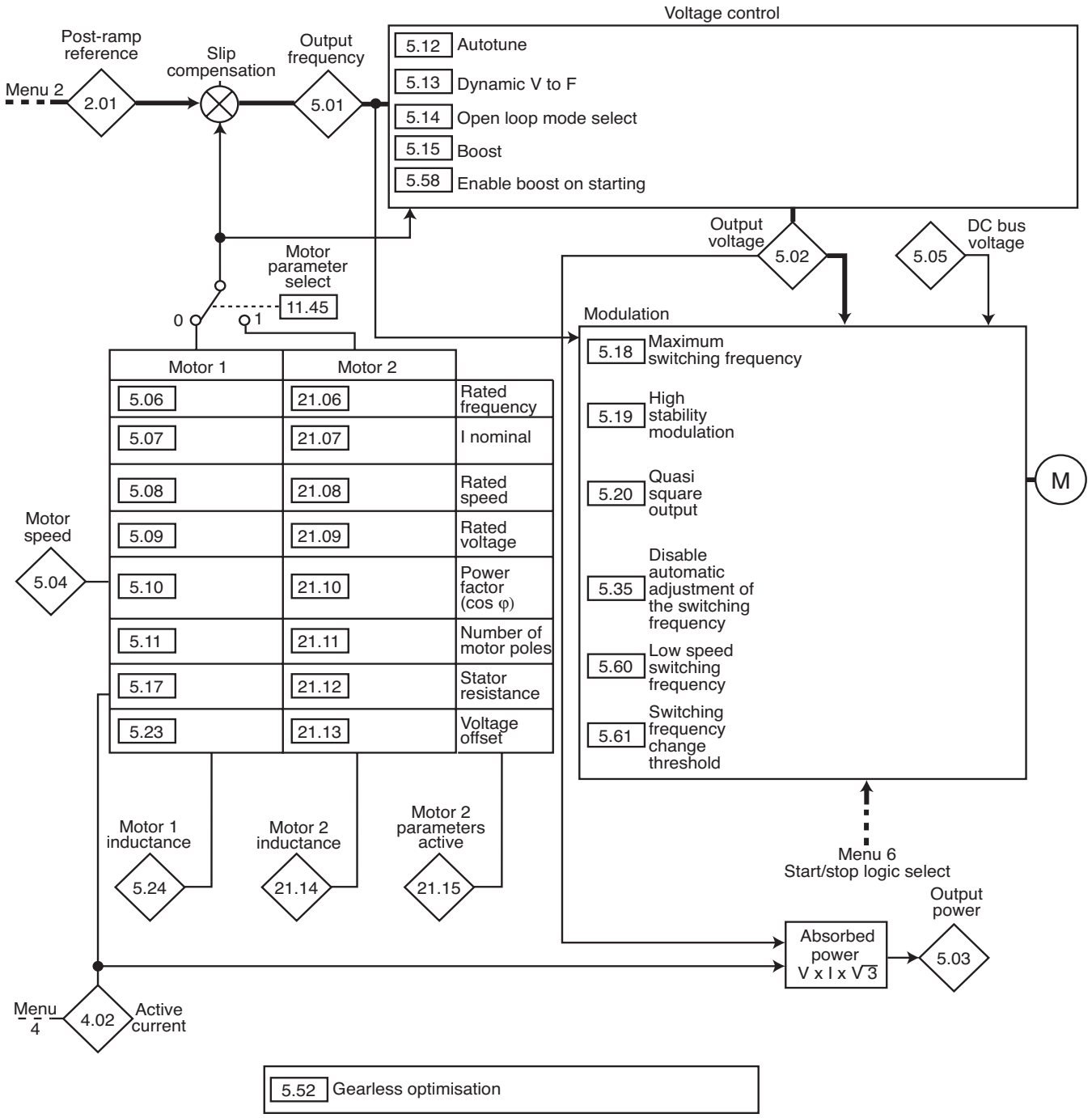
7.1 - List of parameters in Menu 5

Parameter	Name		Type	Adjustment range	Factory setting	User setting
5.01	Output frequency		RO/P	± 400.0 Hz	-	-
5.02	Output voltage		RO/P	0 to 5.09 Volts	-	-
5.03	Output power		RO/P	0 to 200 kW	-	-
5.04	Motor speed		RO/P	± 2 x 1.06 rpm	-	-
5.05	DC bus voltage		RO/P	Voltage code 200 : 0 to 420V Voltage code 400 : 0 to 860V	-	-
5.06	Motor rated frequency		R-W	0 to 400.0 Hz	Eur: 50.0 Hz USA: 60.0 Hz	
5.07	Motor rated current		R-W	0 to drive rated current (A)	Motor rated current corresponding to the rating	
5.08	Motor rated speed		R-W	0 to 9999 rpm	Motor rated speed corresponding to the rating	
5.09	Motor rated voltage		R-W	0 to 480V	Eur L: 200V USA L: 230V Eur H: 400V USA H: 460V	
5.10	Rated power factor (cos φ)		R-W	0 to 1.00	0.85	
5.11	Number of motor poles		R-W	0 to 4	0	
5.12	Autotune		R-W	0 to 2	0	
5.13	Dynamic V to F		R-W	0 or 1	0	
5.14	Open loop mode select	■	R-W	0 to 5	3 then 1	
5.15	Boost		R-W	0 to 25.0% of 5.09	0	
5.16	Not used					
5.17	Stator resistance		R-W	0 to 32.000 Ω	0	
5.18	Maximum switching frequency		R-W	0 to 5	1	
5.19	High stability modulation		R-W	0 or 1	0	
5.20	Quasi square output	■	R-W	0 or 1	0	
5.21 and 5.22	Not used					
5.23	Voltage offset		R-W	0 to 25.5 Volts	0	-
5.24	Transient inductance		R-W	0 to 3200.0 mH	0	
5.25	Stator inductance (Ls)	■	R-W	0 to 3200.0 mH	150.0 mH	
5.26 to 5.31	Not used					
5.32	Motor torque per amp (Kt)	■	R-W	0.01 to 320.00 NmA^{-1}	1.00 NmA^{-1}	
5.33	Motor volt per 1000 rpm (Ke)	■	R-W	0 to 10000 V	98 V	
5.34	Speed display unit		R-W	0 to 2	1	
5.35	Disable automatic adjustment of the switching frequency		R-W	0 or 1	0	
5.36 to 5.50	Not used					
5.51	q axis inductance	■	R-W	0 to 999.9 mH	150.0 mH	
5.52	Gearless optimisation		R-W	0 or 1	0	
5.53 to 5.57	Not used					

: Function not available

Parameter	Name		Type	Adjustment range	Factory setting	User setting
5.58	Enable boost on starting		R-W	0 or 1	0	
5.59	Not used					
5.60	Low speed switching frequency		R-W	0 to 5	0	
5.61	Switching frequency change threshold		R-W	0 to 400.0 Hz	0	

7.2 - Menu 5 diagram



7.3 - Explanation of parameters in menu 5

5.01 **: Output frequency**

Adjustment range : ± 400.0 Hz
5.01 is the drive output frequency.

5.02 **: Output voltage**

Adjustment range : 0 to 5.09 Volts
This is the rms voltage at the drive output.

5.03 **: Output power**

Adjustment range : 0 to 200 kW
5.03 is the calculated motor active power.

$5.03 = 4.01 \times 5.02 \times (\cos\varphi \times \frac{\sqrt{3}}{1000} \text{kW})$.

If this parameter has been assigned to an analog output via menu 7, 10 V corresponds to the maximum power measurable by the drive (I max = 150% of drive rated current).

5.04 **: Motor speed**

Adjustment range : ± 2 x 1.06 rpm
The motor speed is calculated according to the formula:

$$5.04 \text{ (rpm)} = \frac{60 \times \mathbf{5.01}}{\text{number of pairs of motor poles}}$$

5.05 **: DC bus voltage**

Adjustment range : Voltage code 200 = 0 to 420 V
Voltage code 400 = 0 to 860 V
Indicates the DC bus voltage measurement.

5.06 **: Motor rated frequency**

Adjustment range : 0 to 400.0 Hz
Factory setting : **Eur = 50.0 Hz**
USA = 60.0 Hz
This is the point at which motor operation changes from constant torque to constant power.
In standard operation, it is the frequency indicated on the motor nameplate.

5.07 **:Motor rated current**

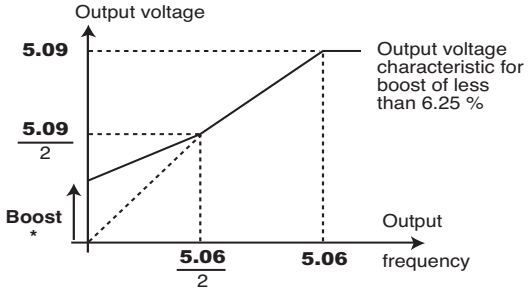
Adjustment range : 0 to drive rated current (A)
Factory setting : Motor rated current corresponding to the drive rating (see section 7.4)
This is the value of the motor rated current indicated on the nameplate. The overload is calculated from this value.

5.08 **:Motor rated speed**

Adjustment range : 0 to 9999 rpm
Factory setting : Motor rated speed corresponding to the drive rating (see section 7.4)
This is the on-load speed of the motor indicated on the nameplate.

5.09 **:Motor rated voltage**

Adjustment range : 0 to 480V
Factory setting : **Eur (voltage code 200) : 200 V**,
USA (voltage code 200) : 230 V
Eur (voltage code 400) : 400 V,
USA (voltage code 400) : 460 V
Defines the voltage/frequency ratio as follows:



* If the fixed boost has been selected 5.14 = 2.

5.10 **: Rated power factor (Cos φ)**

Adjustment range : 0 to 1.00
Factory setting : 0.85
The power factor is measured automatically during a level 2 autotune phase (see 5.12) and set in this parameter. If it has not been possible to carry out the autotune procedure, enter the Cos φ value indicated on the motor nameplate.

5.11 **:Number of motor poles**

Adjustment range : 0 to 4
Factory setting : 0
0 (Automatic) (Auto)
1 (2 Poles) (2P)
2 (4 Poles) (4P)
3 (6 Poles) (6P)
4 (8 Poles) (8P)
When this parameter is at 0, the drive automatically calculates the number of poles according to the rated speed (5.08) and the rated frequency (5.06). However, the value can be entered directly in accordance with the table below:

Motor rated speed rpm	Number of poles	5.11
3000	2	1
1500	4	2
1000	6	3
750	8	4

5.12 : Autotune

Adjustment range : 0 to 2
Factory setting : 0

• The measurement taken when 5.12 = 2 should be taken with the motor uncoupled since the variable speed drive drives the motor at 2/3 of its rated speed. Check that this operation does not present any risk to safety, and ensure that the motor is stopped before the autotune procedure.

• After modifying the motor parameters, repeat autotuning.

0 (Off) (no): No autotune
1 (Stationary) (StoP): Measurement of motor characteristics when stopped.
The stator resistance and the voltage offset are stored in 5.17 and 5.23 respectively.
Procedure:
- Ensure that the motor parameters have been configured and that the motor is stopped.
- Unlock the drive.
- Give a run command. The display indicates "Auto" and "tunE" alternately. Wait for the display to stabilise at 0.
- Disable the drive and remove the run command.

The motor is then ready to operate normally.
Parameter 5.12 returns to 0 as soon as autotuning is complete.
WARNING:
This autotuning is performed automatically even though 5.12 = 0, in the following cases:
- initial drive commissioning
- return to factory settings, after the drive has been unlocked and a run command given

2 (Rotating) (rot): Measurement of motor characteristics while rotating.
The stator resistance and the voltage offset are stored in 5.17 and 5.23 respectively, and the reactive current and leakage inductance are used to calculate the power factor 5.10. This mode is used to obtain optimum performance.
Procedure:
- Ensure that the motor parameters have been configured and that the motor is stopped.
- Unlock the drive.
- Give a run command. The motor accelerates up to 2/3 of rated speed, then performs a freewheel stop. During autotuning, the display indicates "Auto" and "tunE" alternately. Wait for the display to stabilise at 0.

Disable the drive and remove the run command.
The motor is then ready to operate normally.
Parameter 5.12 returns to 0 as soon as autotuning is complete.

5.13 : Dynamic V to F

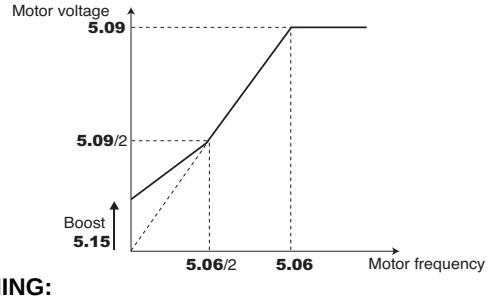
Adjustment range : 0 or 1
Factory setting : 0
0 (Linear) (Lin): The V/F ratio is fixed and set by the base frequency (5.06**).**
1 (Dynamic) (dyn): Dynamic V/F ratio.
Generates a voltage/frequency characteristic which varies with the load. It is for use in quadratic torque applications (pumps/fans/compressors). It can be used in constant torque applications with low dynamics to reduce motor noise.

5.14 : Open loop mode select

Adjustment range : 0 to 5
Factory setting : 3
Determines the open loop control mode. Modes 0, 1, 3 or 4 are used in flux vector control . The difference between these modes is the method used to identify the motor parameters, particularly the stator resistance. As these parameters vary with the temperature and are essential to obtain optimum performance, the machine cycle should be taken into account when selecting the most appropriate mode. Modes 2 and 5 correspond to a U/F ratio control mode. This ratio is linear in mode 2 and square in mode 5.
0 (RS:EACH RUN) (r.run): The stator resistance and voltage offset are measured each time the drive receives a run command.
These measurements are only valid if the machine is stopped, and totally defluxed. The measurement is not taken when the run command is given less than 2 seconds after the previous stop. This is the most effective flux vector control mode. However, the operating cycle must be compatible with the 2 seconds required between a stop command and a new run command.

1 (RS:NO Mes.) (r.no): The stator resistance 5.17 and voltage offset 5.23 are not measured.
This mode is of course the least effective. It should be used only when mode 0 (r.run) is incompatible with the operating cycle. If this were the case, during commissioning, an autotune (5.12) should be performed to read the values measured in 5.17 and 5.23 and these should be used with mode 1 (r.no) in normal operation.

2 (LINEAR V/F) (UtoF): Voltage-frequency ratio with fixed boost adjustable via parameters 5.15 and 5.09.

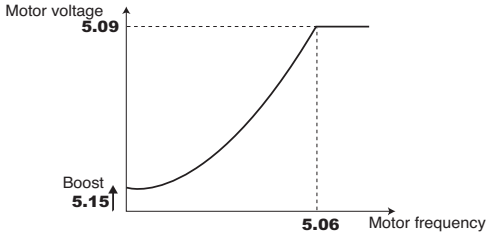


WARNING:
Use this mode to control several motors.

3 (RS:1st RUN) (r.FSt): operation equivalent to setting 1 (RS:NO Mes.) (r.no).

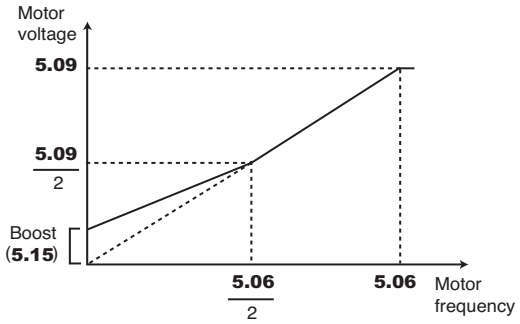
4 (RS:POWER UP) (r.On): operation equivalent to setting 0 (RS:EACH RUN) (r.run) after the first start.

5 (V/F SQUARE) (SqrE): Square law characteristic.



• In mode 4 (r.On), a voltage is briefly applied to the motor. For safety, no electrical circuit must be accessible once the drive has been powered up.

5.15 : Boost
Adjustment range : 0 to 25.0% of motor Un (5.09)
Factory setting : 0
For operation in U/F mode (5.14 at 2) or in open loop flux vector mode if 5.58 = 1, parameter 5.15 is used to overflux the motor at low speed so that it delivers more torque on starting. It is a percentage of the rated motor voltage (5.09).



5.16 : Not used

5.17 : Stator resistance
Adjustment range : 0 to 32.000Ω
Factory setting : 0
This parameter stores the motor stator resistance for flux vector control mode (see parameter 5.14).
The stator resistance value is only read if 5.14 = 0.
If the stator resistance cannot be measured (motor not connected, value higher than the max. rating) an "rS" trip occurs.
During autotuning (5.12 = 1 or 2), the value of the stator resistance is automatically stored in 5.17.

5.18 : Maximum switching frequency
Adjustment range : 0 to 5
Factory setting : 1
Sets the PWM switching frequency.

5.18	LCD display	LED display
0	3 kHz	3hH
1	**4.5 kHz**	**4.5hH**
2	5.5 kHz	5.5hH
3	6 kHz	6hH
4	9 kHz	9hH
5	11 kHz	11hH

WARNING:
A high switching frequency reduces the magnetic noise, but it increases the motor temperature rise and the level of radio-frequency interference emission, and reduces the starting torque.
If the temperature of the IGBTs becomes too high, the drive can reduce the switching frequency selected by the user (see 5.35 and 10.18).

5.19 : High stability modulation
Adjustment range : 0 or 1
Factory setting : 0
0 (Disabled) (OFF): Function disabled.
1 (Enabled) (On): Function enabled. Instabilities can occur:
- at 50% of the motor rated frequency for an underloaded motor
- around and above the motor rated speed, when the motor is underloaded or very heavily loaded.
This function is used to eliminate these instabilities.
It also enables a slight reduction in the drive temperature rise. However, using this mode may result in a slight increase in motor noise.

5.20 : Quasi square output
Adjustment range : 0 or 1
Factory setting : 0
0 (Disabled) (OFF): Function disabled.
1 (Enabled) (On): The maximum drive output voltage is higher, resulting in an increase in motor torque. This is beneficial for applications where it is desirable to reduce speed pick-up times in the event of long cycles.
However, the motor torque may have slight ripples when it is lightly loaded.
Function not available.

5.21 and 5.22 :Not used

5.23 : Voltage offset
Adjustment range : 0 to 25.5 volts
Factory setting : 0
This voltage offset is measured by the drive (see parameter 5.14). It is used to correct imperfections in the drive, especially voltage drops in the IGBTs and idle times. This parameter plays an important role in low-speed operation, i.e. when the drive output voltage is low.
During autotuning (5.12 = 1 or 2), the value of the voltage offset is automatically stored in 5.23.

5.24 : Transient inductance
Adjustment range : 0 to 3200.0 mH
Factory setting : 0
During autotuning with rotation (5.12 = 2), the transient inductance is stored in this parameter.

5.25 : Stator inductance (Ls)
Adjustment range : 0 to 3200.0 mH
Factory setting : 150.0 mH
This is the motor stator inductance at rated flux.

5.26 to 5.31 : Not used

5.32 : Motor torque per amp (Kt)
Adjustment range : 0.01 to 320.00 NmA^{-1}
Factory setting : 1.00 NmA^{-1}
Indicates the motor torque per Amp of active current used to calculate the drive speed loop gains (3.17 = 1).
Function not available.

5.33 **: Motor volt per 1000 rpm (Ke)**
Adjustment range : 0 to 10000 V
Factory setting : 98 V
Used to set the motor voltage per 1000 rpm. Is used to adjust the current loop integral gain to prevent current peaks when the drive is enabled with a spinning motor.

5.34 **: Speed display unit**
Adjustment range : 0 to 2
Factory setting : 1

5.34	LCD display	LED display	Function
0	Hertz	Fr	Output frequency expressed in Hz (5.01)
1	**rpm**	**SP**	**Motor speed expressed in rpm (5.04)**
2	Customised	Cd	Customer unit defined using a coefficient determined in parameter 11.21 as follows: Cd = 5.04 motor speed in rpm x 11.21

5.35 **: Disable automatic adjustment of the switching frequency**
Adjustment range : 0 or 1
Factory setting : 0
0 (Enabled) (Auto): In the event of increased temperature of the IGBTs, the switching frequency is automatically reduced.
1 (Disabled) (no): Automatic adjustment of the switching frequency is disabled. In this case, the drive trips if the temperature of the IGBTs is too high.

5.36 to 5.50 **: Not used**

5.51 **: q axis inductance**
Adjustment range : 0 to 999.9 mH
Factory setting : 150.0 mH
This is the motor stator inductance in quadrature with the total inductance Ls (5.25), used to control a salient-pole synchronous motor.

5.52 **: Gearless optimisation**
Adjustment range : 0 or 1
Factory setting : 0
0 (Disabled) (OFF): Optimisation deactivated.
1 (Enabled) (On): Optimisation activated. Used to obtain a more regular rotation at very low speed (the torque is lower, but "smoother").

5.53 to 5.57 **: Not used**

5.58 **: Enable boost on starting**
Adjustment range : 0 or 1
Factory setting : 0
0 (Disabled) (OFF): No action.
1 (Enabled) (On): In open loop mode, voltage boost on starting (5.15) is active.

5.59 **: Not used**

5.60 **: Low-speed switching frequency**
Adjustment range : 0 to 5
Factory setting : 0

5.60	LCD display	LED display
0	**2 kHz**	**2 hH**
1	2.5 kHz	2.5 hH
2	3 kHz	3 hH
3	4.5 kHz	4.5 hH
4	5.5 kHz	5.5 hH
5	6 kHz	6 hH

Used to set a switching frequency different from that set in 5.18, when the motor frequency 5.01 has reached a threshold defined in 5.61.

WARNING:
A high switching frequency reduces the magnetic noise, but it increases the motor temperature rise and the level of radio-frequency interference emission, and reduces the starting torque.

5.61 **: Switching frequency change threshold**
Adjustment range : 0.0 to 400.0 Hz
Factory setting : 0.0 Hz
If the motor frequency 5.01 is below the threshold set by 5.61, the switching frequency selected by 5.60 is used. Otherwise, it is the switching frequency set in 5.18 which is active.
Reminder: F = (pp x S)/60
where F is the frequency in Hz, pp the number of poles and S the speed in rpm.

7.4 - Factory settings according to the rating

Factory settings 5.07 and 5.08 vary according to the drive rating.

• Factory setting 50 Hz (Eur)

Rating	5.07	5.08
SX13200037	17	1400
SX13200055	27	1429
SX13200075	34	1428
SX23200110	42	1436
SX23200150	60	1437
SX23200220	80	1438
SX33200300	108	1447
SX33200400	138	1451

Rating	5.07	5.08
SX13400075	20	1400
SX13400110	25	1429
SX13400150	35	1428
SX23400220	51	1436
SX23400300	72	1437
SX23400400	91	1438
SX33400550	119	1447
SX33400750	152	1451

• Factory setting 60 Hz

Rating	5.07	5.08
SX13200037	18	1680
SX13200055	29	1715
SX13200075	39	1714
SX23200110	56	1723
SX23200150	74	1724
SX23200220	100	1726
SX33200300	135	1736
SX33200400	167	1741

Rating	5.07	5.08
SX13400075	18	1680
SX13400110	26	1715
SX13400150	34	1714
SX23400220	48	1723
SX23400300	62	1724
SX23400400	76	1726
SX33400550	110	1736
SX33400750	140	1741

Note: Factory settings 21.07 and 21.08 are identical to those for 5.07 and 5.08.

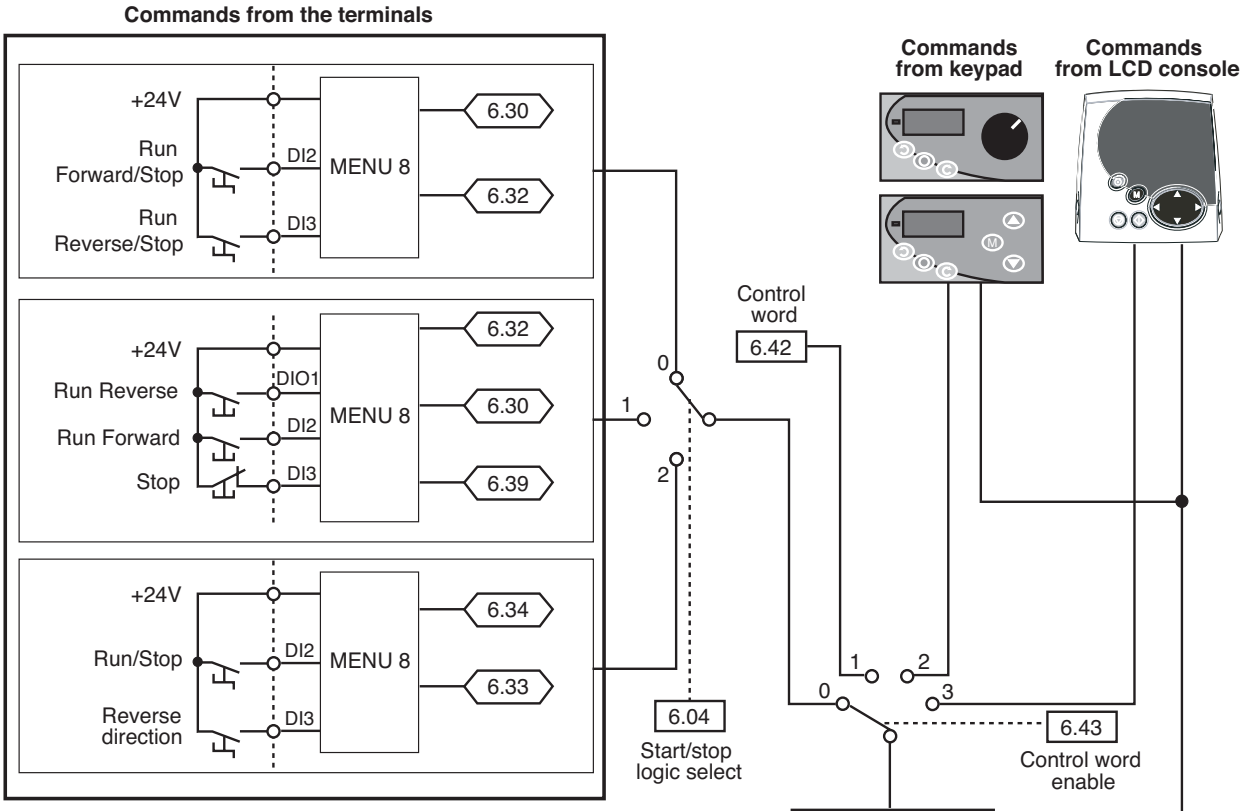
8 - MENU 6: PROGRAMMABLE LOGIC AND TIMERS

8.1 - List of parameters in Menu 6

Parameter	Name		Type	Adjustment range	Factory setting	User setting
6.01	Stop mode		R-W	0 to 4	1	
6.02	Not used					
6.03	Mains loss mode		R-W	0 to 2	0	
6.04	Start/stop logic select		R-W	0 to 2	0	
6.05	Not used					
6.06	DC injection braking level		R-W	0 to 4.07	100.0%	
6.07	DC injection braking time		R-W	0 to 25.0 s	1 s	
6.08	Hold zero speed		R-W	0 or 1	0	
6.09	Catch a spinning motor		R-W	0 to 3	0	
6.10	Enable reduced-voltage operation		R-W	0 or 1	0	
6.11	Enable keypad FWD key		R-W	0 or 1	PT version: 1 PB version: 0	
6.12	Enable keypad Stop key		R-W	0 or 1	1	
6.13	Enable keypad REV key		R-W	0 or 1	0	
6.14	Not used					
6.15	Drive output		R-W	0 or 1	1	
6.16	Not used					
6.17	Reset energy meter		R-W	0 or 1	0	
6.18 and 6.19	Not used					
6.20	Powered-up time: years.days		RO/P	0 to 9.364 years, days	-	-
6.21	Powered-up time: hours.minutes		RO/P	0 to 23.59 hrs, min	-	-
6.22	Run time: years.days		RO/P	0 to 9.364 (years, days)	-	-
6.23	Run time: hours.minutes		RO/P	0 to 23.59 (hrs, min)	-	-
6.24	Energy meter: MWh		RO/P	0 to 999.9 MWh	-	-
6.25	Energy meter: kWh		RO/P	0 to 99.99 kWh	-	-
6.26 to 6.29	Not used					
6.30	Sequencing bit: Run forward		R-A	0 or 1	0	-
6.31	Sequencing bit: Jog		R-A	0 or 1	0	-
6.32	Sequencing bit: Run reverse		R-A	0 or 1	0	-
6.33	Sequencing bit: Forward/reverse		R-A	0 or 1	0	-
6.34	Sequencing bit: Run		R-A	0 or 1	0	-
6.35 to 6.38	Not used					
6.39	Sequencing bit: Stop		R-A	0 or 1	0	-
6.40 and 6.41	Not used					
6.42	Control word		R-W	0 to 32767	0	
6.43	Run/Stop source		R-W	0 to 3	0	
6.44 to 6.50	Not used					
6.51	Downstream contactor management		R-W	0 or 1	0	
6.52	Downstream contactor voltage		R-W	0 to 25.0%	3.0%	
6.53	Downstream contactor current threshold		R-W	0 to 100.0%	10.0%	
6.54	Downstream contactor status		RO/P	0 or 1	-	-

8.2 - Menu 6 diagrams

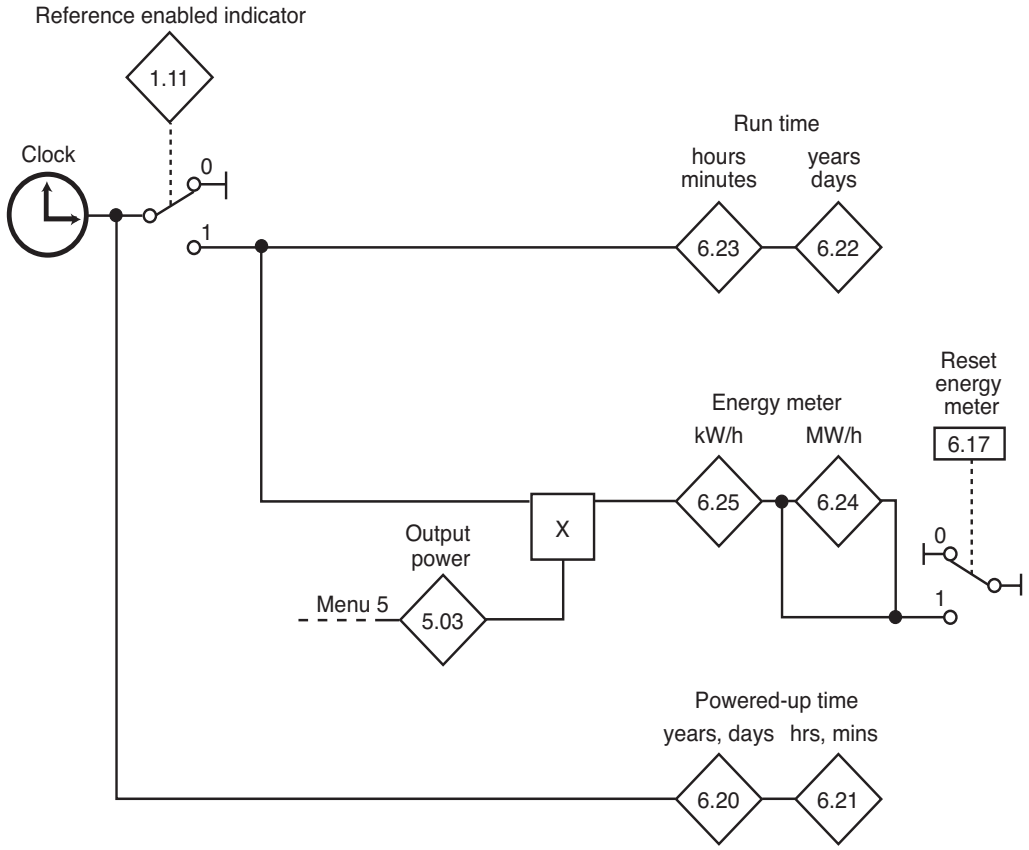
8.2.1 - Programmable logic



6.11	Enable forward key
6.12	Enable stop key
6.13	Enable reverse key

6.01	Stop mode
6.03	Mains loss mode
6.06	Injection braking level
6.07	Injection braking time
6.08	Hold zero speed
6.09	Catch a spinning motor
6.10	Enable reduced-voltage operation
6.15	Drive output

8.2.2 - Timer, energy meter and alarms



8.2.3 - Downstream contact management

6.51	Downstream contactor management
6.52	Downstream contactor voltage
6.53	Downstream contactor current threshold
6.54	Downstream contactor status

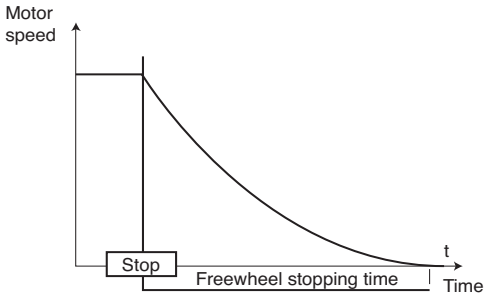
8.3 - Explanation of parameters in menu 6

6.01 **: Stop mode**
Adjustment range :

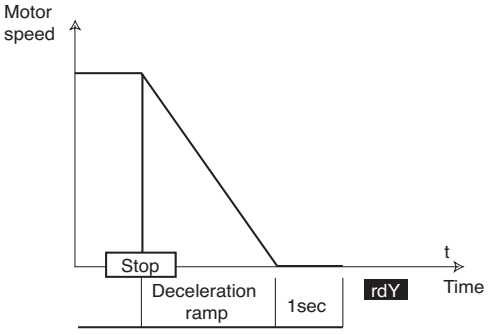
6.01	Function
0	Freewheel stop
1	**Stop on deceleration ramp**
2	Deceleration ramp + DC injection for a set period of time
3	Stop by DC injection braking for a set period of time and elimination at zero speed
4	Stop on DC injection for a set period of time

Factory setting : 1

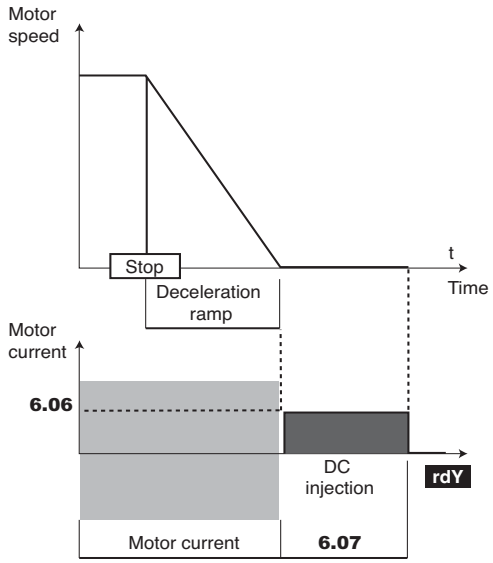
0 (Coast) (FrEE): Freewheel stop.
The power bridge is deactivated as soon as the stop command is given.
The drive cannot receive another run command for 2 s, the motor demagnetisation time.
The display indicates "rdY" 2 seconds after the stop command. The machine stopping time depends on its inertia.



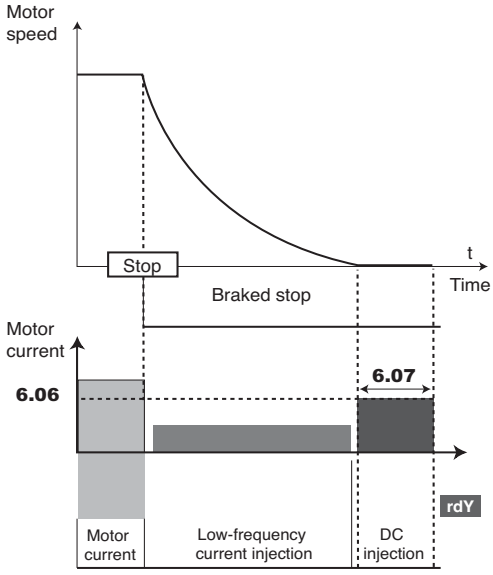
1 (Ramp) (rAMP): Stop on deceleration ramp.
The drive decelerates the motor according to the deceleration mode chosen in parameter 2.04**.**
One second after the stop, the display indicates "rdY".



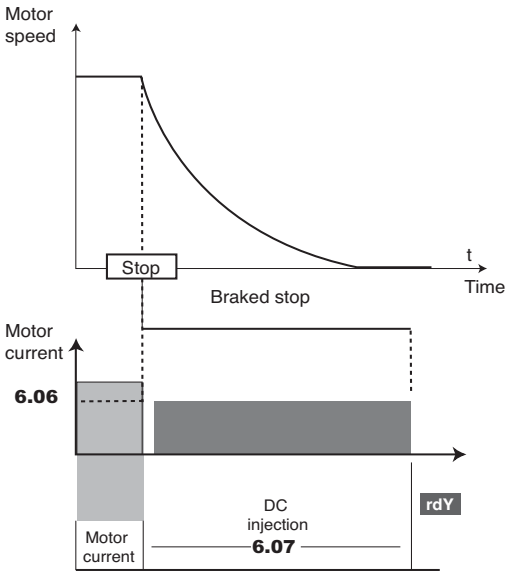
2 (Ramp + DC) (rP.dC): Stop on deceleration ramp with DC injection for a set period of time.
The drive decelerates the motor according to the deceleration mode chosen in parameter 2.04.
When zero frequency is reached, the drive injects DC with an amplitude which can be set in parameter 6.06 for a time defined by parameter 6.07.
The drive then displays "rdY".



3 (DC to 0) (dC-O): Stop by DC injection braking, and elimination at zero speed.
The drive decelerates the motor by setting a low-frequency current resulting in almost zero speed, which the drive detects automatically.
The drive then injects DC with an amplitude which can be set in parameter 6.06 for a time defined by parameter 6.07. The drive then displays "rdY". No run command can be taken into account until "rdY" is displayed.



4 (Timed DC) (dC-t): Stop on DC injection with a set period of time.
The drive decelerates the motor by setting a current defined by parameter 6.06 for a time defined by parameter 6.07, and then the drive displays "rdY". No run command can be taken into account until "rdY" is displayed.



6.02 **: Not used**

6.03 **: Mains loss mode**
Adjustment range : 0 to 2
Factory setting : 0

6.03	Function
0	**Transparent to micro-breaks**
1	Deceleration down to stop
2	Deceleration until the mains returns

0 (NO DETECTION) (diS): The drive does not take account of mains supply breaks and continues to operate while there is sufficient voltage on the DC bus.

1 (FULL STOP) (StOP): In the event of a mains supply break, the drive will decelerate on a ramp, automatically calculated by the drive, so that the motor feeds back energy to the drive's DC bus and therefore continues to power its control electronics. Upon return to normal conditions, deceleration continues until the motor stops, but according to the deceleration mode configured in 2.04.

2 (DELAYED STOP) (rd.th): In the event of a mains supply break, the drive will decelerate on a ramp, automatically calculated by the drive, so that the motor feeds back energy to the drive's DC bus and therefore continues to power its control electronics. Upon return to normal conditions, the motor re-accelerates up to the reference speed.

6.04 **: Start/stop logic select**
Adjustment range : 0 to 2
Factory setting : 0
Used to choose one of 3 Run/Stop command and Direction of rotation management modes.
0 (Run no latch) (Lchd) : DI2 terminal used as FWD/Stop, DI3 terminal used as REV/Stop. Commands given via latched contacts.
1 (Run Latched) (Puls) : DI2 terminal used as FWD, DI3 terminal used as Stop, DIO1 terminal used as REV. Commands given via pulsed contacts.
In this mode, the DI4 input can be assigned by the customer but only as a latched contact and the stop command via DI3 cannot be reassigned. To change from FWD to REV or vice versa, go via a stop command.
2 (Run-Fwd/Rev) (r.InP) : DI2 terminal used as Run/Stop, DI3 terminal used to select the direction of rotation. Commands given via latched contact.
These three configurations result in automatic assignment of the digital inputs. If, within a configuration, an input is not used by the application (no Reverse operation for example), the corresponding input can be reassigned using menu 8.
Note: Modifications to 6.04 must be made with the drive disabled.

6.05 **: Not used**

6.06 **: DC injection braking level**
Adjustment range : 0 to 4.07
Factory setting : 100.0%
This parameter defines the level of current used for DC injection braking.
WARNING:
For efficient braking, the value of parameter 6.06 must be 60% minimum.

6.07 **: DC injection braking time**
Adjustment range : 0 to 25.0 s
Factory setting : 1 s
This parameter defines the DC injection braking time when 6.01 is at 2, 3 or 4.

6.08 **: Hold zero speed**
Adjustment range : 0 or 1
Factory setting : 0
0 (Disabled) (OFF): The drive output is deactivated when the speed is zero.
1 (Enabled) (On): The drive output remains active at zero speed in order to hold the torque at standstill. The drive output is deactivated when 6.08 changes to 0. While holding zero speed, the display indicates "StoP".
Note: When the drive is in the "StoP" state and the Run command has not been activated after one minute, the drive returns to the "rdy" state (drive output deactivated).

6.09 : Catch a spinning motor
Adjustment range : 0 to 3
Factory setting : 0
If this parameter is enabled (6.09 = 1 to 3), when there is a run command or after a mains supply break, the drive executes a procedure to calculate the motor frequency and direction of rotation. It will automatically recalibrate the output frequency to the measured value and reaccelerate the motor up to the reference frequency.

6.09	LCD Display	LED Display	Functions
0	**Disabled**	**no**	**Catch a spinning motor function disabled**
1	2 directions	On.2d	Enable catching of a spinning motor rotating clockwise or counter-clockwise
2	Clockwise	On.Fd	Enable catching of a spinning motor which is rotating clockwise only
3	C/clockwise	On.rS	Enable catching of a spinning motor which is rotating counter-clockwise only

• If the load is stationary at the time of the run command or when the mains supply returns, this operation may cause the machine to rotate in both directions before the motor accelerates.

• Before enabling this function, check that there is no danger to equipment and personnel.

6.10 : Enable reduced-voltage operation
Adjustment range : 0 or 1
Factory setting : 0
0 (Disabled) (OFF): The DC bus undervoltage detection thresholds are unchanged.
1 (Enabled) (On): Used to modify the DC bus undervoltage detection thresholds in 400 V (voltage code 400) drives, so as to be at the same levels as 230 V drives. This enables a 400V (voltage code 400) rating to be supplied with 230 V if necessary, without tripping the drive.
Note: This parameter is not active for "voltage code 200" ratings (6.10 is frozen at 1).

6.11 : Enable keypad FWD key
Adjustment range : 0 or 1
Factory setting : PT version = 1
PB version = 0
0 (Disabled) (OFF): Local control FWD key disabled.
1 (Enabled) (On): Local control FWD key enabled.

6.12 : Enable keypad Stop key
Adjustment range : 0 or 1
Factory setting : 1
0 (Disabled) (OFF): Local control Stop key disabled.
1 (Enabled) (On): Local control Stop key enabled.
If the Stop key is enabled, it is taken into account even if control is via the terminals.
If a stop is ordered via the local console while a run command is present, the run command on the terminals must be opened to authorise restarting.

6.13 : Enable keypad REV key
Adjustment range : 0 or 1
Factory setting : 0
0 (Disabled) (OFF): Local control REV key disabled.
1 (Enabled) (On): Enables the local control REV key.

6.14 : Not used

6.15 : Drive output
Adjustment range : 0 or 1
Factory setting : 1
0 (Disabled) (diSb): Drive disabled.
1 (Enabled) (Enab): Drive enabled.
WARNING:
Disabling via the drive terminals overrides (see 8.10) 6.15. If the drive is enabled via the terminals, the user can then enable or disable the drive using 6.15.
Note:
In control via bus mode (6.43 = 1), 6.15 is automatically set to 0.

6.16 : Not used

6.17 : Reset energy meter
Adjustment range : 0 or 1
Factory setting : 0
0 (Disabled) (OFF): Reset inactive.
1 (Enabled) (On): The counters 6.24 and 6.25 are reset to 0.

6.18 and **6.19** **:Not used**

6.20 : Powered-up time: years.days
Adjustment range : 0 to 9.364 years, days
This parameter records for how many years and days the drive has been powered up.

6.21 : Powered-up time: hours.minutes
Adjustment range : 0 to 23.59 hrs, min
This parameter records for how many hours and minutes the drive has been powered up.
After 23.59, 6.21 returns to 0 and 6.20 is incremented by one day.

6.22 : Run time: years.days

Adjustment range : 0 to 9.364 (years, days)
This parameter records the number of years and days of operation since the drive was first commissioned.

6.23 : Run time: hours.minutes

Adjustment range : 0 to 23.59 (hrs, min)
This parameter records the number of hours and minutes of operation since the drive was first commissioned.
After 23.59, 6.23 returns to 0 and 6.22 is incremented by one day.

6.24 : Energy meter: MWh

Adjustment range : 0 to 999.9 MWh
This parameter records the drive energy consumption in MWh.
This counter can be reset to 0 by changing parameter 6.17 to 1.

6.25 : Energy meter: kWh

Adjustment range : 0 to 99.99 kWh
This parameter records the drive energy consumption in kWh.
This counter can be reset to 0 by changing parameter 6.17 to 1.

6.26 to 6.29 : Not used

6.30 to 6.34 and 6.39 :Sequencing bits for start/stop logic

Adjustment range : 0 or 1
Factory setting : 0
0 (Disabled) (OFF)
1 (Enabled) (On)
The drive's start/stop logic manager (6.04) uses these bits as inputs rather than linking directly to the terminals. This enables the customer to define the use for each drive terminal according to the needs of each application. Although these are read/write type parameters, they are volatile and are not stored when the drive is powered down. Each time the drive is powered up they will be reset to 0.
6.30 : Run forward
6.31 : Jog
6.32 : Run reverse
6.33 : Forward/reverse
6.34 : Run
6.39 : Stop

6.35 to 6.38 : Not used

6.40 and 6.41 :Not used

6.42 : Control word
Adjustment range : 0 to 32767
Factory setting : 0
The control word is used to control the drive via a serial link. Each function has a corresponding binary code:

Bit	Decimal conversion	Function	Equivalent parameter
0	1	Drive enable	6.15
1	2	Run forward	6.30
2	4	Jog	6.31
3	8	Run reverse	6.32
4	16	Forward/Reverse	6.33
5	32	Run	6.34
6	64	Reserved	
7	128	Reserved	
8	256	Analog ref./Preset ref.	1.42
9	512	Reserved	
10	1024	Reserved	
11	2048	Reserved	
12	4096	Reserved	
13	8192	Reset drive	10.33
14	16384	Reserved	

6.42 is used to give commands to the drive. It should correspond to the binary sum of the commands to be given to the drive.
So that the control word can be taken into account, parameter 6.43 should be at 1.

6.43 : Run/Stop source
Adjustment range : 0 to 3
Factory setting : 0
0 (Terminals) (terM): Commands are given by the terminals.
1 (Fieldbus) (buS): The commands come from the control word 6.42.
2 (Keypad) (Pad): The commands come from the keypad.
3 (LCD Keypad) (Lcd): The commands come from the LCD key-pad.
Note: Modifications to 6.43 must be made with the drive disabled.
WARNING:
• The Stop keys on the keypads or the console, if enabled, are always taken into account irrespective of the source of Run/Stop commands.
If a stop is caused by the Stop key on the keypad or the console while the source of commands comes from the terminals or the fieldbus (6.43 = 0 or 1) and a run command is present, the run command must go back to 0 and then 1 in order to be taken into account.
• When a command via bus, keypad or console is enabled (6.43 = 1, 2 or 3), 8.10 changes to 0 automatically since the secure disable input cannot be used with this type of command. In addition, when 6.43 = 1, 6.15 is automatically set to 0. When changing back to terminal block mode (6.43 = 0), 6.15 must be set to 1 to enable the drive.

6.44 to 6.50 : Not used

6.51 **: Downstream contactor management**
Adjustment range : 0 or 1
Factory setting : 0
0 (No) (OFF): Downstream contactor inactive.
1 (Yes) (On): Enables management of the downstream contactor (contactor between the drive and the motor). For safety reasons in certain applications, a contactor placed on the drive output (U, V, W) disconnects the motor supply. Remote control of this contactor is independent of the drive and can deactivate or activate the motor supply with the enabled drive run command. So that the drive does not detect a fault, 6.51 must be set to 1. The drive detects opening and closing of the contactor by controlling the motor current.
When the motor current is less than the setting configured in 6.53, the drive considers that the contactor is open and sends a phase-to-phase voltage (set by 6.52).
When the contactor closes again, the DC voltage sent to the motor creates a current that enables the drive to detect closure of the contactor and restart the motor (the motor accelerates up to the set speed reference).

6.52 **: Downstream contactor voltage**
Adjustment range : 0 to 25.0% of 5.09
Factory setting : 3.0% of 5.09
When downstream contactor management is enabled (6.51 at 1), the drive must detect whether or not the motor is connected. To do this, the drive applies a low voltage which can be set using 6.52, as a percentage of the motor rated voltage. In general, the factory setting is suitable for most applications.

6.53 **: Downstream contactor current threshold**
Adjustment range : 0 to 100.0% of 5.07
Factory setting : 10.0% of 5.07
When downstream contactor management is enabled, 6.53 sets the current detection threshold below which the drive considers the downstream contactor to be open.

6.54 **: Downstream contactor status**
Adjustment range : 0 or 1
0 (Open) (OPen): The downstream contactor is open; the motor is disconnected from the drive.
1 (Closed) (CLoS): The downstream contactor is closed; the motor is connected to the drive.

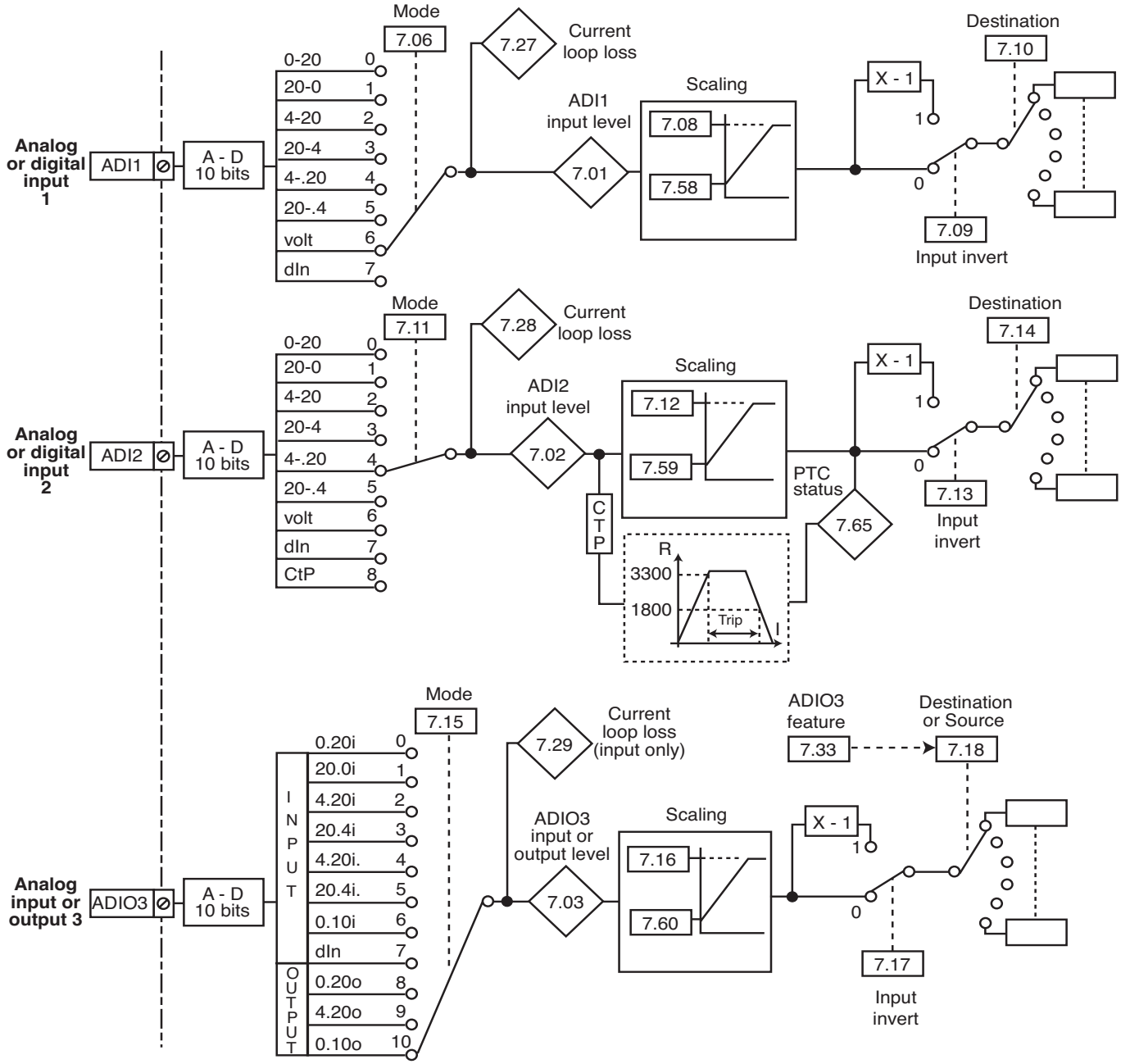
9 - MENU 7: ASSIGNMENT OF ANALOG INPUTS AND OUTPUTS

9.1 - List of parameters in Menu 7

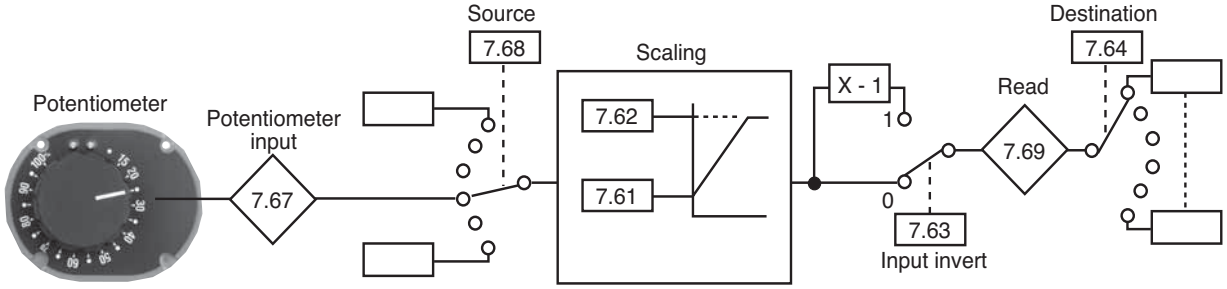
Parameter	Name	Type	Adjustment range	Factory setting	User setting
7.01	ADI1 input level	RO/P	0 to 100.0% (analog) 0.00% or 100.0% (digital)	-	-
7.02	ADI2 input level	RO/P	0 to 100.0% (analog) 0.00% or 100.0% (digital)	-	-
7.03	ADIO3 input or output level	RO/P	0 to 100.0%	-	-
7.04 and 7.05	Not used				
7.06	ADI1 mode	R-W	0 to 7	6	
7.07	Not used				
7.08	ADI1 input scaling	R-W	0 to 2.50	1.00	
7.09	ADI1 input invert	R-W	0 or 1	0	
7.10	ADI1 input destination	R-W/P	0.00 to 21.51	1.36	
7.11	ADI2 mode	R-W	0 to 8	4	
7.12	ADI2 input scaling	R-W	0 to 2.50	1.00	
7.13	ADI2 input invert	R-W	0 or 1	0	
7.14	ADI2 input destination	R-W/P	0.00 to 21.51	1.37	
7.15	ADIO3 mode	R-W	0 to 10	10	
7.16	ADIO3 scaling	R-W	Input: 0 to 2.50 Output: 0 to 32.00	1.00	
7.17	ADIO3 input invert	R-W	0 or 1	0	
7.18	ADIO3 input destination/output source	R-W/P	0.00 to 21.51	5.04	
7.19 to 7.26	Not used				
7.27	ADI1 input current loop loss	RO/P	0 or 1	-	-
7.28	ADI2 input current loop loss	RO/P	0 or 1	-	-
7.29	ADIO3 input or output current loop loss	RO/P	0 or 1	-	-
7.30 to 7.32	Not used				
7.33	ADIO3 feature	R-W	0 to 4	0	
7.34	IGBT junction temperature	RO/P	0 to 200.0 °C	-	-
7.35 to 7.57	Not used				
7.58	Minimum value of ADI1	R-W	0 to 1.00	0	
7.59	Minimum value of ADI2	R-W	0 to 1.00	0	
7.60	Minimum value of ADIO3	R-W	0 to 1.00	0	
7.61	Minimum value of scaling block	R-W	0 to 1.00	0	
7.62	Block scaling	R-W	0 to 2.50	1,00	
7.63	Scaling block invert	R-W	0 or 1	0	
7.64	Scaling block destination	R-W/P	0.00 to 21.51	0.00	
7.65	PTC status	RO/P	0 or 1	-	-
7.66	Internal braking resistor temperature	RO/P	0 to 200.0 °C	-	-
7.67	Local control potentiometer input	RO/P	0 to 100.0%	-	-
7.68	Scaling block source	R-W/P	0.00 to 21.51	7.67	
7.69	Scaling block read	RO/P	± 32000	-	-

9.2 - Menu 7 diagram

9.2.1 - Assignment of analog I/O



9.2.2 - Scaling block



9.2.3 - Temperature indications

7.34 IGBT junction temperature

7.66 Internal braking resistor temperature

9.3 - Explanation of parameters in menu 7

Note: The sampling period is 6 ms for menu 7 inputs and outputs.

7.01 and 7.02 **:ADI1 and ADI2 input levels**

Adjustment range
As analog input : 0 to 100.0% of the adjustment range for the parameter assigned to the input
As digital inputs : 0.00% (corresponds to logical 0) or 100.0% (corresponds to logical 1)
Used to read the value of the analog input or the state of the corresponding digital input.
This input uses an analog/digital converter with 10-bit resolution.

7.03 **: ADIO3 input or output level**

Adjustment range : 0 to 100.0% of the adjustment range of the parameter assigned to the analog input or output.
Used to read the corresponding analog input or output. This input (or output) uses an analog/digital converter with 10-bit resolution.

7.04 and 7.05 **:Not used**

7.06 **: ADI1 mode**
Adjustment range : 0 to 7
Factory setting : 6
Used to define the type of signal on the ADI1 input.
0 (0-20 mA) (0-20): 0-20 mA current signal, 0 mA corresponds to the minimum reference.
1 (20-0 mA) (20-0): 20-0 mA current signal, 20 mA corresponds to the minimum reference.
2 (4-20 trip) (4-20): 4-20 mA current signal with detection of signal loss. 4 mA corresponds to the minimum reference.
3 (20-4 trip) (20-4): 20-4 mA current signal with detection of signal loss. 20 mA corresponds to the minimum reference.
4 (4-20 no trip) (4-.20): 4-20 mA current signal without detection of signal loss. 4 mA corresponds to the minimum reference.
5 (20-4 no trip) (20-.4): 20-4 mA current signal without detection of signal loss. 20 mA corresponds to the minimum reference.
6 (0-10 V) (volt): 0-10 V voltage signal.
7 (Digital input) (d-In): The input is configured as a digital input.

7.07 **: Not used**

7.08 and 7.12 **:ADI1 and ADI2 input scaling**

Adjustment range : 0 to 2.50
Factory setting : 1.00
These parameters are used, if necessary, to scale the analog inputs. However, this rarely proves necessary since the maximum input level (100%) automatically corresponds to the max. value of the destination parameter.
Not used when the input is used as a digital input.

7.09 and 7.13 **:ADI1 and ADI2 input invert**
Adjustment range : 0 or 1
Factory setting : 0
This parameter is used to invert the input signal.
0 (Disabled) (OFF): Input signal not inverted.
1 (Enabled) (On): Input signal inverted.

7.10 **: ADI1 input destination**
Adjustment range : 0.00 to 21.51
Factory setting : 1.36: Analog input 1 assigned to analog reference 1
This address should contain the number of the parameter which you wish to assign to input ADI1.
Only numerical parameters can be assigned if the input is configured as an analog input and bit parameters if the input is configured as a digital input.
If an unsuitable parameter is programmed, no assignment will be taken into account.
Note: When input ADI1 is configured as a digital input, only binary parameters will be taken into account. When input ADI1 is configured as an analog input, only variable parameters are taken into account.

7.11 **: ADI2 mode**
Adjustment range : 0 to 8
Factory setting : 4
Used to define the type of signal on the ADI2 input.
0 (0-20 mA) (0-20): 0-20 mA current signal, 0 mA corresponds to the minimum reference.
1 (20-0 mA) (20-0): 20-0 mA current signal, 20 mA corresponds to the minimum reference.
2 (4-20 trip) (4-20): 4-20 mA current signal with detection of signal loss. 4 mA corresponds to the minimum reference.
3 (20-4 trip) (20-4): 20-4 mA current signal with detection of signal loss. 20 mA corresponds to the minimum reference.
4 (4-20 no trip) (4-.20): 4-20 mA current signal without detection of signal loss. 4 mA corresponds to the minimum reference.
5 (20-4 no trip) (20-.4): 20-4 mA current signal without detection of signal loss. 20 mA corresponds to the minimum reference.
6 (0-10 V) (volt): 0-10 V voltage signal.
7 (Digital input) (d-In): The input is configured as a digital input.
8 (PTC sensors) (CtP): The input is configured to manage the motor PTC sensors.

7.14 : ADI2 input destination
Adjustment range : 0.00 to 21.51
Factory setting : 1.37: Analog input 2 assigned to analog reference 2
This address should contain the number of the parameter which you wish to assign to input ADI2.
Only numerical parameters can be assigned if the input is configured as an analog input and bit parameters if the input is configured as a digital input.
If an unsuitable parameter is programmed, no assignment will be taken into account.

7.15 : ADIO3 mode
Adjustment range : 0 to 10
Factory setting : 10
Used to define whether ADIO3 is used as an input or output and the type of signal used.
0 (I:0-20mA) (0.20i): 0-20 mA current input, 0 mA corresponds to the minimum reference.
1 (I:20-0mA) (20.0i): 20-0 mA current input, 20 mA corresponds to the minimum reference.
2 (I:4-20mA trip) (4.20i): 4-20 mA current input with detection of signal loss. 4 mA corresponds to the minimum reference.
3 (I:20-4mA trip) (20.4i): 20-4 mA current input with detection of signal loss. 20 mA corresponds to the minimum reference.
4 (I:4-20mA no trip) (4.20i) : 4-20 mA current input without detection of signal loss. 4 mA corresponds to the minimum reference.
5 (I:20-4mA no trip) (20.4i) : 20-4 mA current input without detection of signal loss. 20 mA corresponds to the minimum reference.
6 (I:0-10V) (0.10i): 0-10 V voltage input.
7 (Digital input) (d-In): The input is configured as a digital input.
8 (O:0-20mA) (0.20o): 0-20 mA current output, where 20 mA corresponds to the maximum value of the assigned parameter.
9 (O:4-20mA) (4.20o): 4-20 mA current output, where 20 mA corresponds to the maximum value of the assigned parameter.
10 (Output 0-10V) (0.10o): 0-10 V voltage output, where 10 V corresponds to the maximum value of the assigned parameter.

7.16 : ADIO3 scaling
Adjustment range : Input: 0 to 2.50
Output: 0 to 32.00
Factory setting : 1.00
This parameter is used if necessary to scale the analog output (or input). However, this rarely proves necessary since the maximum value of the analog output (or input) automatically corresponds to the maximum value of the parameter which has been assigned.

7.17 : ADIO3 input invert
Adjustment range : 0 or 1
Factory setting : 0
Used to invert the input or output signal.
0 (Disabled) (OFF): Signal not inverted.
1 (Enabled) (On): Signal inverted.

7.18 : ADIO3 input destination/output source
Adjustment range : 0.00 to 21.51
Factory setting : 5.04
This address should contain the number of the parameter which you wish to assign to ADIO3.
Only numerical parameters can be addressed. If an unsuitable parameter is programmed, the corresponding output (or input) will take the value 0.

7.19 to 7.26 : Not used

7.27 to 7.29 : Current loop loss ADI1 to ADIO3
Adjustment range : 0 or 1
In 4-20 mA current mode with detection of signal loss, this parameter goes to 1 when the analog signal goes below 3 mA.
0 (Present) (On)
1 (Faulty) (OFF)
7.27 : corresponds to ADI1.
7.28 : corresponds to ADI2.
7.29 : corresponds to ADIO3. Detection does not work if ADIO3 is used as an output.

7.30 to 7.32 : Not used

7.33 : ADIO3 feature
Adjustment range : 0 to 4
Factory setting : 0
This parameter is used to assign the ADIO3 function quickly when it is being used as an output.
7.33 causes 7.18 to be configured automatically in accordance with the table below.

Value	LCD display	LED display	ADIO3 function	Value of 7.18
0	**Motor spd.**	**SPd**	**Motor speed**	5.04
1	Mot. load	Ld	Motor load	4.02
2	I mot.	A	Motor current	4.01
3	Output P	Puur	Output power	5.03
4	Any	Adv	Any assignment	0.00

If ADIO3 is used as an input, 7.33 is forced to 4.

7.34 :IGBT junction temperature
Adjustment range : 0 to 200.0 °C
Indicates the measured temperature of the IGBT junction. The drives trips when the temperature reaches 110 °C, and can be reset when the temperature falls below 100 °C again.

7.35 to 7.57 : Not used

7.58 : ADI1 min. threshold
Adjustment range : 0 to 1.00
Factory setting : 0
This parameter is a multiplication coefficient applied to the maximum value of the ADI1 destination parameter. For a 0 value of the analog input, it is used to obtain a value different from the minimum value of the destination parameter.
Value 0 = (7.58 x destination parameter max. value) + destination parameter min. value.
Example: ADI1 is assigned to a parameter with an adjustment range of 0 - 30000. If 7.58 = 0.01, 0 - 100% on ADI1 corresponds to 300 - 30000.

7.59 : ADI2 min. threshold
Adjustment range : 0 to 1.00
Factory setting : 0
This parameter is a multiplication coefficient applied to the maximum value of the ADI2 destination parameter. For a 0 value of the analog input, it is used to obtain a value different from the minimum value of the destination parameter.
Value 0 = (7.59 x destination parameter max. value) + destination parameter min. value.
Example: ADI2 is assigned to a parameter with an adjustment range of 0 - 30000. If 7.59 = 0.01, 0 - 100% on ADI2 corresponds to 300 - 30000.

7.60 : ADIO3 min. threshold
Adjustment range : 0 to 1.00
Factory setting : 0
This parameter is a multiplication coefficient applied to the maximum value of the ADIO3 destination parameter. For a 0 value of the analog input, it is used to obtain a value different from the minimum value of the destination parameter.
Value 0 = (7.60 x destination parameter max. value) + destination parameter min. value.
Example: ADIO3 is assigned to a parameter with an adjustment range of 0 - 30000. If 7.60 = 0.01, 0 - 100% on ADIO3 corresponds to 300 - 30000.
Note: This parameter only applies when ADIO3 is configured as an input.

7.61 : Scaling block min. threshold
Adjustment range : 0 to 1.00
Factory setting : 0
This parameter is a multiplication coefficient applied to the maximum value of the block's destination parameter. For a zero value of the source parameter, it is used to obtain the minimum value of the destination parameter.
Value 0 = (7.61 x destination parameter max. value) + destination parameter min. value.
Example: The potentiometer input is assigned to a parameter with an adjustment range of 0 - 30000. If 7.61 = 0.01, 0 - 100% on the potentiometer input corresponds to 300 - 30000.

7.62 : Block scaling
Adjustment range : 0 to 2.50
Factory setting : 1.00
This parameter is used, if necessary, to scale the potentiometer input. However, this rarely proves necessary since the maximum level of the input automatically corresponds to the maximum value of the destination parameter.

7.63 :Scaling block invert
Adjustment range : 0 or 1
Factory setting : 0
This parameter is used to invert the polarity of the potentiometer input.
0 (Disabled) (OFF): Input not inverted.
1 (Enabled) (On): Input inverted.

7.64 : Scaling block destination
Adjustment range : 0.00 to 21.51
Factory setting : 0.00
Used to define the destination for the reference from the potentiometer. With the local control option, the potentiometer input destination is assigned to parameter 1.36 (analog reference 1). In this case, 1.36 is unassigned from 7.10 (analog input 1). The destination can then be modified at any time by the user. In this case, 1.36 can then be assigned to another analog input.

7.65 : PTC status
Adjustment range : 0 or 1
Indicates the status of the PTC sensor.
0 (NotTRIGGERED) (OFF): PTC not tripped.
1 (TRIGGERED) (On): PTC tripped.

7.66 : Internal braking resistor temperature
Adjustment range : 0 to 200.0 °C
Indicates the temperature measured on the braking resistor. The drives trips when the temperature reaches 110 °C, and can be reset when the temperature falls below 100 °C again.

7.67 : Local control potentiometer input
Adjustment range : 0 to 100.0%
Used to read the value of the potentiometer input coming from the local controls.

7.68 : Scaling block source
Adjustment range : 0.00 to 21.51
Factory setting : 7.67
This parameter is used to select the source to be scaled.
If an unsuitable parameter is selected, the input value will be 0.

7.69 : Scaling block read
Adjustment range : ± 32000
Used to read the output value.

Notes

10 - MENU 8: ASSIGNMENT OF DIGITAL INPUTS AND OUTPUTS

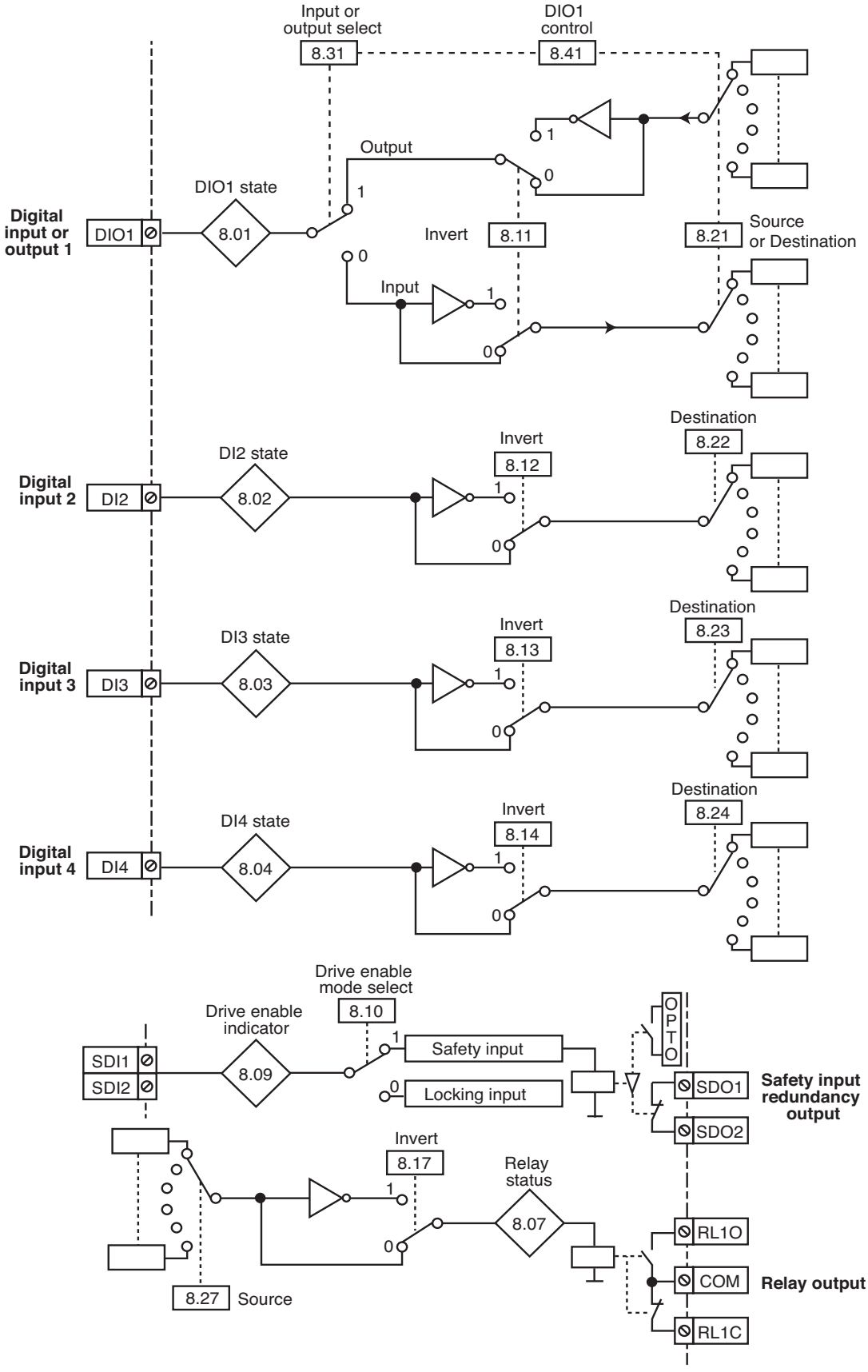
10.1 - List of parameters in Menu 8

Parameter	Name	Type	Adjustment range	Factory setting	User setting
8.01	DIO1 input or output state	RO/P	0 or 1	-	-
8.02	DI2 input state	RO/P	0 or 1	-	-
8.03	DI3 input state	RO/P	0 or 1	-	-
8.04	DI4 input state	RO/P	0 or 1	-	-
8.05 and 8.06	Not used				
8.07	Relay output status	RO/P	0 or 1	-	-
8.08	Not used				
8.09	Secure disable input	RO/P	0 or 1	-	-
8.10	Secure disable select	R-W/P	0 or 1	1	
8.11	DIO1 input or output invert	R-W	0 or 1	0	
8.12	DI2 input invert	R-W	0 or 1	0	
8.13	DI3 input invert	R-W	0 or 1	0	
8.14	DI4 input invert	R-W	0 or 1	0	
8.15 and 8.16	Not used				
8.17	Output relay invert	R-W	0 or 1	0	
8.18 and 8.19	Not used				
8.20	Digital I/O read word	RO	0 to 511	-	-
8.21	DIO1 input destination/output source	R-W/P	0.00 to 21.51	10.03	
8.22	DI2 input destination	R-W/P	0.00 to 21.51	6.30	
8.23	DI3 input destination	R-W/P	0.00 to 21.51	6.32	
8.24	DI4 input destination	R-W/P	0.00 to 21.51	1.41	
8.25 and 8.26	Not used				
8.27	Output relay source	R-W/P	0.00 to 21.51	10.01	
8.28 to 8.30	Not used				
8.31	DIO1 input or output select	R-W	0 or 1	1	
8.32 to 8.40	Not used				
8.41	DIO1 feature	R-W	0 to 9	0	
8.42 to 8.49	Not used				
8.50	Buffer block	R-W	0 or 1	0	
8.51 to 8.60	Not used				
8.61	FWD key status	RO/P	0 or 1	-	-
8.62	Stop key status	RO/P	0 or 1	-	-
8.63	REV key status	RO/P	0 or 1	-	-
8.64 to 8.70	Not used				
8.71	FWD key invert	R-W	0 or 1	0	
8.72	Not used				
8.73	REV key invert	R-W	0 or 1	0	

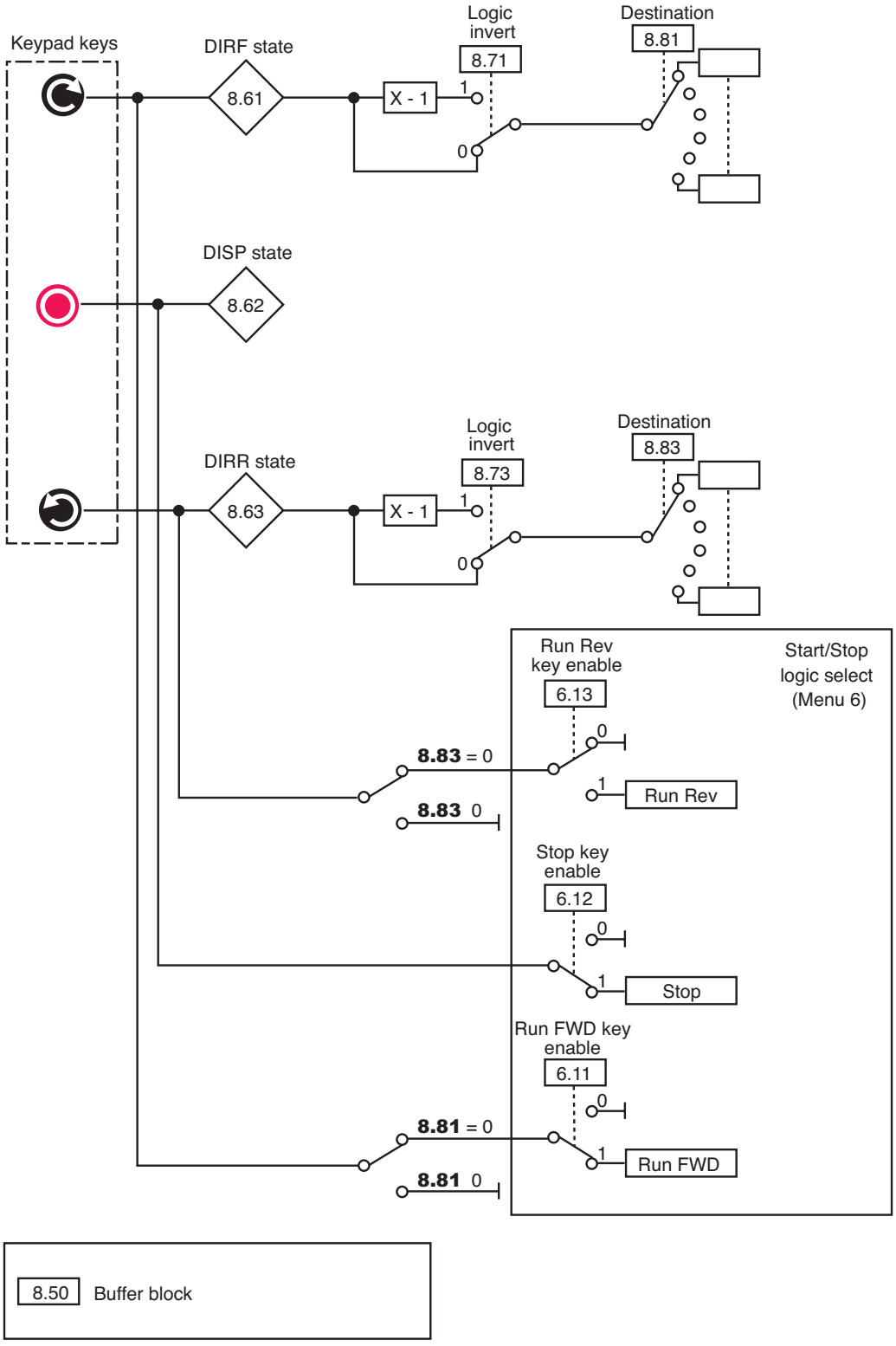
Parameter	Name	Type	Adjustment range	Factory setting	User setting
8.74 to 8.80	Not used				
8.81	FWD key destination	R-W	0.00 to 21.51	0.00	
8.82	Not used				
8.83	REV key destination	R-W	0.00 to 21.51	0.00	

10.2 - Menu 8 diagrams

10.2.1 - Assignment of digital inputs and the relay output



10.2.2 - Local controls



10.3 - Explanation of parameters in menu 8

Note: The sampling period is 2 ms for the digital inputs and outputs.

8.01 **: DIO1 input or output state**

Adjustment range : 0 or 1
This parameter indicates the state of the input or output.
0 (Disabled) (OFF) Inactive.
1 (Enabled) (On): Active.

8.02 **: DI2 input state**

Adjustment range : 0 or 1
This parameter indicates the state of the input.
0 (Disabled) (OFF) Inactive.
1 (Enabled) (On): Active.

8.03 **: DI3 input state**

Adjustment range : 0 or 1
This parameter indicates the state of the input.
0 (Disabled) (OFF): Inactive.
1 (Enabled) (On): Active.

8.04 **: DI4 input state**

Adjustment range : 0 or 1
This parameter indicates the state of the input.
0 (Inactive) (OFF): Inactive.
1 (Active) (On): Active.

8.05 and 8.06 **:Not used**

8.07 **: Relay output status**

Adjustment range : 0 or 1
This parameter indicates the state of the output relay.
0 (Open) (OPen): RL1O open, RL1C closed.
1 (Closed) (CloS): RL1O closed, RL1C open.

8.08 **:Not used**

8.09 **: Secure disable input**

Adjustment range : 0 or 1
This parameter indicates the state of the secure disable input (at the terminals).
0 (Disabled) (diSb): Drive disabled.
1 (Enabled) (Enab): Drive enabled.

8.10 **: Secure disable select**

Adjustment range : 0 or 1
Factory setting : 1
0 (Drive enable) (Enab): The SDI input is used as a simple locking input.
1 (Secur.disab.) (Secu): The SDI input is used as a safety input. In order to conform to safety standard EN 954-1 category 3, the drive must be wired in accordance with the recommended diagram in the installation and commissioning manual ref. 3840.
Note: Modifications to 8.10 must be made with the drive disabled.

• The secure disable input function is automatically disabled 8.10 = 0, when the drive is controlled via keypad, console or fieldbus, for example, when using the "Pad" preset configuration or when 6.43 = 1 to 3.

8.11 **: DIO1 input or output invert**

Adjustment range : 0 or 1
Factory setting : 0
This parameter is used to invert the digital input or output.
0 (Disabled) (OFF): Not inverted.
1 (Enabled) (On): Inverted.

8.12 **: DI2 input invert**

Adjustment range : 0 or 1
Factory setting : 0
This parameter is used to invert the digital input.
0 (Disabled) (OFF): Not inverted.
1 (Enabled) (On): Inverted.

8.13 **: DI3 input invert**

Adjustment range : 0 or 1
Factory setting : 0
This parameter is used to invert the digital input.
0 (Disabled) (OFF): Not inverted.
1 (Enabled) (On): Inverted.

8.14 **: DI4 input invert**

Adjustment range : 0 or 1
Factory setting : 0
This parameter is used to invert the digital input or output.
0 (Disabled) (OFF): Not inverted.
1 (Enabled) (On): Inverted.

8.15 and 8.16 **:Not used**

8.17 **: Output relay invert**

Adjustment range : 0 or 1
Factory setting : 0
This parameter is used to invert the relay status.
0 (Disabled) (OFF): Not inverted.
1 (Enabled) (On): Inverted.
WARNING:
When the secure disable function is enabled 8.10 = 1 (sEcu), the value of 8.17 is fixed at 0, and cannot be modified.

8.18 and 8.19 **:Not used**

8.20 : Digital I/O read word

Adjustment range : 0 to 511
This parameter is used to determine the state of the I/O with a single read operation.
Each bit of this word represents the state of parameters 8.01 to 8.07, 8.09, and 8.61 to 8.63.

Bit	0	1	2	3	4	5	6	7	8
State	8.01	8.02	8.03	8.04	8.61	8.62	8.07	8.63	8.09

8.21 : DIO1 input destination/output source
Adjustment range : 0.00 to 21.51
Factory setting : 10.03: Zero frequency
This parameter is used to select the DIO1 input destination or output source.
Any unprotected "bit" type parameter can be assigned.
If an unsuitable parameter is addressed to an input or output, no assignment is taken into account.

8.22 : DI2 input destination
Adjustment range : 0.00 to 21.51
Factory setting : 6.30: Run FWD/Stop
This parameter is used to select the destination of input DI2.
Any unprotected "bit" type parameter can be assigned to the input.
If an unsuitable parameter is addressed to an input or output, no assignment is taken into account.

8.23 : DI3 input destination
Adjustment range : 0.00 to 21.51
Factory setting : 6.32: Run REV/Stop
This parameter is used to select the destination of input DI3.
Any unprotected "bit" type parameter can be assigned to the input.
If an unsuitable parameter is addressed to an input or output, no assignment is taken into account.

Note: In jog mode, 6.04 = 1, 8.23 is frozen at 6.39. To unfreeze it, the value of 6.04 must be modified.

8.24 : DI4 input destination
Adjustment range : 0.00 to 21.51
Factory setting : 1.41: Selection of analog reference 1 or 2
This parameter is used to select the destination of input DI4.
Any unprotected "bit" type parameter can be assigned to the input.
If an unsuitable parameter is addressed to an input or output, no assignment is taken into account.

8.25 and 8.26 :Not used

8.27 : Output relay source
Adjustment range : 0.00 to 21.51
Factory setting : 10.01: Drive healthy
This parameter is used to select the source for the output relay.
Any unprotected "bit" type parameter can be assigned.
If an unsuitable parameter is addressed to an input or output, no assignment is taken into account.
WARNING:
When the secure disable function is enabled 8.10 = 1, the value of 8.27 is fixed at 10.01, and cannot be modified.

8.28 to 8.30 : Not used

8.31 : DIO1 input or output select
Adjustment range : 0 or 1
Factory setting : 1
Used to configure terminal DIO1 as an input or output.
0 (Input) (In): Terminal configured as an input.
1 (Output) (Out): Terminal configured as an output.

8.32 to 8.40 : Not used

8.41 : DIO1 feature
Adjustment range : 0 to 9
Factory setting : 0
This parameter is used to assign the DIO1 function quickly. Depending on the value of 8.41, 8.21 and 8.31 are automatically configured according to the table below.

8.41	LCD display	LED display	DIO1 function	Value of 8.21	Value of 8.31
0	**Zero spd.**	**n = 0**	**Zero speed output**	10.03	**1**
1	At speed	At.SP	At speed output	10.06	1
2	Min. speed	Lo.SP	Minimum speed output	10.04	1
3	At load	At.Ld	At rated load output	10.08	1
4	Drive active	act	Drive output active	10.02	1
5	Gen. alarm	alar	Drive general alarm output	10.19	1
6	Current lim.	I.Lt	Current limit output	10.09	1
7	Jogging inp.	JoG	Jogging input	6.31	0
8	Reset inp.	rESE	Reset input	10.33	0
9	Any	Adv	Any assignment	0.00	1

8.42 to 8.49 **: Not used**

8.50 **: Buffer block**
Adjustment range : 0 or 1
Factory setting : 0
0 (Disabled) (OFF)
1 (Enabled) (On)
This parameter is used to make a link directly between a binary destination parameter and a binary source parameter.

8.51 to 8.60 **: Not used**

8.61 **: FWD key status**
Adjustment range : 0 or 1
This parameter indicates the state of the input.
0 (Inactive) (OFF): Inactive.
1 (Active) (On): Active.

8.62 **: Stop key status**
Adjustment range : 0 or 1
This parameter indicates the state of the input.
0 (Inactive) (OFF): Inactive.
1 (Active) (On): Active.
To use this state and assign it to another function, disable the Stop function using 6.12 = 0.

8.63 **: REV key status**
Adjustment range : 0 or 1
This parameter indicates the state of the input.
0 (Inactive) (OFF): Inactive.
1 (Active) (On): Active.

8.64 to 8.70 **: Not used**

8.71 **: FWD key invert**
Adjustment range : 0 or 1
Factory setting : 0
This parameter is used to invert the digital input.
0 (Disabled) (OFF): Not inverted.
1 (Enabled) (On): Inverted.

8.72 **: Not used**

8.73 **: REV key invert**
Adjustment range : 0 or 1
Factory setting : 0
This parameter is used to invert the digital input.
0 (Disabled) (OFF): Not inverted.
1 (Enabled) (On): Inverted.

8.74 to 8.80 **: Not used**

8.81 **: FWD key destination**
Adjustment range : 0.00 to 21.51
Factory setting : 0.00
This parameter is used to assign the input destination. The user can modify the input destination at any time. In this case, the input is automatically unassigned from the logic commands.

8.82 **: Not used**

8.83 **: REV key destination**
Adjustment range : 0.00 to 21.51
Factory setting : 0.00
This parameter is used to assign the input destination. The user can modify the input destination at any time. In this case, the input is automatically unassigned from the logic commands.

Notes

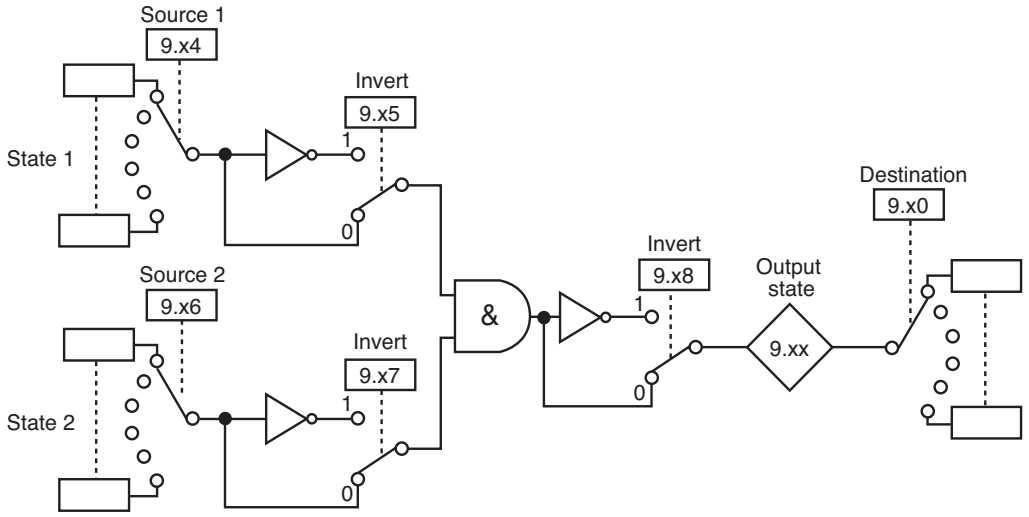
11 - MENU 9: LOGIC FUNCTIONS, MOTORISED POT AND BINARY SUM

11.1 - List of parameters in Menu 9

Parameter	Name	Type	Adjustment range	Factory setting	User setting
9.01 - 9.02 9.61 - 9.71	Logic functions 1 to 4 output	RO	0 or 1	-	-
9.03	Motorised pot output	RO	± 100.0%	-	-
9.04 - 9.14 9.64 - 9.74	Logic functions 1 to 4 source 1	R-W/P	0.00 to 21.51	0.00	
9.05 - 9.15 9.65 - 9.75	Logic functions 1 to 4 source 1 invert	R-W	0 or 1	0	
9.06 - 9.16 9.66 - 9.76	Logic functions 1 to 4 source 2	R-W/P	0.00 to 21.51	0.00	
9.07 - 9.17 9.67 - 9.77	Logic functions 1 to 4 source 2 invert	R-W	0 or 1	0	
9.08 - 9.18 9.68 - 9.78	Logic functions 1 to 4 output invert	R-W	0 or 1	0	
9.09 - 9.19	Not used				
9.10 - 9.20 9.60 - 9.70	Logic functions 1 to 4 destination	R-W/P	0.00 to 21.51	0.00	
9.11 **to** 9.13	Not used				
9.21	Motorised pot mode	R-W	0 to 3	2	
9.22	Motorised pot bipolar select	R-W	0 or 1	0	
9.23	Motorised pot rate	R-W	0 to 250 s	20 s	
9.24	Motorised pot scale factor		0 to 2.50	1.00	
9.25	Motorised pot destination	R-W/P	0.00 to 21.51	0.00	
9.26	Motorised pot up	R-A	0 or 1	-	
9.27	Motorised pot down	R-A	0 or 1	-	
9.28	Motorised pot reset	R-W	0 or 1	0	
9.29	Binary sum ones input	R-A	0 or 1	-	-
9.30	Binary sum twos input	R-A	0 or 1	-	-
9.31	Binary sum fours input	R-A	0 or 1	-	-
9.32	Binary sum output	RO	0 to 39	-	-
9.33	Binary sum destination	R-W/P	0.00 to 21.51	0.00	
9.34	Binary sum offset	R-W	0 to 32	0	
9.35 **to** 9.69	Not used				
9.62 **and** 9.63	Not used				
9.72 **and** 9.73	Not used				

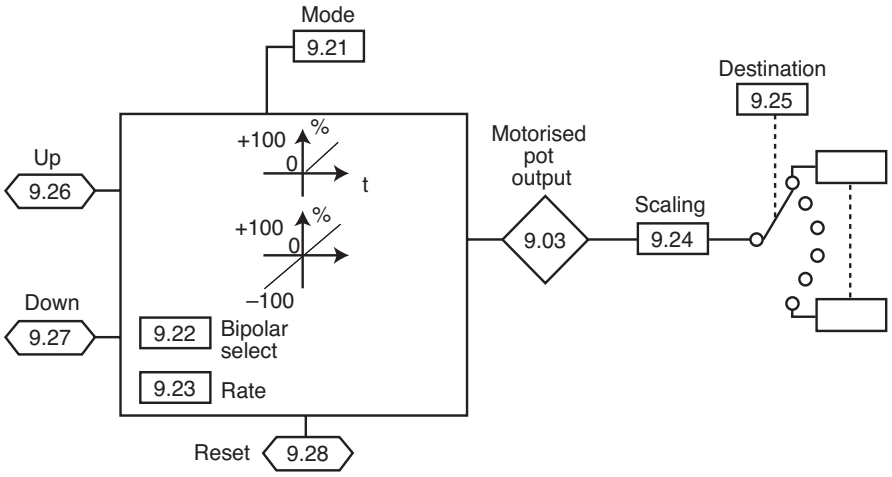
11.2 - Menu 9 diagrams

11.2.1 - Programmable logic

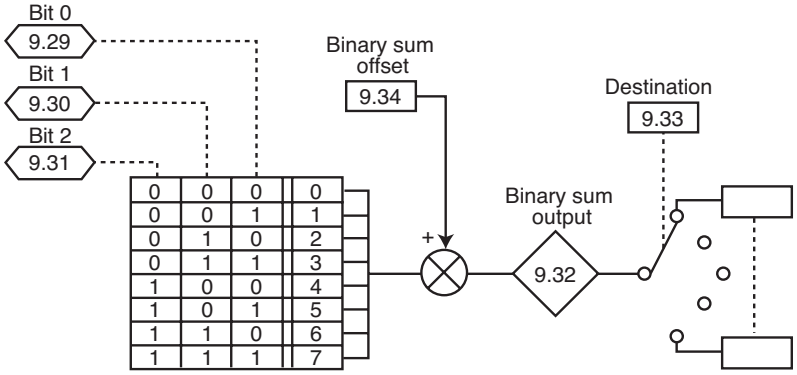


	Source 1	Source 2	Source 1 invert	Source 2 invert	Output invert	Output state	Source destination
Function 1	9.04	9.06	9.05	9.07	9.08	9.01	9.10
Function 2	9.14	9.16	9.15	9.17	9.18	9.02	9.20
Function 3	9.64	9.66	9.65	9.67	9.68	9.61	9.60
Function 4	9.74	9.76	9.75	9.77	9.78	9.71	9.70

11.2.2 - Motorised pot function



11.2.3 - Binary sum function



0	0	0	0	0
0	0	1	1	1
0	1	0	2	2
0	1	1	3	3
1	0	0	4	4
1	0	1	5	5
1	1	0	6	6
1	1	1	7	7

11.3 - Explanation of parameters in menu 9

9.01 **: Logic function 1 output**

9.02 **: Logic function 2 output**

9.61 **: Logic function 3 output**

9.71 **: Logic function 4 output**

Adjustment range : 0 or 1
0 (Disabled) (OFF)
1 (Enabled) (On)
Indicate the state of the logic function outputs.

9.03 **: Motorised pot output**

Adjustment range : ± 100.0%
Indicates the level of the reference before scaling.

9.04 **: Logic function 1 source 1**

9.14 **: Logic function 2 source 1**

9.64 **: Logic function 3 source 1**

9.74 **: Logic function 4 source 1**
Adjustment range : 0.00 to 21.51
Factory setting : 0.00
These parameters are used to select source 1 of the logic functions.
Only "bit" type parameters can be used on these inputs.
If an unsuitable parameter is addressed on one of the function 1 inputs, the output will be frozen at 0.

9.05 **: Logic 1 source 1 invert**

9.15 **: Logic 2 source 1 invert**

9.65 **: Logic 3 source 1 invert**

9.75 **: Logic 4 source 1 invert**
Adjustment range : 0 or 1
Factory setting : 0
This parameter is used to invert source 1 of the logic functions.
0 (Disabled) (OFF): Source 1 not inverted.
1 (Enabled) (On): Source 1 inverted.

9.06 **: Logic function 1 source 2**

9.16 **: Logic function 2 source 2**

9.66 **: Logic function 3 source 2**

9.76 **: Logic function 4 source 2**
Adjustment range : 0.00 to 21.51
Factory setting : 0.00
These parameters are used to select source 2 of the logic functions.
Only "bit" type parameters can be used on these inputs.
If an unsuitable parameter is addressed on one of the function 1 inputs, the output will be frozen at 0.

9.07 **: Logic 1 source 2 invert**

9.17 **: Logic 2 source 2 invert**

9.67 **: Logic 3 source 2 invert**

9.77 **: Logic 4 source 2 invert**
Adjustment range : 0 or 1
Factory setting : 0
These parameters are used to invert source 2 of the logic functions.
0 (Disabled) (OFF): Source 2 not inverted.
1 (Enabled) (On): Source 2 inverted.

9.08 **: Logic 1 output invert**

9.18 **: Logic 2 output invert**

9.68 **: Logic 3 output invert**

9.78 **: Logic 4 output invert**
Adjustment range : 0 or 1
Factory setting : 0
These parameters are used to invert the output of the logic functions.
0 (Disabled) (OFF): Output not inverted.
1 (Enabled) (On): Output inverted.

9.09 and 9.19 **:Not used**

9.10 **: Logic function 1 output destination**

9.20 **: Logic function 2 output destination**

9.60 **: Logic function 3 output destination**

9.70 **: Logic function 4 output destination**
Adjustment range : 0.00 to 21.51
Factory setting : 0.00
These parameters define the internal parameter which will be assigned by the output of the logic functions.
Only unprotected "bit" type parameters can be addressed.
If an unsuitable parameter is programmed, the destination will not be taken into account.

9.21 **: Motorised pot mode**
Adjustment range : 0 to 3
Factory setting : 2
0 (Rst/ENABLE) (Rst.e): The reference is reset to 0 on each power-up. The up/down and reset inputs are active at all times.
1 (Prev/ENABLE) (Pre.e): On power-up, the reference is at the same level as before power-down. The up/down and reset inputs are active at all times.
2 (Rst/DISABLE) (Rst.d): The reference is reset to 0 on each power-up. The up/down inputs are active only when the drive output is active. The reset input is active at all times.
3 (Prev/DISABLE) (Pre.d): On power-up, the reference is at the same level as before power-down. The up/down inputs are active only when the drive output is active. The reset input is active at all times.

9.22 : Motorised pot bipolar select
Adjustment range : 0 or 1
Factory setting : 0
0 (Positive) (Pos): The up/down pot reference is limited to positive values (0 to 100.0%).
1 (Bipolar) (biPo.): The up/down pot reference can change from -100% to +100%.

9.23 : Motorised pot rate
Adjustment range : 0 to 250 s
Factory setting : 20 s
This parameter defines the time it takes for the up/down pot reference to change from 0 to 100.0%.
It will take twice as long to change from -100.0% to +100.0%.
Defines the potentiometer sensitivity.

9.24 : Motorised pot scale factor
Adjustment range : 0 to 2.50
Factory setting : 1.00
The maximum value of the up/down pot reference automatically takes the maximum value of the parameter to which it is assigned.
This parameter can therefore be used to adapt the maximum value of the up/down pot reference to the maximum value required by the application.
Example:
- The up/down reference is addressed to a preset reference.
- The maximum value of a preset reference is 32000 rpm.
- We want the maximum value of the up/down reference to correspond to 1500 rpm.

$$\Rightarrow 9.24 = \frac{1500}{32000} = 0.05$$

9.25 : Motorised pot destination
Adjustment range : 0.00 to 21.51
Factory setting : 0.00
This parameter is used to define the numerical parameter which the up/down pot reference will control.
Example: The up/down pot reference acts as a speed reference. The up/down pot reference can be sent to a preset reference.
==> 9.25 = 1.21.

9.26 : Motorised pot up
Adjustment range : 0 or 1
0 (Disabled) (OFF)
1 (Enabled) (On)
A digital input must be assigned to this parameter for controlling the motorised pot up function.

9.27 : Motorised pot down
Adjustment range : 0 or 1
0 (Disabled) (OFF)
1 (Enabled) (On)
A digital input must be assigned to this parameter for controlling the motorised pot down function.

9.28 : Motorised pot reset
Adjustment range : 0 or 1
Factory setting : 0
0 (Disabled) (No): Reset inactive.
1 (Enabled) (RSEt): The motorised pot reference is reset to zero.

9.29 to 9.31 : Binary sum inputs

Adjustment range : 0 or 1
Used to modify remotely, using a combination of digital inputs, a parameter whose selection includes more than two possible options.
0 (Disabled) (OFF)
1 (Enabled) (On)
9.29: Binary sum ones input.
9.30: Binary sum twos input.
9.31: Binary sum fours input.

9.31	9.30	9.29	Decimal conversion
0	0	0	0
0	0	1	1
0	1	0	2
0	1	1	3
1	0	0	4
1	0	1	5
1	1	0	6
1	1	1	7

9.32 : Binary sum output
Adjustment range : 0 to 39
Used to read the decimal value of the binary sum output.

9.33 : Binary sum destination
Adjustment range : 0.00 to 21.51
Factory setting : 0.00
Used to define the parameter that the binary sum will control. Any bit, switch or numerical type parameter can be assigned to the binary sum.

9.34 : Binary sum output offset
Adjustment range : 0 to 32
Factory setting : 0
Used to add an offset to the binary sum output.

9.35 to 9.59 : Not used

9.62 and 9.63 :Not used

9.72 and 9.73 :Not used

12 - MENU 10: DRIVE STATES AND DIAGNOSTICS

12.1 - List of parameters in Menu 10

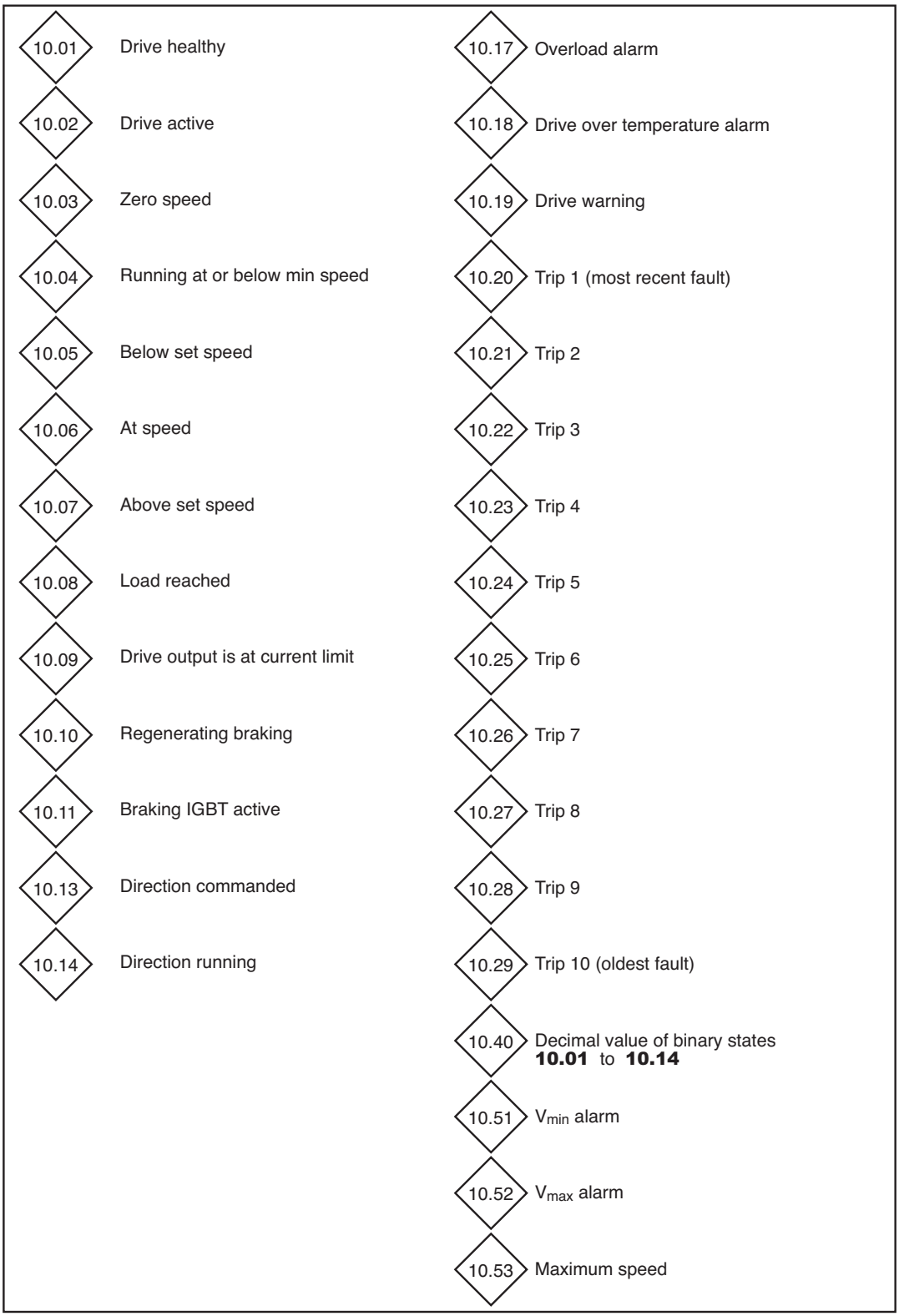
Parameter	Name	Type	Adjustment range	Factory setting	User setting
10.01	Drive healthy	RO/P	0 or 1	-	-
10.02	Drive active	RO/P	0 or 1	-	-
10.03	Zero speed	RO/P	0 or 1	-	-
10.04	Running at minimum speed	RO/P	0 or 1	-	-
10.05	Below set speed	RO/P	0 or 1	-	-
10.06	At speed	RO/P	0 or 1	-	-
10.07	Above set speed	RO/P	0 or 1	-	-
10.08	Load reached	RO/P	0 or 1	-	-
10.09	Drive output at current limit	RO/P	0 or 1	-	-
10.10	Drive regenerating	RO/P	0 or 1	-	-
10.11	Braking IGBT active	RO/P	0 or 1	-	-
10.12	Braking resistor alarm	RO/P	0 or 1	-	-
10.13	Direction commanded	RO/P	0 or 1	-	-
10.14	Direction running	RO/P	0 or 1	-	-
10.15 and 10.16	Not used				
10.17	Overload alarm	RO/P	0 or 1	-	-
10.18	Drive over temperature alarm	RO/P	0 or 1	-	-
10.19	Drive general warning	RO/P	0 or 1	-	-
10.20	Trip 1 (most recent trip)	RO/P	0 to 54	-	-
10.21	Trip 2	RO/P	0 to 54	-	-
10.22	Trip 3	RO/P	0 to 54	-	-
10.23	Trip 4	RO/P	0 to 54	-	-
10.24	Trip 5	RO/P	0 to 54	-	-
10.25	Trip 6	RO/P	0 to 54	-	-
10.26	Trip 7	RO/P	0 to 54	-	-
10.27	Trip 8	RO/P	0 to 54	-	-
10.28	Trip 9	RO/P	0 to 54	-	-
10.29	Trip 10 (oldest trip)	RO/P	0 to 54	-	-
10.30	Full power braking time	R-W	0 to 400.0 s	3.0 s (size 2: 4.0 s)	
10.31	Full power braking period	R-W	0 to 25.0 min	1.0 min	
10.32	Not used				
10.33	Drive reset	R-W	0 or 1	0	
10.34	No. of auto-reset attempts	R-W	If 10.91=No (0): 0 to 5 If 10.91=Yes (1): 0 to 100	0	
10.35	Auto-reset delay	R-W	0 to 25.0 s	1.0 s	
10.36	Hold drive healthy until last attempt	R-W	0 or 1	0	
10.37	Brak. IGBT/Stop on minor trip	R-W	0 or 1	0	
10.38	Serial link user trip	R-W/P	0 to 100	0	
10.39	Braking energy overload accumulator	RO/P	0 to 100.0%	-	-
10.40	Decimal value of binary states 10.01 to 10.14	RO/P	0 to 16383	-	-
10.41 to 10.50	Not used				
10.51	V_{min} alarm	RO	0 or 1	-	-
10.52	V_{max} alarm	RO	0 or 1	-	-
10.53	Maximum speed	RO	0 or 1	-	-

Parameter	Name	Type	Adjustment range	Factory setting	User setting
10.54 to 10.57	User alarms 1 to 4	R-W	0 or 1	0	
10.58 to 10.60	Not used				
10.61	User trip 1	R-W	0 or 1	0	
10.62	Not used				
10.63	User trip 2	R-W	0 or 1	0	
10.64	Not used				
10.65	User trip 3	R-W	0 or 1	0	
10.66	Not used				
10.67	User trip 4	R-W	0 or 1	0	
10.68	Not used				
10.69	Trip active at standstill	R-W	0 or 1	1	
10.70	Trip auto-reset when powered	R-W	0 or 1	1	
10.71 to 10.90	Not used				
10.91	Increase number of automatic trips	R-W	0 or 1	0	

Notes

12.2 - Menu 10 diagrams

12.2.1 - Operating states



12.2.2 - Braking resistor and trip management configuration

Braking resistor

10.12	Braking resistor alarm
10.30	Full power braking time
10.31	Full power braking period
10.39	Braking energy overload accumulator

Trip management

10.33	Drive reset
10.34	No. of auto-reset attempts
10.35	Auto-reset delay
10.36	Hold drive healthy until last attempt
10.37	Action on trip detection
10.38	User trip
10.54	User alarm 1
10.55	User alarm 2
10.56	User alarm 3
10.57	User alarm 4
10.61	User trip 1
10.63	User trip 2
10.65	User trip 3
10.67	User trip 4
10.69	Trip active at standstill
10.70	Trip auto reset when powered
10.91	Increase number of automatic trips

12.3 - Explanation of parameters in menu 10

10.01 **: Drive healthy**

Adjustment range : 0 or 1
0 (Disabled) (OFF):
1 (Enabled) (On):
This parameter is at 1 when the drive is not in the trip state. If parameter 10.36 is at 1, this bit will remain at 1 during the trip phase if an auto-reset is supposed to occur. Once the number of auto-resets is reached, the next trip will cause this bit to change to zero.

10.02 **: Drive active**

Adjustment range : 0 or 1
0 (Disabled) (OFF)
1 (Enabled) (On)
This parameter is at 1 when the drive output is active.

10.03 **: Zero speed**

Adjustment range : 0 or 1
0 (Disabled) (OFF):
1 (Enabled) (On):
This parameter is at 1 when the absolute value of the speed is less than or equal to the threshold defined by parameter 3.05.
10.03 changes back to 0 when the speed becomes greater than 3.05 + 10 rpm.

10.04 **: Running at minimum speed**

Adjustment range : 0 or 1
0 (Disabled) (OFF):
1 (Enabled) (On):
In bipolar mode (1.10 = 1), the operation of this parameter is identical to that of parameter 10.03.
In unipolar mode (1.10 = 0), this parameter is at 1 if the absolute value of the ramp output is less than or equal to the minimum speed 1.07 + (30 rpm/number of pairs of motor poles).
10.04 changes back to 0 when the speed becomes greater than [1.07 + (30 rpm/number of pairs of poles) + 10 rpm].
The minimum speed is defined by parameter 1.07.

10.05 **: Below set speed**

Adjustment range : 0 or 1
0 (Disabled) (OFF):
1 (Enabled) (On):
This parameter is at 1 when the absolute value of the motor speed is greater than 1.03 - (3.06 ÷ 2).
10.05 changes back to 0 when the speed becomes greater than [1.03 - (3.06 ÷ 2) + 10 rpm].

10.06 **: At speed**

Adjustment range : 0 or 1
0 (Disabled) (OFF):
1 (Enabled) (On):
This parameter is at 1 when the absolute value of the motor speed is between 1.03 - (3.06 ÷ 2) and 1.03 + (3.06 ÷ 2).

10.07 **: Above set speed**

Adjustment range : 0 or 1
0 (Disabled) (OFF):
1 (Enabled) (On):
This parameter is at 1 when the absolute value of the motor speed is greater than 1.03 + (3.06 ÷ 2).
10.07 changes back to 0 when the speed becomes less than [1.03 + (3.06 ÷ 2) - 10 rpm].

10.08 **: Nominal load reached**

Adjustment range : 0 or 1
0 (Disabled) (OFF):
1 (Enabled) (On):
This parameter is at 1 when the active current 4.02 is at or above the rated active current.
Rated active current = 5.07 x 5.10.

10.09 **: Drive output at current limit**

Adjustment range : 0 or 1
0 (Disabled) (OFF):
1 (Enabled) (On):
This parameter is at 1 when drive current limiting is active.

10.10 **: Drive regenerating**

Adjustment range : 0 or 1
0 (Disabled) (OFF):
1 (Enabled) (On):
This parameter is at 1 when energy is being transferred from the motor to the DC bus (driving load).

10.11 **: Braking IGBT active**

Adjustment range : 0 or 1
0 (Disabled) (OFF):
1 (Enabled) (On):
This parameter is at 1 when energy is being dissipated in the optional braking resistor (provided it is connected).

10.12 **: Braking resistor alarm**

Adjustment range : 0 or 1
0 (Disabled) (OFF):
1 (Enabled) (On):
This parameter is at 1 when external resistance braking is active and the cumulative braking power exceeds 75% of 10.39.
Note: This alarm depends on the values set in 10.30 and 10.31.

10.13 **: Direction commanded**

Adjustment range : 0 or 1
0 (Forward) (Fd): The pre-ramp reference is negative (reverse).
1 (Reverse) (rSe): The pre-ramp reference is positive (forward).

10.14 : Direction running

Adjustment range : 0 or 1
0 (Forward) (Fd): The post-ramp reference is negative (reverse).
1 (Reverse) (rSe): The post-ramp reference is positive (forward).
Note: Do not take this parameter into account with the motor stopped.

10.15 and 10.16 **:Not used**

10.17 : Motor overload alarm

Adjustment range : 0 or 1
0 (Disabled) (OFF):
1 (Enabled) (On):
This parameter is at 1 when the motor current exceeds 110% of the programmed motor rated current and the cumulative overload exceeds 75% of the overload capacity of the motor. If the motor current is not reduced, the drive will trip on fault I x t, or will reduce the current automatically according to the protection mode configured in 4.16.

10.18 : Drive overtemperature alarm

Adjustment range : 0 or 1
0 (Disabled) (OFF):
1 (Enabled) (On):
This parameter is at 1 when the measured temperature of the IGBTs is higher than 100 °C, or when the drive automatically reduces the configured switching frequency, owing to overheating of the heatsink.

10.19 : Drive general warning

Adjustment range : 0 or 1
0 (Disabled) (OFF):
1 (Enabled) (On):
This parameter is at 1 when at least one of the alarms 10.12, 10.17 or 10.18 is activated.

10.20 to 10.29 : Last 10 trips stored

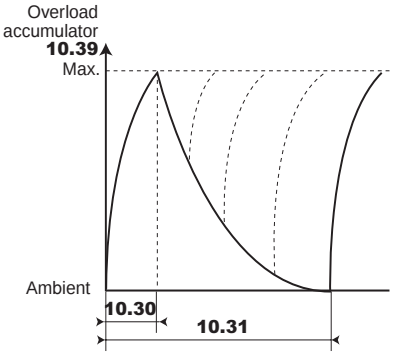
Adjustment range : 0 to 54
Contains the last 10 drive trips.
10.20: Indicates the most recent trip.
10.29: Indicates the oldest trip.

The possible trips are:

No.	LCD display	LED display	Reason for trip
1	DC UnderVolt	UU	DC bus undervoltage
2	DC over volt	OU	DC bus overvoltage
3	Over current	OI.AC	Overcurrent at drive output
4	Brak. IGBT	OI.br	Braking IGBT transistor overcurrent
6	Out Ph. loss	ph.AC	Loss of a motor phase with brake enabled
7	Over speed	OSP	Over speed
19	Brak. resist.	it.br	Braking resistor overload I x t
20	Motor I^2t	it.AC	Motor overload I x t
21	Th IGBT U	Oht1	IGBT overheating detected by internal sensor
22	BR over heat	Oht2	Internal braking resistor overheating detected by thermal sensor
24	Motor PTC	th	Motor thermal sensor has tripped
26	24V OVERLOAD	O.Ld1	Overload on the +24V power supply or digital
27	ADI1 loss	CL1	Loss of the current reference on analog input ADI1
28	ADI2 loss	CL2	Loss of the current reference on analog input ADI2
29	AIO3 loss	CL3	Loss of the current reference on analog input ADIO3
30	COM loss	SCL	Loss of serial link communication
31	EEPROM fail.	EEF	EEPROM trip or transfer problem with XPressKey (drive and key version different)
33	Stator res.	rS	Trip during measurement of the stator resistance
34	Fieldbus loss	Fbus	Disconnection of the fieldbus during operation or error detected by the bus option
35	Sec. disable	Secd	Secure disable input trip
36	U sign. loss	Enc1	Loss of channel U
37	V sign. loss	Enc2	Loss of channel V
38	W sign. loss	Enc3	Loss of channel W
41	User 1	tr01	User trip 1 via digital input
42	User 2	tr02	User trip 2 via digital input
43	User 3	tr03	User trip 3 via digital input
44	User 4	tr04	User trip 4 via digital input
45 to 51	User 05 to user 10	tr05 to tr10	User 5 trip via serial link to User 10 trip via serial link

10.30 **: Full power braking time**
Adjustment range : 0 to 400.0 s
Factory setting : 3.0 s, except for size 2 drives: 4.0 s
This parameter defines for how long the braking resistor can withstand the maximum braking voltage (780 V or 390 V) without damage. It is used to determine the time before the drive trips due to braking overload.
WARNING:
If this parameter is left at 0, the braking resistor will not be protected.

10.31 **: Full power braking period**
Adjustment range : 0 to 25.0 min
Factory setting : 1.0 min
This parameter defines the time period which must elapse between two consecutive braking periods at full power as defined by parameter 10.30. It is used to configure the thermal time constant for the resistor used.



WARNING:
If this parameter is left at 0, the braking resistor will not be protected.

10.32 **: Not used**

10.33 **: Drive reset**
Adjustment range : 0 or 1
Factory setting : 0
0 (Disabled) (OFF):
1 (Enabled) (On):
A 0 to 1 change in this parameter will cause a drive reset.
If a remote drive reset is required, a terminal must be assigned to this parameter.
If the drive trips due to IGBT overcurrent, either at the output bridge or the braking transistor, the drive cannot be reset for 10 seconds (IGBT recovery time).

10.34 **: Number of auto-reset attempts**

Adjustment range : if 10.91 = 0: 0 to 5
if 10.91 = 1: 0 to 100
Factory setting : 0
0: There will be no automatic reset. A command must be given.
1 to 5: There will be as many automatic reset attempts as have been programmed.
When the counter reaches the permitted number of reset attempts, the drive finally locks. This last trip can only be reset via a command.
If no trips occur, the counter is decremented by one value every 5 minutes.

10.35 **: Auto-reset delay**

Adjustment range : 0 to 25.0 s
Factory setting : 1.0 s
This parameter defines the time between the drive tripping and the automatic reset (subject to a minimum stop time for trips relating to overcurrents).

10.36 **: Hold drive healthy during auto-reset**

Adjustment range : 0 or 1
Factory setting : 0
0 (No) (OFF): 10.01 **(drive healthy) is reset to zero each time the drive trips, without taking account of any auto-resets that could occur.**
1 (Yes) (On): Parameter 10.01 is held at 1 during the trip phases which are reset automatically.

10.37 **: Brak. IGBT/Stop on minor trip**
Adjustment range : 0 or 1
Factory setting : 0
0 (YES/Fr.WHEEL) (Free): Freewheel stop on all trip types.
1 (YES/Ctrled) (Ctld): The drive will control deceleration before tripping on minor trips it.AC, Oht1, Oht2, th, OLd1, CL1, CL2, CL3, SCL, EEF, Fbus, tr05, tr10.

10.38 **: Serial link user trip**
Adjustment range : 0 to 100
Factory setting : 0
This parameter is used to generate user trips, via the serial link.
Trips generated by the user will be indicated by trxx in the trip table, xx being the trip code. Only values ≥ 45 and ≤ 51 can generate a trip.
Customers wishing to reset the drive via the serial link can do so by giving this parameter the value 100.

10.39 **: Braking energy overload accumulator**

Adjustment range : 0 to 100.0%
This parameter gives an indication of the braking resistor temperature modelled according to parameters 10.30 and 10.31. A zero value means that the resistor is close to the ambient temperature and 100% is the maximum temperature (trip level).

10.40 **: Decimal value of binary states** 10.01 **to** 10.14
Adjustment range : 0 to 16383
This parameter is used with a serial communications interface. The value of this parameter is the addition of the drive bits envisaged for read-only mode, with the following binary weights:
- 10.01 = 2^0
- 10.02 = 2^1
- 10.03 = 2^2
- 10.04 = 2^3
- 10.05 = 2^4
- 10.06 = 2^5
- 10.07 = 2^6
- 10.08 = 2^7
- 10.09 = 2^8
- 10.10 = 2^9
- 10.11 = 2^{10}
- 10.12 = 2^{11}
- 10.13 = 2^{12}
- 10.14 = 2^{13}

10.41 to 10.50 : Not used

10.51 **: V_{min} alarm**
Adjustment range : 0 or 1
0 (Disabled) (OFF)
1 (Enabled) (On)
Changes to 1 when the motor speed (5.04) < V_{min} (1.07 or 21.02) + 3.51 in open loop mode or speed (3.02) < V_{min} (1.07 or 21.02) + 3.51 in closed loop mode.
10.51 changes back to 0 when the speed is greater than (5.04) < V_{min} (1.07 or 21.02) + 3.51 + 10 rpm in open loop mode or greater than (3.02) < V_{min} (1.07 or 21.02) + 3.51 + 10 rpm.
Note: In bipolar mode, alarm 10.51 is not active.

10.52 **: V_{max} alarm**
Adjustment range : 0 or 1
0 (Disabled) (OFF)
1 (Enabled) (On)
Changes to 1 when the motor speed (5.04) > V_{max} (1.06 or 21.01) - 3.52 in open loop mode or speed (3.02) > V_{max} (1.06 or 21.01) - 3.52 in closed loop mode.
10.52 changes back to 0 when the speed is lower than (5.04) > V_{max} (1.06 or 21.01) - 3.52 - 10 rpm in open loop mode, or (3.02) > V_{max} (1.06 or 21.01) - 3.52 - 10 rpm.

10.53 **: Maximum speed**
Adjustment range : 0 or 1
0 (Disabled) (OFF)
1 (Enabled) (On)
Changes to 1 when the motor speed (5.04) > V_{max} (1.06 or 21.01) - 15 rpm.
10.53 changes back to 0 when the speed is lower than (5.04) > V_{max} (1.06 or 21.01) - 3.53 - 25 rpm.

10.54 to 10.57 : User alarms 1 to 4
Adjustment range : 0 or 1
Factory setting : 0
0 (Disabled) (OFF)
1 (Enabled) (On)
When these parameters change to 1, the drive display alternates between the messages "Alar. " and "USr(1to4)" (no tripping of the drive).
Note:
User alarm 1 overrides user alarm 2.
User alarm 2 overrides user alarm 3.
User alarm 3 overrides user alarm 4.

10.58 to 10.60 : Not used

10.61 **: User trip 1**
Adjustment range : 0 or 1
Factory setting : 0
0 (Disabled) (OFF): The drive has not tripped.
1 (Enabled) (On): The drive trips, may or may not control deceleration according to the configuration of 10.62 and generates a trip code tr01.
Note: Automatic reset (10.34) is not permitted.

10.62 **: Not used**

10.63 **: User trip 2**
Adjustment range : 0 or 1
Factory setting : 0
0 (Disabled) (OFF): The drive has not tripped.
1 (Enabled) (On): The drive trips, may or may not control deceleration according to the configuration of 10.64 and generates a trip code tr02.
Note: Automatic reset (10.34) is not permitted.

10.64 **: Not used**

10.65 **: User trip 3**
Adjustment range : 0 or 1
Factory setting : 0
0 (Disabled) (OFF): The drive has not tripped.
1 (Enabled) (On): The drive trips, may or may not control deceleration according to the configuration of 10.66 and generates a trip code tr03.

10.66 **: Not used**

10.67 **: User trip 4**
Adjustment range : 0 or 1
Factory setting : 0
0 (Disabled) (OFF): The drive has not tripped.
1 (Enabled) (On): The drive trips, may or may not control deceleration according to the configuration of 10.68 and generates a trip code tr04.

10.68 **: Not used**

10.69 **: Trip active at standstill**
Adjustment range : 0 or 1
Factory setting : 1
0 (Disabled) (OFF):
1 (Enabled) (On):
This parameter is used to make drive trips active at standstill. The trips concerned are: UU, phAC , EnC1, EnC2, EnC3, Oht2, itAC, th, CL1, CL2, CL3, Oht1.

10.70 **: Trip auto-reset when powered**
Adjustment range : 0 or 1
Factory setting : 1
0 (Disabled) (OFF):
1 (Enabled) (On):
This parameter is used to automatically reset the trip with power "UU" applied.

10.71 to 10.89 : Not used

10.90 **: LED command**
Adjustment range : 0 to 1000
In the PUMP preset configuration (11.46 = 8), this parameter is used to control output ADI03:
- 10.90 is at 0 when 10.01 is at 1 (drive healthy).
- 10.90 is at 1000 when 10.01 is at 0 (drive tripped).
- 10.90 changes alternately from 600 to 1000 when 10.09 is at 1 (current limiting active).

10.91 **: Increase number of automatic trips**
Adjustment range : 0 or 1
Factory setting : 0
0 (Disabled) (ON)
1 (Enabled) (OFF)
This parameter is used to obtain more automatic trip resets. When it is enabled, the maximum value of 10.34 changes from 5 to 100.
In addition, the 10-second delay before detection of IGBT overcurrent (OIAC) is no longer taken into account (see 10.33). The delay is then set by 10.35.

13 - MENU 11: SERIAL LINK - DRIVE CHARACTERISTICS - MISCELLANEOUS

13.1 - List of parameters in Menu 11

Parameter	Name	Type	Adjustment range	Factory setting	User setting
11.01	Parameter 46 set-up	R-W	0.00 to 21.51	6.04	
11.02	Parameter 47 set-up	R-W	0.00 to 21.51	8.10	
11.03	Parameter 48 set-up	R-W	0.00 to 21.51	7.15	
11.04	Parameter 49 set-up	R-W	0.00 to 21.51	7.33	
11.05	Parameter 50 set-up	R-W	0.00 to 21.51	8.41	
11.06	Parameter 51 set-up	R-W	0.00 to 21.51	1.05	
11.07	Parameter 52 set-up	R-W	0.00 to 21.51	1.10	
11.08	Parameter 53 set-up	R-W	0.00 to 21.51	1.29	
11.09	Parameter 54 set-up	R-W	0.00 to 21.51	1.30	
11.10	Parameter 55 set-up	R-W	0.00 to 21.51	2.04	
11.11	Parameter 56 set-up	R-W	0.00 to 21.51	2.06	
11.12	Parameter 57 set-up	R-W	0.00 to 21.51	2.07	
11.13	Parameter 58 set-up	R-W	0.00 to 21.51	6.01	
11.14	Parameter 59 set-up	R-W	0.00 to 21.51	6.09	
11.15	Parameter 60 set-up	R-W	0.00 to 21.51	5.18	
11.16	Parameter 61 set-up	R-W	0.00 to 21.51	5.06	
11.17	Parameter 62 set-up	R-W	0.00 to 21.51	5.11	
11.18	Parameter 63 set-up	R-W	0.00 to 21.51	5.12	
11.19	Parameter 64 set-up	R-W	0.00 to 21.51	11.42	
11.20	Parameter 65 set-up	R-W	0.00 to 21.51	11.43	
11.21	Parameter scaling	R-W	0 to 9.999	1.000	
11.22	Unit displayed at power-up	R-W	0 to 5	0	
11.23	Serial address	R-W	0 to 247	1	
11.24	Serial mode	RO/P	0 or 1	-	-
11.25	Baud rate	R-W	0 to 9	6	
11.26	Min comms transmit delay	R-W	0 to 250 ms	2	
11.27	Modbus RTU frame format	R-W	0 to 3	0	
11.28	Not used				
11.29	Drive software version	RO/P	1.00 to 9.99	-	-
11.30	User security code	R-W	0 to 9999	0	
11.31	User drive mode	R-W	0 to 3	1	
11.32	Max. drive current rating	RO/P	1.5 to 75.0 A	-	-
11.33	Drive voltage rating	RO/P	200 to 480 V	-	-
11.34 to 11.40	Not used				
11.41	Status mode time-out	R-W	10 to 250 s	240 s	
11.42	Parameter cloning	R-W	0 to 3	0	
11.43	Factory settings	R-W/	0 to 2	0	
11.44	Quick setup menu access	R-W	0 to 2	0	
11.45	Motor parameter select	R-W	0 or 1	0	
11.46	Preset configuration select	R-W/P	0 to 13	PT version = 11 Other = 0	
11.47	Display duration in alternating mode	R-W	0 to 250 s	5 s	
11.48	Last preset configuration	RO	0 to 12	-	-
11.49	Parameter displayed at power-up	R-W	0.00 to 21.51	0.00	
11.50 to 11.58	Not used				
11.59	Drive variant	R-W	0 to 99	-	
11.60	Drive identification code	RO/P	0 to 32000	-	-
11.61	Advanced menu access code	R-W	0 to 9999	149	

Parameter	Name	Type	Adjustment range	Factory setting	User setting
11.62	Not used				
11.63	Timeout on RJ45	R-W	0 to 25.0 s	0	
11.64	Save parameters in EEPROM	R-W	0 or 1	0	
11.65	Menu of parameters to be saved in EEPROM	R-W	0 to 21	0	

13.2 - Menu 11 diagram

Menu 0 configuration

11.01	Parameter **46** set-up	11.11	Parameter **56** set-up
11.02	Parameter **47** set-up	11.12	Parameter **57** set-up
11.03	Parameter **48** set-up	11.13	Parameter **58** set-up
11.04	Parameter **49** set-up	11.14	Parameter **59** set-up
11.05	Parameter **50** set-up	11.15	Parameter **60** set-up
11.06	Parameter **51** set-up	11.16	Parameter **61** set-up
11.07	Parameter **52** set-up	11.17	Parameter **62** set-up
11.08	Parameter **53** set-up	11.18	Parameter **63** set-up
11.09	Parameter **54** set-up	11.19	Parameter **64** set-up
11.10	Parameter **55** set-up	11.20	Parameter **65** set-up

Drive configuration

11.29	Software version	11.33	Drive voltage rating
11.31	User drive mode	11.48	Last preset configuration
11.32	Drive current rating	11.59	Drive variant

Parameter setting

11.30	User security code
11.42	Parameter cloning
11.44	Parameter-setting level

Display

11.21	Customer unit
11.22	Unit displayed at power-up
11.41	Status mode time-out
11.47	Display duration in alternating mode
11.49	Parameter displayed at power-up

Serial link

11.23	Serial address
11.24	Serial mode
11.25	Baud rate
11.26	Minimum comms transmit delay
11.27	Modbus RTU frame format
11.63	"Timeout" on RJ45

Miscellaneous

11.43	Load defaults
11.45	Motor 2 parameters select
11.46	Preset configuration select
11.64	Save parameters in EEPROM
11.65	Menus of parameters to be saved in EEPROM

13.3 - Explanation of parameters in menu 11

11.01 to 11.20 **: Menu 0 set-up**
Adjustment range : 0.00 to 21.51
Factory setting : See table below.
These parameters are used, in order, to define parameters 46 to 65 in menu 0. These parameters are independent of the preset configuration.

Parameter	Default value	Menu 0 destination
11.01	6.04	46
11.02	8.10	47
11.03	7.15	48
11.04	7.33	49
11.05	8.41	50
11.06	1.05	51
11.07	1.10	52
11.08	1.29	53
11.09	1.30	54
11.10	2.04	55
11.11	2.06	56
11.12	2.07	57
11.13	6.01	58
11.14	6.09	59
11.15	5.18	60
11.16	5.06	61
11.17	5.11	62
11.18	5.12	63
11.19	11.42	64
11.20	11.43	65

11.21 **: Parameter scaling**
Adjustment range : 0 to 9.999
Factory setting : 1.00
This is a multiplication coefficient applied to the motor speed for expressing the speed in a unit defined by the user (see 5.34).
Example: To obtain a reading in m/min for an application where the product is moving 200 mm for each motor revolution ==> 11.21 = 0.2.

11.22 **: Unit displayed at power-up**
Adjustment range : 0 to 5
Factory setting : 0
0 (Speed) (Spd): On power-up, the speed is displayed. The unit depends on the setting of 5.34 **(frequency in Hz, speed in rpm or a unit defined by the user).**
1 (Load) (Load): On power-up, the load is displayed.
The unit displayed depends on the setting of 4.21 (motor load as a % or output current in A).
2 (Speed/Load) (SP.Ld): Displays the speed and the load alternately, or the current. The display time of each value can be configured in 11.47.
3 (USER) (USER): On power-up, the user parameter selected by 11.49 is displayed.
4 (Speed/User) (SP.US): On power-up, the speed and the user parameter selected by 11.49 are displayed alternately.
5 (Load/User) (Ld.US): On power-up, the load and the user parameter selected by 11.49 are displayed alternately.

11.23 **: Serial address**
Adjustment range : 0 to 247
Factory setting : 1
Used to define the drive address in the case of control or supervision via the serial link in Modbus RTU. Avoid values containing a zero as they are used to address groups of drives.

11.24 **: Serial mode**
Adjustment range : 0 or 1
Protocol used for communication via the serial link.
0 (LS NET) (LSnt): LS Net protocol.
1 (Modbus RTU) (rtu): Modbus RTU protocol.

11.25 **: Baud rate**
Adjustment range : 0 to 9
Factory setting : 6
Used to select the data transfer speed in Modbus RTU.

11.25	LCD display (kbaud)	LED display (baud)
0	0.3	300
1	0.6	600
2	1.2	1200
3	2.4	2400
4	4.8	4800
5	9.6	9600
6	**19.2**	**19200**
7	38.4	38400
8	57.6	57600
9	115.2	115200

Note: If the CT Comms cable is used, the baud rate is limited to 38400 baud.

11.26 **: Min comms transmit delay**
Adjustment range : 0 to 250 ms
Factory setting : 2 ms
As the serial link is 2-wire type, Rx is connected to Tx and Rx\ to Tx\. A communication fault may occur if the receiver responds to a request before the sender has had time to switch. Parameter 11.26 is used to introduce a time between reception and the data feedback. After transmitting a request, the drive requires 1.5 ms before receiving the next command. The adjustment is made in 2 ms intervals.

11.27 **: Modbus RTU frame format**
Adjustment range : 0 to 3
Factory setting : 0
0 (NONE,2STOP) (OP.2S): No parity, 2 stop bits
1 (NONE,1STOP) (OP.1S): No parity, 1 stop bit
2 (EVEN,STOP) (eP.1S): Even parity, 1 stop bit
3 (ODD,1STOP) (oP.1S): Odd parity, 1 stop bit

11.28 **: Not used**

11.29 **: Drive software version**
Adjustment range : 1.00 to 9.99
Indicates the drive software version.

11.30 : User security code
Adjustment range : 0 to 9999
Factory setting : 0
If this parameter is other than 0 and 11.44 is set to 2 (Loc), no parameter modification can take place. To modify a parameter, the user must enter a code equivalent to the value of 11.30.

11.31 User drive mode
Adjustment range : 0 to 3
Factory setting : 0
This parameter is used to select the control mode.
0 (OPEN LOOP) (oP.LP): The drive is controlled in open loop mode. The open loop control mode is defined by parameter 5.14**.**
1 (OPEN LOOP) (oP.LP): The drive is controlled in open loop mode. The open loop control mode is defined by parameter 5.14.
2 (CL LP Vector) (cL.LP): The drive controls an induction motor in closed loop flux vector control mode. The encoder type and control mode are defined by parameter 3.38.
3 (SERVO) (SruO): The drive controls a servo motor. The encoder type and control mode are defined by parameter 3.38.
The choice of operating mode can only be made when the drive is stopped.
Note: The change from open loop mode (11.31 = 0 or 1) to closed loop mode (11.31 = 2 or 3), or vice versa, causes a return to factory settings of parameters 12.45 Brake apply frequency or brake apply speed, and 12.46 magnetisation time delay/speed threshold.

11.32 : Drive current rating
Adjustment range : 1.5 to 75.0 A
This parameter indicates the drive rated current corresponding to the permitted total motor current.

11.33 : Drive voltage rating
Adjustment range : 200 to 480 V
This parameter indicates the drive rated voltage.

11.34 to **11.40 : Not used**

11.41 : Status mode time-out
Adjustment range : 10 to 250 s
Factory setting : 240 s
In parameter-setting mode, if there is no action on the keypad for the time set in 11.41, the display automatically returns to read mode. When the user returns to parameter-setting mode, the display is positioned on the last parameter accessed.

11.42 : Parameter cloning
Adjustment range : 0 to 3
Factory setting : 0
Disable the drive before cloning or transferring parameters using the XpressKey (open SDI terminal). Then, connect XPressKey to the drive's serial link.
0 (Disabled) (no): No action.
1 (Key to Drive) (rEad): When this parameter is stored at 1, the display alternates between "rEad" and "hEy?" ". Confirm the transfer of parameters into the drive by pressing the "Key" button. When the transfer is complete, the parameter reverts to 0. The rEad function can also be activated via the pushbutton located on the copy key. The first press on the button corresponds to parameter 11.42 changing to 1 and the second press confirms it. Press the button on the key within 10 seconds after selecting 1 in 11.42.
2 (Drive to Key) (Prog): When this parameter is stored at 2, the display alternates between "Prog" and "hEy?" ". Confirm the transfer of parameters into XPressKey by pressing the Key button on the XPressKey. When the transfer is complete, the parameter reverts to 0. Press the button on the Key within 10 seconds after selecting 2 in 11.42.
3 (Auto key mem) (Auto): Any modification of a parameter is automatically saved to the copy key. The action is confirmed at the time of storing (M key). No data is written to the copy key on a return to factory settings.
WARNING:
• The copy key contains parameters relating to the drive rating. If the parameters are copied into a drive with a different rating, the parameters relating to the drive and the motor characteristics will not be copied and the drive will go into alarm mode "C.rtg". If the user confirms the transfer by pressing the Key button on the XPressKey, the parameters are transferred into the drive, apart from the "motor" parameters (5.07**,** 5.08**,** 5.09**,** 4.13**,** 4.14**).**
• Do not transfer parameters with the XPressKey between two drives with different voltage/frequency ("T" drive to a "TL" or vice versa, and "TL-50Hz" drive to "TL-60Hz" and vice versa, for example).

11.43 : Factory settings
Adjustment range : 0 to 2
Factory setting : 0
WARNING:
Disable the drive before changing 11.43**.**
0 (DISABLED) (no): Return to factory settings is not performed.
1 (50Hz HIGH) (Eur): Configures the drive to factory settings for 50 Hz mains supply.
2 (60Hz HIGH) (USA): Configures the drive to factory settings for 60 Hz mains supply.

11.44 : Quick setup menu access
Adjustment range : 0 to 2
Factory setting : 0
This parameter determines the access level in menu 0, but only when the drive keypad is used.

11.44	LCD display	LED display	Access level
0	**Level 1**	**L1**	**Access to parameters** 01 **to** 10
1	Level 2	L2	Access to parameters 01 to 80
2	Read only	Loc	All parameters can be read, but none can be modified, unless a code the same as parameter 11.30 is entered at the time of accessing the parameter.

The locking procedure using a security code is described in section 4.3.6 of the installation and commissioning manual ref. 3840.

11.45 : Motor parameter select
Adjustment range : 0 or 1
Factory setting : 0
This parameter is used to select the set of parameters corresponding to the characteristics of motor 2.

11.45 **= 0 (Motor 1) (Mot1)**	11.45 **= 1 (Motor 2) (Mot2)**	**Description**
1.06	21.01	Maximum reference clamp
1.07	21.02	Minimum reference clamp
1.14	21.03	Reference selector
2.11	21.04	Acceleration ramp
2.21	21.05	Deceleration ramp
5.06	21.06	Rated frequency
5.07	21.07	Rated current
5.08	21.08	Rated speed
5.09	21.09	Rated voltage
5.10	21.10	Rated power factor (cos φ)
5.11	21.11	Number of motor poles
5.17	21.12	Stator resistance
5.23	21.13	Voltage offset
5.24	21.14	Transient inductance
-	21.15	Motor 2 parameters active
5.25	21.24	Stator inductance (Ls)
5.33	21.30	Motor volts per 1000 rpm (Ke)
5.51	21.51	q axis inductance

WARNING:
• Switching from one set of motor parameters to the other is performed with the drive disabled.
• When the parameter set for motor 2 is selected, all punctuation marks on the display are lit except for the comma.

11.46 : Selection of preset configuration

Adjustment range : 0 to 13
Factory setting : PT version = 11
other = 0

Used to select a configuration which automatically assigns the I/O and defines parameters 11 to 24 of menu 0.
Note: Modifications to 11.46 must be made with the drive disabled.
11.46 is stored permanently. If one of the relevant parameters is modified by the user after automatic configuration, 11.46 automatically switches to mode 13 (OPEn).

Menu 0	Preset configurations													
	0 (A1.A2)	1 (A1.Pr)	2 (A2.Pr)	3 (4Pr)	4 (8Pr)	5 (E.Pot)	6 (Torq)	7 (Pid)	8 (PUMP)	9 (ACtP)	10 (HoiS)	11 (Pad)	12 (HuAC)	13 (OPEn)
11	7.06	7.06	7.06	1.21	1.21	7.06	7.06	7.06	7.06	-	-	1.51	-	-
12	7.11	1.22	1.22	1.22	1.22	9.28	7.11	7.11	7.11	-	1.22	1.21	7.11	-
13	-	1.23	1.23	1.23	1.23	9.21	-	14.10	14.10	-	-	6.11	-	-
14	-	1.24	1.24	1.24	1.24	9.22	-	14.11	14.11	-	-	6.12	-	-
15	-	-	-	-	1.25	9.23	-	14.12	14.56	-	-	6.13	-	-
16	-	-	-	-	1.26	9.24	-	14.13	12.04	-	-	-	-	-
17	-	-	-	-	1.27	9.03	-	14.14	16.05	-	-	-	-	-
18	-	-	-	-	1.28	-	-	14.15	14.51	-	-	-	-	-
19	-	-	-	-	-	-	7.12	7.12	14.53	-	-	-	-	-
20	-	-	-	-	-	-	-	7.16	14.54	-	-	-	-	-
21	-	-	-	-	-	-	-	14.20	14.55	-	-	-	-	-
22	-	-	-	-	-	-	-	14.21	5.04	-	-	-	-	-
23	-	-	-	-	-	-	-	14.19	16.38	-	-	-	-	-
24	-	-	-	-	-	-	-	14.01	16.28	-	-	-	-	-

0 (0-10V/4-20mA) (A1.A2) : A current reference input and a voltage reference input selectable via digital input.
1 (0-10V/3Pr) (A1.Pr) : One voltage reference input and 3 preset references, selectable via 2 digital inputs.
2 (4-20mA/3Pr) (A1.Pr) : One current reference input and 3 preset references, selectable via 2 digital inputs.
3 (4 Preset ref) (4Pr) : 4 preset references, selectable via 2 logic inputs.
4 (8 Preset ref) (8Pr) : 8 preset references, selectable via 3 logic inputs.
5 (Motorised pot.) (E.Pot) : Motorised potentiometer (up, down).
6 (Torque ctrl) (Torq) : Speed or torque control with speed limiting.
7 (PID CTRL) (Pid) : PID control.
8 (Pumps&Vent.) (PUMP) : Pump regulation.
9 (ANALOG/PTC (ACtP) : A voltage or current reference and a PTC sensor input.
10 (HOIST CONTROL) (HoiS): control of travelling crane.
11 (KEYPAD CTRL) (Pad) : Local control via the keypad.
12 (AUTO/MANUAL) (HuAC): Auto/manual mode.
13 (Open) (OPEn) : No configuration, parameter-setting mode is open.

Note: Modification of certain parameters in menu 0 automatically causes 11.46 to change to "OPEn" (open parameter setting). This may result in modification of the wiring diagram for the selected preset configuration.

11.47 : Display duration in alternating mode

Adjustment range : 0 to 250 s
Factory setting : 5 s
In alternating display mode, 11.22 = 2, used to define for how long each value is displayed.

11.48 : Last preset configuration

Adjustment range : 0 to 12
0 (0-10V/4-20mA) (A1.A2)
1 (0-10V/3Pr) (A1.Pr)
2 (4-20mA/3Pr) (A2.Pr)
3 (4 Preset ref) (4Pr)
4 (8 Preset ref) (8Pr)
5 (Motorised pot.) (E.Pot)
6 (Torque ctrl) (Torq)
7 (PID CTRL) (Pid)
8 (Pumps&Vent.) (PUMP)
9 (ANALOG/PTC (ACtP)
10 (HOIST CONTROL) (HoiS)
11 (KEYPAD CTRL) (Pad)
12 (AUTO/MANUAL) (HuAC)
This parameter stores and indicates the last preset configuration selected by 11.46. Value 13 (OPEn) is not taken into account.

11.49 : Parameter displayed at power-up

Adjustment range : 0.00 to 21.51
Factory setting : 0.00
This parameter is used to select the parameter to be displayed at power-up (see 11.22).

11.50 to 11.58 : Not used

11.59 : Drive variant
Adjustment range : 0 to 99
Indication of the drive type.
0 (Display) (N): Drive with display only. Parameters can be set only via the LCD keypad or a PC.
1 (Local control) (CP): Drive fitted with local controls (1 FWD key (), 1 REV key (), 1 Stop key () and 1 potentiometer). The parameters are set as described above.
2 (6 keys) (SEt): Drive fitted with 6 keys (1 FWD key (), 1 REV key (), 1 Stop key () one () key, 1 () key and one Mode key ()). The user menu parameters can be set using the , and keys. Advanced parameters can be accessed via the LCD keypad or PC.
3 to 99: Reserved.
WARNING:
After modifying this parameter, return to factory settings (see 11.43).

11.60 : Drive identification code
Adjustment range : 0 to 32000
This product code gives information on the drive rating, size, hardware version and variant.
When the nameplate is not visible, this code can be given to your CONTROL TECHNIQUES contact.

11.61 : Advanced menu access code
Adjustment range : 0 to 9999
Factory setting : 149
This parameter is used to limit access to menus 1 to 21 when setting the parameters via the LCD keypad.
If this parameter does not equal 0, the value of parameter 11.61 should be entered to enable switching from Menu 0 to Menu 1.
In factory settings mode, simply enter the value 149 to access all menus.

11.62 : Not used

11.63 : Timeout on RJ45
Adjustment range : 0 to 25.0 s
Factory setting : 0
Used to generate the "SCL" trip if no communication has taken place within the time period set by this parameter.
The value 0 deactivates monitoring of the communication on the drive's RJ45 connector.

11.64 : Save parameters in EEPROM
Adjustment range : 0 or 1
Factory setting : 0
0 (No) (OFF)
1 (Yes) (On)
This parameter is used to store in EEPROM the values of drive parameters that have been changed via the fieldbus.
- Select the menu(s) to be saved using 11.65 (set 11.65 = 0 to save all the menus).
- Confirm the save using 11.64 = 1 (On).
- Saving completed is indicated by 11.64 reverting to 0 (OFF).

11.65 : Menus of parameters to be saved in EEPROM
Adjustment range : 0 to 21
Factory setting : 0
This parameter is used to select the menu(s) to be saved. Set 11.65 = 0 to save all the menus (see 11.64).

14 - MENU 12: THRESHOLD DETECTORS, VARIABLE SELECTORS AND BRAKE CONTROL FUNCTION

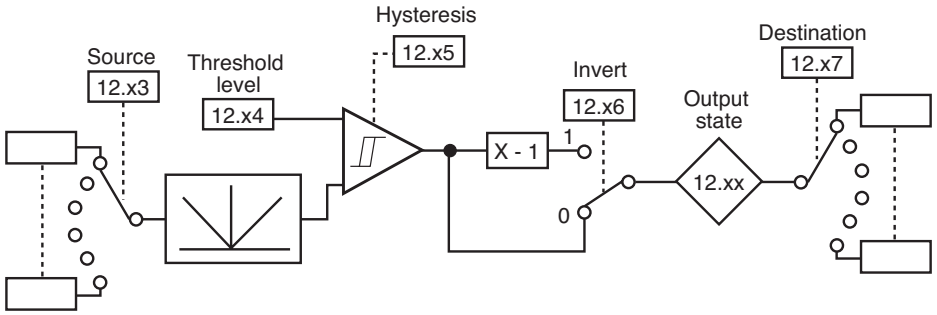
14.1 - List of parameters in Menu 12

Parameter	Name		Type	Adjustment range	Factory setting	User setting
12.01 - 12.02 12.61 - 12.71	Comparator 1 to 4 output		RO	0 or 1	-	-
12.03 - 12.23 12.63 - 12.73	Comparator 1 to 4 source		R-W/P	0.00 to 21.51	0.00	
12.04 - 12.24 12.64 - 12.74	Comparator 1 to 4 level		R-W	0 to 100.0%	0	
12.05 - 12.25 12.65 - 12.75	Comparator 1 to 4 hysteresis		R-W	0 to 25.0%	0	
12.06 - 12.26 12.66 - 12.76	Comparator 1 to 4 output invert		R-W	0 or 1	0	
12.07 - 12.27 12.67 - 12.77	Comparator 1 to 4 destination		R-W/P	0.00 to 21.51	0.00	
12.08 - 12.28	Function 1 and 2 variable 1 source		R-W/P	0.00 to 21.51	0.00	
12.09 - 12.29	Function 1 and 2 variable 2 source		R-W/P	0.00 to 21.51	0.00	
12.10 - 12.30	Function block 1 and 2 select		R-W	0 to 9	0	
12.11- 12.31	Function 1 and 2 output destination		R-W/P	0.00 to 21.51	0.00	
12.12- 12.32	Function block 1 and 2 output		RO/P	± 100.00%	-	-
12.13- 12.33	Function 1 and 2 variable 1 scale		R-W	± 4,000	1,000	
12.14- 12.34	Function 1 and 2 variable 2 scale		R-W	± 4,000	1,000	
12.15- 12.35	Function 1 and 2 associated parameter		R-W	0 to 100.00	0	
12.16 to 12.22	Not used					
12.36 to 12.39	Not used					
12.40	Brake release		RO	0 or 1	-	
12.41	Brake controller		R-W	0 to 3	0	
12.42	Upper current threshold		R-W	0 to 200%	10 %	
12.43	Lower current threshold		R-W	0 to 200%	10 %	
12.44	Brake release frequency		R-W	0 to 20.0 Hz	1.0 Hz	
12.45	Brake apply frequency	◧	R-W	0 to 20.0 Hz	2.0 Hz	
	Brake apply speed	◧	R-W	0 to 100 rpm	5 rpm	
12.46	Pre-brake release delay	◧	R-W	0 to 25.00 s	0.10 s ◧	
	Brake apply delay	◧	R-W		0.30 s ◧	
12.47	Post-brake release delay		R-W	0 to 25.00 s	0.10 s	
12.48	Brake apply delay	◧	R-W	0 to 25.00 s	1.00 s	
12.49	Position controller during brake release	◧	R-W	0 or 1	0	
12.50	Not used					
12.51	Forced brake release		R-W	0 or 1	0	

: Function not available.

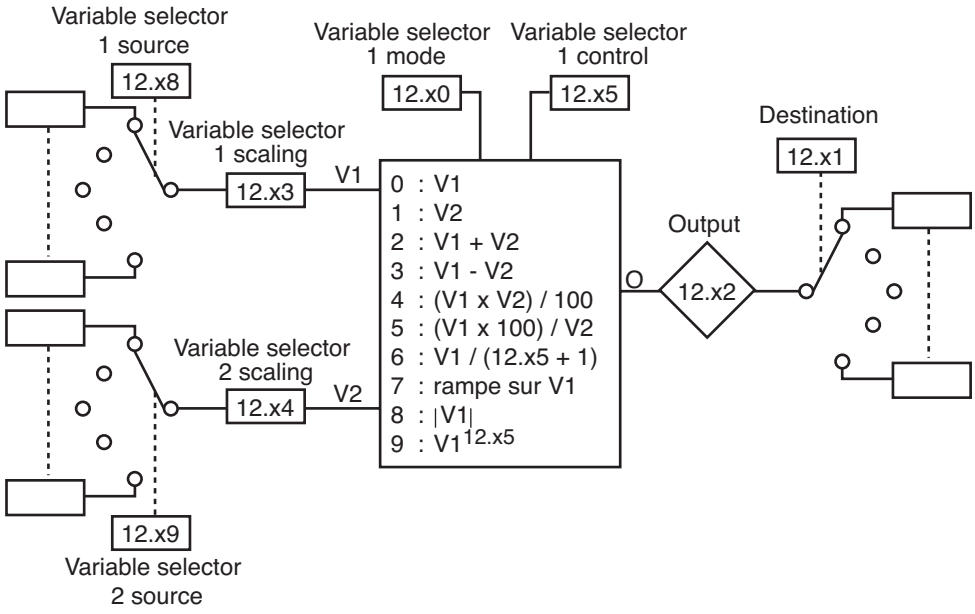
14.2 - Menu 12 diagrams

14.2.1 - Comparators



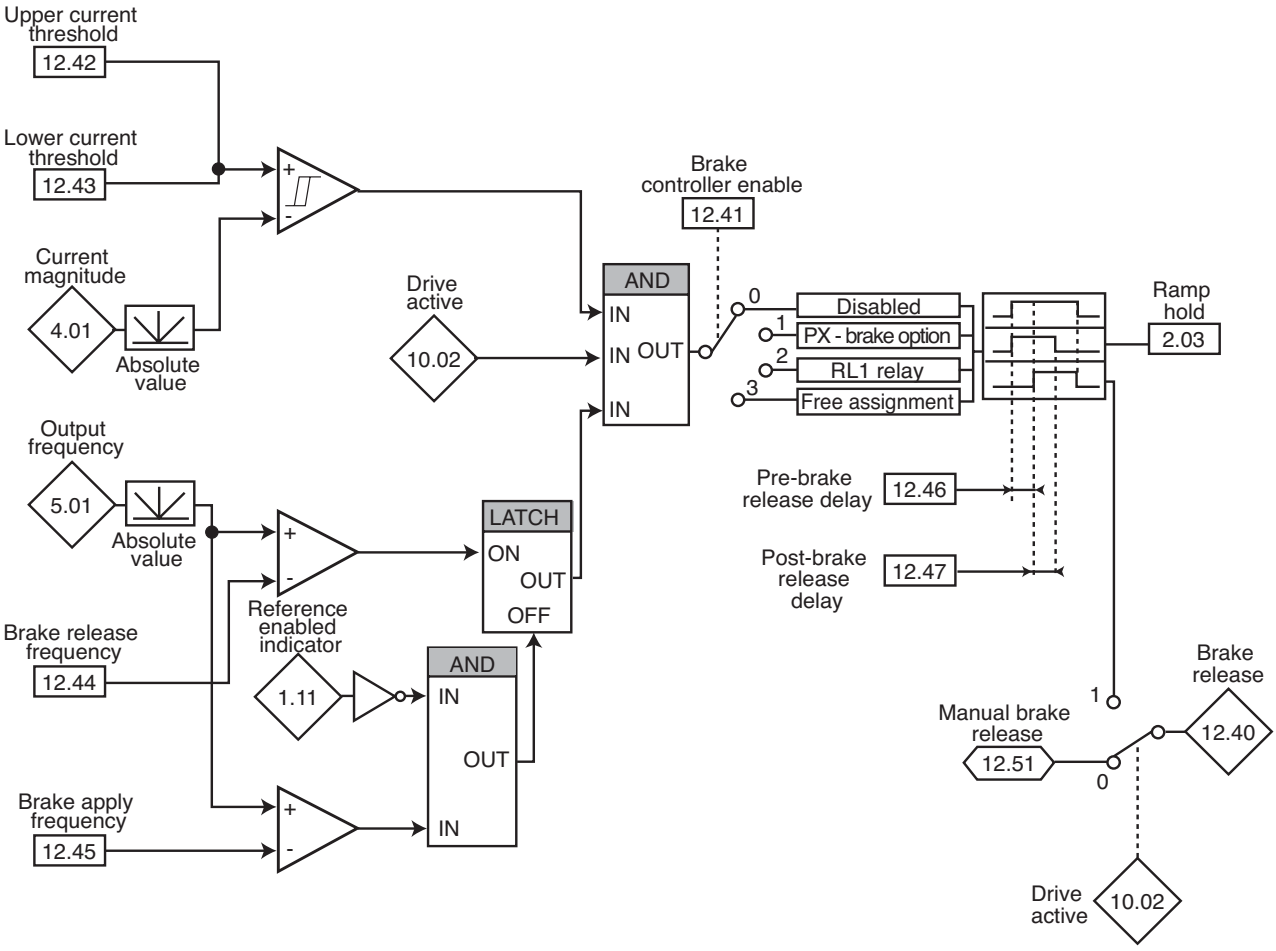
	Source	Threshold level	Hysteresis	Output state	Invert	Destination
Comparator 1	12.03	12.04	12.05	12.01	12.06	12.07
Comparator 2	12.23	12.24	12.25	12.02	12.26	12.27
Comparator 3	12.63	12.64	12.65	12.61	12.66	12.67
Comparator 4	12.73	12.74	12.75	12.71	12.76	12.77

14.2.2 - Processing of internal variables

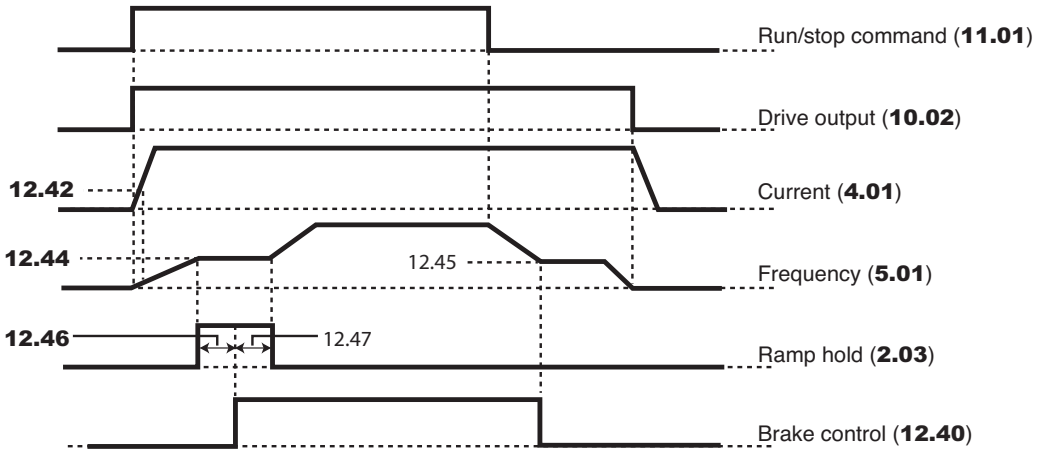


	Variable 1 source	Variable 1 scaling	Variable 2 source	Variable 2 scaling	Function selection	Associated parameter	Output destination	Output
Block 1	12.08	12.13	12.09	12.14	12.10	12.15	12.11	12.12
Block 2	12.28	12.33	12.29	12.34	12.30	12.35	12.31	12.32

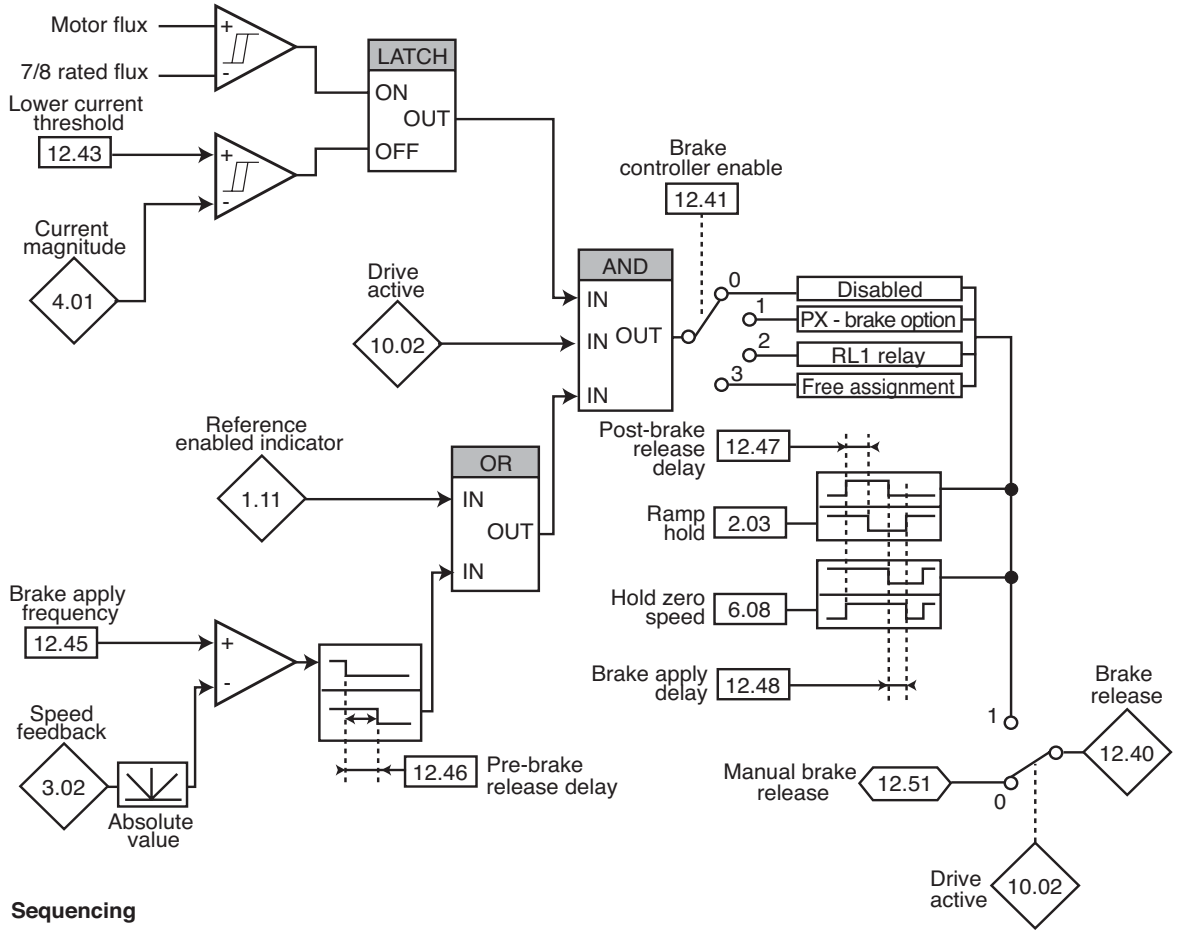
14.2.3 - Brake control in open loop mode



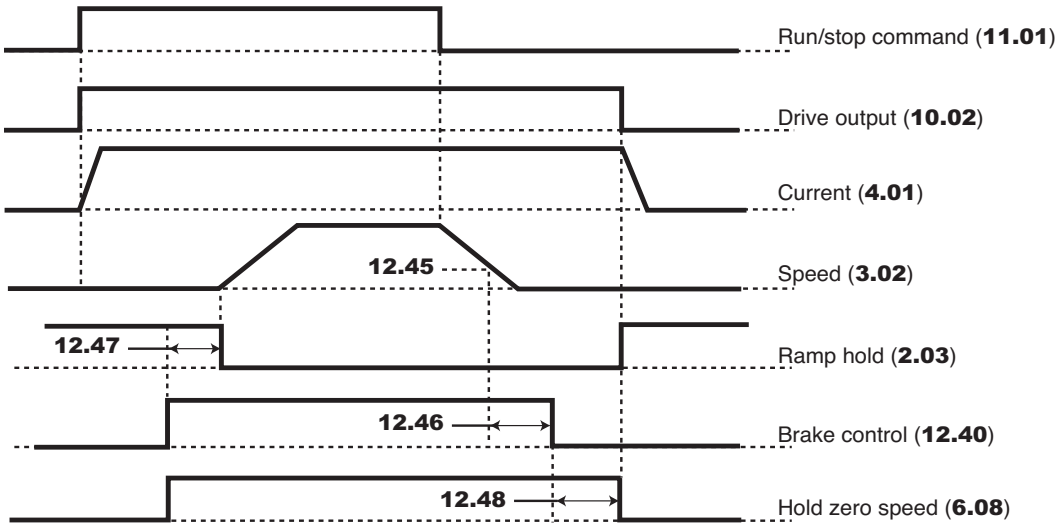
Sequencing



14.2.4 - Brake control in closed loop mode



Sequencing



14.3 - Explanation of parameters in menu 12

12.01 **: Comparator 1 output**

12.02 **: Comparator 2 output**

12.61 **: Comparator 3 output**

12.71 **: Comparator 4 output**

Adjustment range : 0 or 1
0 (Disabled) (OFF): The input variable is less than or equal to the comparator threshold.
1 (Enabled) (On): The input variable is greater than the comparator threshold.

12.03 **: Comparator 1 source**

12.23 **: Comparator 2 source**

12.63 **: Comparator 3 source**

12.73 **: Comparator 4 source**
Adjustment range : 0.00 to 21.51
Factory setting : 0.00
These parameters define the variable which is to be compared to the configured threshold.
The absolute value of the variable is taken into account. Only non-bit parameters can be programmed as the source.
If an unsuitable parameter is programmed, the input value is taken to equal 0.

12.04 **: Comparator 1 threshold**

12.24 **: Comparator 2 threshold**

12.64 **: Comparator 3 threshold**

12.74 **: Comparator 4 threshold**
Adjustment range : 0 to 100.0%
Factory setting : 0
These parameters are used to set the comparator trip threshold.
The threshold is expressed as a percentage of the maximum value of the compared variable.

12.05 **: Comparator 1 hysteresis**

12.25 **: Comparator 2 hysteresis**

12.65 **: Comparator 3 hysteresis**

12.75 **: Comparator 4 hysteresis**
Adjustment range : 0 to 25.0%
Factory setting : 0
These parameters define the window within which the comparator output will not change state.
The output will change to 1 when the variable reaches the threshold value + (hysteresis /2).
The output will change to 0 when the variable drops below the threshold value - (hysteresis /2).
The hysteresis is expressed as a percentage of the maximum value of the compared variable.

12.06 **: Comparator 1 output invert**

12.26 **: Comparator 2 output invert**

12.66 **: Comparator 3 output invert**

12.76 **: Comparator 4 output invert**
Adjustment range : 0 or 1
Factory setting : 0
These parameters are used to invert the comparator output.
0 (Disabled) (OFF): Output not inverted.
1 (Enabled) (On): Output inverted.

12.07 **: Comparator 1 output destination**

12.27 **: Comparator 2 output destination**

12.67 **: Comparator 3 output destination**

12.77 **: Comparator 4 output destination**
Adjustment range : 0.00 to 21.51
Factory setting : 0.00
These parameters define the internal parameter which will be assigned by the comparator output.
Only bit type parameters can be programmed.
If an unsuitable parameter is programmed, the output is not sent to any address.

12.08 **: Function 1 variable 1 source**

12.28 **: Function 2 variable 1 source**
Adjustment range : 0.00 to 21.51
Factory setting : 0.00
These parameters define the source parameter for variable 1 to be processed.
Only "numerical" parameters (read-only) can be assigned.
If an unsuitable parameter is selected, the value of the variable will be 0.

12.09 : Function 1 variable 2 source

12.29 : Function 2 variable 2 source
Adjustment range : 0.00 to 21.51
Factory setting : 0.00
These parameters define the source parameter for variable 2 to be processed.
Any "numerical" parameter (read-only) can be assigned.
If an unsuitable parameter is selected, the value of the variable will be 0.

12.10 : Function block 1 select

12.30 : Function block 2 select
Adjustment range : 0 to 9
Factory setting : 0
These parameters are used to define the function of the internal variables processing block.

	LCD	LED	Comment
0	**O=V1**	**In1**	**Used to transfer an internal variable**
1	O=V2	In2	Used to transfer an internal variable
2	O=V1+V2	IP2	Addition of 2 variables
3	O=V1-V2	I-2	Subtraction of 2 variables
4	O=V1xV2/100	IM2	Multiplication of 2 variables
5	O=V1/V2x100	Id2	Division of 2 variables: O=(V1x100)/V2
6	O=filter/V1	Filt	Creation of a first-order filter: O=V1/(12.x5 +1)
7	O= ramp/V1	raMP	Creation of a linear ramp. 12.x5 is used to adjust the value of the ramp
8	O=abs(V1)	abso	Absolute value
9	O=V1^(12.x5)	Puur	V1 to the power 12.x5 : $O=V1^{12.x5}$

• If 12.10 or 12.30 equals 2, 3, 4 or 5:
When the result of the calculation is greater than 32767, the output 12.11 or 12.31 is limited to 32767.
When the result of the calculation is less than -32768, the output 12.11 or 12.31 is limited to -32768.
• If 12.10 or 12.30 equals 5:
To avoid a calculation error if V2 = 0, the result of the operation will be 0.
• If 12.10 or 12.30 equals 7:
The ramp time defined by 12.15 or 12.35 corresponds to the time for changing from 0 to 100% of the maximum value of the source parameter.
• If 12.10 or 12.30 equals 9:
To avoid a calculation error, it is the absolute value of the signal V1 which is taken into account before calculating its square root or cube root.

12.11 : Function 1 output destination

12.31 : Function 2 output destination
Adjustment range : 0.00 to 21.51
Factory setting : 0.00
These parameters are used to select the destination of the processed variable.
Any unprotected "non-bit" parameter can be assigned.
If an unsuitable parameter is selected, the value of the variable taken into account is zero.

12.12 : Function block 1 output

12.32 : Function block 2 output

Adjustment range : ± 100.00%
Indicates the value of the function output as a percentage of the adjustment range for the destination parameter.
Note: When 12.11 or 12.31 is assigned to 0.00, the adjustment range for 12.12 or 12.32 is ± 32000.

12.13 : Function 1 variable 1 scale

12.33 : Function 2 variable 1 scale
Adjustment range : ± 4.000
Factory setting : 1.000
Used to scale variable 1 before processing.
WARNING:
The value at the scaling output can only be between -32767 and +32767. Take this into account according to the adjustment range of the source parameter.

12.14 : Function 1 variable 2 scale

12.34 : Function 2 variable 2 scale
Adjustment range : ± 4.000
Factory setting : 1.000
Used to scale variable 2 before processing.
WARNING:
The value at the scaling output can only be between -32767 and +32767. Take this into account according to the adjustment range of the source parameter.

12.15 : Function 1 associated parameter

12.35 : Function 2 associated parameter
Adjustment range : 0 to 100.00
Factory setting : 0
Depending on its function, the internal variables processing block may need an associated parameter.
If the block is used to implement a first-order filter, the associated parameter is used as a coefficient; if it is used to generate a ramp, this parameter is used to adjust the value of the ramp (in seconds). The ramp time corresponds to the time for changing from 0 to 100% of the maximum value of the source parameter.
If the block is used as power, this parameter is used as follows:

Function	Associated parameter value
$V1^2$	2.00
$V1^3$	3.00
$\sqrt{V1}$	12.00
$\sqrt[3]{V1}$	13.00

12.16 to 12.22 **: Not used**

12.36 to 12.39 **: Not used**

12.40 **: Brake release**

Adjustment range : 0 or 1
Indicates the state of the brake control output.
0 (Disabled) (OFF): The brake is applied.
1 (Enabled) (On): The brake is released.

12.41 **: Brake controller**

Adjustment range : 0 to 3
Factory setting : 0
Used to enable brake control and to select to which digital output it will be assigned.
0 (Disabled) (dis): Brake control is not enabled.
1 (On contactor) (COnt): Brake control is enabled and directed towards the integrated brake contactor option.
2 (On relay) (rEl): Brake control is enabled and directed towards the relay. In this case, the "drive healthy" indication is rerouted to digital output DIO1 (8.27 = 12.40 and 8.21 = 10.01).
3 (User select) (USEr): Brake control is enabled. The output is not assigned automatically; it is up to the user to select the destination for parameter 12.40.
WARNING: The safety function overrides brake control. If 8.10 = 1 then 12.41 = 2, brake control is enabled, but the relay remains assigned to 10.01 "Drive healthy" and 12.41 changes to 3 "User select". Consequently, disable the safety function by 8.10 = 0 before setting 12.41= 2.

12.42 **: Upper current threshold**

Adjustment range : 0 to 200%
Factory setting : 10%
Used to set the current threshold at which the brake will be controlled. This current level should provide sufficient torque at the time the brake is released.

12.43 **: Lower current threshold**

Adjustment range : 0 to 200%
Factory setting : 10 %
Used to set the current threshold below which brake control will be disabled (brake engaged). It should be set so that loss of the motor power supply is detected.

12.44 **: Brake release frequency**

Adjustment range : 0 to 20.0 Hz
Factory setting : 1.0 Hz
Used to set the frequency threshold at which the brake will be controlled. This frequency level should ensure sufficient torque is provided to drive the load in the right direction when the brake is released. This threshold is usually set at a value slightly above the frequency corresponding to the motor slip at full load.
Example: - 1500 rpm = 50 Hz
- Rated on-load speed = 1470 rpm
- Slip = 1500 - 1470 = 30 rpm
- Slip frequency = 30/1500 x 50 = 1 Hz

12.45 **: Brake apply frequency or speed threshold**

Adjustment range : 0 to 20.0 Hz, 0 to 100 rpm
Factory setting : 2.0 Hz, 5 rpm
Used to set the frequency or speed threshold at which brake control will be disabled. This threshold enables the brake to be applied before zero speed so as to avoid load veering while the brake is being engaged.
If the frequency or speed drops below this threshold when no stop request has been made (change of direction of rotation), brake control will remain activated. This exception can be used to avoid the brake being applied as the motor passes through zero speed.

12.46 **: Pre-brake release delay ( ) Brake apply delay ( )**

Adjustment range : 0 to 25.00 s
Factory setting : 0.10 s and 0.30 s
: This time delay is triggered when all the conditions for brake release have been met. It allows enough time to establish an adequate level of reactive current in the motor and to ensure that the slip compensation function is fully activated. When this time delay has elapsed, brake control is enabled (12.40 = 1).
For the full duration of this time delay, the ramp applied to the reference is held constant (2.03 = 1).

: This time delay is used to delay the brake apply command in relation to the passage below the minimum speed threshold (12.45). It is useful for avoiding repeated oscillation of the brake when it is being applied around zero speed.

12.47 **: Post-brake release delay**

Adjustment range : 0 to 25.00 s
Factory setting : 0.10 s
This time delay is triggered when brake control is enabled. It is used to allow time for the brake to release before unlocking the ramp (2.03 = 0).

12.48 **: Brake apply delay**

Adjustment range : 0 to 25.00 s
Factory setting : 0
This time delay is used to maintain the torque at standstill (6.08 = 1) while the brake is applied. When this time delay has elapsed, the drive output is deactivated.

12.49 **: Position controller during brake release ( )**

Adjustment range : 0 or 1
Factory setting : 0
0 (Disabled) (OFF): The ramp is held when the drive output is not active, until the post-brake release delay (12.47) has expired. This allows the speed reference to remain at 0 until the brake is released.
1 (Enabled) (On): Position controller enabled while the ramp is held. This function avoids the load moving during the brake release phase.
Function not available.

12.50 **: Not used**

12.51 **: Forced brake release**

Adjustment range : 0 or 1
Factory setting : 0
0 (Disabled) (OFF)
1 (Enabled) (On)
When the drive output is active (10.02 = 1), the brake control output 12.40 is enabled when the release conditions determined by the brake control are met. When the drive output is inactive, the brake control output 12.40 is forced to 1 if 12.51 is at 1.

Notes

15 - MENU 13: RESERVED

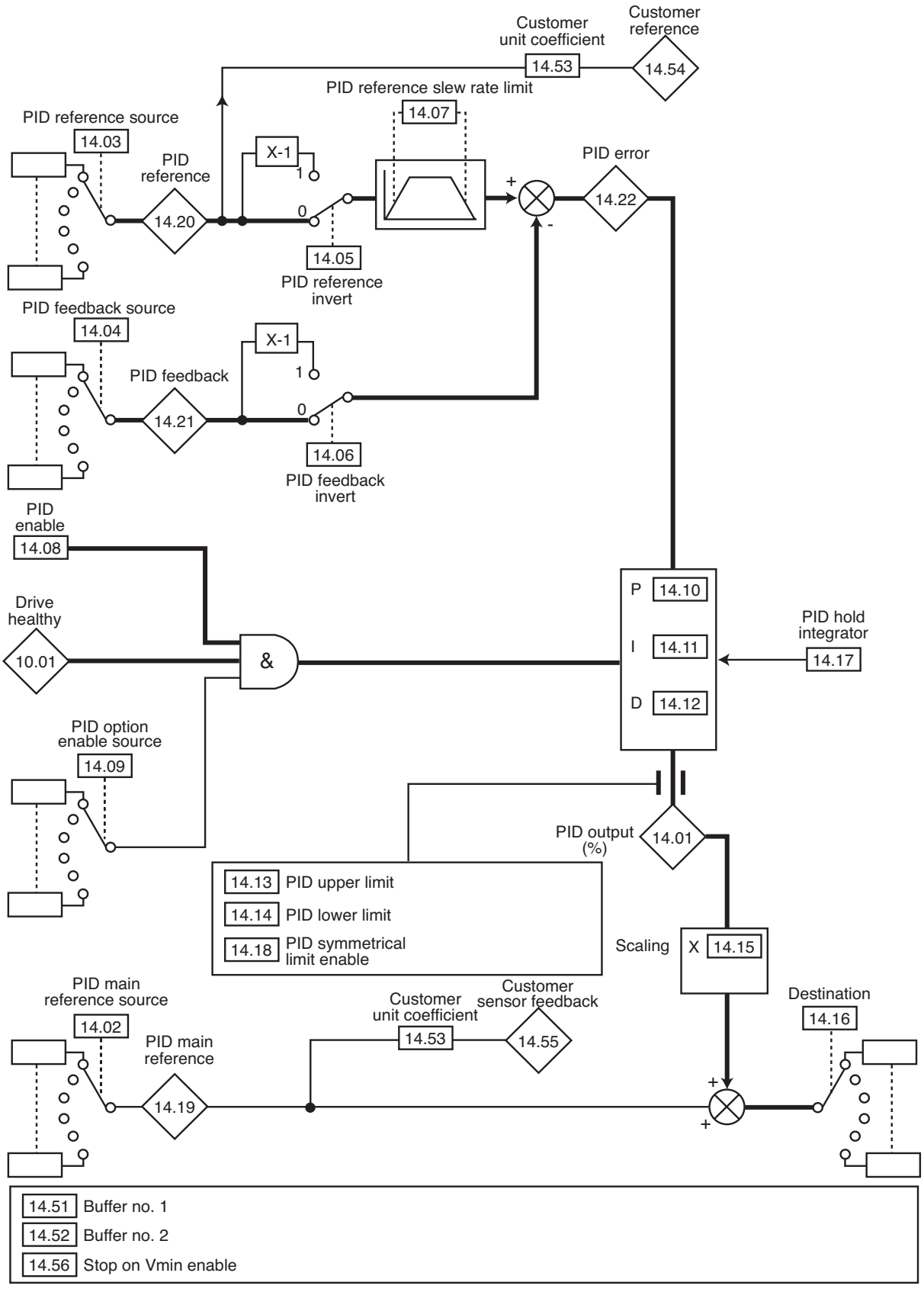
Notes

16 - MENU 14: PID CONTROLLER

16.1 - List of parameters in Menu 14

Parameter	Name	Type	Adjustment range	Factory setting	User setting
14.01	PID output	RO/P	± 100.0%	-	-
14.02	PID main reference source	R-W/P	0.00 to 21.51	0.00	
14.03	PID reference source	R-W/P	0.00 to 21.51	0.00	
14.04	PID feedback source	R-W/P	0.00 to 21.51	0.00	
14.05	PID reference invert	R-W	0 or 1	0	
14.06	PID feedback invert	R-W	0 or 1	0	
14.07	PID reference slew rate limit	R-W	0 to 600.0 s	0	
14.08	PID enable	R-W	0 or 1	0	
14.09	PID option enable source	R-W/P	0.00 to 21.51	10.01	
14.10	PID proportional gain	R-W	0 to 320.00	10,00	
14.11	PID integral gain	R-W	0 to 320.00	5,00	
14.12	PID derivative gain	R-W	0 to 2.50	0	
14.13	PID upper limit	R-W	0 to 100.0%	100.0%	
14.14	PID lower limit	R-W	± 100.0%	-100.0%	
14.15	PID output scaling	R-W	0 to 2.50	1.00	
14.16	PID output destination	R-W/P	0.00 to 21.51	0.00	
14.17	PID hold integrator	R-W	0 or 1	0	
14.18	PID symmetrical limit enable	R-W	0 or 1	0	
14.19	PID main reference	RO/P	± 100.0%	-	-
14.20	PID reference	RO/P	± 100.0%	-	-
14.21	PID feedback	RO/P	± 100.0%	-	-
14.22	PID error	RO/P	± 100.0%	-	-
14.23 to 14.50	Not used				
14.51	Buffer no. 1	R-W	±100.0%	0	
14.52	Buffer no. 2	R-W	±100.0%	0	
14.53	Customer unit coefficient	R-W	0 to 30	1	
14.54	Customer reference value	RO/P	±32000	-	-
14.55	Customer feedback value	RO/P	±32000	-	-
14.56	Stop on Vmin enable	R-W	0 or 1	0	

16.2 - Menu 14 diagram



16.3 - Explanation of parameters in menu 14

14.01 **: PID output**

Adjustment range : ± 100.0%
This parameter indicates the level of the PID controller output before scaling.

14.02 **: PID main reference source**
Adjustment range : 0.00 to 21.51
Factory setting : 0.00
This parameter defines the variable which acts as the main reference for the PID controller.
Only non-bit parameters can be programmed as the source.
If an unsuitable parameter is programmed, the input value is taken to equal 0.
All PID variables are automatically scaled so that these variables have an adjustment range of ±100.0% or 0 to 100.0% if they are unipolar.

14.03 **: PID reference source**
Adjustment range : 0.00 to 21.51
Factory setting : 0.00
This parameter defines the variable which acts as a reference for the PID controller.
Only non-bit parameters can be programmed as the source.
If an unsuitable parameter is programmed, the input value is taken to equal 0.
All PID variables are automatically scaled so that these variables have an adjustment range of ±100.0% or 0 to 100.0% if they are unipolar.

14.04 **: PID feedback source**
Adjustment range : 0.00 to 21.51
Factory setting : 0.00
This parameter defines the variable which acts as the feedback for the PID controller.
Only non-bit parameters can be programmed as the source.
If an unsuitable parameter is programmed, the input value is taken to equal 0.
All PID variables are automatically scaled so that these variables have an adjustment range of ±100.0% or 0 to 100.0% if they are unipolar.

14.05 and 14.06 : **PID invert**
Adjustment range : 0 or 1
Factory setting : 0
0 (Disabled) (OFF): Input not inverted.
1 (Enabled) (On): Input inverted.
These parameters are used to invert the sign of the PID reference and feedback (14.05: PID reference invert, 14.06 : PID feedback invert).

14.07 **: PID reference slew rate limit**
Adjustment range : 0 to 600.0 s
Factory setting : 0
This parameter defines the time taken for the PID reference to go from 0 to 100.0% after an abrupt variation of the input from 0 to 100%. A variation of -100.0% to +100.0% will take twice as long.

14.08 **: PID enable**
Adjustment range : 0 or 1
Factory setting : 0
0 (Disabled) (OFF): The PID controller is disabled.
1 (Enabled) (On): The PID controller is enabled.
WARNING:
Should the values of 14.10**,** 14.11 **and** 14.12 **be modified, set** 14.08 **to 0 first and then back to 1 so that this change is taken into account by the drive.**

14.09 **: PID option enable source**

Adjustment range : 0.00 to 21.51
Factory setting : 10.01
This parameter is used to enable the PID controller on a condition in addition to 14.08.
For the PID controller to be enabled, 14.08, 10.01 and the additional condition must be at 1.
Only bit parameters can be assigned.
If an unsuitable parameter is chosen, the input will automatically take the value 1 to avoid locking the enable output.
Note: Parameter 00.00 does not lock the enable output.

14.10 **: PID proportional gain**
Adjustment range : 0 to 320.00
Factory setting : 10.00
This is the proportional gain applied to the PID error.
After modifying this parameter, refer to 14.08.
Note: The gain values configured for a V2.20 drive must not be kept for a V3.10 drive (the adjustment range is completely different for these 2 software versions).

14.11 **: PID integral gain**
Adjustment range : 0 to 320.00
Factory setting : 5.00
This is the gain applied to the PID error before integration.
After modifying this parameter, refer to 14.08.
Note: The gain values configured for a V2.20 drive must not be kept for a V3.10 drive (the adjustment range is completely different for these 2 software versions).

14.12 **: PID derivative gain**
Adjustment range : 0 to 2.50
Factory setting : 0
This is the gain applied to the PID error before derivation.
After modifying this parameter, refer to 14.08.

14.13 **: PID upper limit**
Adjustment range : 0 to 100.0%
Factory setting : 100.0%
This parameter is used to limit the maximum value of the PID output (see 14.18).

14.14 **: PID lower limit**
Adjustment range : ± 100.0%
Factory setting : -100.0%
This parameter is used to limit the maximum negative value or the minimum positive value of the PID output.
This parameter is inactive if 14.18 = 1 (see 14.18).

14.15 : PID output scaling
Adjustment range : 0 to 2.50
Factory setting : 1.00
This parameter is used to scale the PID output before it is added to the main reference.
The sum of both references is automatically scaled according to the adjustment range of the parameter to which it is addressed.

14.16 : PID output destination
Adjustment range : 0.00 to 21.51
Factory setting : 0.00
Used to define to which parameter the PID output is addressed.
Only unprotected non-bit parameters can be assigned.
If an unsuitable parameter is assigned, the output will not be sent to any address.
If the PID output is supposed to affect the speed, it is advisable to address it to a preset reference.

14.17 : PID hold integrator
Adjustment range : 0 or 1
Factory setting : 0
0 (Disabled) (OFF): Integration is carried out normally when the PID loop is activated.
1 (Enabled) (On): The value of the integrator is frozen and remains at this value until 14.17 goes back to 0.
In both cases, when the PID loop is deactivated, the value of the integrator is reset to 0.

14.18 : PID symmetrical limit enable
Adjustment range : 0 or 1
Factory setting : 0
0 (Disabled) (OFF): Inactive.
1 (Enabled) (On): 14.13 and 14.14 take the same value and it is 14.13 which is effective.

14.19 : PID main reference
Adjustment range : ± 100.0%
This parameter indicates the value of the main reference.

14.20 : PID reference
Adjustment range : ± 100.0%
This parameter indicates the value of the PID reference.

14.21 : PID feedback
Adjustment range : ± 100.0%
This parameter indicates the value of the PID feedback.

14.22 : PID error
Adjustment range : ± 100.0%
This parameter indicates the error between the main reference and the feedback.

14.23 to 14.50 : Not used

14.51 : Buffer no. 1
Adjustment range : ± 100.00%
Factory setting : 0
This parameter is used to assign an analog input to the PID reference or feedback.

14.52 : Buffer no. 2
Adjustment range : ± 100.00%
Factory setting : 0
This parameter is used to assign an analog input to the PID reference or feedback.

14.53 : Customer unit coefficient
Adjustment range : 0 to 30
Factory setting : 1
This parameter is a multiplication coefficient allowing the PID reference and PID feedback to be displayed as a customer value (14.54 and 14.55).

14.54 : Customer reference value
Adjustment range : ± 32000
This parameter indicates the value of the PID reference in customer units (scaled using 14.53).

14.55 : Customer feedback value
Adjustment range : ± 32000
This parameter indicates the value of the PID feedback in customer units (scaled using 14.53).

14.56 : Stop on Vmin enable
Adjustment range : 0 or 1
Factory setting : 0
0 (Disabled) (OFF)
1 (Enabled) (On)
This parameter is used to enable the automatic run/stop function when preset configuration 05 = 11.46 = 8.
During operation, if 14.56 = 1 and the flow rate is at minimum (min. speed) for a time period set by 16.15 (parameter set automatically when the configuration is enabled), the pump stops.
WARNING:
This stop on Vmin function is only active when using the "PUMP" preset configuration. When not using this configuration, 14.56 **is a simple "bit" parameter (buffer block).**

17 - MENU 15: MODBUS RTU AND FIELDBUS CONNECTION OPTIONS, AND ADDITIONAL I/O

Please consult the manuals for the corresponding options (PX-Modbus RTU, SM-Fieldbus, PX-I/O).

Notes

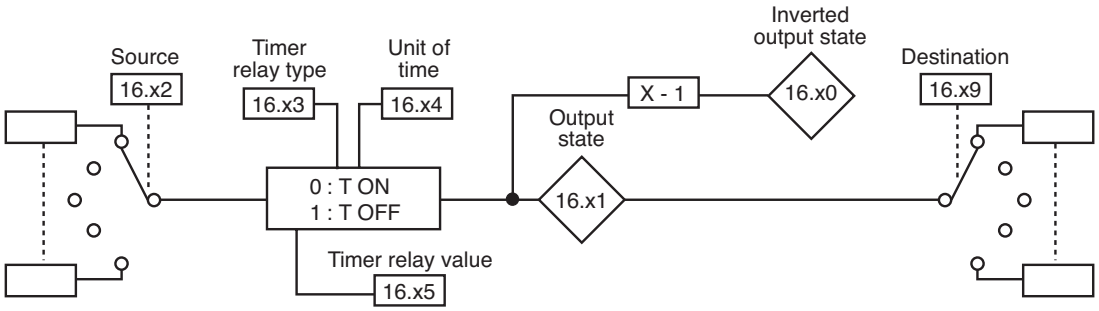
18 - MENU 16: PLC FUNCTIONS

18.1 - List of parameters in Menu 16

Parameter	Name	Type	Adjustment range	Factory setting	User setting
16.01 - 16.11 16.21 - 16.31	Timer relays 1 to 4 output state	RO	0 or 1	-	-
16.02 - 16.12 16.22 - 16.32	Timer relays 1 to 4 input source	R-W/P	0.00 to 21.51	0.00	
16.03 - 16.13 16.23 - 16.33	Timer relays 1 to 4 mode select	R-W	0 or 1	0	
16.04 - 16.14 16.24 - 16.34	Timer relays 1 to 4 unit of time	R-W	0 to 2	0	
16.05 - 16.15 16.25 - 16.35	Timer relays 1 to 4 value	R-W	0 to 60.0	0	
16.06 to 16.08	Not used				
16.09 - 16.19 16.29 - 16.39	Timer relays 1 to 4 output destination	R-W	0.00 to 21.51	0.00	
16.10 - 16.20 16.30 - 16.40	Timer relays 1 to 4 inverted output state	RO/P	0 or 1	-	-
16.16 to 16.18 16.26 to 16.28 16.36 to 16.38	Not used				
16.41 - 16.51 16.61 - 16.71	Latching relays 1 to 4 output state	RO	0 or 1	-	-
16.42 - 16.52 16.62 - 16.72	Latching relays 1 to 4 ON source	R-W	0.00 to 21.51	0.00	
16.43 - 16.53 16.63 - 16.73	Latching relays 1 to 4 OFF source	R-W	0.00 to 21.51	0.00	
16.44 - 16.54 16.64 - 16.74	Latching relays 1 to 4 OFF source inversion	R-W	0 or 1	0	
16.45 to 16.48 16.50 16.55 to 16.58 16.60 16.65 to 16.68 16.70 16.75 to 16.78	Not used				
16.49 - 16.59 16.69 - 16.79	Latching relays 1 to 4 output destination	R-W	0.00 to 21.51	0.00	
16.80	Current counter value	RO	0 to 9999	-	-
16.81	Counter output state	RO	0 or 1	-	-
16.82	Upcounting counter input	R-A	0 or 1	-	-
16.83	Downcounting counter input	R-A	0 or 1	-	-
16.84	Counter output trip threshold	R-W	0 to 9999	0	
16.85	Initial counter values	R-W	0 to 9999	0	
16.86	Counter power-up status	R-W	0 or 1	0	
16.87	Counter enable source	R-W/P	0.00 to 21.51	0.00	
16.88	Counter initialisation	R-W	0 or 1	0	
16.89	Counter output destination	R-W/P	0.00 to 21.51	0.00	

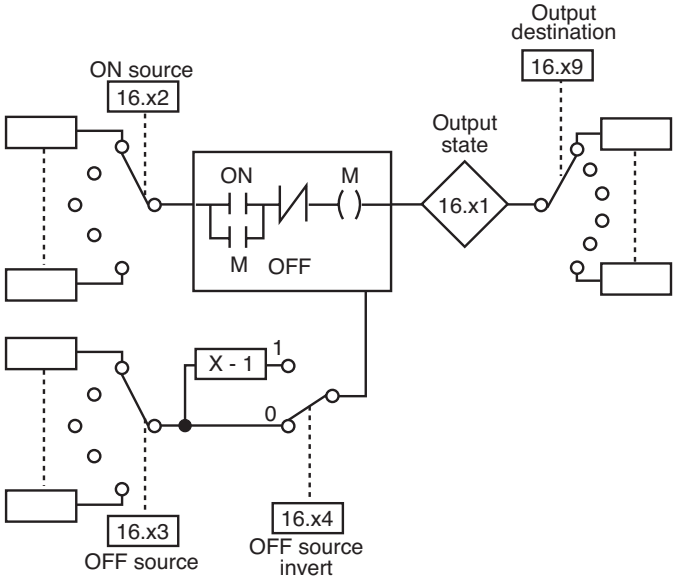
18.2 - Menu 16 diagrams

18.2.1 - Timer relays



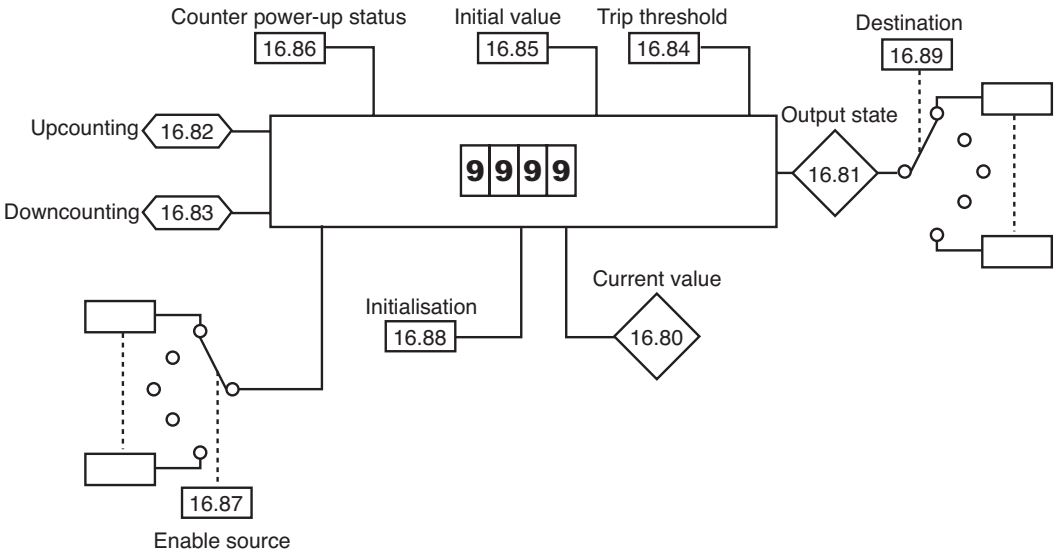
	Source	Timer type selection	Time delay	Unit of time	Output state	Inverted output state	Destination
Timer 1	16.02	16.03	16.05	16.04	16.01	16.10	16.09
Timer 2	16.12	16.13	16.15	16.14	16.11	16.20	16.19
Timer 3	16.22	16.23	16.25	16.24	16.21	16.30	16.29
Timer 4	16.32	16.33	16.35	16.34	16.31	16.40	16.39

18.2.2 - Latching relays



	ON source	OFF source	OFF source inversion	Output state	Output destination
LR 1	16.42	16.43	16.44	16.41	16.49
LR 2	16.52	16.53	16.54	16.51	16.59
LR 3	16.62	16.63	16.64	16.61	16.69
LR 4	16.72	16.73	16.74	16.71	16.79

18.2.3 - Counter



18.3 - Explanation of parameters in menu 16

16.01 **: Timer 1 output**

16.11 **: Timer 2 output**

16.21 **: Timer 3 output**

16.31 **: Timer 4 output**

Adjustment range : 0 or 1
0 (Disabled) (OFF)
1 (Enabled) (On)
These parameters indicate the state of the timer relay outputs.

16.02 **: Timer 1 source**

16.12 **: Timer 2 source**

16.22 **: Timer 3 source**

16.32 **: Timer 4 source**
Adjustment range : 0.00 to 21.51
Factory setting : 0.00
These parameters are used to select the source for the timer relay inputs.
Only "bit" type parameters can be assigned to these inputs. If an unsuitable parameter is addressed on an input, the input will be frozen at 0.

16.03 **: Timer 1 mode select**

16.13 **: Timer 2 mode select**

16.23 **: Timer 3 mode select**

16.33 **: Timer 4 mode select**
Adjustment range : 0 or 1
Factory setting : 0
0 (ON timer) (On): The relay is used for on-delay timing. The output changing to 1 is delayed in relation to the input changing to 1.
1 (OFF timer) (OFF): The relay is used for off-delay timing. The output changing to 0 is delayed in relation to the input changing to 0.

16.04 **: Timer 1 unit**

16.14 **: Timer 2 unit**

16.24 **: Timer 3 unit**

16.34 **: Timer 4 unit**
Adjustment range : 0 to 2
Factory setting : 0
0 (Second) (Sec): The unit of time for the timer relay is the second.
1 (Minute) (Min): The unit of time for the timer relay is the minute.
2 (Hour) (hour): The unit of time for the timer relay is the hour.

16.05 **: Timer 1 value**

16.15 **: Timer 2 value**

16.25 **: Timer 3 value**

16.35 **: Timer 4 value**
Adjustment range : 0 to 60.0
Factory setting : 0
These parameters are used to set the timer delay periods. The unit depends on the configuration of 16.04, 16.14, 16.24 and 16.34.

16.06 to 16.08 **: Not used**

16.09 **: Timer 1 output destination**

16.19 **: Timer 2 output destination**

16.29 **: Timer 3 output destination**

16.39 **: Timer 4 output destination**
Adjustment range : 0.00 to 21.51
Factory setting : 0.00
These parameters are used to select the destination for the timer relay outputs.
Only "bit" type parameters can be assigned to these outputs. If an unsuitable parameter is addressed on an output, the output will be frozen at 0.

16.10 **: Timer 1 inverted output state**

16.20 **: Timer 2 inverted output state**

16.30 **: Timer 3 inverted output state**

16.40 **: Timer 4 inverted output state**

Adjustment range : 0 or 1
0 (Disabled) (OFF)
1 (Enabled) (On)
These parameters indicate the state of the inverted output of the timer relays.

16.16 to 16.18 **: Not used**

16.26 to 16.28

16.36 to 16.38

16.41 **: Latch 1 output**

16.51 **: Latch 2 output**

16.61 **: Latch 3 output**

16.71 **: Latch 4 output**

Adjustment range : 0 or 1
These parameters indicate the state of the latching relay outputs.

16.42 **: Latch 1 ON source**

16.52 **: Latch 2 ON source**

16.62 **: Latch 3 ON source**

16.72 **: Latch 4 ON source**

Adjustment range : 0.00 to 21.51
Factory setting : 0.00
These parameters are used to select the enable source for the latching relays. A pulse on an input causes the corresponding output to change to 1.
Only "bit" type parameters can be assigned to these inputs. If an unsuitable parameter is addressed on an input, the input will be frozen at 0.

16.43 **: Latch 1 OFF source**

16.53 **: Latch 2 OFF source**

16.63 **: Latch 3 OFF source**

16.73 **: Latch 4 OFF source**

Adjustment range : 0.00 to 21.51
Factory setting : 0.00
These parameters are used to select the disable source for the latching relays. A pulse on an input causes the corresponding output to change to 0.
Only "bit" type parameters can be assigned to these inputs. If an unsuitable parameter is addressed on an input, the input will be frozen at 0.

16.44 **: Latch 1 OFF source inversion**
16.54 **: Latch 2 OFF source inversion**
16.64 **: Latch 3 OFF source inversion**
16.74 **: Latch 4 OFF source inversion**

Adjustment range : 0 or 1
Factory setting : 0
These parameters are used to invert the OFF source for the latching relays.
0 (Disabled) (OFF): Source not inverted.
1 (Enabled) (On): Source inverted.

16.45 **to** 16.48 **,** 16.50 **: Not used**

16.55 **to** 16.58 **,** 16.60

16.65 **to** 16.68 **,** 16.70

and 16.75 to 16.78

16.49 **: Latch 1 output destination**

16.59 **: Latch 2 output destination**

16.69 **: Latch 3 output destination**

16.79 **: Latch 4 output destination**

Adjustment range : 0.00 to 21.51
Factory setting : 0.00
These parameters are used to select the destination for the latching relay outputs.
Only "bit" type parameters can be assigned to these outputs. If an unsuitable parameter is addressed on an output, the output will be frozen at 0.

16.80 **: Current counter value**

Adjustment range : 0 to 9999
Indicates the current counter value.

16.81 **: Counter output state**

Adjustment range : 0 or 1
0 (Disabled) (OFF): The current counter value is less than the trip threshold.
1 (Enabled) (On): The current counter value has reached the trip threshold.

16.82 **: Upcounting counter input**

Adjustment range : 0 or 1
0 (Disabled) (OFF)
1 (Enabled) (On)
A pulse on this input increments the counter value by 1.
Note:
• Slow pulse counting (<100 Hz):
Any function or digital input (except for DI4 and DI3) can be assigned to 16.82 (upcounting) and 16.83 (downcounting).
• Fast pulse counting (<5 kHz):
Digital input DI4 (upcounting) assigned to 16.82.
Digital input DI3 (downcounting) assigned to 16.83.
Upcounting and downcounting fast pulses must not arrive simultaneously.

16.83 **: Downcounting counter input**

Adjustment range : 0 or 1
0 (Disabled) (OFF)
1 (Enabled) (On)
A pulse on this input decrements the counter value by 1.
Note:
• Slow pulse counting (<100 Hz):
Any function or digital input (except for DI4 and DI3) can be assigned to 16.82 (upcounting) and 16.83 (downcounting).
• Fast pulse counting (<5 kHz):
Digital input DI4 (upcounting) assigned to 16.82.
Digital input DI3 (downcounting) assigned to 16.83.
Upcounting and downcounting fast pulses must not arrive simultaneously.

16.84 **: Counter output trip threshold**

Adjustment range : 0 to 9999
Factory setting : 0
Used to determine the trip threshold which will cause the counter output to change to 1.

16.85 **: Initial counter value**

Adjustment range : 0 to 9999
Factory setting : 0
Used to determine a threshold value from which the counter will upcount or downcount.

16.86 : Counter power-up status
Adjustment range : 0 or 1
Factory setting : 0
0 (Prev. val.) (Prec): On power-up, the counter takes the value it had before power-down.
1 (Reset to 0) (0): On power-up, the counter takes the value of 16.85.

16.87 : Counter enable source
Adjustment range : 0.00 to 21.51
Factory setting : 0.00
Used to select the internal bit which enables upcounting or downcounting. While this input is not enabled, pulses on the upcount and downcount inputs are not taken into account.
Only "bit" type parameters can be programmed. If an unsuitable parameter is addressed, the input will be frozen at 0.

16.88 : Counter initialisation
Adjustment range : 0 or 1
Factory setting : 0
0 (Disabled) (OFF): Inactive.
1 (Enabled) (On): Causes initialisation of the counter to the initial value.

16.89 : Counter output destination
Adjustment range : 0.00 to 21.51
Factory setting : 0.00
Determines the internal parameter which will be assigned by the counter output.
Only "bit" type parameters can be programmed.
If an unsuitable parameter is assigned, the output is not sent to any address.

19 - MENUS 17 TO 20: RESERVED

Notes

20 - MENU 21: OPERATING PARAMETERS FOR A SECOND MOTOR

20.1 - List of parameters in Menu 21

Parameter	Name		Type	Adjustment range	Factory setting	User setting
21.01	Motor 2 maximum reference clamp		R-W	0 to 32000 rpm	Eur: 1500 rpm USA: 1800 rpm	
21.02	Motor 2 minimum reference clamp		R-W/P	0 to 32000 rpm	0	
21.03	Motor 2 reference selector		R-W	0 to 4	0	
21.04	Motor 2 acceleration rate		R-W	0 to 600.0 s/1000 rpm	3.0 s/1000 rpm	
21.05	Motor 2 deceleration rate		R-W	0 to 600.0 s/1000 rpm	5.0 s/1000 rpm	
21.06	Motor 2 rated frequency		R-W	0 to 400.0 Hz	Eur: 50.0 Hz USA: 60.0 Hz	
21.07	Motor 2 rated current		R-W	0 to drive rated current (A)	Motor rated current (A) corresponding to the drive rating	
21.08	Motor 2 rated speed		R-W	0 to 9999 rpm	Motor rated speed (rpm) corresponding to the drive rating	
21.09	Motor 2 rated voltage		R-W	0 to 480 V	Eur L: 200 V USA L: 230 V Eur H: 400 V USA H: 460 V	
21.10	Motor 2 rated power factor (cos φ)		R-W	0 to 1.00	0.85	
21.11	Motor 2 number of poles		R-W	0 to 4	0	
21.12	Motor 2 stator resistance		R-W	0 to 32.000 Ω	0	
21.13	Motor 2 voltage offset		RO	0 to 25.5 V	-	
21.14	Motor 2 inductance		R-W	0 to 3200.0 mH	0	
21.15	Motor 2 parameters active		RO/P	0 or 1	-	
21.16 to 21.23	Not used					
21.24	Motor 2 stator inductance L_S	▣	R-W	0 to 3200.0 mH	150.0 mH	
21.25 to 21.29	Not used					
21.30	Motor volts per 1000 rpm (Ke)	▣	R-W	0 to 10000 V	98 V	
21.31 to 21.50	Not used					
21.51	q axis inductance	▣	R-W	0 to 999.9 mH	150.0 mH	

: Function not available.

20.2 - Explanation of parameters in menu 21

21.01 **: Motor 2 maximum reference clamp**
Adjustment range : 0 to 32000 rpm
Factory setting : **Eur = 1500 rpm**
USA = 1800 rpm
This parameter defines the maximum speed in both directions of rotation.
This parameter is equivalent to 1.06 **for motor 1.**

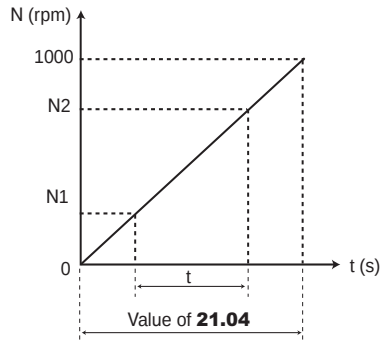
• Before setting the maximum reference clamp, check that the motor and the driven machine can withstand it.

21.02 **: Motor 2 minimum reference clamp**
Adjustment range : 0 to 32000 rpm
Factory setting : 0
In unipolar mode, this parameter defines the minimum speed.
WARNING:
This parameter is inactive during jog operation.
This parameter is equivalent to 1.07 **for motor 1.**

21.03 **: Motor 2 reference selector**
Adjustment range : 0 to 4
Factory setting : 0
0 (Term. inputs) (SEL): The speed reference is selected by combining the digital inputs assigned to parameters 1.41 **and** 1.42**.**
1 (Analog 1) (Ana1): The speed reference comes from analog input 1.
2 (Analog 2) (Ana2): The speed reference comes from analog input 2.
3 (Preset) (Pr): The speed reference comes from the preset references.
4 (Keypad) (Pad): No speed reference is taken into account.
This parameter is equivalent to 1.14 **for motor 1.**

21.04 **: Motor 2 acceleration rate**
Adjustment range : 0 to 600.0 s/1000 rpm
Factory setting : 3 s/1000 rpm
Sets the time for acceleration from 0 to 1000 rpm.

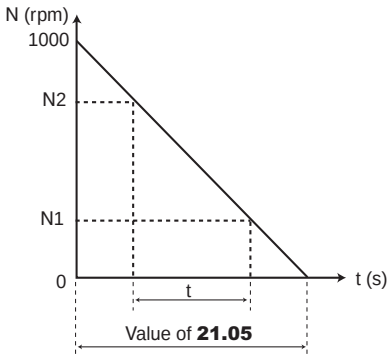
$$21.04 = \frac{t(s) \times 1000\ rpm}{(N2 - N1)\ rpm}$$



This parameter is equivalent to 2.11 **for motor 1.**

21.05 **: Motor 2 deceleration rate**
Adjustment range : 0 to 600.0 s/1000 rpm
Factory setting : 5.0 s/1000 rpm
Sets the time for deceleration from 1000 rpm to 0.

$$21.05 = \frac{t(s) \times 1000\ rpm}{(N2 - N1)\ rpm}$$



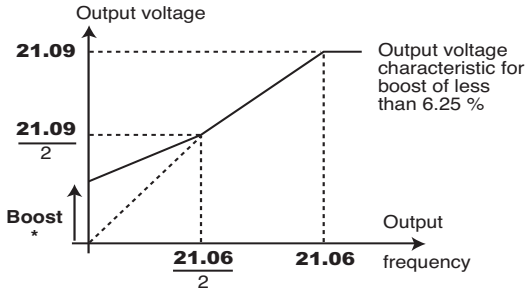
This parameter is equivalent to 2.21 **for motor 1.**

21.06 **: Motor 2 nominal frequency**
Adjustment range : 0 to 400.0 Hz
Factory setting : **Eur = 50.0 Hz**
USA = 60.0 Hz
This is the point at which motor operation changes from constant torque to constant power.
During standard operation, it is the frequency indicated on the motor nameplate.
This parameter is equivalent to 5.06 **for motor 1.**

21.07 **: Motor 2 nominal current**
Adjustment range : 0 to drive rated current (A)
Factory setting : Motor rated current corresponding to the drive rating
This is the value of the motor rated current indicated on the nameplate. Above this value the motor is overloaded.
This parameter is equivalent to 5.07 **for motor 1.**

21.08 **: Motor 2 nominal speed**
Adjustment range : 0 to 9999 rpm
Factory setting : Motor rated speed corresponding to the drive rating
This is the on-load speed of the motor indicated on the nameplate.
This parameter is equivalent to 5.08 **for motor 1.**

21.09 **: Motor 2 nominal voltage**
Adjustment range : 0 to 480 V
Factory setting : **Eur L: 200 V**
USA L = 230 V
Eur H: 400 V
USA H: 460 V
Defines the voltage/frequency ratio as follows:



* If the fixed boost has been selected 5.14 = 2.
This parameter is equivalent to 5.09 **for motor 1.**

21.10 **: Motor 2 power factor (Cos φ)**
Adjustment range : 0 to 1.00
Factory setting : 0.85
The power factor is measured automatically during a level 2 autotune phase (see 5.12) and set in this parameter. If it has not been possible to carry out the autotune procedure, enter the Cos φ value indicated on the motor nameplate.
This parameter is equivalent to 5.10 **for motor 1.**

21.11 **: Motor 2 number of poles**
Adjustment range : 0 to 4
Factory setting : 0
0 (AUTO) (Auto)
1 (2POLES) (2P)
2 (4POLES) (4P)
3 (6POLES) (6P)
4 (8POLES) (8P)
When this parameter is at 0 (Auto), the drive automatically calculates the number of poles according to the rated speed (21.08) and the rated frequency (21.06). However, the value can be entered directly as number of pairs of poles.

21.11	Motor nominal speed rpm	Number of poles
1	3000	2
2	1500	4
3	1000	6
4	750	8

This parameter is equivalent to 5.11 **for motor 1.**

21.12 **: Motor 2 stator resistance**
Adjustment range : 0 to 32.000 Ω
Factory setting : 0
This parameter stores the motor stator resistance for flux vector control mode (see parameter 5.14).
The stator resistance value is only read if 5.14 = 0.
If the stator resistance cannot be measured (motor not connected, value higher than the max. rating) an "rS" trip occurs.
During autotuning (5.12 = 1 or 2), the value of the stator resistance is automatically stored.
This parameter is equivalent to 5.17 **for motor 1.**

21.13 **: Motor 2 voltage offset**
Adjustment range : 0 to 25.5 volts
This voltage offset is measured by the drive (see parameter 5.14). It is used to correct imperfections in the drive, especially voltage drops in the IGBTs and idle times. This parameter plays an important role in low-speed operation, i.e. when the drive output voltage is low.
During autotuning (5.12 = 1 or 2), the value of the voltage offset is automatically stored.
This parameter is equivalent to 5.23 **for motor 1.**

21.14 **: Motor 2 inductance**
Adjustment range : 0 to 3200.0 mH
Factory setting : 0
During autotuning with rotation (5.12 = 2), the transient inductance is stored in this parameter.
This parameter is equivalent to 5.24 **for motor 1.**

21.15 **: Motor 2 map enable**
Adjustment range : 0 or 1
0 (Disabled) (OFF)
1 (Enabled) (On)
21.15 changes from 0 to 1 when the motor 2 parameters are active.
They are taken into account when 11.45 is set to 1 and the drive is disabled or in the trip state. During drive operation, 11.45 can be set to 1, but the characteristics of motor 2 are not taken into account. This parameter can be assigned to a digital output, in order to control closing of the second motor contactor when the motor 2 characteristics have been enabled.

21.16 to 21.23 **: Not used**

21.24 **: Motor 2 stator inductance L_S**
Adjustment range : 0 to 3200.0 mH
Factory setting : 150.0 mH
This is the motor stator inductance at rated flux.
This parameter is equivalent to 5.25 **for motor 1.**

21.25 to 21.29 **: Not used**

21.30 **: Motor volt per 1000 rpm (Ke)**
Adjustment range : 0 to 10000 V
Factory setting : 98 V
Used to set the motor voltage per 1000 rpm. Is used to adjust the current loop integral gain to prevent current peaks when the drive is enabled with a spinning motor.
This parameter is equivalent to 5.33 **for motor 1.**
Function not available.

21.31 to 21.50 **: Not used**

21.51 **: q axis inductance**
Adjustment range : 0 to 999.9 mH
Factory setting : 150.0 mH
This is the motor stator inductance in quadrature with the total inductance Ls (21.24), used to control a salient-pole synchronous motor.
This parameter is equivalent to 5.51 **for motor 1.**

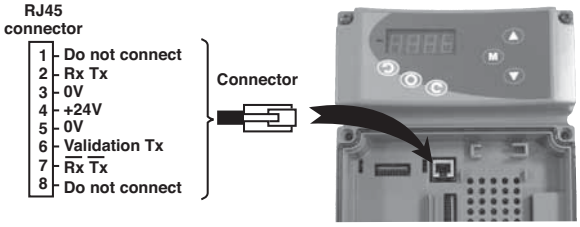
Notes

21 - OPERATION WITH MODBUS RTU

21.1 - Serial link

As standard, the Commander SX incorporates an RS485/2-wire serial link port accessible via an RJ45 connector.

21.1.1 - Location and connection



21.1.2 - Protocols

The drive handles the following protocols:
- Modbus RTU
- LS Net

The drive automatically recognises the protocol used, and this can be read in 11.24 "Serial mode".

21.1.3 - Parameter setting

Depending on the application, the following parameters need to be modified.
11.23: Serial address
11.25: Serial link baud rate
11.27: Modbus frame format
For more information on these parameters, refer to menu 11, section 12.3.

21.1.4 - Networking

The Commander SX serial port allows the drive to communicate with a 2-wire RS485 network.
• The network must then be connected in a "daisy-chain" (and not a star).
• At minimum, terminals 2, 3 and 7 and the shielding must be connected.

The CT Comms cable option allows a PC to be connected directly to the Commander SX. This cable, with a 9-pin SUB-D connector at one end and an RJ45 at the other, incorporates an isolated RS232/RS485 converter.
WARNING:
Do not use this cable for networking several Commander SXs (the "24 V"s must not be linked).

21.2 - Parameter setting using the PC

The SX SOFT parameter-setting software makes it very easy to set up the Commander SX from a PC.
- Quick configuration: the drive parameters are set very quickly using a "quick configuration" screen.
- Supervision during commissioning: used to supervise the various data relating to operation on a single screen.
- File storing: used to save all the parameter files thus enabling very quick duplication of an already existing setting.

To connect the PC to the Commander SX, use the CT Comms cable option described opposite or use a 2-wire RS232/RS485 converter (e.g. Amplicon 485 FI).
For PCs equipped with USB ports, ask your usual CONTROL TECHNIQUES contact.

21.3 - Control word and status word

Commander SX control commands can be managed using a single parameter 6.42, called the "control word".
This is because the value of 6.42 corresponds to a word in which each bit is associated with a command. The command is enabled when the bit is at 1, and disabled when the bit is at 0.
To enable commands using the control word, set 6.43 = 1 (control commands via the terminals are no longer active), when the drive is disabled.

Parameter 10.40, called the status word, is used to group data on the drive. The value of 10.40 corresponds to a 15-bit word, and each bit is associated with a drive status parameter.

6.42**: Control word**

Bits of control word 6.42	Corresponding parameters	Functions
0	6.15	Drive unlocking
1	6.30	Run forward
2	6.31	Jog
3	6.32	Run reverse
4	6.33	Forward/Reverse
5	6.34	Run
6	-	Reserved
7	-	Reserved
8	1.42	Analog reference/preset reference
9	-	Reserved
10	-	Reserved
11	-	Reserved
12	-	Reserved
13	10.33	Drive reset/Reset
14	-	Reserved

10.40**: Status word**

Bits of status word 10.40	Corresponding parameters	Drive status
0	10.01	Drive healthy
1	10.02	Drive active
2	10.03	Zero speed
3	10.04	Running at minimum speed
4	10.05	Below set speed
5	10.06	At speed
6	10.07	Above set speed
7	10.08	Nominal load reached
8	10.09	Drive output at current limit
9	10.10	Drive regenerating
10	10.11	Braking IGBT active
11	10.12	Braking resistor alarm
12	10.13	Direction commanded
13	10.14	Direction running

21.4 - MODBUS RTU

21.4.1 - General

The MODBUS RTU protocol is a master-slave type protocol (a single master per network).

Description	Characteristics
Normal physical layer for multi-drop operation	2-wire RS485
Bit stream	Standard UART asynchronous symbols with Non-Return to Zero (NRZ)
Symbol	Each symbol consists of: 1 start bit 8 data bits (least significant bit transmitted first) 1 or 2 stop bits depending on 11.27
Baud rate	300, 600, 1200, 2400, 4800, 9600, 19200, 38400, 57600, 115200 baud

Note: If the CT Comms cable is used, the baud rate is limited to 38400 baud.

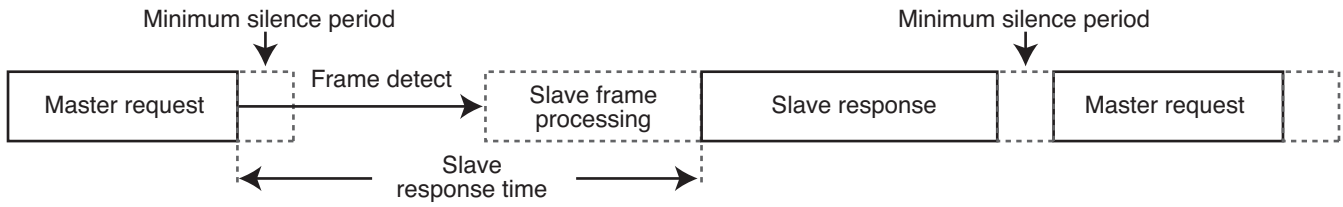
21.4.2 - Description of exchanges

Exchanges are initiated by the master, which sends its request: if the slave concerned has understood it, it sends its response. Each frame (question or response) contains four types of data:
- The address of the slave concerned which receives the question frame (master request) or the address of the slave which sends the response frame (encoded on one byte)
- The function code which selects a command (read or write words, bits etc) for question and response frames (encoded on one byte)
- The data field containing the parameters relating to the command (encoded on "n" bytes)
- The frame CRC, calculated on sixteen bits, which is used to detect transmission errors.

The frame is terminated with a minimum silence period, equivalent to the transmission time for 3.5 characters (e.g. at 19200 baud, the silence period must be at least 1/19200 x 11 bits x 3.5, i.e. 2 ms). This silence period indicates the end of the message, and the slave can start to process the transmitted data.
All data is encoded in hexadecimal format.

Slave address	Function code	Message data	16-bit CRC	Silence interval

All master requests will lead to a response from a single slave. The slave will respond within the maximum allotted time (the minimum response time is never less than the silence period).



21.4.3 - Parameter mapping

Commander SX drives are configured using a **menu.parameter** notation.
The "menu" and "param" indices can take the values 0 to 99. The menu.param is mapped into a MODBUS RTU register **menu x 100 + parameter**.

In order to map the parameters correctly, the slave increments (+1) the address of the received register.
Example: X = menu; Y = parameter

Drive parameter	Register address (protocol level)
X.Y	(X x 100) + (Y – 1)
Examples:	
1.02	101
1.00	99
0.01	0
12.33	1232

21.4.4 - Data encoding

MODBUS RTU uses a "big-endian" representation for the addresses and data items (except for the CRC which is "little-endian"). This means that, when a numerical quantity "bigger" than one byte is transmitted, the most significant byte is sent first.
For example:

		1st	2nd	…
16 – bits 0x1234	would be:	0x12	0x34	

21.4.5 - Function codes

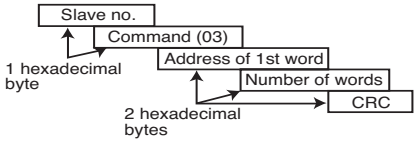
The function code determines the context and format of the message data.

Function code		Description
Decimal	Hexadecimal	
3	03	Read multiple 16-bit registers or words
6	06	Write single 16-bit register or word
16	10	Write multiple 16-bit registers or words
23	17	Read and write multiple 16-bit registers or words

• Function code 3: Read multiple
Reads a contiguous array of registers. The slave imposes an upper limit on the number of registers which can be read. If the limit is exceeded, the slave does not respond.
Note: 99 parameters maximum can be read.

Frame sent by the Master:

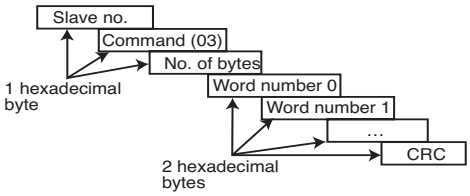
Bytes	Description
0	Slave address (1 to 247)
1	Function code 0x03
2	Start word address MS byte
3	Start word address LS byte
4	Number of words to be read MS byte
5	Number of words to be read LS byte
6	CRC LS byte
7	CRC MS byte



Frame returned by the slave:

Bytes	Description
0	Slave address
1	Function code 0x03
2	Number of bytes to be read
3	Word 0 MS byte
4	Word 0 LS byte
5	Word 1 MS byte
6	Word 1 LS byte
...	…
n	CRC LS byte
n + 1	CRC MS byte

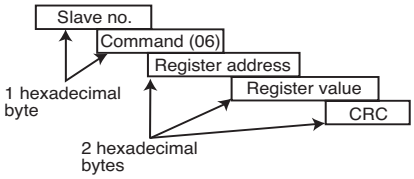
Where n = 3 + number of bytes to be read.



• Function code 6: Write single register
Writing of a value to a single 16-bit register. The normal response is an echo of the request, returned after the register contents have been written.

Frame sent by the master:

Bytes	Description
0	Slave address (0 to 247)
1	Function code 0x06
2	Register address MS byte
3	Register address LS byte
4	Register value MS byte
5	Register value LS byte
6	CRC LS byte
7	CRC MS byte



Frame sent by the slave:

Bytes	Description
0	Slave address
1	Function code 0x06
2	Register address MS byte
3	Register address LS byte
4	Register value MS byte
5	Register value LS byte
6	CRC LS byte
7	CRC MS byte

• Function code 16: Write multiple

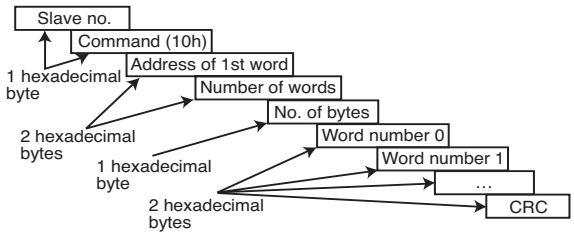
Writes a contiguous array of registers. The slave imposes an upper limit on the number of registers which can be written. If the limit is exceeded, the slave does not respond.

Note: 12 parameters maximum can be written.

Frame sent by the Master:

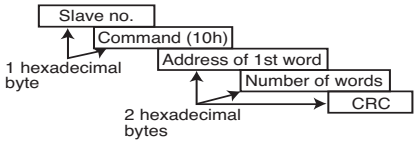
Bytes	Description
0	Slave address (1 to 247)
1	Function code 0x10
2	Start word address MS byte
3	Start word address LS byte
4	Number of words to be written MS byte
5	Number of words to be written LS byte
6	Number of bytes to be written
7	Word 0 to be written MS byte
8	Word 0 to be written LS byte
9	Word 1 to be written MS byte
10	Word 1 to be written LS byte
...	…
n	CRC LS byte
n + 1	CRC MS byte

Where n = 7 + number of bytes to be written.



Frame returned by the slave:

Bytes	Description
0	Slave address (1 to 247)
1	Function code 0x10
2	Start word address MS byte
3	Start word address LS byte
4	Number of words written MS byte
5	Number of words written LS byte
6	CRC LS byte
7	CRC MS byte



• Function code 23: Read/write

Writes and reads two contiguous arrays of registers. The slave imposes an upper limit on the number of registers which can be written. If the limit is exceeded, the slave does not respond.

Note: 99 parameters maximum can be read and 10 parameters maximum can be written.

Frame sent by the Master:

Bytes	Description
0	Slave address (1 to 247)
1	Function code 0x17
2	Start word to be read address MS byte
3	Start word to be read address LS byte
4	Number of words to be read MS byte
5	Number of words to be read LS byte
6	Start word to be written address MS byte
7	Start word to be written address LS byte
8	Number of words to be written MS byte
9	Number of words to be written LS byte
10	Number of bytes to be written
11	Word 0 MS byte
12	Word 0 LS byte
13	Word 1 MS byte
14	Word 1 LS byte
...	…
n	CRC LS byte
n + 1	CRC MS byte

Where n = 11 + number of bytes to be written.

Frame returned by the slave:

Bytes	Description
0	Slave address (1 to 247)
1	Function code 0x17
2	Number of bytes to be read
3	Word 0 MS byte
4	Word 0 LS byte
5	Word 1 MS byte
6	Word 1 LS byte
...	…
n	CRC LS byte
n + 1	CRC MS byte

Where n = 3 + number of bytes to be read.

21.4.6 - Example

Drive address = 11.
Reads 3 parameters from 1.08.
0108 becomes 0107 which is equal to 006B in hexadecimal (Modbus address = parameter address - 1).

• Request

	Example (hex)	RTU (binary)
Slave address	B	0000 1011
Function	03	0000 0011
Start word address (MS byte)	00	0000 0000
Start word address (LS byte)	6B	0110 1011
Number of words (MS byte)	00	0000 0000
Number of words (LS byte)	03	0000 0011
Check		CRC (16 bits)
Total bytes:		8

• Response

	Example (hex)	RTU (binary)
Slave address	B	0000 1011
Function	03	0000 0011
Number of bytes	06	0000 0110
Word 0 (MS byte)	02	0000 0010
Word 0 (LS byte)	2B	0010 1011
Word 1 (MS byte)	00	0000 0000
Word 1 (LS byte)	00	0000 0000
Word 2 (MS byte)	00	0000 0000
Word 2 (LS byte)	63	0110 0011
Check		CRC (16 bits)
Total bytes:		11

21.4.7 - Wait time

In MODBUS RTU, when the master sends a message to a slave, it imposes a wait time between the end of its request and the start of the response from the slave, which makes it possible to detect any missing response.

21.4.8 - Exceptions

If the message is incorrect and the frame is not received, or if the CRC trips, the slave will not produce an exception, and in this case the master will not receive a response from the slave ("timeout"). If a write request (function code 16 or 23) exceeds the maximum size accepted by the slave, then the slave will reject the message. No exception will be transmitted and the master will not receive a response.

21.4.9 - CRC

This control word is used to detect transmission errors. It is calculated on 16 bits from all the bytes in the question and response frames.
Algorithm:

```
START
    CRC = 0xFFFF
    Number of bytes processed = 0
    Next byte = first byte
    REPEAT
    {
        Byte to be processed = next byte;
        CRC = CRC XOR byte to be processed
        REPEAT eight times
        {
            IF (CRC odd) then
            CRC = CRC/2 XOR
            0xA001
            else
            CRC = CRC/2
        }
        Number of bytes processed = Number of bytes
            processed + 1
    }
    WHILE(Number of bytes processed ≤ Number of bytes
            to be processed)
END.
```

Notes