LEROY SOMER

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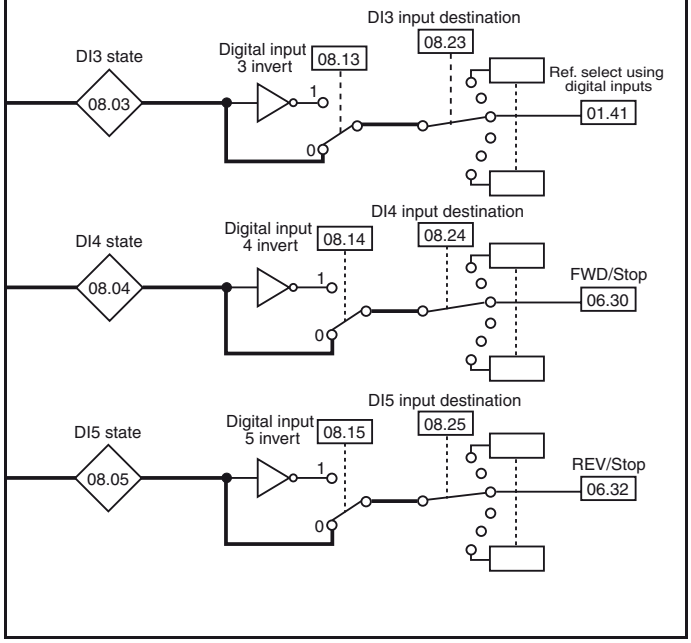

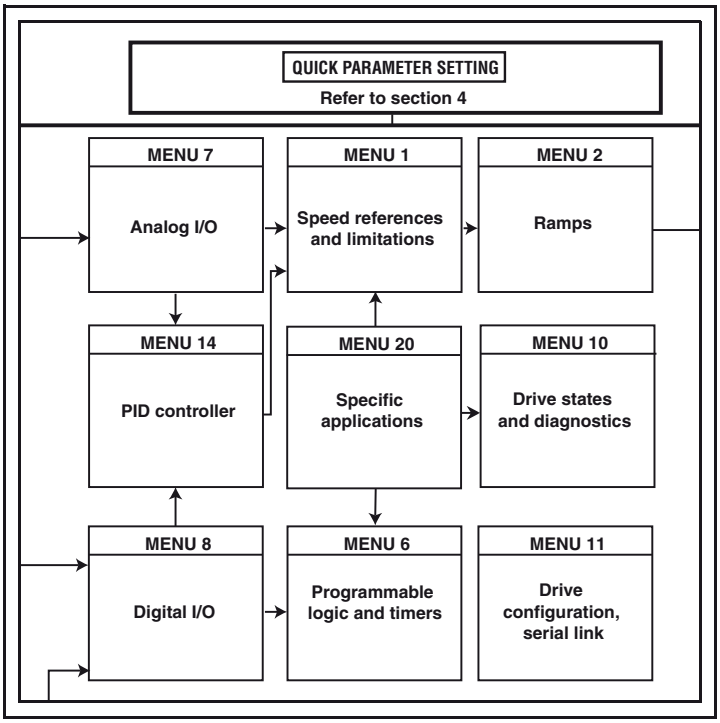

POWERDRIVE MD2/FX

Variable speed drive

Commissioning manual

POWERDRIVE MD2/FX
Variable speed drive

NOTE

LEROY-SOMER 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.

⚠ CAUTION

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 comply with the power connection diagrams recommended in this manual.

The variable speed drive is fitted with safety devices which, in the event of a problem, 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.

LEROY-SOMER declines all responsibility in the event of the above recommendations not being observed.

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This manual only describes the commissioning and configuration of the POWERDRIVE. For additional information about installation, product characteristics and warnings, refer to the installation manual for the relevant product.

Manual corresponding to software versions higher than or equal to 5.00

POWERDRIVE MD2/FX
Variable speed drive

SAFETY AND OPERATING INSTRUCTIONS FOR VARIABLE SPEED DRIVES
(In accordance with the low voltage directive 2006/95/EC)

• Throughout the manual, this symbol warns of consequences which may arise from inappropriate use of the drive, since electrical risks may lead to material or physical damage as well as constituting a fire hazard.

1 - General

Depending on their degree of protection, the variable speed drives may contain unprotected live parts, which may be moving or rotating, as well as hot surfaces, during operation. Unjustified removal of protection devices, incorrect use, faulty installation or inappropriate operation could represent a serious risk to personnel and equipment.
For further information, consult the manual.
All work relating to transportation, installation, commissioning and maintenance must be performed by experienced, qualified personnel (see IEC 364, CENELEC HD 384 or DIN VDE 0100, as well as national specifications for installation and accident prevention).
In these basic safety instructions, qualified personnel means persons competent to install, mount, commission and operate the product and possessing the relevant qualifications.

2 - Use

Variable speed drives are components designed for integration in installations or electrical machines.
When integrated in a machine, commissioning must not take place until it has been verified that the machine conforms with directive 2006/42/EC (Machinery Directive). It is also necessary to comply with standard EN 60204, which stipulates in particular that electrical actuators (which include variable speed drives) cannot be considered as circuit-breaking devices and certainly not as isolating switches.
Commissioning can take place only if the requirements of the Electromagnetic Compatibility Directive (EMC 2004/108/EC) are met.
The variable speed drives meet the requirements of the Low Voltage Directive 2006/95/EC. The harmonised standards of the DIN VDE 0160 series in connection with standard VDE 0660, part 500 and EN 60146/VDE 0558 are also applicable.
The technical characteristics and instructions concerning the connection conditions specified on the nameplate and in the documentation provided must be observed without fail.

3 - Transportation, storage

All instructions concerning transportation, storage and correct handling must be observed.
The climatic conditions specified in the technical manual must be observed.

4 - Installation

The installation and cooling of equipment must comply with the specifications in the manual supplied with the product.
The variable speed drives must be protected against any excessive stress. In particular, there must be no damage to parts and/or modification of the clearance between components during transportation and handling. Avoid touching the electronic components and contact parts.
The variable speed drives contain parts which are sensitive to electrostatic stresses and may be easily damaged if handled incorrectly. Electrical components must not be exposed to mechanical damage or destruction (risks to health!).

5 - Electrical connection

When work is performed on variable speed drives which are powered up, the national accident prevention regulations must be respected.
The electrical installation must comply with the relevant specifications (for example conductor cross-sections, protection via fused circuit-breaker, connection of protective conductor). More detailed information is given in the manual.
Instructions for an installation which meets the requirements for electromagnetic compatibility, such as screening, earthing, presence of filters and correct insertion of cables and conductors, are given in the documentation supplied with the variable speed drives. These instructions must be followed in all cases, even if the variable speed drive carries the CE mark. Adherence to the limits given in the EMC legislation is the responsibility of the manufacturer of the installation or the machine.

6 - Operation

Installations in which variable speed drives are to be integrated must be fitted with additional protection and monitoring devices as laid down in the current relevant safety regulations, such as the law on technical equipment, accident prevention regulations, etc. Modifications to the variable speed drives using control software are permitted.
Active parts of the device and the live power connections must not be touched immediately after the variable speed drive is powered down, as the capacitors may still be charged. In view of this, the warnings fixed to the variable speed drives must be observed.
Permanent magnet motors generate electrical energy while running, even when the drive is switched off. In this case, the drive continues to be powered by the motor terminals. If the load is capable of turning the motor, a switching device must be provided upstream of the motor to isolate the drive during maintenance operations.
During operation, all doors and protective covers must be kept closed.

7 - Servicing and maintenance

Refer to the manufacturer's documentation.
See the Maintenance section in this document.

This manual is to be given to the end user.

Notes

POWERDRIVE MD2/FX
Variable speed drive
CONTENTS

1 - INTRODUCTION

• 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 contained in the installation document or the manual supplied with the drive must have been strictly observed.

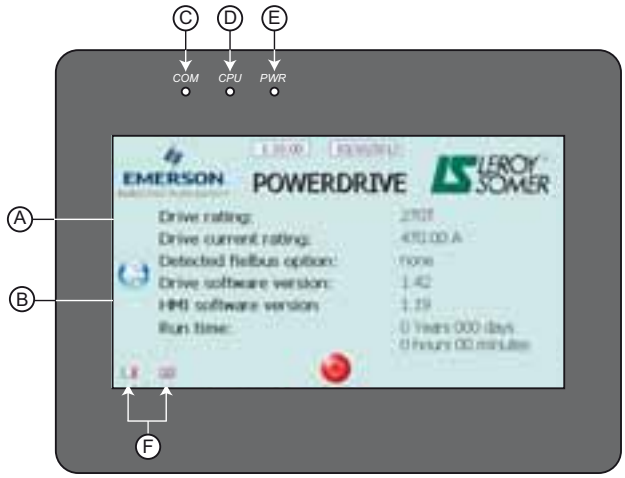
• Users of the drive should take particular care to avoid starting it accidentally.

2 - PARAMETER-SETTING INTERFACE

2.1 - Presentation

The interface consists of a touch screen which can be used to access various menus. It is supplied with its own connection cable.

After a loading phase following powering-up of the drive, the parameter-setting interface displays the following screen:



Ref.	Function
A	Touch screen
B	Touch button allowing simple access to the main menu
C	"COM" LED indicating the state of communication with the drive Off: no communication Flashing: communicating
D	"CPU" LED indicating the state of the interface CPU
E	"PWR" LED indicating the state of the interface power supply
F	Touch-sensitive buttons for language selection (can take a few minutes to load)

The interface operating temperature is -10°C to +50°C.
After 10 minutes without activity on the display, it returns to the "**Reading mode**" screen.

2.2 - Interface architecture

From the welcome screen, press the touch-sensitive key **B** as indicated below to access the main page of the parameter-setting interface, consisting of 5 touch-sensitive buttons:

- Informations: Can be used to obtain Informations very quickly about the drive, the fieldbus option, the parameter-setting interface, and also provides access to the language selection.

- Reading mode: Is used to display the status of the drive when stopped or during operation, as well as its main measurement points.

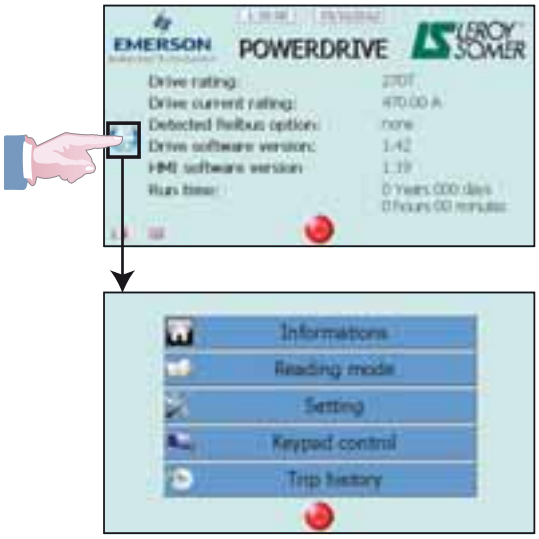
- Setting: Used for reading and/or modification of all the drive parameters, saving parameters, as well as to set the date and time on the display.

- Keypad control: Gives direct access to motor control via the touch screen (Run/Stop, direction of rotation, speed reference). These screen parameters can be set using the Setting/ Keypad Control setup via the keypad menu. keypad control is disabled in factory-set configuration.

- Trip history: Gives a quick overview of the last 10 drive trips.

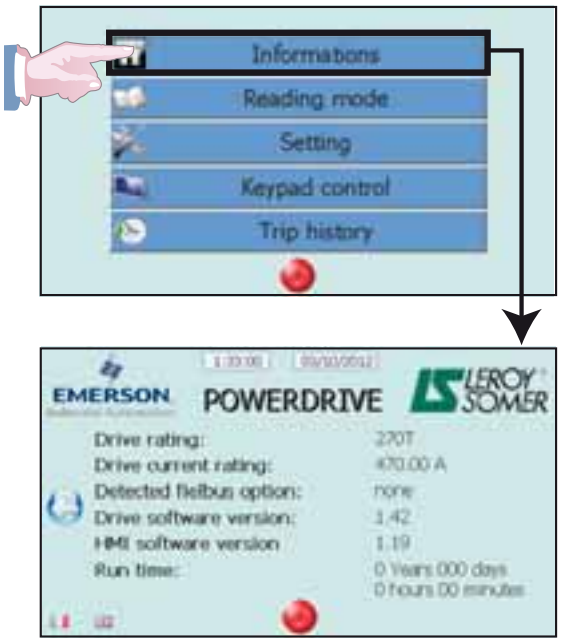
-  : This button is accessible on all screens in factory-set configuration and is used to give a stop command or reset a trip. To disable it, see section 2.2.3.4.

At any time and regardless of the screen displayed, the  button can be used to return to previous pages, as far as the interface main page.



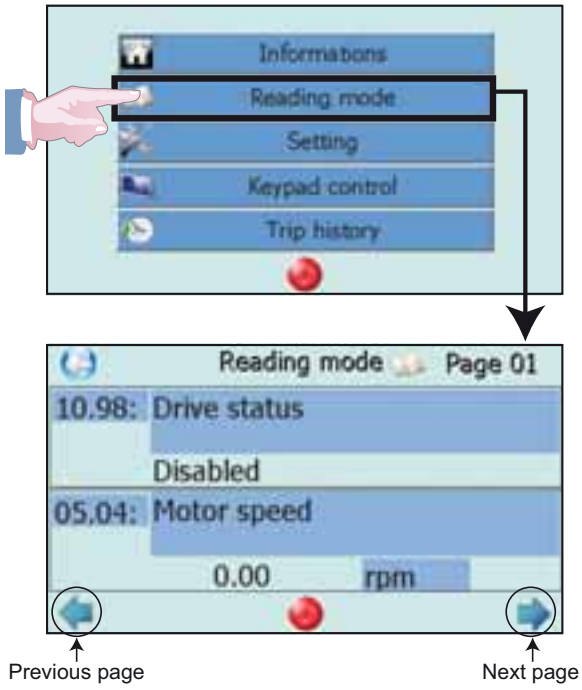
2.2.1 - "Informations" page

This screen displays the date, time and briefly summarises the drive configuration: rating, rated current, fieldbus option, software versions and run time.
It is also the welcome page when the parameter-setting interface is switched on.



2.2.2 - "Reading mode" page

By means of 12 screen pages, this Reading mode is used to display a number of parameters representing the drive status, when stopped or running.



List of parameters displayed in Reading mode

Page	Name	Address
Page 01	Drive status	**10.98**
	Motor speed	**05.04**
Page 02	Current magnitude	**04.01**
	Output frequency	**05.01**
Page 03	Active current	**04.02**
	Output voltage	**05.02**
Page 04	Output power	**05.03**
	DC bus voltage/Supply voltage	**05.05** **07.81**
Page 05	Analog input 1	**07.01**
	Analog input 2	**07.02**
Page 06	Analog input 3	**07.03**
	AO1 output	**07.68**
Page 07	Digital inputs DI1 to DI5	**08.01** to **08.05**
	Relays 1 and 2/STO inputs	**08.07** to **08.09**
Page 08	Reference selected indicator	**01.49**
	Preset selected reference indicator	**01.50**
Page 09	Speed reference selected	**01.01**
	Pre-ramp reference	**01.03**
Page 10	Post-ramp reference	**02.01**
	Control board temperature	**07.55**
Page 11	Run time	**06.22** **06.23**
	PID reference in user units	**14.62**
Page 12	PID feedback in user units	**14.63**

2.2.3 - "Setting" page

This screen provides access to five sub-menus, all relating to parameter setting:

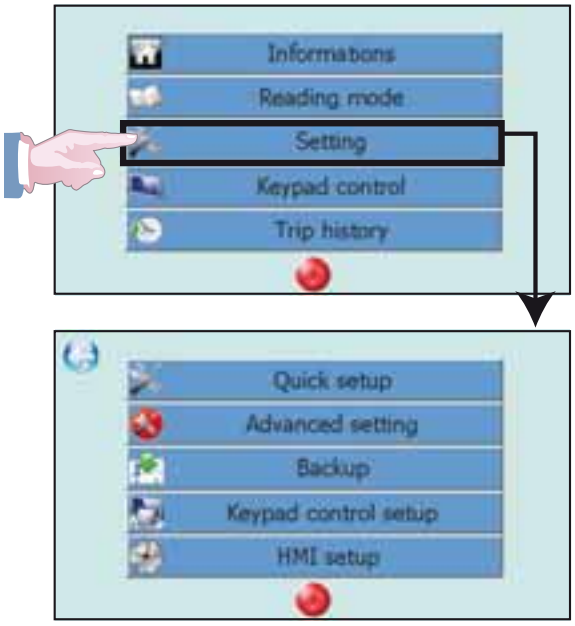
- "Quick setup": Provides access to a simplified menu used for quick drive configuration of standard applications.

- "Advanced setting": Provides read and/or write access to all drive parameters (access to this page is code-protected).

- "Backup": Used to copy the drive parameters to the parameter-setting interface or vice versa (access to this page is code-protected).

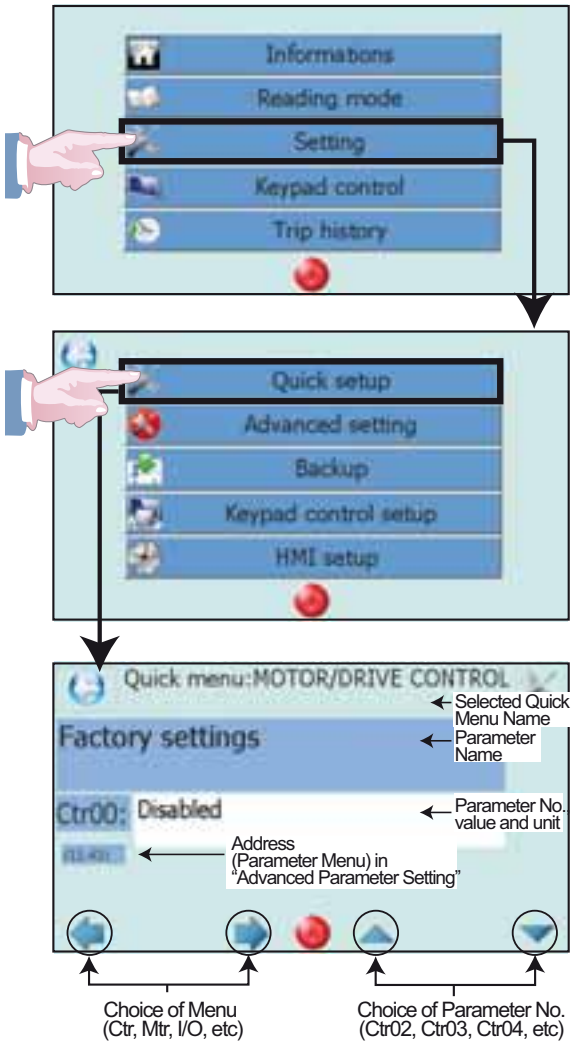
- "Keypad control setup": Used to configure the FWD/REV, Stop and Speed reference commands necessary to control the drive via the interface (access to this page is code-protected).

- **"HMI setup":** Used to set the interface date and time, as well as to calibrate the touch screen and its brightness (access to this page is code-protected).



2.2.3.1 - Quick setup

"Quick setup" contains the most commonly used parameters.

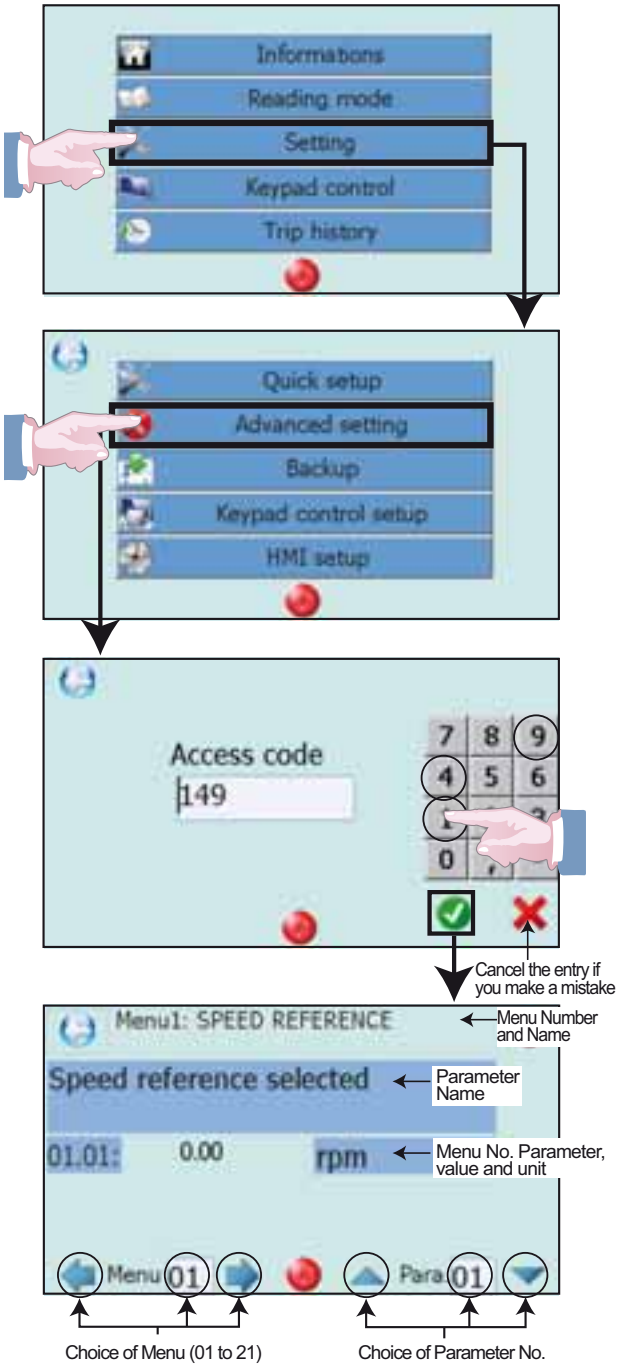


For a more detailed explanation of the menus and parameters offered in "**Quick setup**", refer to section 4.

To modify a parameter value, refer to section 2.2.3.2.

2.2.3.2 - Advanced setting

"**Advanced setting**" provides read and write access to all drive parameters, grouped in menus. It is aimed mainly at experienced users or for applications requiring specific Setting.

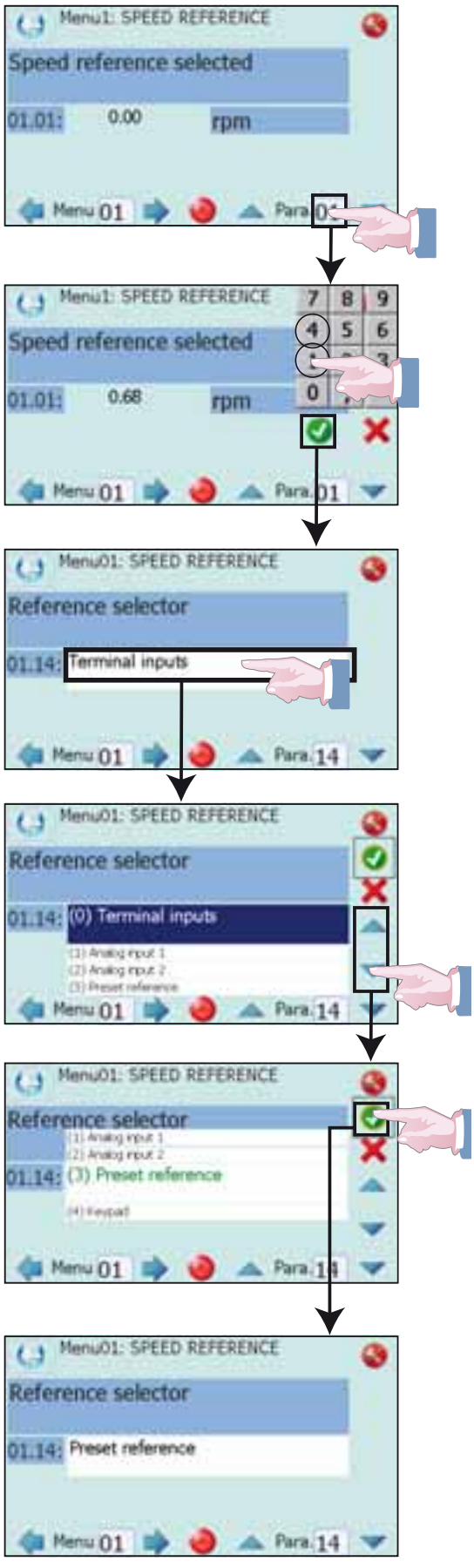


• The value of the Read/Write parameters is displayed in a white zone.
• The value of the Read-Only parameters is displayed on a blue background (without active touch zone).

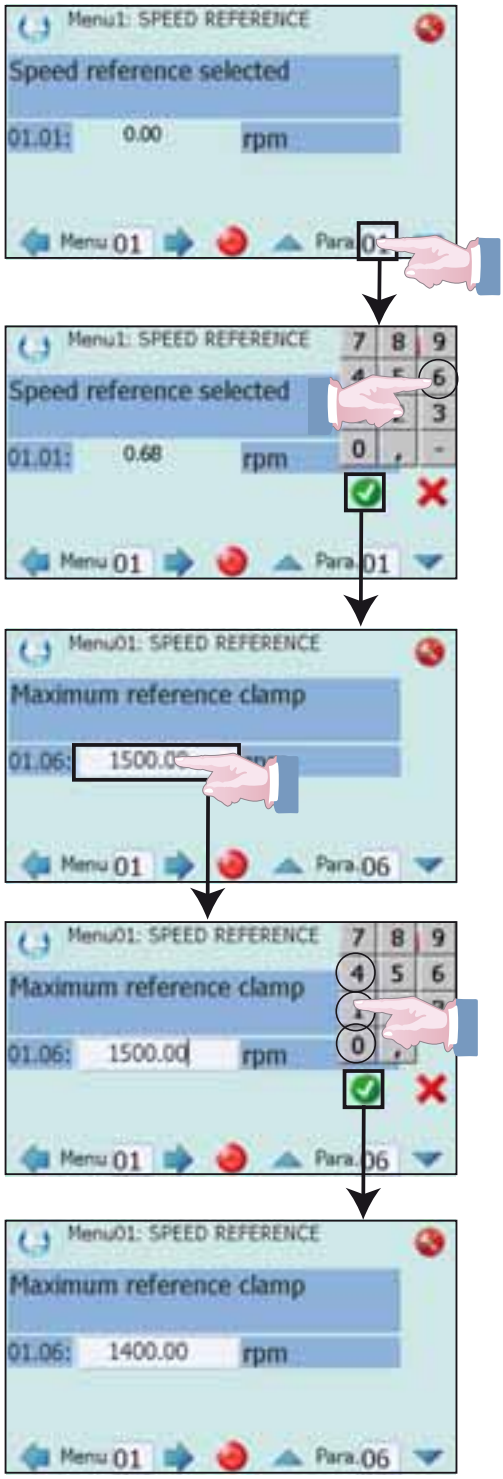
For a more detailed explanation of the menus and parameters offered in "**Advanced setting**", refer to section 5.

Code 149 is the default code. To modify it, refer to parameter **11.61** in section 5.12.

• **Example of changing a multiple-choice parameter (01.14)**

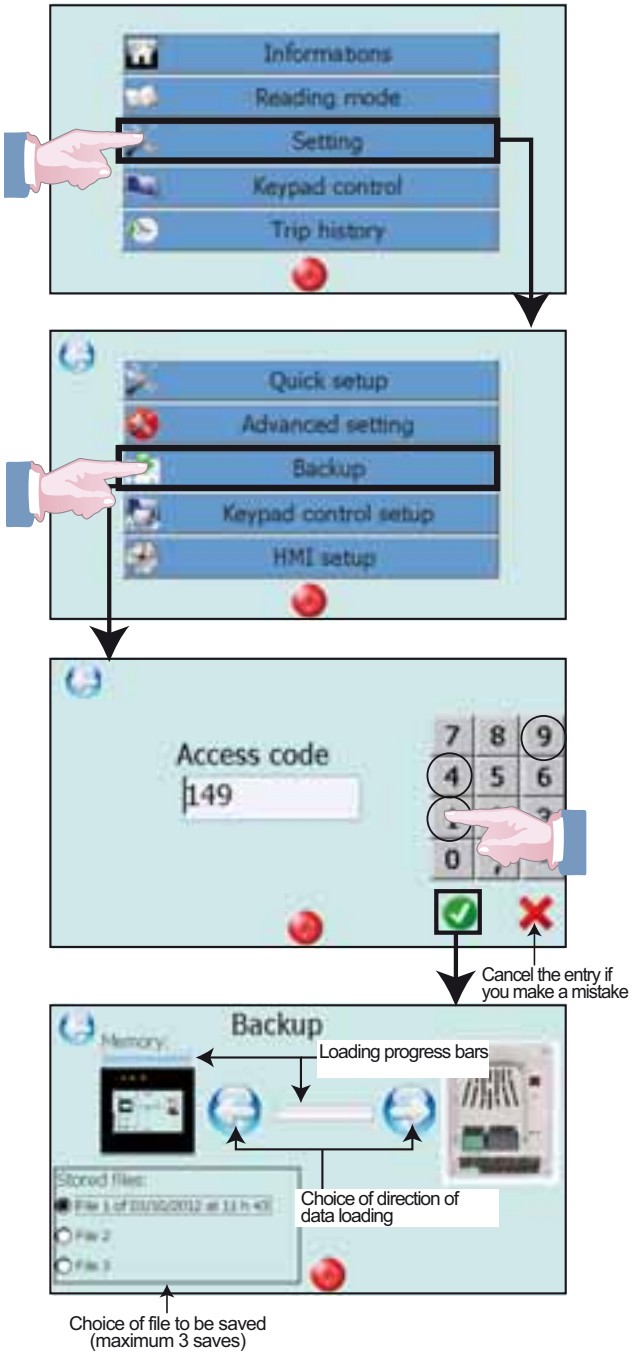


• Example of changing a numerical parameter (01.06)



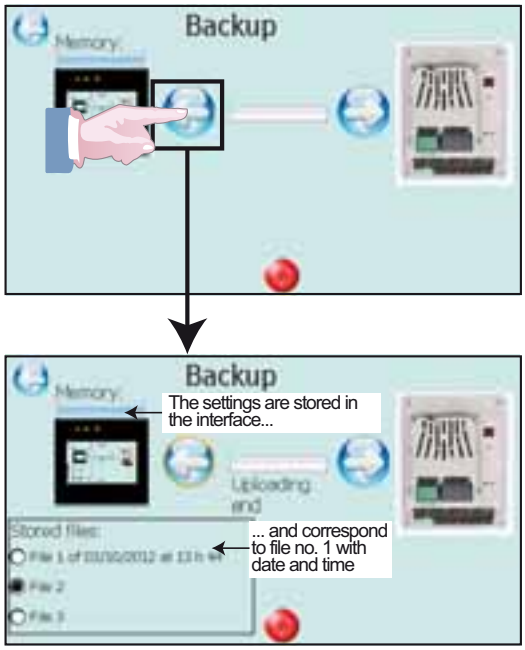
2.2.3.3 - Backup

"**Backup**" allows the user to copy up to 3 complete sets of drive parameters.



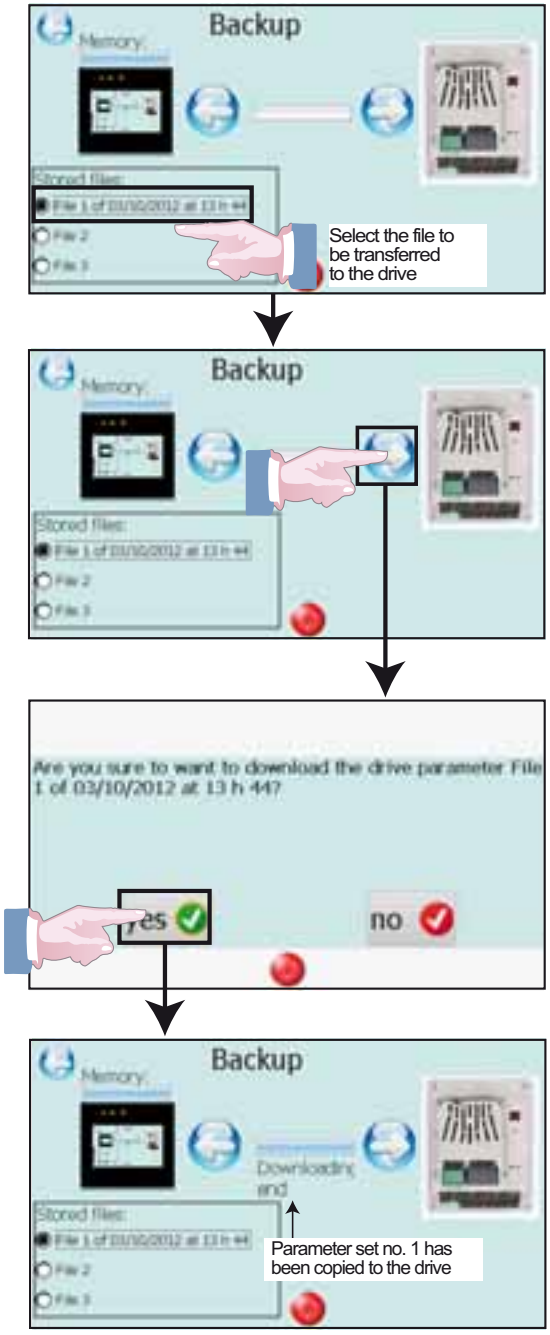
POWERDRIVE MD2/FX
Variable speed drive
PARAMETER-SETTING INTERFACE

• Example of Backup operation from drive to interface:



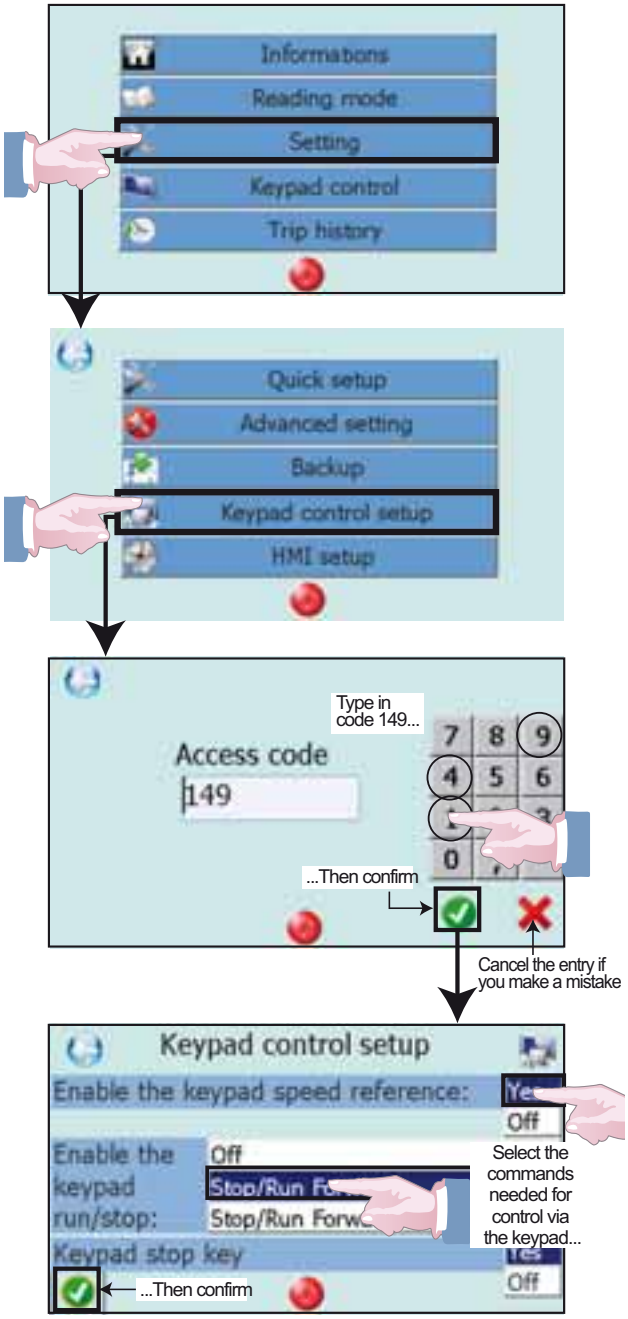
Note:
Repeat the procedure to Backup to 3 different sets of drive parameters. Simply select the file before commencing the Backup procedure.

• Example of Backup operation from interface to drive:

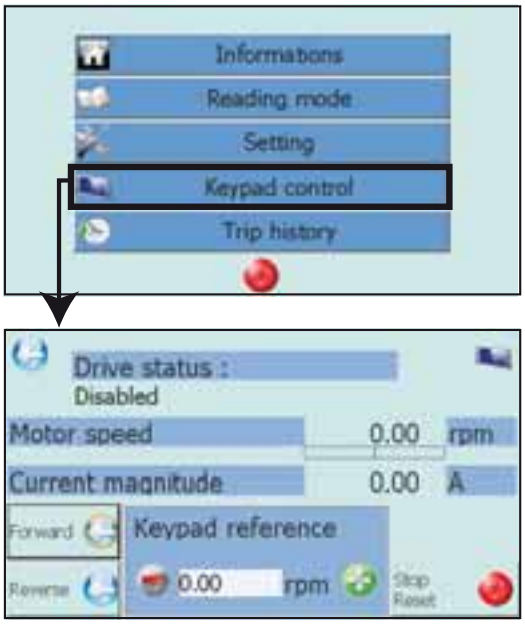


2.2.3.4 - Keypad control setup

"Keypad control setup" is used to enable or disable the Stop/Reset, Forward, Reverse and Speed reference touch-sensitive buttons found on the "**keypad control**" screen, accessible from the main page (see section 2.2.4).
keypad control is disabled by default, only the Stop/Reset button is active.
To modify this configuration, the STO-1 and STO-2 inputs must not be connected to the 24V.



To view the new touch-sensitive buttons that have been enabled, you need to return to the main page, then select "keypad control".
For more details on the "keypad control" screen, see section 2.2.4.

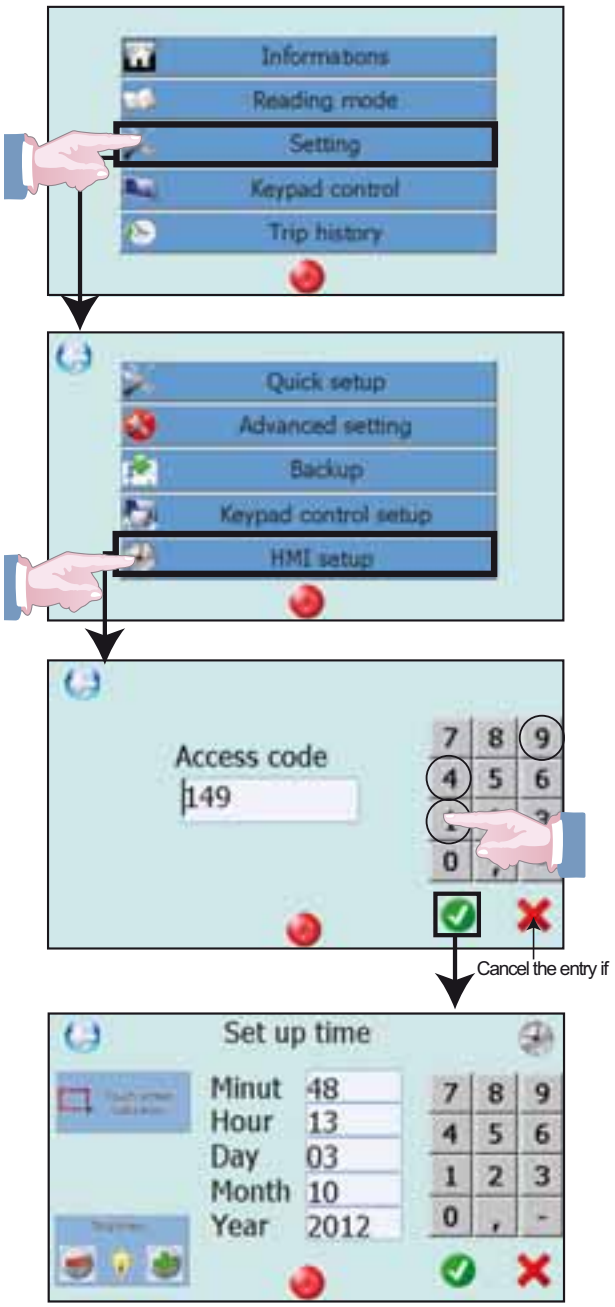


CAUTION:
Selections made in the "Keypad control setup" page have interactions with the Quick or advanced Setting parameters:

- **Setting the keypad reference to "Yes" forces Spd.03 (1.14) "Reference selector" to "Keypad".**
- **Enabling Run/Stop commands via the keypad forces 06.43 (Ctr.05) to "LCD keypad". The Stop key on the "keypad control" page is then active regardless of the setting of 06.12.**
- **Setting the "Keypad stop key" modifies the value of 06.12.**
- **Setting the reference via the keypad modifies the value of 01.17.**

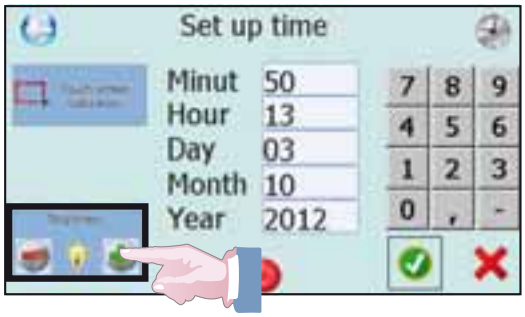
2.2.3.5 - HMI setup

"HMI setup" is used to set the date and time, check or correct the touch screen calibration and its brightness.



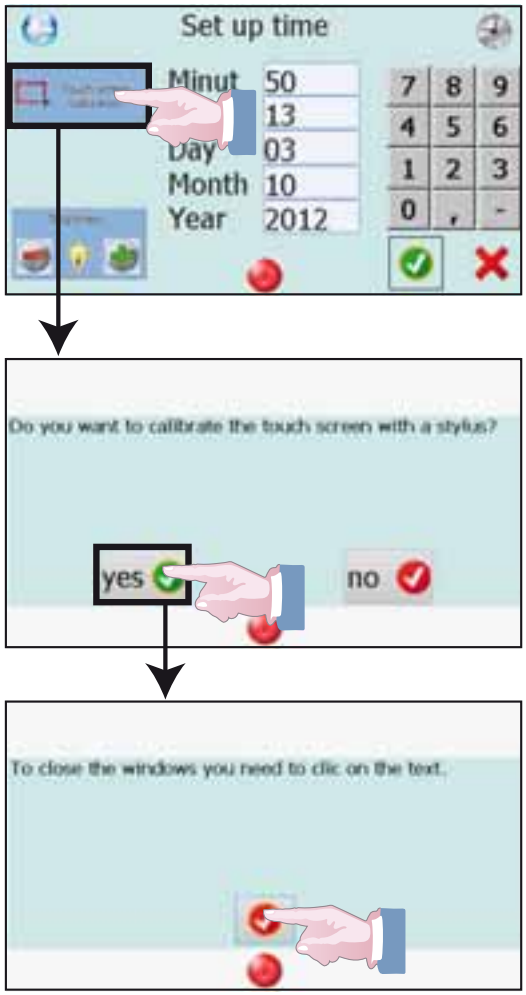
• **Setup time**

• **Setting the screen brightness**



Click on the plus sign to increase the brightness or the minus sign to reduce it.

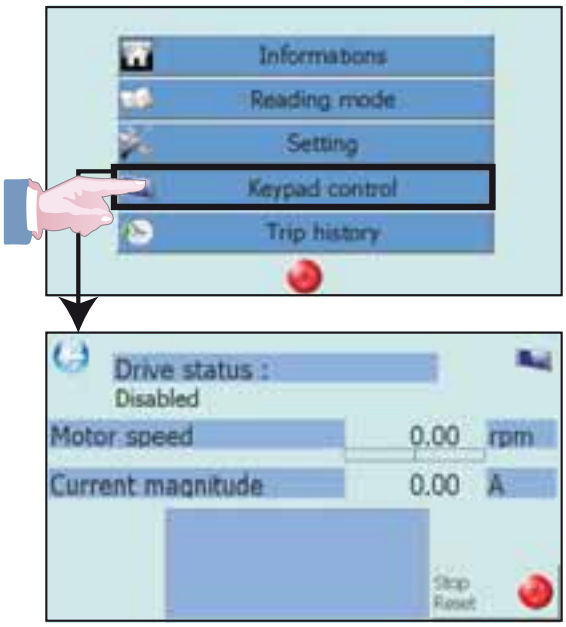
• Setting the screen calibration
A stylus is used for this calibration in order to set the touch screen parameters correctly.



The stylus should then be positioned at several points suggested by crosses positioned on the screen. At the end of calibration, click on the text at the top of the screen to return to the "Date/Time" page.

2.2.4 - Keypad control

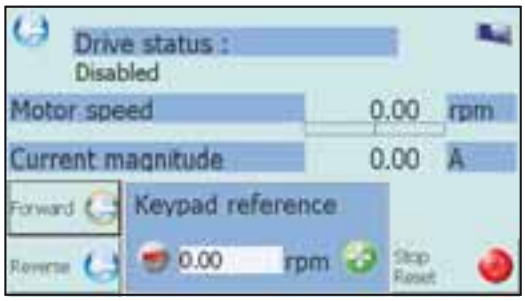
"Keypad control " is used to control the drive interface using the parameter-setting interface.



By default, the screen gives Informations about the drive status, the calculated motor speed and the current magnitude. The Stop/Reset command is also active.

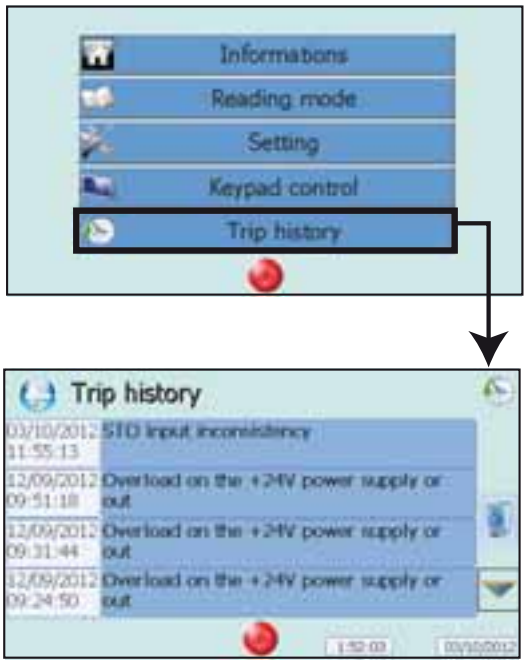
This screen can be configured: the Forward, Reverse and Speed reference commands can be activated using the **"Keypad control"** function (refer to section 2.2.3.4).

When all the commands are active, the screen below appears.



2.2.5 - "Trip history" page

"Trip history" displays the last 10 drive trips with the precise date and time of the event.



When the drive trips, it is displayed in a red banner, at the top of the interface screen. When the drive trips an alarm, it is displayed in a orange banner.

To clear a trip: resolve the problem, then press the Stop/ Reset button.
If necessary, see section 7 - Trips - Diagnostics.

2.2.6 - "Stop/Reset" function

This button is accessible on all screens in factory-set configuration and is used to give a stop command or reset the drive.
It can be disabled if necessary from **"Keypad control setup"** or depending on the values of the **06.12** and **06.43** parameters (see section 2.2.3.4).

CAUTION:
• The Stop/Reset key is automatically enabled for keypad control (regardless of the value of parameter 06.12 "Keypad stop key").
• If the Stop/Reset touch-sensitive button is deactivated (06.12 = Disabled), it does not appear on the interface pages, unless the drive trips.

2.3 - Communication loss alarm

If communication between the drive and the parameter-setting interface is broken, the following message appears on the screen, preventing access to all the interface functions. To restore the serial link, check the connection between the drive and the parameter-setting interface, then press the  key to return to the current page.

3 - PARAMETER-SETTING SOFTWARE

With MDX-SOFT, setting parameters and supervising the **POWERDRIVE** from a PC is very user-friendly. Numerous functions are available:

- Quick commissioning with the simplified menu
- File saving
- Help file
- Comparison of 2 files or one file with the factory settings
- Supervision (in table or progress bar form)
- Diagnostics
- Representation of parameters in a table

The MDX-SOFT software can be downloaded from the Internet at the following address:
http://www.leroy-somer.com/fr/telechargements/logiciels/

To connect the PC to the POWERDRIVE, use an "MDX-USB Isolator" isolated USB kit.

• In conformity with standard EN 60950, the drive USB link can only be used via a device that provides isolation of 4 kV (MDX-USB isolator option).

4 - QUICK SETUP MODE

"Quick setup" contains the parameters most commonly used in standard applications.
Depending on the control type and operating mode selected, the menus offered to the user will adapt in order to make it easier configure the drive to the driven machine and the application.

STRUCTURE
"Quick setup" is shown in the form of 5 user menus:
- **BASIC CONTROL OF THE VARIABLE SPEED DRIVE (Ctr)**
- **MOTOR NAMEPLATE (Mtr)**,
- **SPEEDS AND RAMPS (Spd)**
- **CUSTOMER INTERFACE (I/O)**
- **ADDITIONAL SETTINGS (Apl)**

Using the parameter-setting interface or MDX-SOFT software, select the **BASIC CONTROL OF THE VARIABLE SPEED DRIVE (Ctr)** menu, and modify the suggested parameters in order, while keeping the default setting of any unused functions. Depending on your selections, some menus are automatically adapted (transparent for the user).
Next, set the parameters in the **MOTOR NAMEPLATE (Mtr)** and **SPEEDS AND RAMPS (Spd)** menus.
If the application requires other functions, refer to the **CUSTOMER INTERFACE (I/O)** and **ADDITIONAL SETTINGS (Apl)** menus.

4.1 - List of parameters

• Ctr MENU: BASIC CONTROL OF THE VARIABLE SPEED DRIVE

Parameter	Address	Name	Adjustment range	Factory setting
Ctr.01	**11.43**	Factory settings	Disabled Centrifugal application Brake motor application Other application	Disabled
Ctr.02	**11.31**	User drive mode	Reserved Induction motor in open loop mode Induction motor in vector control mode PM motor (Servo) in vector control mode Active rectifier on Main power Active rectifier for synchronous motor Active rectifier for induction motor DC/DC converter	Induction motor in open loop mode
Ctr.03	**05.18**	Switching frequency	2 - 2.5 - 3 - 3.5 - 4 - 4.5 - 5 - 5.5 - 6 - 6.5 - 7- 8 9 - 10 - 11 - 12 - 13 - 14 - 16 - 18 kHz	FX: 4 kHz MD2: 3 kHz
Ctr.04	**04.07**	Symmetric current limit	0.0 to 300.0% (% active In)	110.0%
Ctr.05	**06.43**	Run/Stop source	Terminals Fieldbus Not active LCD keypad	Terminals
Ctr.06	**06.04**	Start stop logic select	Run no latch Run latched Run Fwd/Rev Controlled run (no latch)	Controlled run (no latch)
Ctr.07	**01.10**	Bipolar reference enable	No or Yes	No
Ctr.08	**06.01**	Stop mode	Coast Ramp Ramp + DC Zero speed DC Timed DC	Ramp
Ctr.09	**06.09**	Catch a spinning motor	Disabled Enabled	Disabled
Ctr.10	**06.03**	Mains loss mode	No detection Full stop Delayed stop	No detection

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Variable speed drive
QUICK SETUP MODE

Parameter	Address	Name	Adjustment range	Factory setting
Ctr.11	**10.80**	Auto reset type	Controlled Automatic Auto for 1081, 1082, 1083, 1084 Auto except 1081, 1082, 1083, 1084	Controlled
Ctr.12	**05.59**	Rotation direction	Clockwise C/clockwise	Clockwise
Ctr.13	**05.14**	Open loop mode selection	Rs measured each run Rs not measured Linear U/F law with boost Rs measured after each factory setting Rs measured after each power up Square U/F law with boost	Rs measured after each power up
Ctr.14	**05.12**	Autotune	None Stationary: motor data completed Rotating: motor data incompleted Encoder offset measure	None

• Mtr MENU: MOTOR NAMEPLATE

Parameter	Address	Name	Adjustment range	Factory setting
Mtr.01	**05.06**	Motor rated frequency	0.01 to 590.00 Hz	50.00 Hz
Mtr.02	**05.07**	Motor rated current	0.00 to 2.2 x **11.32**	Depends on rating
Mtr.03	**05.08**	Motor rated speed	0.00 to 60000.00 rpm	1500.00 rpm
Mtr.04	**05.09**	Motor rated voltage	0 to 999 V	400 V
Mtr.05	**05.10**	Rated power factor	0.00 to 1.00	0.85
Mtr.06	**05.70**	PTC validation	Disabled Drive terminal Encoder option terminal 2 PTC inputs	Disabled
Mtr.07	**05.50**	Motor ventilation	Not cooled Self cooled Forced cooling	Self cooled
If Ctr.02 = PM motor (Servo) in vector control mode:				
Mtr.08	**05.24**	Transient inductance / Ld	0.000 to 9000.000 mH	0.000 mH
Mtr.09	**05.33**	Motor volt per 1000 rpm (Ke)	0 to 32000 V	98 V
If MDX-ENCODER option detected:				
Mtr.10	**03.38**	Encoder type	Incremental Reserved U, V, W only Incremental UVW Hall effect sensor Software encoder n°1 Software encoder n° 2 Software encoder n° 3 Software encoder n° 4 Software encoder n°5 Resolver	Software encoder n° 2
Mtr.11	**03.34**	Encoder lines per revolution	0 to 32000 lpr	1024 lpr
Mtr.12	**03.36**	Encoder supply voltage	5V or 15V	5V
Mtr.13	**03.25**	Position feedback phase angle	0.0 to 359.9°	0.0°

POWERDRIVE MD2/FX
Variable speed drive
QUICK SETUP MODE

• Spd MENU: SPEEDS AND RAMPS

Parameter	Address	Name	Adjustment range	Factory setting
Spd.01	**01.06**	Maximum reference clamp	0.00 to 60000.00 rpm	1500.00 rpm
Spd.02	**01.07**	Minimum reference clamp	0.00 to **Spd.01** rpm	0.00 rpm
Spd.03	**01.14**	Reference selector	Terminal inputs Analog input 1 Analog input 2 Preset reference Keypad	Terminal inputs
Spd.04	**01.21**	Preset ref. 1	± **Spd.01** rpm	0.00 rpm
Spd.05	**01.22**	Preset ref. 2	± **Spd.01** rpm	0.00 rpm
Spd.06	**02.11**	Acceleration rate 1	0.1 to 3200.0 s	20.0 s
Spd.07	**02.21**	Deceleration rate 1	0.1 to 3200.0 s	20.0 s
Spd.08	**02.04**	Deceleration ramp mode select	Fixed ramp Automatic ramp Automatic ramp + Fixed ramp +	Automatic ramp
If Ctr.02 = Induction motor in vector control mode or PM motor (Servo) in vector control mode:				
Spd.09	**03.10**	Speed loop proportional gain Kp1	0 to 32000	200
Spd.10	**03.11**	Speed loop integral gain Ki1	0 to 32000	100

• I/O MENU: CUSTOMER INTERFACE

Parameter	Address	Name	Adjustment range	Factory setting
I/O.01	**07.11**	Analog input 2 mode	0-20 mA 20-0 mA 4-20 mA with detection 20-4 mA with detection 4-20 mA without detection 20-4 mA without detection	4-20 mA without detection
I/O.02	**07.15**	AI3 signal type	0-20 mA 20-0 mA 4-20 mA with detection 20-4 mA with detection 4-20 mA without detection 20-4 mA without detection 0-10 V +/-10 V	0-10 V
I/O.03	**07.21**	AO1 analog output 1 mode	+/-10 V 0-20 mA 4-20 mA	4-20 mA
I/O.04	**07.19**	AO1 analog output 1 source	Motor speed Current magnitude Output power Active current	Current magnitude
I/O.05	**07.20**	AO1 analog output 1 scale	0.000 to 4.000	1.000

POWERDRIVE MD2/FX
Variable speed drive
QUICK SETUP MODE

Parameter	Address	Name	Adjustment range	Factory setting
I/O.06	**08.21**	DI1 input destination	None Bit 0 Reference selection using digital inputs Bit 0 Preset reference selection using digital inputs Run forward Jog Run reverse FWD/Reverse Run/Stop Stop Drive reset Motorised potentiometer up Motorised potentiometer down Motorised potentiometer reset	None
I/O.07	**08.22**	DI2 input destination		Bit 0 Reference selection using digital inputs
I/O.08	**08.23**	DI3 input destination		Bit 0 Preset reference selection using digital inputs
I/O.09	**08.24**	DI4 input destination		Run forward
I/O.10	**08.25**	DI5 input destination		Run reverse
I/O.11	**08.26**	DO1 digital output source	None Zero speed At speed Nominal load reached Motor overtemperature alarm Vmax alarm Brake release Comparator 4 output Comparator 5 output	Zero speed
I/O.12	**08.28**	Output relay 2 source		Vmax alarm

• Apl MENU: ADDITIONAL SETTINGS 1, if Ctr.01 = Centrifugal application

Parameter	Address	Name	Adjustment range	Factory setting
Apl.01	**09.21**	Motorised potentiometer mode	Reset/Enable Previous/Enable Reset/Disable Previous/Disable Min. Ref/Enable Min. Ref/Disable	Reset/Disable
Apl.02	**09.23**	Motorised potentiometer rate	0 to 250 s	20 s
Apl.03	**09.24**	Motorised potentiometer scale factor	0.00 to 2.50	1.00
Apl.04	**09.25**	Motorised potentiometer destination	None Preset ref. 1 Preset ref. 2 Preset ref. 3 Preset ref. 4	None
Apl.05	**12.74**	Comparator 4 threshold	0.00 to 60000.00	0.00
Apl.06	**12.77**	Comparator 4 output destination	None User trip 1 User trip 2 User trip 3 User trip 4	None
Apl.07	**12.78**	Comparator 4 masking	0.0 to 255.0 s	30.0 s
Apl.08	**12.84**	Comparator 5 threshold	0.00 to 60000.00	200.00
Apl.09	**12.87**	Comparator 5 output destination	None User trip 1 User trip 2 User trip 3 User trip 4	None
Apl.10	**12.88**	Comparator 5 masking	0.0 to 255.0 s	30.0 s

POWERDRIVE MD2/FX
Variable speed drive
QUICK SETUP MODE

Parameter	Address	Name	Adjustment range	Factory setting
Apl.11	**14.03**	PID reference source	None Analog input 1 Analog input AI2 Analog input 3 Buffer 1	None
Apl.12	**14.04**	PID feedback source	None Analog input 1 Analog input 2 Analog input 3 Buffer 1	None
Apl.13	**14.08**	PID enable	Disabled Enabled	Disabled
Apl.14	**14.16**	PID output destination	None Preset ref. 1 Preset ref. 2 Preset ref. 3 Preset ref. 4	None
Apl.15	**14.10**	PID proportional gain	0.000 to 32.000	1.000
Apl.16	**14.11**	PID integral gain	0.000 to 32.000	0.500
Apl.17	**14.61**	User unit factor	± 200.00	1.00
Apl.18	**14.60**	User unit	% bar mbar Pa PSI °C °F m^3/s m^3/min m^3/hr l/min	%
Apl.19 and **Apl.20**	**-**	Not used		

• Apl MENU: ADDITIONAL SETTINGS 2, if Ctr.01 = Brake motor application

Parameter	Address	Name	Adjustment range	Factory setting
Apl.01	**12.41**	Brake controller	Disabled Enabled	Disabled
Apl.02	**12.42**	Upper current threshold	0 to 200%	30%
Apl.03	**12.44**	Brake release speed	0.00 to 100.00 rpm	30.00 rpm
Apl.04	**12.45**	Brake apply speed	0.00 to 100.00 rpm	5.00 rpm
Apl.05	**12.46**	Brake delay	0.00 to 25.00 s	0.30 s
Apl.06	**12.47**	Post-brake release delay	0.00 to 25.00 s	1.00 s
Apl.07	**03.05**	Zero speed threshold	0.00 to 500.00 rpm	30.00 rpm
Apl.08 to **Apl.20**	**-**	Not used		

4.2 - Explanation of parameters

Key:

: Indicates a parameter used when the drive is configured in open loop mode.

: Indicates a parameter used when the drive is configured in flux vector control mode.

(#) : Indicates the factory setting for the relevant parameter.

4.2.1 - Basic control of the variable speed drive

Ctr.01 : Factory settings

Disabled (#):
When the drive has completed the procedure for returning to factory settings, **Ctr.01** returns to "Disabled".

Centrifugal application:
Return to factory settings of all parameters and adaptation of the "**Quick setup**" menu to a centrifugal application (quadratic torque). The "Additional settings 1" Apl menu becomes active (refer to section 4.2.5).

Brake motor application:
Return to factory settings of all parameters and adaptation of the "**Quick setup**" menu to an application with brake motor. The "Additional settings 2" Apl menu becomes active (refer to section 4.2.6).

Other application:
Return to factory settings of all parameters without adaptation of the "**Quick setup**" menu. The "Additional settings 1 & 2" Apl menus are inactive.

Note: If the proposed configurations are not suitable, the user can adapt the "Additional settings" Apl menu to his application. In this case, refer to parameters **11.01** to **11.20** in the "**Advanced setting**" menu (section 5).

Ctr.02 : User drive mode
This parameter can only be modified when the drive is stopped (drive ready or disabled).

Induction motor in open loop mode (#):
Asynchronous motor controlled in open loop mode (without speed feedback).

Induction motor in vector control mode:
Asynchronous motor controlled in closed loop mode with speed feedback or with the sensorless function (see **Mtr.10**).

Servo:
Permanent magnet motor controlled in closed loop mode with speed feedback or with the sensorless function (see **Mtr.10**).

Active rectifier on Main power:
Reserved for the "**Advanced setting**" menu (menu 18).

Active rectifier for synchronous motor:
Reserved for the "**Advanced setting**" menu (menu 18).

Active rectifier for induction motor:
Reserved for the "**Advanced setting**" menu (menu 18).

DC/DC converter:
Reserved

Ctr.03 : Switching frequency
Sets the PWM switching frequency in kHz.

Note: For frequencies higher than 6 kHz, please consult LEROY-SOMER.
For the **POWERDRIVE FX**, **Ctr.03** must be 4 kHz or higher.

Ctr.04 : Symmetric current limit
Used to set the maximum permanent current limit permitted.

Note: In "**Quick setup**", **Ctr.04** has a maximum limit of 150%. If necessary, refer to "**Quick setup**" menu 4.

Ctr.05 : Run/Stop source

Terminals (#):
Commands come from the control terminal block.

Fieldbus:
Commands come from a fieldbus. For this configuration, refer to section 5 "**Quick setup**".

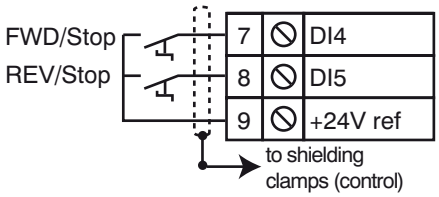
Not active:
Not used.

LCD keypad:
Commands come from the MDX-Powerscreen or MDX-KEYPAD parameter-setting interface, connected to the drive.

Ctr.06 : Start stop logic select
In Terminals mode (see **Ctr.05**), used to choose one of 4 Run/Stop command and Rotation direction management modes.

Note: Modifications to **Ctr.06** must be made with the drive disabled.

Run no latch:
Command for FWD/Stop and REV/Stop via stay-put contacts.
In its factory setting:
- Terminal DI4 preset to FWD/Stop.
- Terminal DI5 preset to REV/Stop.



On power-up or after a trip reset, if a Run command is already selected, the motor starts as soon as the speed reference appears.

Run latched:
Command for Run and Stop via jog contacts.
In this mode, use DI5 to give the Stop command.
To do this, configure:
- **I/O.10** = **Stop** (DI5 assignment).
- **I/O.07** = **Run reverse** (DI2 assignment if necessary).

POWERDRIVE MD2/FX
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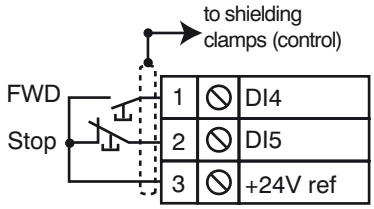
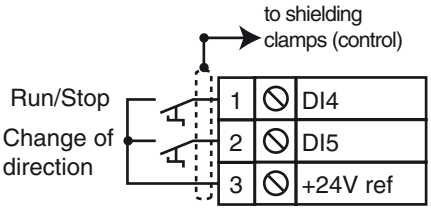
In its factory setting:
- Terminal DI4 preset to FWD.

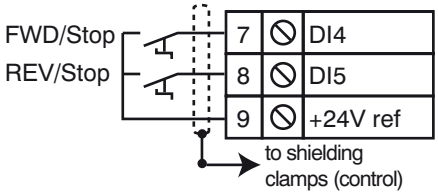


To change from FWD to REV or vice versa, go via a Stop command.

Run Fwd/Rev:
Command for Run/Stop via stay-put contact.
In this mode, use DI4 as Run/Stop, and DI5 to give the direction of rotation.
To do this, configure:
- **I/O.09** = **Run/Stop** (DI4 assignment).
- **I/O.10** = **FWD/Reverse** (DI5 assignment).



Controlled run (no latch) (#):
Command for FWD/Stop and REV/Stop via stay-put contacts.
In its factory setting:
- Terminal DI4 preset to FWD/Stop.
- Terminal DI5 preset to REV/Stop.



On power-up or after a trip reset, if a run command is already selected, the motor does not start. The Run input (DI4 or DI5) must be cycled for the command to take effect.

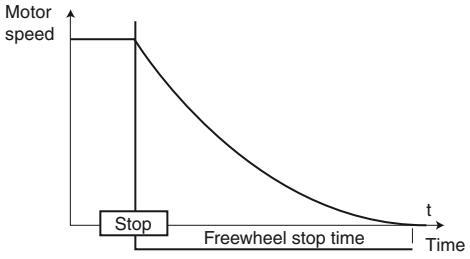
Ctr.07 : Bipolar reference enable

No (#):
All negative references are treated as invalid.

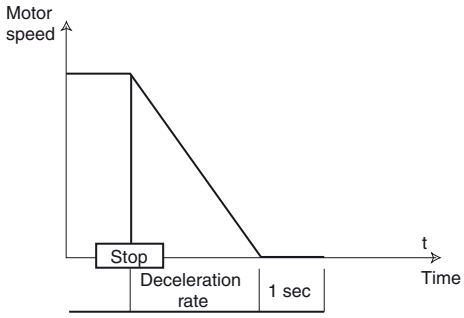
Yes:
Used for changing the direction of rotation by the polarity of the reference (which may come from the preset references).

Ctr.08 : Stop mode

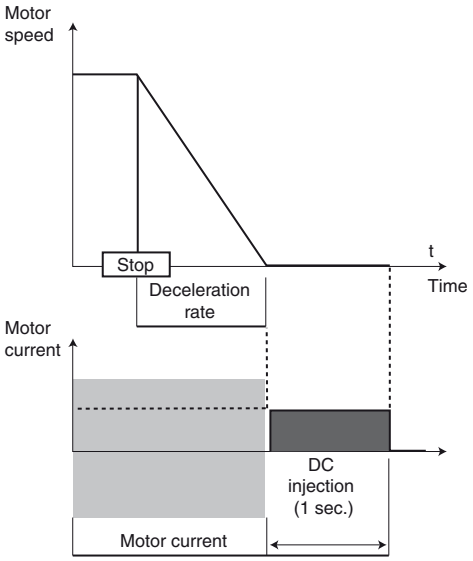
Coast:
The drive stops in freewheel mode.
The power bridge is deactivated as soon as the stop command is given.
The drive cannot receive another run command for 2 seconds, the time required for motor demagnetisation.
After this stopping time, the drive is "ready". The machine stopping time depends on its inertia.



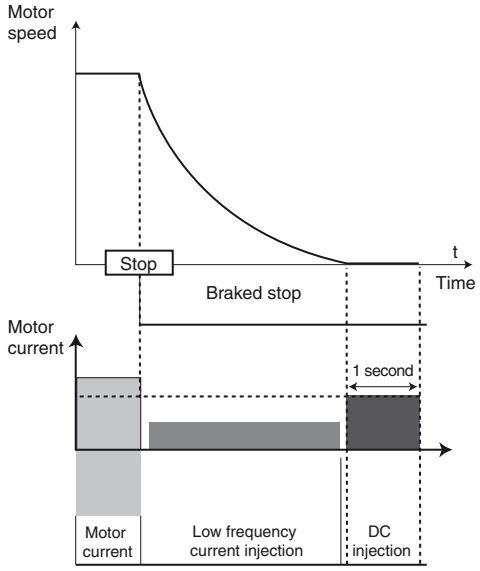
Ramp (#):
Stop on deceleration ramp.
The drive decelerates the motor according to the deceleration mode chosen in parameter **Spd.08**.
One second after the stop, the drive is "ready".



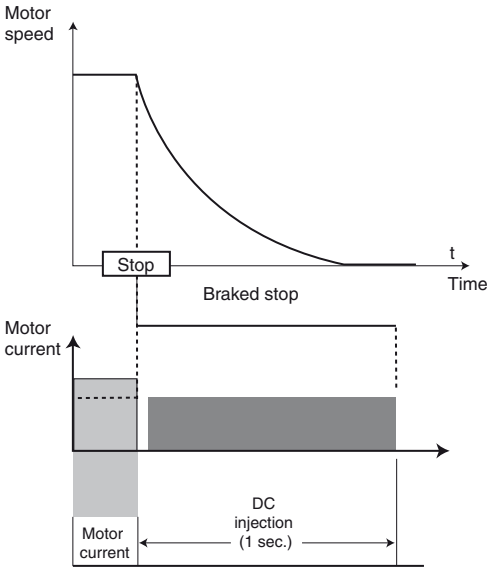
Ramp + DC ( ):
Stop on deceleration ramp with DC injection.
The drive decelerates the motor according to the deceleration mode chosen in parameter **Spd.08**.
When zero frequency is reached, the drive injects DC current for 1 second.
The drive is "ready".



Zero speed DC (3) ( ):
Stop by braking using low frequency current injection, then DC injection at zero speed.
The drive decelerates the motor by imposing a low frequency current until it reaches almost zero speed, which the drive detects automatically.
The drive then injects DC current for 1 second. No run command can be taken into account until the drive is "ready".



Timed DC ( ):
Stop on DC injection.
The drive decelerates the motor by imposing a current for 1 second. No run command can be taken into account until the drive is "ready".



Note: In closed loop mode ( ), the "Ramp + DC", "Zero speed DC" and "Timed DC" stop modes are equivalent to the "Ramp" stop mode.

Ctr.09 : Catch a spinning motor

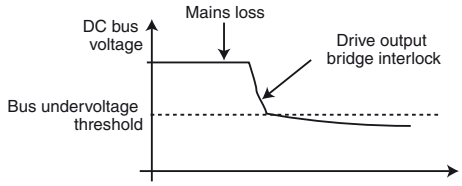
• If the load is stationary at the time of the run command or when the mains supply returns, this operation may cause the machine to rotate in both directions before the motor accelerates. Before enabling this function, check that there is no danger to equipment and personnel.

Disabled (#):
Catch a spinning motor disabled on a motor which is rotating.

Enabled:
If the drive output is inactive, the drive executes a procedure to calculate the motor frequency and direction of rotation. After the output bridge is reactivated, it will automatically recalibrate the output frequency to the measured value and reaccelerate the motor up to the reference frequency.

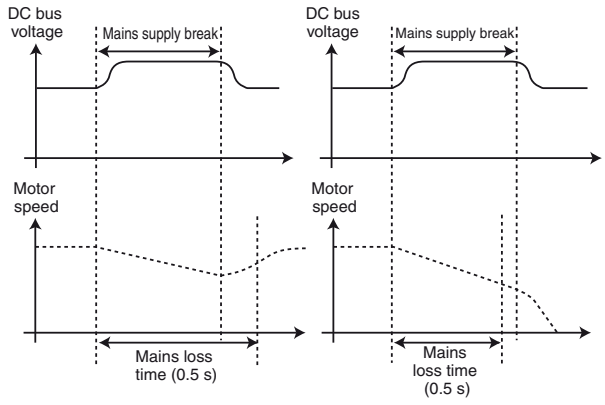
Ctr.10 : Mains loss mode

No detection (#):
The drive does not take account of mains supply breaks and continues to operate while there is sufficient voltage in the DC bus.



Full stop:
If there is a mains supply break, the drive will decelerate on a ramp, which is automatically calculated by the drive, so that the motor feeds back the energy to the DC bus. On return to normal conditions, deceleration continues until the motor stops, according to the stop mode programmed in **Ctr.08**.
The drive trips on "Mains loss".

Delayed stop:
If there is a mains supply break, the drive will decelerate on a ramp, which is automatically calculated by the drive, so that the motor feeds back the energy to the DC bus.
On return to normal conditions:
- If the duration of the mains loss is less than 0.5 s, the motor reaccelerates up to its reference speed.
- If the duration of the mains loss is greater than 0.5 s, deceleration continues in freewheel mode. The drive trips on "Mains loss".



Ctr.11 : Auto reset type

Controlled (#):
Trip reset by a Reset command on the terminals or via the parameter-setting interface.

Automatic:
All trips automatically reset.

Auto for 1081, 1082, 1083, 1084:
Reserved for "**Advanced setting**" mode (menu 10).

Auto except 1081, 1082, 1083, 1084:
Reserved for "**Advanced setting**" mode (menu 10).

Ctr.12 : Rotation direction
This parameter is used to modify the direction of rotation when viewed from the drive end, without changing the speed reference sign.
It is only taken into account when the drive is stopped.

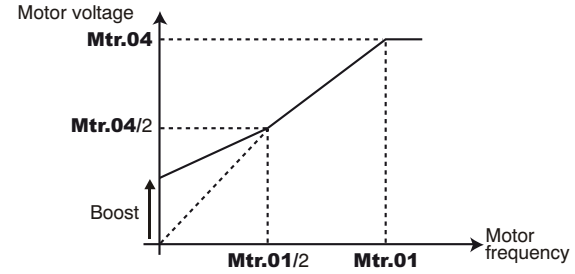
Ctr.13 : Open loop mode select (🔒)
Determines the open loop control mode. The "Rs measured each run", "Rs not measured", "Rs measured after each factory setting" and "Rs measured after each power up" modes are used for flux vector control of induction motors. These 4 modes are distinguished by the method used to identify the motor parameters, in particular the stator resistance. As these parameters vary with temperature and are essential for obtaining optimum performance, the machine cycle must be taken into account when selecting the most appropriate mode.
The "Linear U/F law with boost" and "Square U/F law with boost" modes correspond to control by U/F ratio modes for induction motors.

Rs measured each 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 should be compatible with the 2 seconds required between a stop command and a new run command.

Rs not measured:
The stator resistance and voltage offset are not measured.
This mode is less effective than the "Rs measured each run" mode but it is compatible with all operating cycles. During commissioning, an autotune when stopped should be carried out (**Ctr.14**) so as to automatically fill in the stator resistance and voltage offset values.

Linear U/F law with boost:
Voltage-frequency ratio with fixed boost.

Note: Use this mode to control several motors connected in parallel.

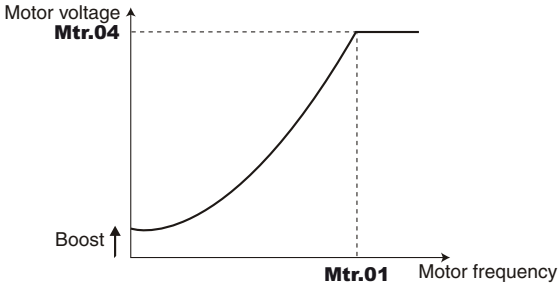


Rs measured after each factory setting:
After a return to factory settings, the stator resistance and voltage offset are measured the first time the drive is enabled (drive output active).

Rs measured after each power up (#):
The stator resistance and voltage offset are measured the first time the drive is enabled (drive output active) following each power-up.

CAUTION:
A voltage is briefly applied to the motor. For safety reasons, no electrical circuit must be accessible once the drive is powered up.

Square U/F law with boost:
Square voltage/frequency law with fixed boost.



Ctr.14 : Autotune

• During the autotune phase, brake control is disabled.

• Measurements taken when Ctr.14 = Running must be performed with the motor uncoupled since the drive drives the motor at 2/3 of its rated speed. This autotune is necessary only in closed loop operating mode (▣). Make sure that this operation does not present any safety risks, and that the motor is stopped before the autotune procedure.

• After modifying the motor parameters, repeat autotuning.

None (#):
No autotune performed.
At the end of an autotune procedure, **Ctr.14** reverts to None.

Stationary: Motor data completed
- If **Ctr.02** = Induction motor in open loop mode or Induction motor in vector control mode: The stator resistance and voltage offset respectively are measured and stored.
- If **Ctr.02** = PM motor (Servo) in vector control mode: The stator resistance and voltage offset respectively are measured and stored.
  The stator inductance is measured but not stored. An alarm is generated if its value is very different from the value entered in **Mtr.08**. The current loop is automatically set.
- Other **Ctr.02** modes: no action.

Procedure:
- Ensure that the motor parameters have been configured (**Mtr "Motor nameplate"** menu) and that the motor is stopped.
- Enable the drive.
- Give a run command.
- Wait until the procedure ends.
- Disable the drive and remove the run command.
  The motor is then ready to operate normally.
  Parameter **Ctr.14** reverts to "None" as soon as autotuning is complete.

Rotating: motor data incompleted
- If **Ctr.02** = Induction motor in open loop mode: Procedure not compatible with this control mode.
- If **Ctr.02** = Induction motor in vector control mode: The stator resistance and voltage offset are measured and stored. The Transient inductance / Ld **Mtr.08** and total inductance "Ls" are also measured and stored. The power factor **Mtr.05** is automatically updated.
- If **Ctr.02** = PM motor (Servo) in vector control mode: The stator resistance and voltage offset are measured and stored. The Transient inductance / Ld **Mtr.08** and no-load EMF **Mtr.09** are measured and stored. An alarm is generated if their values are very different from the values entered in **Mtr.08** and **Mtr.09**.
- Other **Ctr.02** modes: no action.

Procedure:
- Ensure that the motor parameters have been configured and that the motor is stopped.
- Enable the drive.
- If the drive is undersized in relation to the motor power, reduce the current limit **Ctr.04** in order to avoid causing the drive to trip.
- Give a run command. The motor is driven, then performs a freewheel stop when autotuning is complete.
- Wait until the procedure ends.
- Disable the drive and remove the run command.
  The motor is then ready to operate normally.
  Parameter **Ctr.14** reverts to "None" as soon as autotuning is complete.

Encoder offset measure:
In this mode, the motor runs at very low speed so that the encoder offset can be measured. This mode is only active if **Mtr.10** is set to "UVW only", "Incremental UVW", "Hall effect sensor" or "Resolver". The Position feedback phase angle is automatically stored in **Mtr.13**.

CAUTION:
If a stop command is given before the end of the autotune phase, an "Autotune" trip is generated.

4.2.2 - Motor nameplate

Mtr.01 : Motor rated frequency

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.

Mtr.02 : Motor rated current

This is the value of the motor rated current indicated on the nameplate. The main purpose of the motor rated current is to define the motor temperature.

Mtr.03 : Motor rated speed

This is the on-load speed of the motor indicated on the nameplate.

Note: This value must take into account the slip of the asynchronous motor with respect to the synchronous speed. Under no circumstances must this slip be negative.

Mtr.04 : Motor rated voltage

Enter the rated voltage indicated on the nameplate taking account of the normal power supply conditions.
Defines the voltage/frequency ratio.

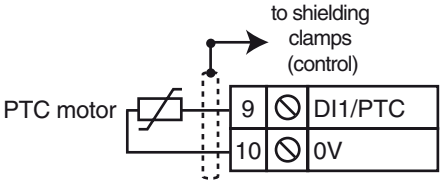
Mtr.05 : Rated power factor

The Cos φ is measured automatically during an autotune when running phase (see **Ctr.14**) and stored in this parameter. If it has not been possible to carry out this autotune procedure, enter the Cos φ value indicated on the motor nameplate.

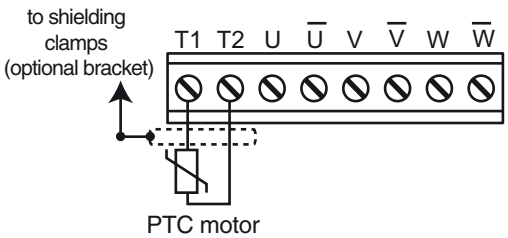
Mtr.06 : PTC validation

Disabled (#):
PTC temperature sensors not managed by the drive.

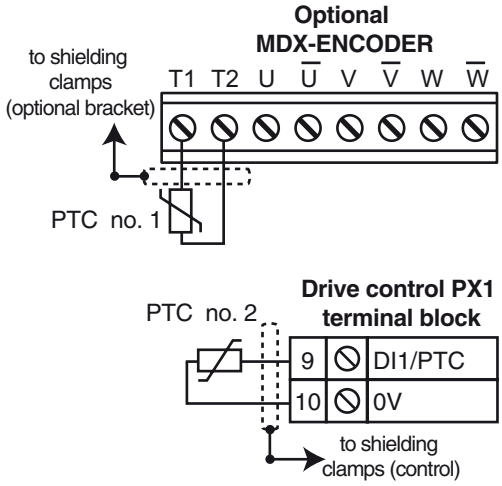
Drive terminal:
PTC sensor connected to DI1/PTC and drive control terminal block 0V is taken into account.



Encoder option terminal:
PTC sensor connected to T1 and T2 on the MDX-ENCODER option terminal block is taken into account.



2 PTC inputs:
2 PTC sensors connected to DI1/PTC and the drive control terminal block 0V and to T1 and T2 on the MDX-ENCODER option terminal block respectively are taken into account.



CAUTION:
If Mtr.06 is set to "Drive terminal" or "2 PTC inputs", then digital input DI1 must not be used (do not assign I/O.06).

Mtr.07 : Motor ventilation

Not cooled:
The motor has neither an internal fan nor a forced ventilation unit.

Self cooled (#):
The motor has a fan on the shaft.

Forced cooling:
The motor has a forced ventilation unit.

Mtr.08 : Transient inductance / Ld

- Asynchronous motor: Value of the overall leakage inductance viewed from the stator. The value of **Mtr.08** is stored automatically during an autotune when running in flux vector mode (**Ctr.14** = Rotating).
- Synchronous motor: Value of the cyclical stator inductance. The value of **Mtr.08** is used in permanent magnet motor sensorless control mode (**Mtr.10** = Software encoder n°1 or Software encoder n°2). This inductance should be entered from the nameplate by setting a value corresponding to 80% of the Ld value on the nameplate, or else using the autotune procedure (see **Ctr.14**).

Note:
This parameter is only visible if **Ctr.02** = PM motor (Servo) in vector control mode.

Mtr.09 : Motor volt per 1000 rpm (Ke) (▣)
This is the value of the motor voltage for 1000 rpm.
The value of **Mtr.09** is used in permanent magnet motor sensorless control mode (**Mtr.10** = Software encoder n°1 or Software encoder n°2).

This electromotive force should be entered from the nameplate by setting the Ke value on the nameplate, or else using the autotune procedure (see **Ctr.14**).
Note:
This parameter is only visible if **Ctr.02** = PM motor (Servo) in vector control mode.

Mtr.10 : Encoder type

Incremental:
If **Ctr.02** = Induction motor in vector control mode, an incremental encoder with quadrature complemented signals A, B can be used.

Reserved:

U, V, W only:
If **Ctr.02** = PM motor (Servo) in vector control mode, a simplified encoder with only U, V, W commutation channel signals can be used. This selection also allows use in downgraded operation of an encoder whose A and B channels are not operational.

Incremental UVW:
If **Ctr.02** = PM motor (Servo) in vector control mode, an incremental encoder with complemented signals A, B and complemented commutation channels U, V, W can be used.

Hall effect sensor:
If **Ctr.02** = PM motor (Servo) in vector control mode, Hall effect sensors mounted on certain permanent magnet motors can be used.

Software encoder n°1:
If **Ctr.02** = PM motor (Servo) in vector control mode, used to confirm the position 1 observer (software encoder), recommended for applications with high inertia (more than 20 times the motor inertia). If necessary, refer to section 5 of the advanced menus.
If **Ctr.02** = Induction motor in vector control mode, used to confirm the position 1 observer (software encoder), reserved for applications with a low overtorque requirement on starting (pump, ventilation, etc).

Software encoder n°2 (#):
If **Ctr.02** = PM motor (Servo) in vector control mode, used to confirm the position 2 observer (software encoder), recommended for applications with low inertia (applied inertia less than 20 times the motor inertia).
If **Ctr.02** = Induction motor in vector control mode, used to confirm the position 2 observer (software encoder), recommended for applications with a high overtorque requirement on starting (grinders, presses, extruders, etc).

Software encoder n°3:
Reserved.

Software encoder n°4:
Mode reserved for "**Advanced setting**".

Software encoder n°5:
Reserved.

Resolver:
Reserved.

Mtr.11 : Encoder lines per revolution
Used to configure the number of lines per incremental encoder revolution. Converts the encoder input into a speed.

Mtr.12 : Encoder supply voltage

5V (#):
This parameter is used to set the encoder supply voltage to 5V.

15V:
This parameter is used to set the encoder supply voltage to 15V.

CAUTION:
Before selecting "15V", check that the encoder used can withstand this voltage.

Mtr.13 : Position feedback phase angle (▣)
Indicates the result of the phasing test performed during autotuning (see **Ctr.14**). It is stored when the drive is powered down and will only be modified automatically after another autotune.

• The phase angle, when it is known, can be entered manually. Any incorrect value can cause the motor to rotate in the wrong direction or trip the drive.

4.2.3 - Speeds and ramps

Spd.01 : Maximum reference clamp

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

Maximum speed in both directions of rotation.

Spd.02 : Minimum reference clamp

In unipolar mode, defines the minimum speed (inactive in bipolar mode).

CAUTION:

• This parameter is inactive during jog operation.

• If the value of Spd.01 is lower than that of Spd.02, the value of Spd.02 is automatically changed to the new value of Spd.01.

Spd.03 : Reference selector

Terminal inputs (#):

Selection of the speed reference on differential analog input 1 or 2 via digital input DI3.

Analog input 1:

The speed reference comes from differential analog input 1 (AI1+ and AI1- terminals).

Analog input 2:

The speed reference comes from differential analog input 2 (AI2+ and AI2- terminals).

Preset reference:

Selection of the speed reference comes from preset reference RP1 or RP2 via digital input DI2 (set **Spd.04** for RP1 or **Spd.05** for RP2).

Keypad:

The speed reference comes from the parameter-setting interface (see section 2.2.4).

Spd.04 : Preset ref. 1

Used to define preset reference Pr1.

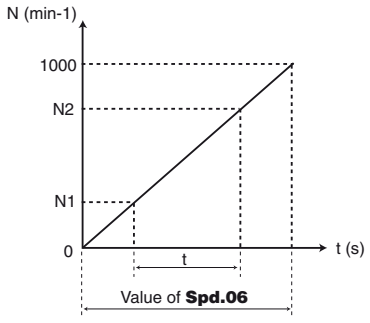
Spd.05 : Preset ref. 2

Used to define preset reference Pr2.

Spd.06 : Acceleration rate 1

Sets the time for acceleration from 0 to 1000 rpm.

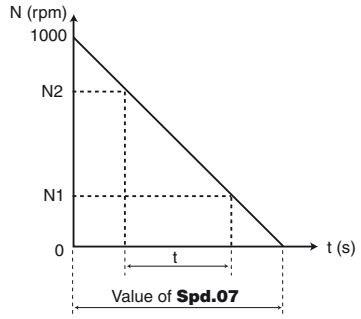
$$\textbf{Spd.06} = \frac{t(s) \times 1000\ rpm}{(N2 - N1)\ rpm}$$



Spd.07 : Deceleration rate 1

Sets the time for deceleration from 1000 rpm to 0.

$$\textbf{Spd.07} = \frac{t(s) \times 1000\ rpm}{(N2 - N1)\ rpm}$$



Spd.08 : Deceleration ramp mode select

In factory-setting configuration, this parameter is not relevant for the POWERDRIVE FX.

Fixed ramp:

Deceleration ramp imposed. If the deceleration ramp which has been set is too fast in relation to the inertia of the load, the DC bus voltage exceeds its maximum value ("T" rating: 710 V; "TH" rating: 1100 V) and the drive trips on "DC bus overvoltage".

CAUTION:

Select "Fixed ramp" mode when a braking resistor is being used.

Automatic ramp (#):

Standard deceleration ramp with automatic extension of the ramp time in order to avoid causing a drive DC bus overvoltage trip ("T" rating: 710 V; "TH" rating: 1100 V).

Automatic ramp +:

The drive allows the motor voltage to be increased to up to 1.2 times the rated voltage set in **Mtr.04** (motor rated voltage), to avoid reaching the maximum DC bus voltage threshold ("T" rating: 710 V; "TH" rating: 1100 V). However, if this is not sufficient, the standard deceleration ramp time is extended, to avoid causing a drive DC bus overvoltage trip.

For the same amount of energy, this mode enables faster deceleration than "Automatic ramp" mode.

Fixed ramp +:

Same as "Automatic ramp +" mode, but the ramp is imposed. If the configured ramp is too fast, the drive trips on DC bus overvoltage.

CAUTION:

In "Automatic ramp +" and "Fixed ramp +" modes, the motor must be capable of withstanding the additional losses relating to the increase in voltage at its terminals.

Spd.09 : Speed loop proportional gain Kp1 (▣)

Sets 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 fairly stable in the event of sudden variations in speed, both at no load and on load.

Spd.10 : Speed loop integral gain Ki1 (▣)
Sets the stability of the motor speed on load impact.
Increase the integral gain to limit the speed recovery time in the event of load impact.

4.2.4 - Customer interface

I/O.01 : Analog input 2 mode
Used to define the type of signal connected to the differential analog input AI2.
If a mode with detection is selected, the drive will cause an "AI2 current loop loss" trip on detection of signal break.

0-20 mA:
0 to 20 mA current input.

20-0 mA:
20 to 0 mA current input.

4-20 mA with detection:
4 to 20 mA current input with detection.

20-4 mA with detection:
20 to 4 mA current input with detection.

4- 20 mA without detection (#):
4 to 20 mA current input without detection.

20-4 mA without detection:
20 to 4 mA current input without detection.

I/O.02 : AI3 signal type
Used to define the type of signal connected to the differential analog input AI3.
If a mode with detection is selected, the drive will cause an "AI3 current loop loss" trip on detection of signal break.

0-20 mA:
0 to 20 mA current input.

20-0 mA:
20 to 0 mA current input.

4-20 mA with detection:
4 to 20 mA current input with detection.

20-4 mA with detection:
20 to 4 mA current input with detection.

4-20 mA without detection:
4 to 20 mA current input without detection.

20-4 mA without detection:
20 to 4 mA current input without detection.

0-10V (#):
0 to 10 V voltage input

± 10V:
± 10 V voltage input.

I/O.03 : AO1 analog output 1 mode
Used to define the type of signal supplied on the analog output.

± 10 V:
± 10 V voltage output.

0-20 mA:
0 to 20 mA current output.

4-20 mA (#):
4 to 20 mA current output.

I/O.04 : AO1 analog output 1 source
This parameter is used to select the source you wish to assign to analog output AO1.
The source can be assigned to the actual motor speed, the current magnitude, the motor power or the motor active current.

I/O.05 : AO1 analog output 1 scale
This parameter is used to scale the AO1 analog output.
Note: When **I/O.05** = 1.000, the maximum value of the analog output corresponds to the maximum value of the parameter which is assigned to it.

I/O.06 : DI1 input destination

I/O.07 : DI2 input destination

I/O.08 : DI3 input destination

I/O.09 : DI4 input destination

I/O.10 : DI5 input destination
These parameters are used to select the destination for digital inputs DI1 to DI5.
The destination can be assigned to reference selection by digital input combination (bit 0), selection of the preset reference (bit 0), run forward, jog, run reverse, change of direction of rotation (forward/reverse), run/stop, stop, trip reset, motorised potentiometer up, motorised potentiometer down and motorised potentiometer reset.

CAUTION:
If Mtr.06 is set to "Drive terminal" or "2 PTC inputs", then digital input DI1 must not be used (do not assign I/O.06).

I/O.11 : DO1 digital output source

I/O.12 : Output relay 2 source
These parameters are used to select the source you wish to assign to digital output DO1 or output relay RL2.
The source can be assigned to zero speed, at speed, nominal load reached, the motor overtemperature alarm, the maximum speed alarm, state of the brake control output, comparator 4 or 5 output.

4.2.5 - Additional settings 1, if Ctr.01 = Centrifugal application

Apl.01 : Motorised potentiometer mode

Reset/Enable:
The reference is reset to 0 on each power-up. The up/down and reset inputs are active at all times.

Previous/Enable:
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.

Reset/Disable (#):
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.

Previous/Disable:
On power-up, the reference is at the same level as before power-down. The up/down inputs are only active when the drive output is active. The reset input is active at all times.

Min. Ref/Enable:
On power-up, the reference value equals the minimum speed (**Spd.02**). The up/down and reset inputs are active at all times.

Min. Ref/DISABLE:
On power-up, the reference value equals the minimum speed (**Spd.02**). The up/down inputs are only active when the drive output is active. The reset input is active at all times.

Apl.02 : Motorised potentiometer rate
This parameter defines the time it takes for the motorised potentiometer 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.

Apl.03 : Motorised potentiometer scale factor
The maximum value of the motorised potentiometer 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 motorised potentiometer reference to the maximum value required by the application.
Example:
- The up/down reference is addressed to a preset reference with the adjustment range ± **Spd.01**.
- If **Spd.01** = 1500 rpm, so that the maximum value of the up/down reference corresponds to 1000 rpm:

$$\Rightarrow \textbf{Apl.03} = \frac{1000}{\textbf{Spd.01}} = 0{,}67$$

Apl.04 : Motorised potentiometer destination
This parameter is used to define the numerical parameter which the motorised potentiometer reference will control.
Example: The motorised potentiometer reference acts as a speed reference. The motorised potentiometer reference can be sent to a preset reference (select for example RP1: Preset Reference **Spd.04**).

APl.05 : Comparator 4 threshold
By default, the comparator 4 source is assigned to the motor power.
APl.05 is used to set the comparator trip threshold and consequently detect an underload.
The threshold is expressed in kW by default.

APl.06 : Comparator 4 output destination
This parameter defines the internal parameter which will be assigned by the comparator output.
The destination can be assigned to user trip 1 to 4.

APl.07 : Comparator 4 masking
This masking is used to delay detection when the drive is enabled in order to avoid detection on starting.

APl.08 : Comparator 5 threshold
By default, the comparator 5 source is assigned to the motor speed.
APl.05 is used to set the comparator trip threshold and consequently detect an underload.
The threshold is expressed in rpm by default.

APl.09 : Comparator 5 output destination
This parameter defines the internal parameter which will be assigned by the comparator output.
The destination can be assigned to user trip 1 to 4.

APl.10 : Comparator 5 masking
This masking is used to delay detection when the drive is enabled in order to avoid detection on starting.

APl.11 : PID reference source
This parameter defines the variable which acts as a reference for the PID controller.
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.
The source can be assigned to analog input AI1, AI2 or AI3 or to buffer variable 1.

APl.12 : PID feedback source
This parameter defines the variable which acts as the feedback for the PID controller.
All the 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.
The source can be assigned to analog input AI1, AI2 or AI3 or to buffer variable 1.

APl.13 : PID enable
Disabled (#):
The PID controller is disabled.
Enabled:
The PID controller is enabled.

APl.14 : PID output destination
Used to define the parameter to which the PID output is addressed.
In this case, as the PID output is supposed to affect the speed, select for example RP1: Preset reference or RP2: Preset reference.

APl.15 : PID proportional gain
This is the proportional gain applied to the PID error.

APl.16 : PID integral gain
This is the integral gain applied to the PID error before integration.

APl.17 : User unit factor
This parameter is a multiplication coefficient allowing the PID reference and PID feedback to be displayed as a user value in the parameter-setting interface Reading mode pages (see section 2.2.2).

APl.18 : User unit
This parameter describes the unit which will be displayed for the PID reference and the PID feedback in the parameter-setting interface Reading mode pages (see section 2.2.2).

APl.19 to APl.20 : Not used

4.2.6 - Additional settings 2, if **Ctr.01** = Brake motor application

Apl.01 : Brake controller

Disabled (#):
Brake control is disabled.

Enabled:
Brake control is enabled.

Apl.02 : Upper current threshold (◧)
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.

Apl.03 : Brake release speed
Used to set the speed threshold at which the brake will be controlled. This speed level should ensure sufficient torque is provided to drive the load in the right direction when the brake is released. In general, this threshold is set at a value slightly above the motor slip expressed in rpm.
Example:
- 1500 rpm = 50 Hz
- Rated on-load speed = 1470 rpm
- Slip = 1500 - 1470 = 30 rpm

Apl.04 : Brake apply speed
Used to set the 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.

Apl.05 : Brake delay

◧ : 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.
During the whole pre-brake delay period, the ramp applied to the reference is held constant.

■◗ : This time delay is used to delay the brake apply command in relation to passage below the minimum speed threshold (**Apl.04**). It is useful for avoiding repeated oscillation of the brake when it is being applied around zero speed.

Apl.06 : Post-brake release delay
This time delay is triggered when brake control is enabled. It is used to allow time for the brake to release before unlocking the speed ramp.

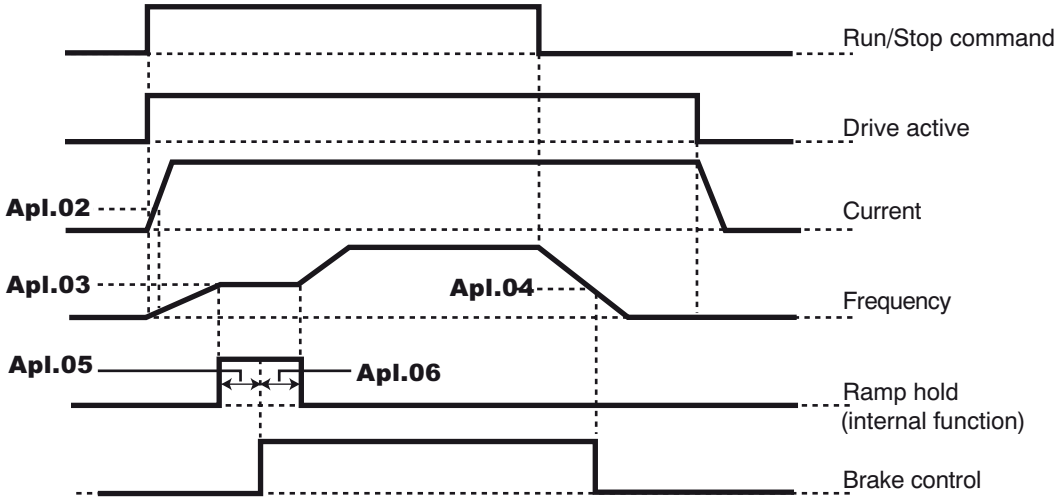
Apl.07 : Zero speed threshold
If the motor speed is at or below the level defined by this parameter, the "Zero speed" alarm will be enabled. In factory-set configuration, this alarm is assigned to digital output DO1 using parameter **I/O.11**.
In open loop mode, upon a stop command, the drive decelerates on the selected ramp to the threshold set by **Apl.07**, and then the motor goes into freewheel mode.

Apl.08 to **Apl.20** : **Not used**

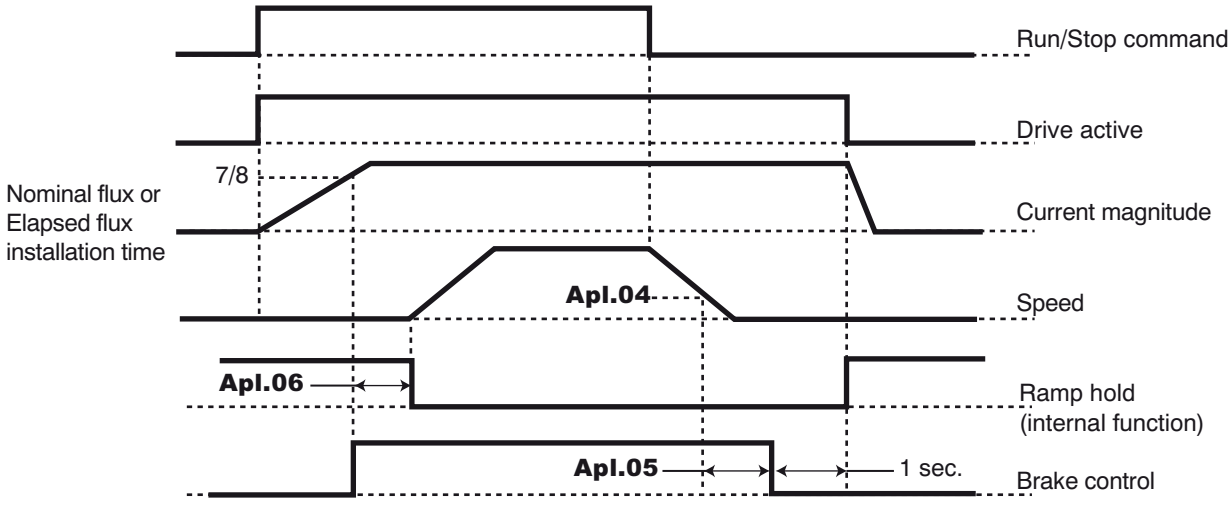
4.3 - Examples of standard configurations

4.3.1 Brake control

- **Ctr.02** = Induction motor in open loop mode



- **Ctr.02** = Induction motor in vector control mode

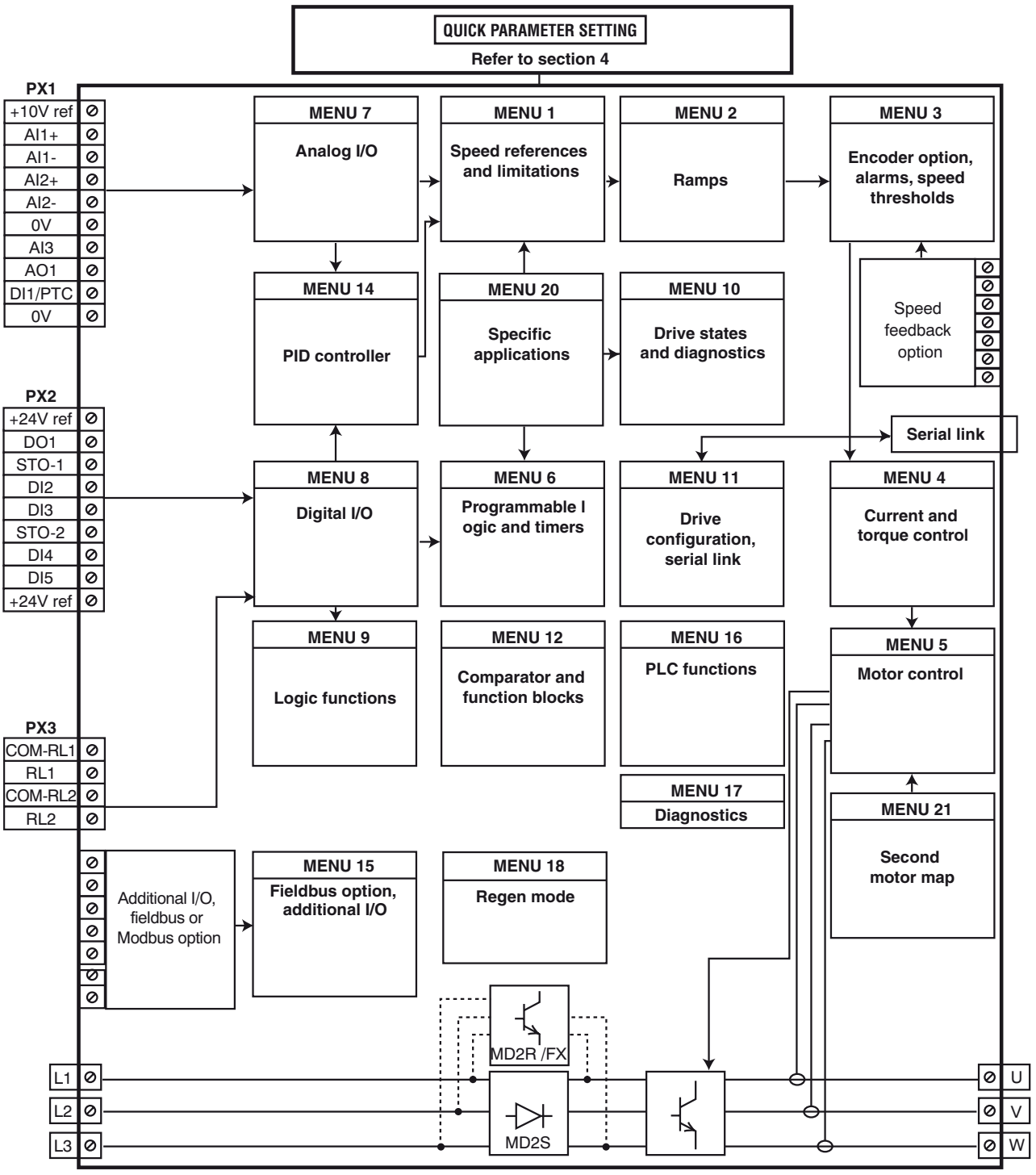


5 - ADVANCED PARAMETER-SETTING MODE

5.1 - Introduction

• Before setting the drive parameters using the diagrams, all instructions relating to installation, connection and commissioning of the drive must have been followed to the letter (manuals supplied with the drive).

5.1.1 - Menu organisation

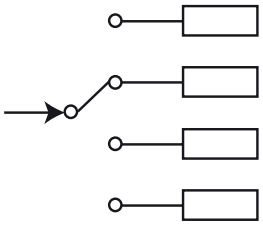


5.1.2 - Explanations of symbols used

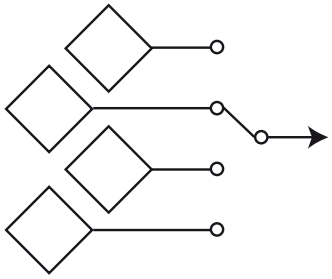
01.06 : A number in bold refers to a parameter.

DI2 : Refers to a drive input or output terminal.

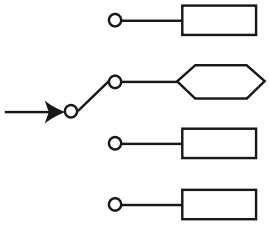
01.21 : Parameters which appear in a rectangle are parameters with Read and Write access.
They can be designated as an assignment destination for connection to:
- Digital inputs for bit parameters
- Analog inputs for non-bit parameters
- Outputs of internal functions (comparators, logical or arithmetic operations, etc)



01.01 : Parameters which appear in a diamond are parameters with Read Only access and 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 arithmetic operations, etc)



01.36 : Parameters which appear in a hexagon are parameters which can only be assigned to:
- Digital inputs for bit parameters
- Analog inputs for non-bit parameters
- Destinations of internal functions (comparators, logical or arithmetical operations, etc.)



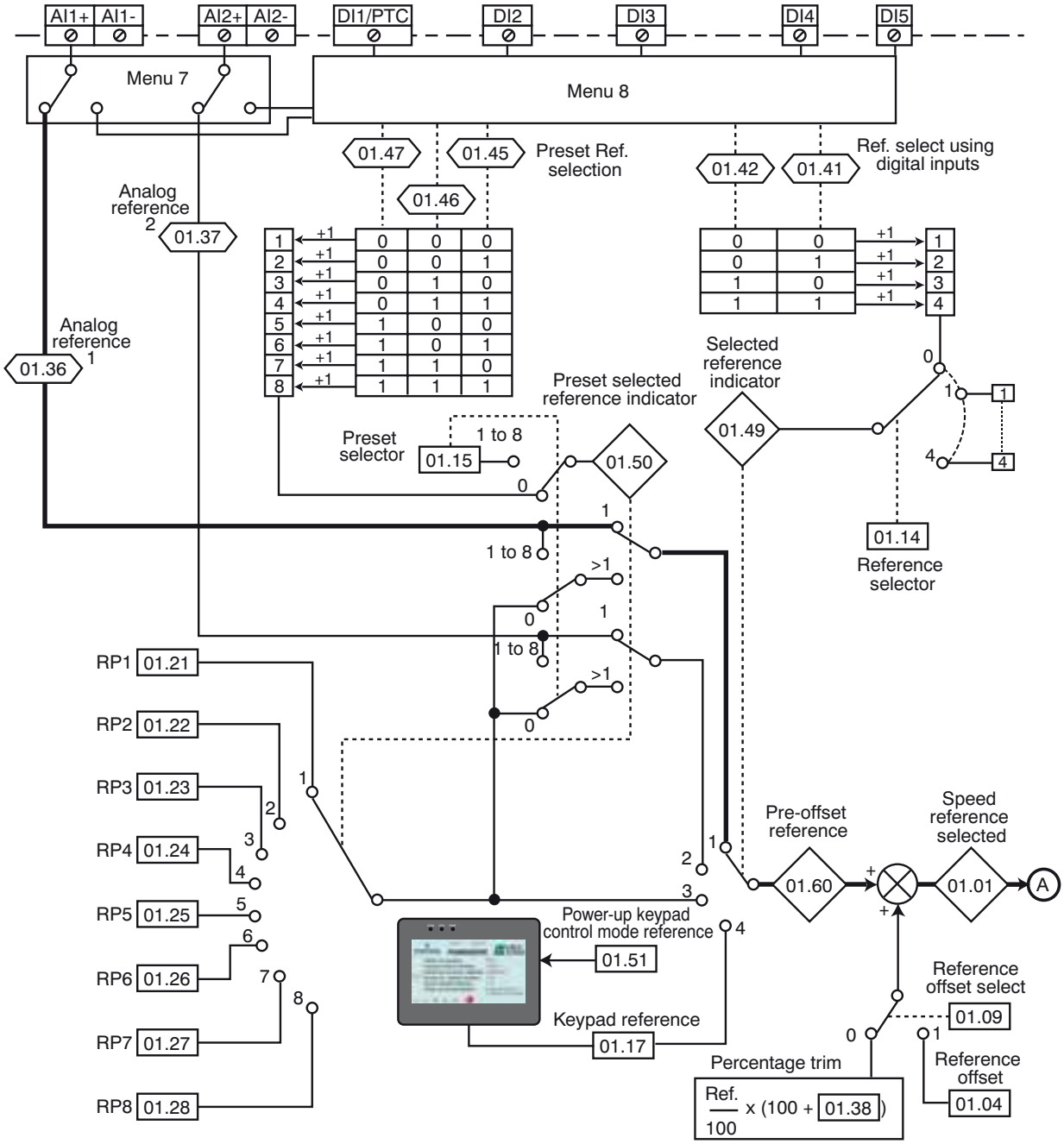
: Indicates a parameter used when the drive is configured in open loop Flux Vector Control mode or V/F.

: Indicates a parameter used when the drive is configured in closed loop Flux Vector Control mode with speed feedback or sensorless function.

5.2 - Menu 1: Speed references and limitations

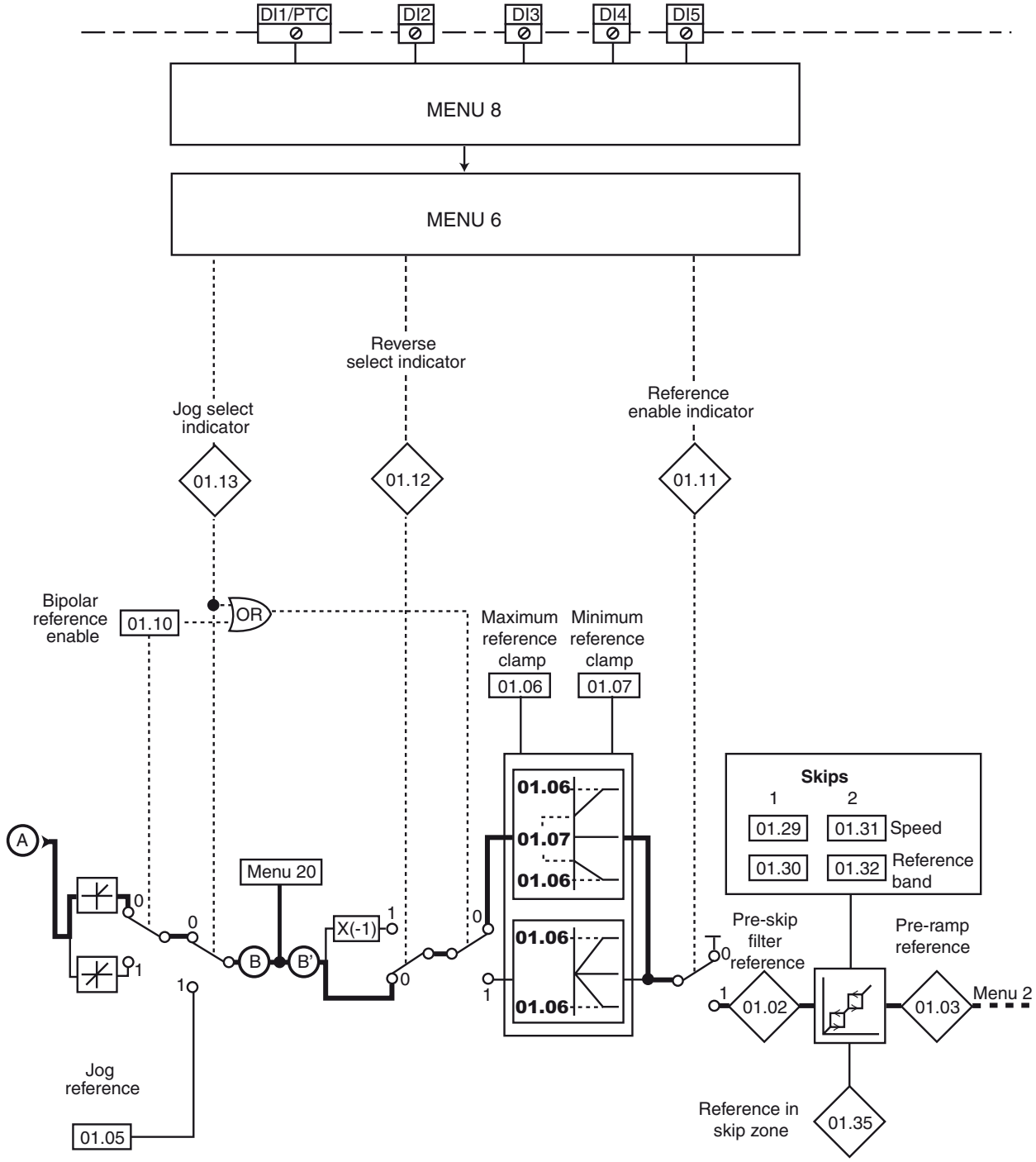
5.2.1 - Menu 1 diagrams

• Selection of reference (speed)



POWERDRIVE MD2/FX
Variable speed drive
ADVANCED PARAMETER-SETTING MODE

• Limiting and filters



5.2.2 - Explanation of parameters in menu 1

01.01 : Speed reference selected

Adjustment range : ± **01.06**
Format: 32 bits
Indicates the speed reference value.

01.02 : Pre-skip filter reference

Adjustment range : ± **01.06** or **01.07** to **01.06**
Format: 32 bits
Speed reference after limiting but before the skips.

01.03 : Pre-ramp reference

Adjustment range : ± **01.06** or **01.07** to **01.06**
Format: 32 bits
Indicates the speed reference after the skips but before the acceleration or deceleration ramps.

01.04 : Reference offset
Adjustment range : ± **01.06**
Factory setting : 0.00 rpm
Format: 32 bits
This reference is added to (positive value) or subtracted from (negative value) the selected reference if **01.09** is set to "Ref + **01.04**". It can be used to correct the selected main reference to obtain an accurate setting.

01.05 : Jog reference
Adjustment range : 0.00 to **01.06**
Factory setting : 45.00 rpm
Format: 32 bits
Operating speed when a jog input is configured and **06.31** = 1.

01.06 : Maximum reference clamp
Adjustment range : 0.00 to 60000.00 rpm
Factory setting : 1500.00 rpm
Format: 32 bits
• Before setting the maximum limit, check that the motor and the driven machine can withstand it.
Maximum speed in both directions of rotation.

01.07 : Minimum reference clamp
Adjustment range : 0.00 to **01.06**
Factory setting : 0.00 rpm
Format: 32 bits
In unipolar mode, defines the minimum speed (inactive in bipolar mode).
CAUTION:
• This parameter is inactive during jog operation.
• If the value of 01.06 is lower than that of 01.07, the value of 01.07 is automatically changed to the new value of 01.06.

01.08 : Not used

01.09 : Reference offset select
Adjustment range : Ref. x **01.38** (0) or Ref. + **01.04** (1)
Factory setting : Ref. x **01.38** (0)
Format: 8 bits
Ref. x 01.38 (0):
A value proportional to this reference is added to the main reference. The percentage is adjusted using parameter **01.38** (see explanation for **01.38**).
Ref. + 01.04 (1) :
A fixed value set in **01.04** is added to the main reference.

01.10 : Bipolar reference enable
Adjustment range : No (0) or Yes (1)
Factory setting : No (0)
Format: 8 bits
No (0):
All negative references are treated as invalid.
Yes (1):
Used for changing the direction of rotation by the polarity of the reference (which may come from the preset references).

01.11 : Run command

Adjustment range : Stop (0) or Run (1)
Format: 8 bits
Used to control enabling of the run command.

01.12 : Reverse select indicator

Adjustment range : Run forward (0) or Run reverse (1)
Format: 8 bits
Run forward (0):
forward.
Run reverse (1):
reverse.

01.13 : Jog select indicator

Adjustment range : Disabled (0) or Enabled (1)
Format: 8 bits
Disabled (0):
Jog operation disabled.
Enabled (1):
Jog operation enabled.

01.14 : Reference selector
Adjustment range : Terminal inputs (0), Analog input 1 (1), Analog input 2 (2), Preset Reference (3),Keypad (4)
Factory setting : Terminal inputs (0)
Format: 8 bits

Terminal inputs (0):
The speed reference is selected by combining the digital inputs assigned to parameters **01.41** and **01.42**.

Analog input 1 (1):
The speed reference comes from differential analog input 1 (AI1+, AI1-).

Analog input 2 (2):
The speed reference comes from differential analog input 2 (AI2+, AI2-).

Preset reference (3):
The speed reference comes from the preset references (RP1 to RP8).

Keypad (4): The speed reference comes from the parameter-setting interface (see section 2.2.4).

01.15 : Preset selector
Adjustment range : Terminal inputs (0), Preset reference 1 to Preset reference 8
Factory setting : Terminal input (0)
Format: 8 bits
This parameter is used to select the preset references.

Terminal input (0):
Used to select the reference by combining the digital inputs assigned to parameters **01.45** to **01.47**.

Preset reference 1 to

Preset reference 8:

Used to select preset references 1 to 8.

01.16 : Not used

01.17 : Keypad reference
Adjustment range : ± **01.06**
Factory setting : 0.00 rpm
Format: 32 bits
Used to set the speed reference value by means of the parameter-setting interface (see section 2.2.4).

01.18 to 01.20 : Not used

01.21 to 01.28 : Preset ref. 1 to Preset ref. 8
Adjustment range : ± **01.06**
Factory setting : 0.00 rpm
Format: 32 bits
In order, **01.21** to **01.28** are used to define preset references 1 to 8.

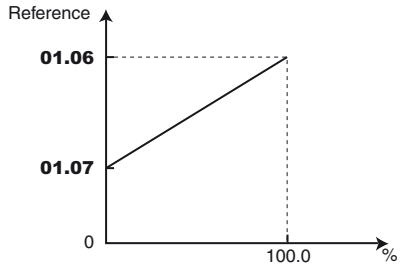
01.29 and 01.31 : Skip references 1 and 2
Adjustment range : 0.00 to **01.06**
Factory setting : 0.00 rpm
Format: 32 bits
Two skips are available to avoid a machine running at critical speeds. When one of these parameters is at 0, the corresponding skip reference is deactivated.

01.30 and 01.32 : Skip reference bands 1 and 2
Adjustment range : 0.00 to 300.00 rpm
Factory setting : 15.00 rpm
Format: 32 bits
Define the skip band around the avoided speed. The total skip will therefore equal the threshold set ± skip reference band. When the absolute value of the reference is within the window determined in this way, the drive will prevent operation in this zone.

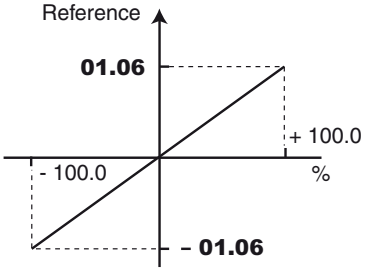
01.33 and 01.34 : Not used

01.35 : Reference in skip zone
Adjustment range : Disabled (0) or Enabled (1)
This parameter is Enabled (1) when the selected reference is within one of the skip zones.
In this case, the motor speed does not correspond to the requested reference.

01.36 and 01.37 :Analog references 1 and 2
Adjustment range : **01.07** to **01.06** (**01.10** = 0)
± **01.06** (**01.10** = 1)
Format: 32 bits
The analog inputs assigned to these parameters are automatically scaled so that 100.0% of the input corresponds to the maximum reference (**01.06**). Similarly the 0% input level will correspond to the minimum reference **01.07** or 0 according to **01.10**.
Unipolar mode (**01.10** = 0)



Bipolar mode (**01.10** = 1)



01.38 : Percentage trim
Adjustment range : ± 100.0%
Factory setting : 0.0%
Format: 16 bits
An offset proportional to the selected reference can be added to this reference.
The multiplication coefficient is determined by the analog input assigned to **01.38**.

$$\text{Final ref} = \frac{\text{Selected ref. x (01.38 + 100)}}{100}$$

01.39 and 01.40 :Not used

01.41 Reference select via digital input (bit 0)
Adjustment range : Ana 1/Preset (0) or Ana 2/Keypad (1)
Format: 8 bits

01.42 Reference select via digital input (bit 1)
Adjustment range : Ana 1/Ana 2 (0) Preset/Keypad (1)
Format: 8 bits
Used to assign the digital inputs to selection of the speed reference.
01.41: bit 0
01.42: bit 1

01.14	01.42	01.41	Value 01.49	Selected reference
0	0	0	1	Analog input 1
	0	1	2	Analog input 2
	1	0	3	Preset reference
	1	1	4	Keypad

01.43 and 01.44 :Not used

01.45 to 01.47 : Preset Ref. selection
Adjustment range : Disabled (0) or Enabled (1)
Format: 8 bits
Used to assign the digital inputs to selection of the preset references.
01.45: bit 0
01.46: bit 1
01.47: bit 2

01.15	01.47	01.46	01.45	Value 01.50	Selected reference
0	0	0	0	1	Preset reference 1 (RP1)
	0	0	1	2	Preset reference 2 (RP2)
	0	1	0	3	Preset reference (RP3)
	0	1	1	4	Preset reference 4 (RP4)
	1	0	0	5	Preset reference 5 (RP5)
	1	0	1	6	Preset reference 6 (RP6)
	1	1	0	7	Preset reference 7 (RP7)
	1	1	1	8	Preset reference 8 (RP8)

01.48 : Not used

01.49 : Reference selected indicator
Adjustment range : Analog input 1 (1),
Analog input 2 (2),
Preset reference (3),
Keypad (4)
Format: 8 bits
Indicates the value selected by **01.14**.

01.50 : Preset selected reference indicator
Adjustment range : Preset reference 1 (1) to
Preset reference 8 (8)
Format: 8 bits
Indicates the value selected by **01.15**.

01.51 : Power-up keypad control mode reference
Adjustment range : Reset to 0 (0), Last value (1), Preset 1 (2)
Factory setting : Reset to 0 (0)
Format: 8 bits

Reset to 0 (0):
On power-up, the speed reference coming from the parameter-setting interface is reset to zero.

Last value (1):
On power-up, the speed reference coming from the parameter-setting interface retains the value it had before power-down.

Preset 1 (2):
On power-up, the speed reference coming from the parameter-setting interface takes the value of preset reference 1 (**01.21**).

01.52 to 01.59 : Not used

01.60 : Pre-offset reference
Adjustment range : ± **01.06**
Format: 32 bits
Indicates the value of the selected speed reference before offset.

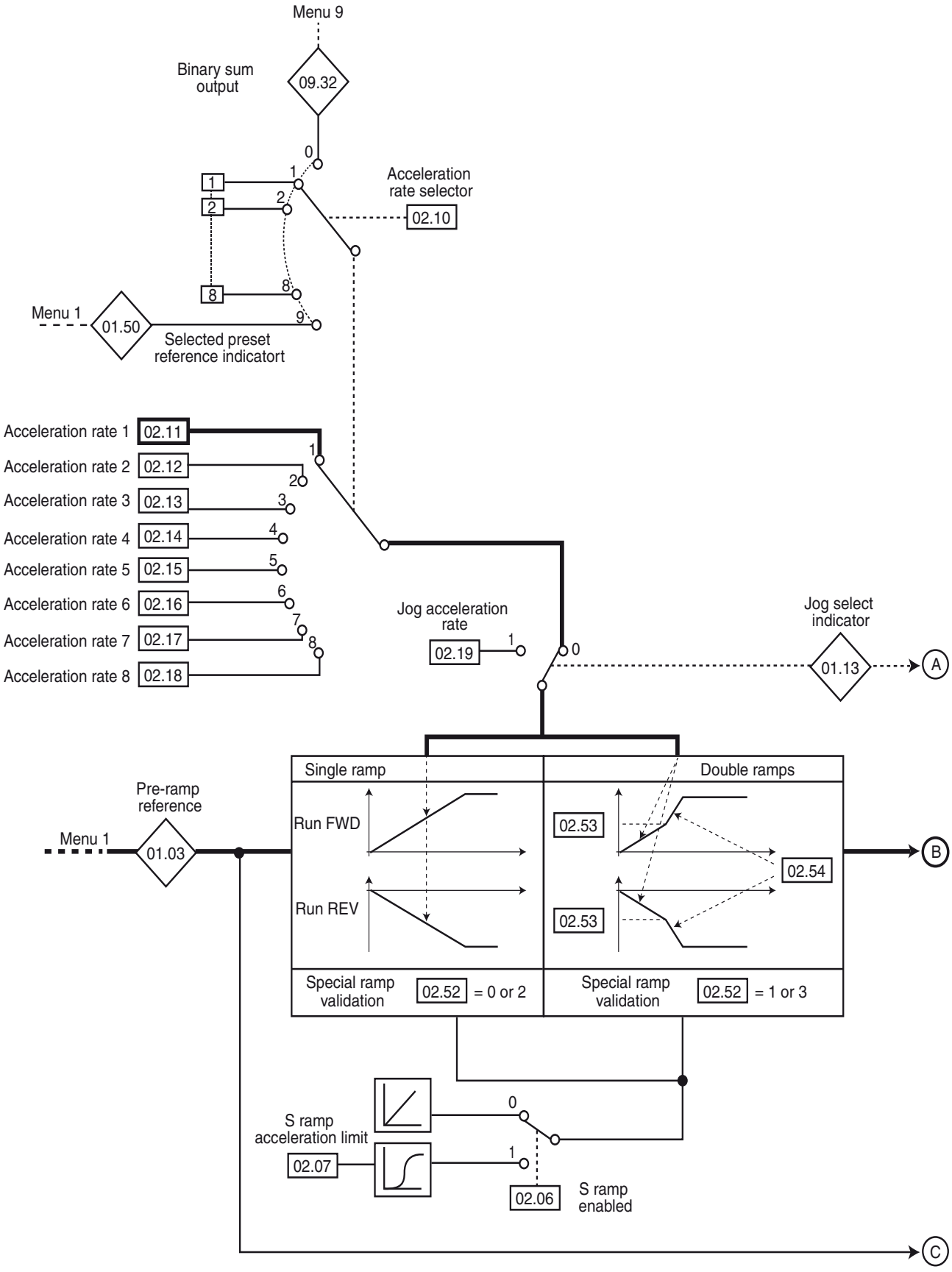
01.61 to 01.78 : Not used

Notes

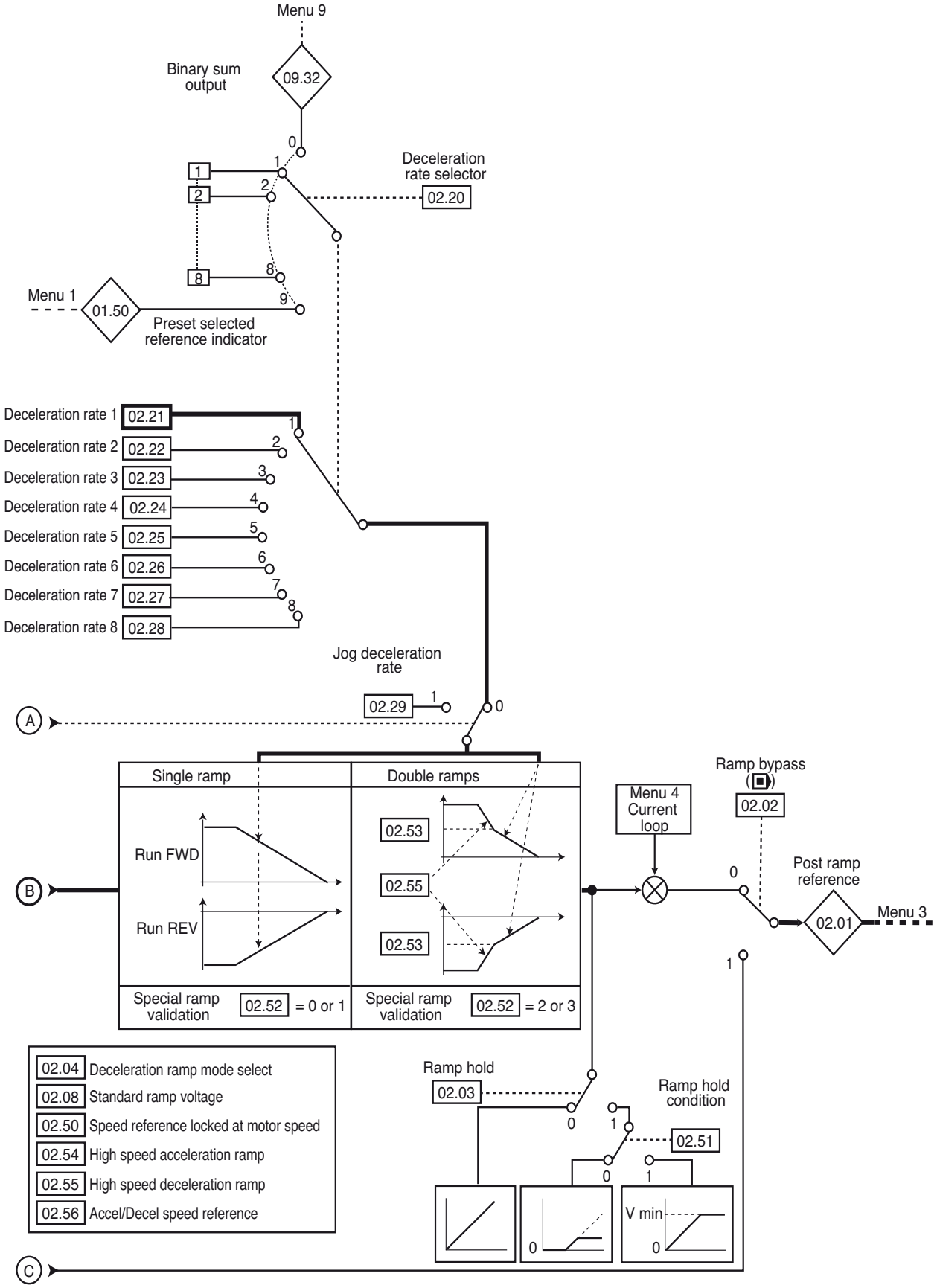
5.3 - Menu 2: Ramps

5.3.1 - Menu 2 diagrams

• Acceleration ramps



• Deceleration ramps



5.3.2 - Explanation of parameters in menu 2

02.01 : Post ramp reference

Adjustment range : • If **01.10** = 0 and **02.02** = 0: 0 to **01.06**
• If **01.10** = 0 and **02.02** = 1: **01.07** to **01.06**
• If **01.10** = 1: ± **01.06**
Format: 32 bits
Measurement of the post-ramp reference. Used for diagnostics.

02.02 : Ramp bypass ( )
Adjustment range : Off (0) or On (1)
Factory setting : Off (0)
Format: 8 bits

Off (0):
Active ramps.

On (1):
Ramps short-circuited.

02.03 : Ramp hold
Adjustment range : No or Yes (1)
Factory setting : No
Format: 8 bits

No:
Ramp freed.

Yes (1):
The ramp is held and acceleration (or deceleration) is therefore interrupted.
CAUTION:
The ramp hold function is disabled if a stop command is given.

02.04 : Deceleration ramp mode select
Adjustment range : Fixed ramp (0), Automatic ramp (1), Automatic ramp + (2), Fixed ramp + (3)
Factory setting : Automatic ramp (1)
Format: 8 bits

This parameter is not relevant for the POWERDRIVE FX when 10.77 = No.

Fixed ramp (0):
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 **02.08**) and the drive trips on DC bus overvoltage.
CAUTION:
Select mode 02.04 = Fixed ramp (0) when a braking resistor is being used.

Automatic ramp (1):
Standard deceleration ramp with automatic extension of the ramp time in order to avoid causing a drive DC bus overvoltage trip (threshold set in **02.08**).

Automatic ramp + (2):
The drive allows the motor voltage to be increased up to 1.2 times the rated voltage set in **05.09** (motor rated voltage), to avoid reaching the maximum DC bus voltage threshold (threshold set in **02.08**). However, if this is not sufficient, the standard deceleration ramp time is extended, to avoid causing a drive DC bus overvoltage trip.
For the same amount of energy, mode 2 enables faster deceleration than mode 1.

Fixed ramp + (3):
Same as mode 2, but the ramp is imposed. If the configured ramp is too fast, the drive trips on DC bus overvoltage.
CAUTION:
In mode 2 and 3, the motor must be capable of withstanding additional losses relating to the increase in voltage at its terminals.

02.05 : Not used

02.06 : S ramp enabled
Adjustment range : No or Yes (1)
Factory setting : No
Format: 8 bits

No:
The ramp is linear.

Yes (1):
A curved part (defined in **02.07**) at the start and end of the ramp avoids load swinging.
CAUTION:
The S ramp is disabled during controlled decelerations (02.04 = Automatic ramp (1) or Automatic ramp + (2)).

02.07 : S ramp acceleration limit
Adjustment range : 2 to 10
Factory setting : 10
Format: 16 bits
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%.

Note:
In S ramp mode, the total ramp time will be greater than that of the selected ramp.

02.08 : Standard ramp voltage
Adjustment range : 0 to 1300 V
Factory setting : T rating = 710 V, TH rating = 1100 V
Format: 16 bits
This parameter is not relevant for the POWERDRIVE FX when 10.77 = Off.
It is used when the drive is configured in standard deceleration mode (**02.04** = Automatic ramp (1) or Automatic ramp + (2)).
The minimum value of this parameter must be 50 V higher than the DC bus voltage obtained with the maximum supply voltage (bus U = mains U x √2). If this condition is not adhered to, the motor performs a freewheel stop. If this threshold is too high and there are no resistors connected, the drive will trip on DC bus overvoltage.

02.09 : **Not used**

02.10 : **Acceleration rate selector**

Adjustment range : Terminal inputs (0), Acceleration rate 1 (1) to Acceleration rate 8 (8), Related to preset speed (9)
Factory setting : Acceleration rate 1 (1)
Format: 8 bits
This parameter is used to select the acceleration ramp as follows:

Terminal inputs (0):
Selection of the acceleration ramp via digital inputs. The choice of ramp comes from the binary/decimal converter in menu 9 (**09.32**).

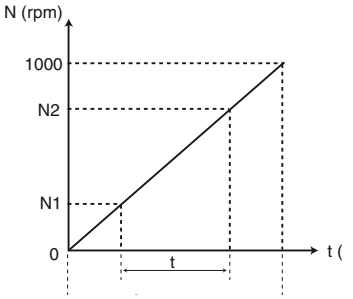
Acceleration rate 1 (1) to Acceleration rate 8 (8):
Selection of acceleration ramps 1 to 8.

Related to preset speed (9):
The ramp is automatically associated with the corresponding preset speed.

Note:
If you are using the binary sum, the value of the offset **09.34** must at least equal 1 so that **09.32** > 0.

02.11 to **02.18** : Acceleration rates 1 to 8
Adjustment range : 0.1 to 3200.0 s *
Factory setting : 20.0 s
Format: 16 bits
Sets the time for acceleration from 0 to 1000 rpm *.

02.11 to **02.18** = $\frac{t(s) \times 1000\ rpm}{(N2 - N1)\ rpm}$ *

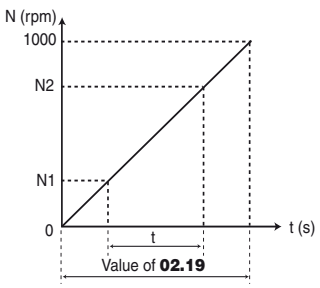


02.11: Acceleration rate 1 (main ramp in factory settings)
02.12 to **02.18**: Acceleration rate 2 to Acceleration rate 8

02.19 : **Jog acceleration rate**

Adjustment range : 0.1 to 3200.0 s *
Factory setting : 0.2 s
Format: 16 bits
Sets the time for acceleration from 0 to 1000 rpm *.

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



02.20 : **Deceleration rate selector**

Adjustment range : Terminal inputs (0), Deceleration rate 1 (1) to Deceleration rate 8 (8), Related to preset speed (9)
Factory setting : Deceleration rate 1 (1)
Format: 8 bits
This parameter is used to select the deceleration ramp as follows:

Terminal inputs (0):
Selection of the deceleration ramp via digital inputs. The choice of ramp comes from the binary/decimal converter in menu 9 (**09.32**).

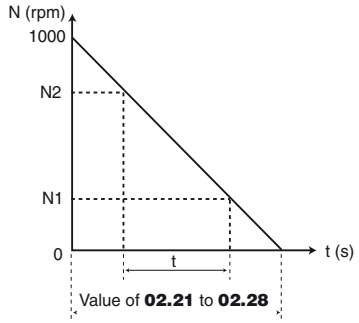
Deceleration rate 1 (1) to Deceleration rate 8 (8):
Selection of deceleration ramps 1 to 8

Related to preset speed (9):
The ramp is automatically associated with the corresponding preset speed.

Note:
If you are using the binary sum, the value of the offset **09.34** must at least equal 1 so that **09.32** > 0.

02.21 to **02.28** : Deceleration rates 1 to 8
Adjustment range : 0.1 to 3200.0 s *
Factory setting : 20.0 s
Format: 16 bits
Sets the time for deceleration from 1000 rpm * to 0.

02.21 to **02.28** = $\frac{t(s) \times 1000\ rpm}{(N2 - N1)\ rpm}$ *

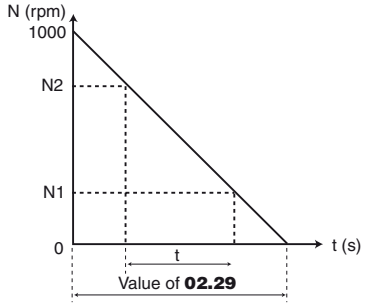


02.21: Deceleration rate 1 (main ramp in factory settings)
02.22 to **02.28**: Deceleration rate 2 to Deceleration rate 8

* **Note:** The reference speed can be changed from 1000 to 100 min^{-1} using parameter **02.56**. This makes it possible to multiply the acceleration and deceleration times by 10.

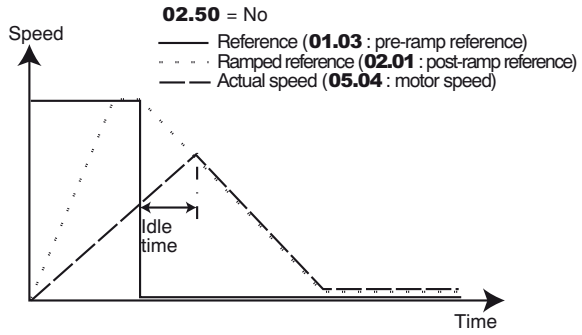
02.29 : **Jog deceleration rate**
Adjustment range : 0.1 to 3200.0 s *
Factory setting : 0.2 s
Format: 16 bits
Sets the time for deceleration from 1000 rpm * to 0.

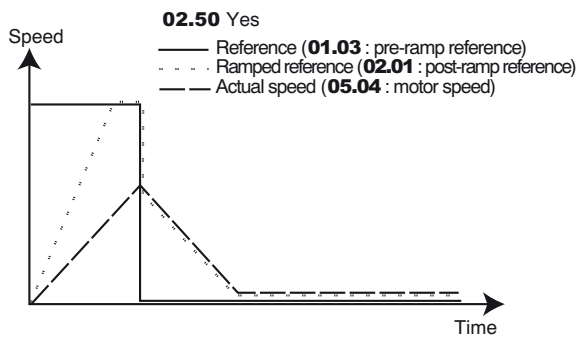
$$\mathbf{02.29} = \frac{t(s) \times 1000\ rpm}{(N2 - N1)\ rpm} \ *$$



02.30 to **02.49** :Not used

02.50 : **Speed reference locked at motor speed**
Adjustment range : No (0) or Yes (1)
Factory setting : Yes (1)
Format: 8 bits
In applications with high inertia, the actual speed does not necessarily manage to follow the ramp reference. In this case, on a stop command or change of reference, an idle time, linked to the difference between the reference and the actual speed, can occur. By enabling **02.50**, the speed and ramp are locked, so that the idle time disappears.





02.51 : **Ramp hold condition**
Adjustment range : Always (0) or Speed > **01.07** (1)
Factory setting : Always (0)
Format: 8 bits

Always (0):
When **02.03** = Yes (1), the ramp is always held.

Speed > 01.07 (1):
When **02.03** = Yes (1), the ramp is freed between 0 and V min (**01.07**), above this speed the ramp is locked.

02.52 : **Special ramp validation**
Adjustment range : Disabled (0)
2 acceleration ramps (1)
2 deceleration ramps (2)
2 acceleration deceleration ramps (3)
Factory setting : Disabled (0)
Format: 8 bits

Disabled (0):
Double ramps not enabled.

2 acceleration ramps (1):
Double ramps on acceleration. From 0 to the speed defined in **02.53**, the acceleration ramp used is that defined by **02.11** to **02.19**. From **02.53**, the acceleration ramp used is defined in **02.54**.

2 deceleration ramps (2):
Double ramps on deceleration. The drive decelerates to the speed defined in **02.53** with the deceleration ramp defined by **02.55**, then decelerates to 0 with the ramp defined by **02.21** to **02.28**.

2 Acceleration deceleration ramps (3):
Double ramps on acceleration and deceleration. The drive accelerates or decelerates to the speed defined in **02.53**, and the acceleration and deceleration ramps used are those defined by **02.11** to **02.19** and **02.21** to **02.29** respectively. From **02.53**, the acceleration and deceleration ramps used are defined by **02.54** and **02.55** respectively.

02.53 : **Speed threshold for accel./decel.**
Adjustment range : ± **01.06**
Factory setting : 400.00 rpm
Format: 32 bits
See explanation in **02.52**.

02.54 : **High speed acceleration ramp**
Adjustment range : 0.1 to 3200.0 s *
Factory setting : 20.0 s
Format: 16 bits
See explanation in **02.52** and **02.56**.

02.55 : **High speed deceleration ramp**
Adjustment range : 0.1 to 3200.0 s *
Factory setting : 20.0 s
Format: 16 bits
See explanation in **02.52** and **02.56**.

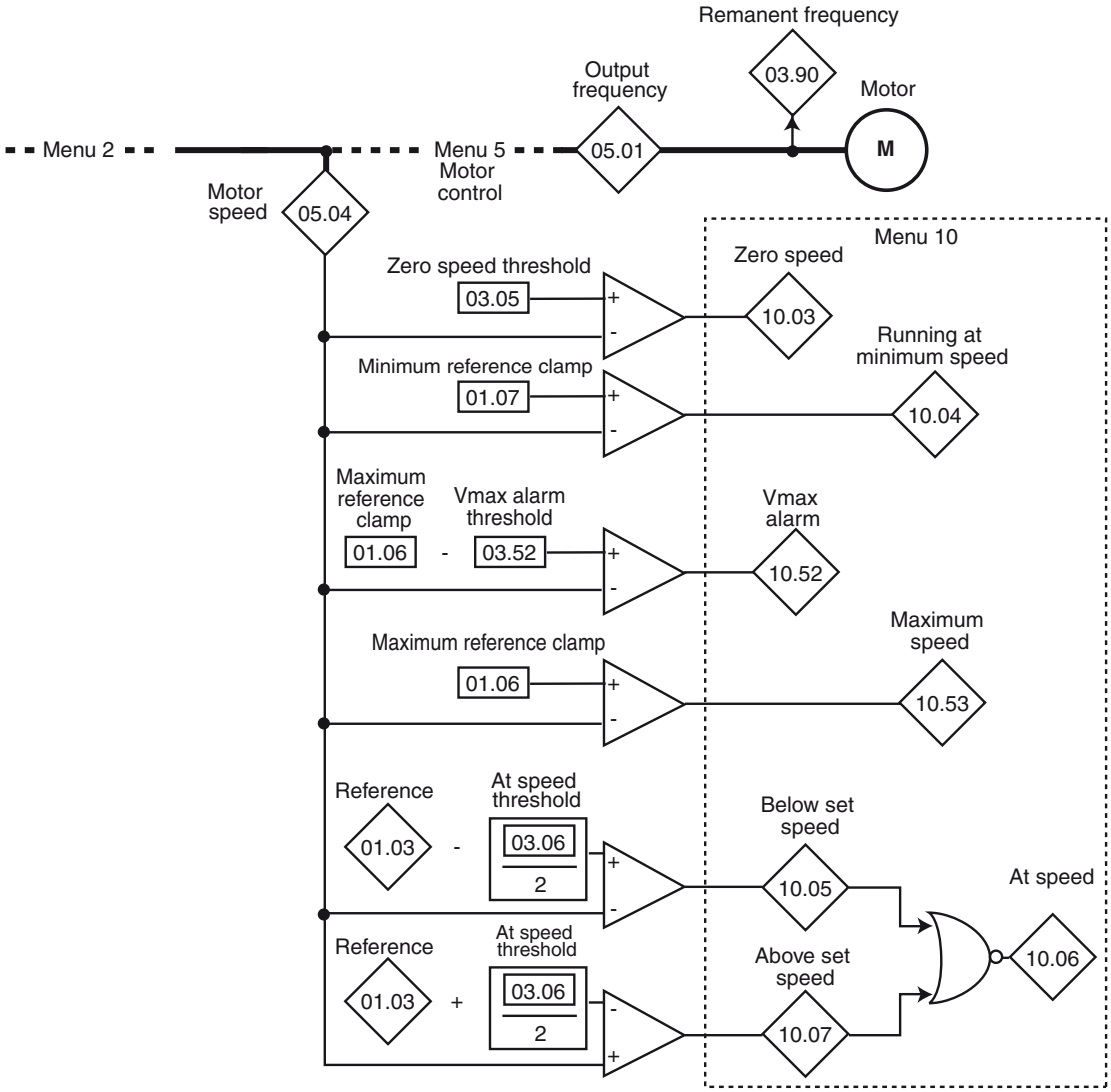
*** Note:** The reference speed can be changed from 1000 to 100 min^{-1} using parameter **02.56**. This makes it possible to multiply the acceleration and deceleration times by 10.

02.56 **: Accel/Decel speed reference**
Adjustment range : 1000 min^{-1} (0), 100 min^{-1} (1)
Factory setting : 1000 min^{-1} (0)
Format: 8 bits
This parameter is used to change the speed reference for the acceleration and deceleration times.
This parameter affects parameters **02.11** to **02.19**, **02.21** to **02.29** and **02.54** to **02.55**

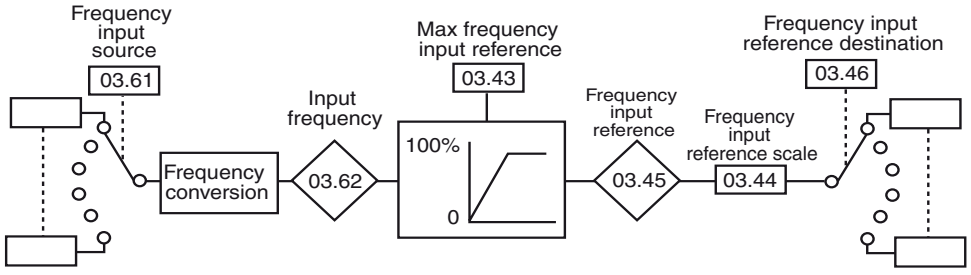
5.4 - Menu 3: Encoder option, Alarms, Speed thresholds

5.4.1 - Menu 3 diagrams

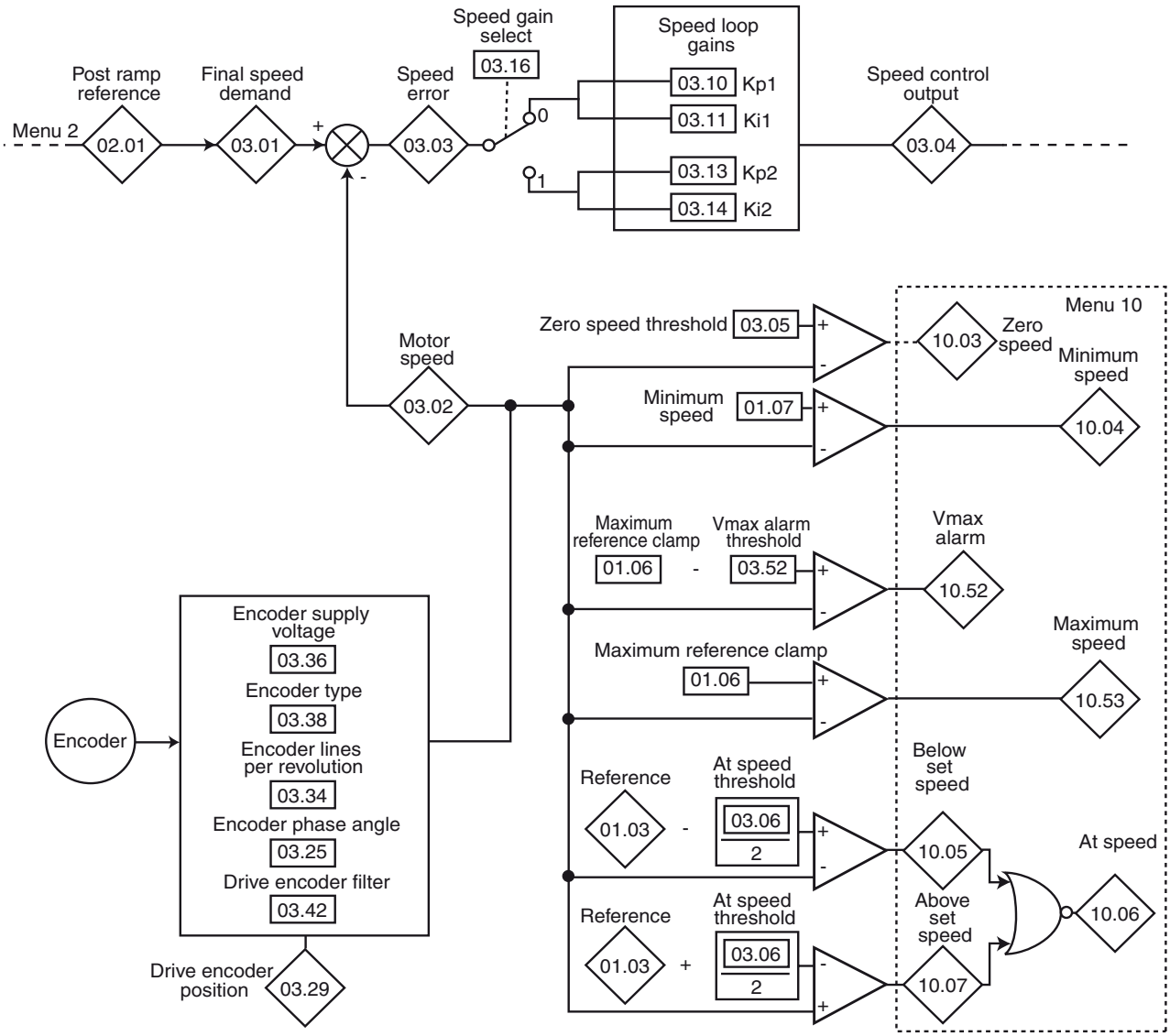
• Basic version



Frequency input

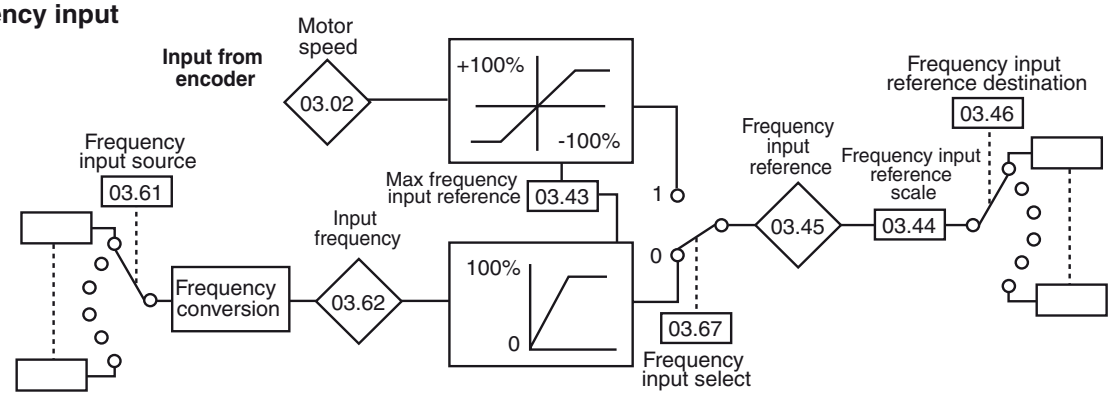


• With encoder option



03.17	Speed gain set-up	03.90	Remanent frequency
03.18	Total inertia	03.91	Remanent voltage measure
03. 59	Resolver resolution		

Frequency input



5.4.2 - Explanation of parameters in menu 3

Parameters marked with the symbol ▣ are only used in flux vector mode.

03.01 : Final speed reference (▣)

Adjustment range : ± 2 x **01.06** rpm
Format: 32 bits
Represents the sum of the post ramp reference and the hard speed reference if this has been enabled.

03.02 : Motor speed feedback

Adjustment range : ± 2 x **01.06** rpm
Format: 32 bits
Actual speed from the encoder.

03.03 : Speed error (▣)

Adjustment range : ± 2 x **01.06** rpm
Format: 32 bits
Difference between the final speed reference and the speed feedback.

03.04 : Speed controller output (▣)

Adjustment range : ± 300.0%
Format: 16 bits
The speed controller output produces a torque reference to be used in determining the value of the active current.

03.05 : Zero speed threshold
Adjustment range : 0.00 to 500.00 rpm
Factory setting : 30.00 rpm
Format: 32 bits
If the motor speed **05.04** (▣) or the motor speed feedback **03.02** (▣) is at or below the level defined by this parameter, the zero speed information **10.03** will be at 1, otherwise it will be at 0.
In open loop mode, upon a stop command the drive decelerates on the selected ramp to the threshold set by **03.05**, then the motor goes into freewheel mode.

03.06 : At speed window
Adjustment range : 0.00 to 500.00 rpm
Factory setting : 30.00 rpm
Format: 32 bits
Defines the window within which the **10.06** "At speed" alarm is activated.
10.06 is at 1 when the post-ramp reference equals the reference ± (**03.06**/2).
CAUTION:
For values of 03.06 < 20, see parameters 10.05 and 10.07.

03.07 to 03.09 : Not used

03.10 : Speed loop proportional gain Kp1 (▣)
Adjustment range : 0 to 32000
Factory setting : 200
Format: 16 bits
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 fairly stable in the event of sudden variations in speed, both at no load and on load.

03.11 : Speed loop integral gain Ki1 (▣)
Adjustment range : 0 to 32000
Factory setting : 100
Format: 16 bits
Adjusts the stability of the motor speed on load impact.
Increase the integral gain to limit the speed recovery time in the event of load impact.

03.12 : Speed loop differential gain Kd1 (▣)
Reserved.

03.13 : Speed loop proportional gain Kp2 (▣)
Adjustment range : 0 to 32000
Factory setting : 200
Format: 16 bits
Adjusts the stability of the motor speed in the event of sudden variations in the reference.
The drive uses Kp1 (**03.10**) or Kp2 (**03.13**) depending on the value of **03.16**.

03.14 : Speed loop integral gain Ki2 (▣)
Adjustment range : 0 to 32000
Factory setting : 100
Format: 16 bits
Adjusts the stability of the motor speed on load impact.
The drive uses Ki1 (**03.11**) or Ki2 (**03.14**) depending on the value of **03.16**.

03.15 : Speed loop differential gain Kd2 (▣)
Reserved

03.16 : Speed controller gain select (▣)
Adjustment range : Gains # 1 (0) or Gains # 2 (1)
Factory setting : Gains # 1 (0)
Format: 8 bits
This parameter can be modified when the drive is disabled or enabled.

Gains # 1 (0):
Selection of Kp1 (**03.10**), Ki1 (**03.11**) and Kd1 (**03.12**) gains.

Gains # 2 (1):
Selection of Kp2 (**03.13**), Ki2 (**03.14**) and Kd2 (**03.15**) gains.

03.17 : Speed gain set-up (▣)
Adjustment range : Manual mode 1 (0), Automatic (1), Manual mode 2 (2)
Factory setting : Manual mode 1 (0)
Format: 8 bits

Manual mode 1 (0):
The speed controller operates with the gains entered by the user. The regulation is optimised for normal to high inertias.

Automatic (1):
Reserved.

Manual mode 2 (2):
The speed controller operates with the gains entered by the user. The regulation is optimised for low inertias.

03.18 : Motor and load inertia (▣)
Adjustment range : 0.000 to 32.000 kg.m^2
Factory setting : 0.000 Kg.m^2
Format: 16 bits
Corresponds to the total inertia applied to the motor (motor inertia + load inertia).

03.19 : Not used

03.20 : Bandwidth (▣)
Reserved.

03.21 : Damping factor (▣)
Reserved.

03.22 : Hard speed reference (▣)
Reserved.

03.23 : Hard speed reference selector (▣)
Reserved.

03.24 : Not used

03.25 : Position feedback phase angle (▣)
Adjustment range : 0.0 to 359.9 °
Factory setting : 0.0 °
Format: 32 bits
Indicates the result of the phasing test performed during autotuning (see **05.12**). It is stored when the drive is powered down and will only be modified automatically after another autotune.

⚠ **• 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.**

03.26 to 03.28 : Not used

03.29 : Drive encoder position (▣)
Adjustment range : 0 to 16383 points
Format: 16 bits
Indicates the position of the encoder in relation to the line it was on at power-up.

03.30 to 03.33 : Not used

03.34 : Encoder lines per revolution
Adjustment range : 0 to 32000 lpr
Factory setting : 1024 lpr
Format: 16 bits
Used to configure the number of lines per incremental encoder revolution. Converts the encoder input into a speed.

03.35 : Not used

03.36 : Encoder supply voltage
Adjustment range : 5V (0) or 15V (1)
Factory setting : 5V (0)
Format: 8 bits
Used to choose the encoder supply voltage.
CAUTION:
Before selecting "15V", check that the encoder used can withstand this voltage.

03.37 : Not used

03.38 : Encoder type

Adjustment range : Incremental (0), Reserved (1), U, V, W only (2), Incremental UVW (3), Hall effect sensor (4), Software encoder n°1 (5), Software encoder n° 2 (6), Software encoder n° 3 (7), Software encoder n° 4 (8), Software encoder n°5 (9), Resolver (10)
Factory setting : Software encoder n° 2 (6)
Format: 8 bits

Incremental (0):
11.31 = "PM motor (Servo) in vector control mode". Incremental encoder with quadrature complemented signals A, B.

Reserved (1):
Reserved.

U, V, W only (2):
If **11.31** = "PM motor (Servo) in vector control mode", a simplified encoder with only U, V, W commutation channel signals can be used. This selection also allows use in downgraded operation of an incremental encoder whose A and B channels are not operational.

Incremental UVW (3):
If **11.31** = "PM motor (Servo) in vector control mode", an incremental encoder with complemented signals A, B and complemented commutation channels U, V, W can be used.

Hall effect sensor (4):
If **11.31** = "PM motor (Servo) in vector control mode", Hall effect sensors mounted on some permanent magnet motors can be used.

Software encoder n° 1 (5):
If **11.31** = "PM motor (Servo) in vector control mode", used to confirm the position 1 observer (software encoder). Recommended for applications with high inertia (more than 20 times the motor inertia). On the run command, the motor is "parked" in a known position. The "parking" current and time are set by parameters **05.52** and **05.53** respectively.
If **11.31** = "Induction motor in vector control mode", used to confirm the speed 1 observer (software encoder), reserved for applications with a low overtorque requirement on starting (pump, ventilation, etc).

Software encoder n° 2 (6):
If **11.31** = "PM motor (Servo) in vector control mode", used to confirm the position 2 observer (software encoder). Recommended for applications with low inertia (applied inertia less than 20 times the motor inertia).
If **11.31** = "Induction motor in vector control mode", used to confirm the speed 2 observer (software encoder). Recommended for applications with a high overtorque requirement on starting (grinders, presses, extruders, etc).

Software encoder n° 3 (7):
Reserved.

Software encoder n° 4 (8):
If **11.31** = "PM motor (Servo) in vector control mode", used to confirm the position 4 observer (software encoder), reserved for applications where the inertia applied to the motor shaft is higher than 60. On the run command, the motor is "parked" in a known position. The "parking" current and time are set by parameters **05.52** and **05.53** respectively.
After the "parking" phase, the motor starts in a specific control mode, optimised for starting high inertias. When the machine speed reaches the value set in **02.53**, the position reconstitution mode switches to a mode more suited to operation on the application useful speed range.
In this control mode, it is advisable to use a double speed ramp (**02.52** = 2) with a longer acceleration ramp in the starting phase (**02.11**) than the acceleration ramp (**02.54**) used over the useful speed range.
If **11.31** = Induction motor in vector control mode: reserved.

Software encoder n°5 (9):
Reserved.
CAUTION:
For operation in "Software encoder n° 1" to "Software encoder n°5" of permanent magnet motors, check that:
- The load torque does not exceed 50% of the motor rated torque between 0 and 10% of the motor rated speed.
- The ratio between the load inertia and the motor inertia is less than 60 (Software encoder n° 1 or 2) or less than 200 (Software encoder n° 4).

Resolver (10):
Reserved

Note:
Procedure to be followed when **03.38** is set to one of the "software encoder" modes:
1) Enter the menu 5 parameters from the nameplate (**05.06** to **05.10** for asynchronous motors or **05.06** to **05.10** + **05.24**, **05.25**, **05.33**, **05.51** for permanent magnet motors).
2) Perform an autotune when stopped (**05.12** = 1)
When the nameplate data is not available, perform an autotune when running procedure (**05.12** = 2).
CAUTION:
These operating modes are only active for "Induction motor in vector control mode" mode (11.31=2, "PM motor (Servo) in vector control mode" (11.31 = 3), "Active rectifier for synchronous motor (11.31 = 5).

CAUTION:
The MDX-ENCODER option is required for managing incremental encoders with or without commutation channels (03.38 = 0 to 3) and for managing Hall effect sensors (03.38 = 4).

03.39 to 03.41 : Not used

03.42 : Drive encoder filter ( )
Adjustment range : 0 to 10
Factory setting : 3
Format: 16 bits
This parameter is used to insert a filter in the encoder speed feedback, such that:
time constant = $2^{\mathbf{03.42}}$ ms.
It is particularly useful to reduce the current demand when the load has high inertia and significant gain (**03.10** or **03.11**) is required on the speed controller.
The filter is inactive if **03.42** = 0.

03.43 : Max frequency input reference
Adjustment range : 0.00 to 60000.00
Factory setting : 5000.00
Format: 32 bits
Adjusts the input frequency which should correspond to 100% of the destination numerical value.

03.44 : Frequency input reference scale
Adjustment range : 0.000 to 2.000
Factory setting : 1.000
Format: 16 bits
Used for scaling the numerical reference to be converted into pulses.

03.45 : Frequency input reference
Adjustment range : 0.00 to 100.00 % ( ); ± 100.00% ( )
Format: 16 bits
Indicates the value of the numerical reference resulting from conversion of the pulse signal.

03.46 : Frequency input reference destination
Adjustment range : **00.00** to **21.51**
Factory setting : **00.00**
Format: 16 bits
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, **03.46** will be frozen at 0.

03.47 to 03.51 : Not used

03.52 : Vmax alarm threshold
Adjustment range : 0.00 to 500.00 rpm
Factory setting : 90.00 rpm
Format: 32 bits
Triggers an alarm **10.52** when the motor speed is such that:
- (**05.04**) > V max (**01.06** or **21.01**) - **03.52** in open loop mode
- (**03.02**) > Max spd (**01.06** or **21.01**) - **03.52** in flux vector mode

03.53 and 03.54 : Not used

03.55 : Resolver speed
Adjustment range : ± (2 x **01.06**)
Format: 32 bits
Indicates the speed from the resolver.

03.56 : Resolver filter
Adjustment range : 0 to 3
Factory setting : 1
Format: 16 bits
This parameter is used to insert a filter in the encoder speed feedback, such that:
time constant = $2^{\mathbf{03.56}}$ ms.

03.57 : Resolver polarity
Adjustment range : 2 poles (0), 4 poles (1), 6 poles (2), 8 poles (3)
Factory setting : 2 poles (0)
Format: 16 bits
Indicates the number of pairs of resolver poles.
This value should be entered from the resolver manufacturer data.

03.58 : Resolver transformation ratio
Adjustment range : 1:1 (0), 2:1 (1), 3:1 (2), 4:1 (3)
Factory setting : 1:1 (0)
Format: 16 bits
This value should be entered from the resolver manufacturer data.

03.59 : Resolver resolution
Adjustment range : 10 bits (0), 12 bits (1), 14 bits (2), 16 bits (3)
Factory setting : 14 bits (2)
The resolver position resolution depends on the maximum motor speed (see table below).
On the MDX-RESOLVER option an incremental encoder type output is emulated. The resolution of this output is set via parameter **03.34** "Encoder lines per revolution".

Resolution **03.59**	Maximum motor speed	Maximum value of **03.34**
10 bits (0)	100,000 rpm	256
12 bits (1)	40,000 rpm	1024
14 bits (2)	20,000 rpm	4096
16 bits (3)	5000 rpm	16384

03.60 : Not used

03.61 : Frequency input source
Adjustment range : **00.00** to **21.51**
Factory setting : **00.00**
Format: 16 bits
Used to select the source of pulses.
Note: Only use inputs DI4 and DI5 as the frequency input source corresponding respectively to parameters **08.04** and **08.05**. The maximum input frequency should be 10 kHz. If the input frequency is more than 10 kHz, use an MDX-ENCODER option, and set **03.67** to Encoder input (1).

03.62 : Input frequency
Adjustment range : 0.00 to 5000.00 Hz
Format: 32 bits
Pulse input frequency which will be converted to a numerical reference.
Application example:
Pulses from an inductive sensor connected to a digital input are converted to a reference which is assigned to the speed reference.

03.63 to 03.66 : Not used

03.67 : Frequency input select (▣)
Adjustment range : Digital in (0) or Encoder in (1)
Factory setting : Digital in (0)
Format: 8 bits

Digital in (0):
The **03.45** reference is generated from a frequency signal from DI4 or DI5 (see **03.61**).

Encoder in (1):
The encoder signal is used to generate the frequency input reference (see **03.45**).

03.68 to 03.89 : Not used

03.90 : Remanent frequency
Adjustment range : ± 590.00 Hz
Format: 32 bits
Indicates the frequency of the remanent voltage present at the motor terminals when the drive is disabled. This parameter is reset to zero when the drive is enabled.

03.91 : Remanent voltage measure
Adjustment range : None (0), Digital (1)
Digital and analog (2)
Factory setting : Digital (1)
Format: 8 bits

None (0):
Only use this setting if the drive has no machine remanent voltage sensors.

Digital (1):
Use this setting when the product has a digital information feedback for both the machine remanent voltages (all **POWERDRIVE** products).

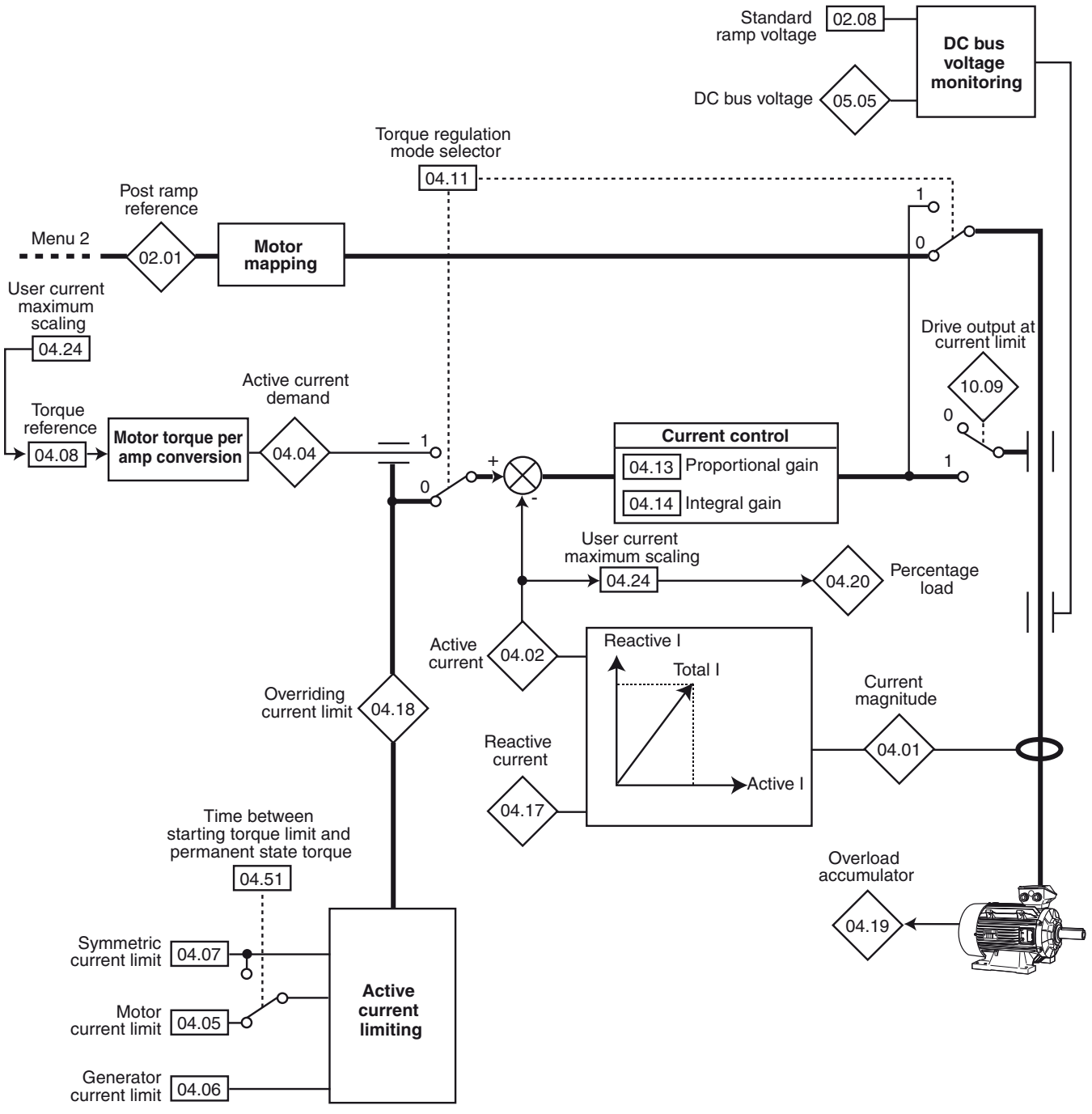
Digital and analog (2):
Use this setting when, in addition to the digital information, the product has analog measurements of the machine remanent voltages. This mode allows better quality of measurement (only **POWERDRIVE FX** - **POWERDRIVE MD2** 60 to 270T).

Notes

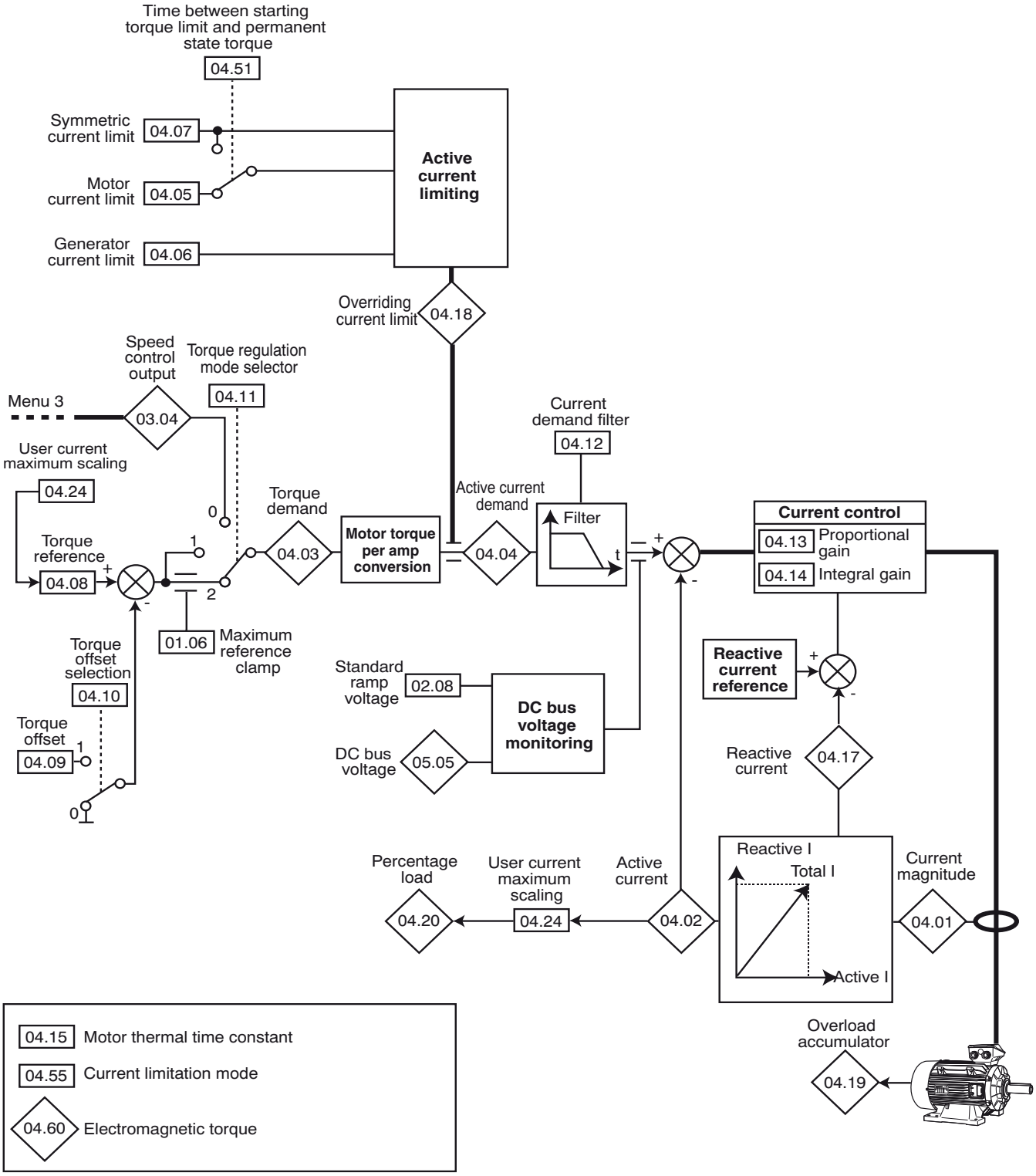
5.5 - Menu 4: Current loop - Torque control

5.5.1 - Menu 4 diagrams

• Open loop control



• Closed loop control



5.5.2 - Explanation of parameters in menu 4

04.01 : Current magnitude

Adjustment range : 0.00 to 2.22 x **11.32** (A)
Format: 32 bits
Reading of the rms current in each drive output phase.
This is the result of the vectorial sum of the magnetising current and the active current.
Note: Max. drive current = 2.22 x **11.32**.

04.02 : Active current

Adjustment range : ± 2.22 x **11.32**
Format: 32 bits
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.

04.03 : Torque demand

Adjustment range : ± 999.9%
Format: 16 bits
Value of the torque demand required by the motor as a % of the rated motor torque.

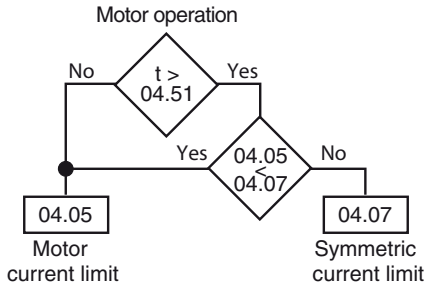
04.04 : Active current demand

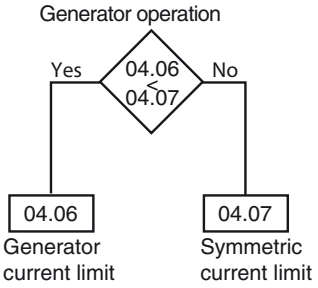
Adjustment range : ± 999.9%
Format: 16 bits
The current demand is the result of conversion of the torque reference **04.08** into active current.
04.04 = **04.03** when the drive current limit is not reached and the motor is not in the defluxing zone.

04.05 : Motoring current limit
Adjustment range : 0.0 to 300.0% (% motor active In)
Factory setting : 150.0% In
Format: 16 bits
Used to set the maximum starting current limit permitted in motor mode during a maximum time specified by **04.51**.
When the value of **04.05** is less than **04.07**, then **04.05** overrides **04.07**.

04.06 : Regenerating current limit
Adjustment range : 0.0 to 300.0% (% motor active In)
Factory setting : 110.0% In
Format: 16 bits
Used to set the maximum permanent current limit permitted in generator mode.

04.07 : Symmetric current limit
Adjustment range : 0.0 to 300.0% (% motor active In)
Factory setting : 110.0%
Format: 16 bits
Used to set the maximum permanent current limit permitted in motor mode and in generator mode.
Note:
If **11.31** is set to "Induction motor in open loop mode" (1) and **05.14** is set to "None: Linear U/F law with boost" (2) or "None: Square U/F law with boost" (5), the only current limit is then defined by **04.07**.





04.08 : Torque reference
Adjustment range : ± **04.24** (% motor active In)
Factory setting : 0.0% In
Format: 16 bits
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.
The maximum value of **04.08** is fixed by **04.24**.

04.09 : Torque offset
Adjustment range : ± 150.0%
Factory setting : 0.0%
Format: 16 bits

04.10 : Torque offset selection
Adjustment range : No (0) or Yes (1)
Factory setting : No (0)
Format: 8 bits

No (0):
The torque reference equals parameter **04.08**.

Yes (1):
The torque reference equals parameter **04.08** plus the torque offset value **04.09**.

04.11 : Torque regulation mode selector
Adjustment range : Speed regulation (0), Direct torque (1), Controlled torque (2)
Factory setting : Speed regulation (0)
Format: 8 bits

(1) :

Speed regulation (0):
Speed control with current limiting by parameter **04.07**.

Direct torque (1):
Torque control. The speed reference is no longer active and the torque reference may be given by analog reference 2 (if it is programmed on the torque reference, parameter **04.08**). The output frequency is adjusted so that the active current measured by the drive equals the reference.

(2) :

Speed regulation (0):
Speed control with current limiting by parameter **04.07**.

Direct torque (1):
Direct torque control. The motor torque is set to the value of **04.08** (**04.08** + **04.09** if **04.10** is set to "Yes").
The motor speed value therefore depends on the resistive torque of the application.

Controlled torque (2):
Torque control with overspeed protection provided by parameter **01.06**.

• In torque control mode (04.11 = 1), if the resistive torque goes to zero, the drive accelerates the machine to the maximum speed given by the minimum value between 1.3 x 01.06 and 01.06 +1000 rpm. It is therefore imperative to ensure that parameter 01.06, which limits the maximum speed, is set so as to ensure the safety of equipment and personnel.

04.12 : Current demand filter ((2))
Adjustment range : 0 to 10
Factory setting : 2
Format: 8 bits
This filter is used to introduce a time constant aimed at reducing any noise generated by the speed loop, such that: time constant = $2^{04.12}$ ms.

04.13 : Current loop proportional gain
Adjustment range : 1 to 999
Factory setting : 50
Format: 16 bits

- With an asynchronous motor: the factory-set value of **04.13** is suitable for most applications.
- With a synchronous motor: to adapt the value of the proportional gain, apply the following formula:
  04.13 = k x kVA x Ld

  Where:
  k = 1 for 400/460 V drives
  k = 0.6 for 690 V drives
  kVA = drive rating (eg: value 340 for a 340T drive)
  Ld = inductance value indicated on the motor nameplate in mH

04.14 : Current loop integral gain
Adjustment range : 0 to 250
Factory setting : 40
Format: 16 bits
This parameter is used to adjust the current loop bandwidth. The factory setting of **04.14** is suitable for most applications.

04.15 : Motor thermal time constant
Adjustment range : 1 to 32000 s
Factory setting : 1800 s
Format: 16 bits
Based on the current, torque and speed levels, a relative level of motor heat and iron losses is estimated. Depending on the type of machine ventilation given by parameter **05.50** and the value of the thermal time constant **04.15**, an estimate of the machine thermal load level (%) is given in **04.19**.

04.16 : Not used

04.17 : Magnetising current
Adjustment range : 0 to + 2.22 x **11.32** (A)
Format: 32 bits
Magnetising current reading.

04.18 : Overriding current limit
Adjustment range : 0 to 300% (% max. active In)
Format: 16 bits
Indication of the transient limit of the drive current. This value depends on **04.05**, **04.06**, **04.51** and internal limits.

04.19 : Motor thermal state
Adjustment range : 0.0 to 120.0%
Format: 16 bits
This parameter indicates the estimated thermal state of the motor from the values entered in the menu 5 motor parameters and parameter **04.15**. An alarm appears on the local display when **04.19** exceeds 100% (see **10.17**). **04.19** is reset to 0 on each power-up.
Note: The use of a PTC sensor is therefore strongly recommended to protect the motor.

04.20 : Percentage load
Adjustment range : ± **11.32** (% active In)
Format: 16 bits
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).
The maximum value of **04.20** is fixed by **04.24**.

04.21 to **04.23** : **Not used**

04.24 : **User current maximum scaling**
Adjustment range : ± 999.9%
Factory setting : 150.0%
Format: 16 bits
Defines the maximum value of parameter **04.20** and parameter **04.08**.

04.25 to **04.50** : **Not used**

04.51 : **Time between starting and permanent torque**
Adjustment range : 0 to 250 s
Factory setting : 60 s
Format: 16 bits
On starting, time permitted for torque limit **04.05** before changing to torque limit **04.07**.

04.52 to **04.54** : **Not used**

04.55 : **Current limitation mode**
Adjustment range : Active current (0) or Total current (1)
Factory setting : Active current (0)
Format: 8 bits

Active current (0):
The current limits as described in **04.05**, **04.06**, **04.07** take effect by action on the active part of the motor current.
This mode is always applied if **11.31** is other than "Open Loop (1)".

Total current (1):
The current limits as described in **04.05**, **04.06**, **04.07** take effect by direct limiting of the overall motor current.
This mode is only operational if **11.31** = "Open Loop (1)".

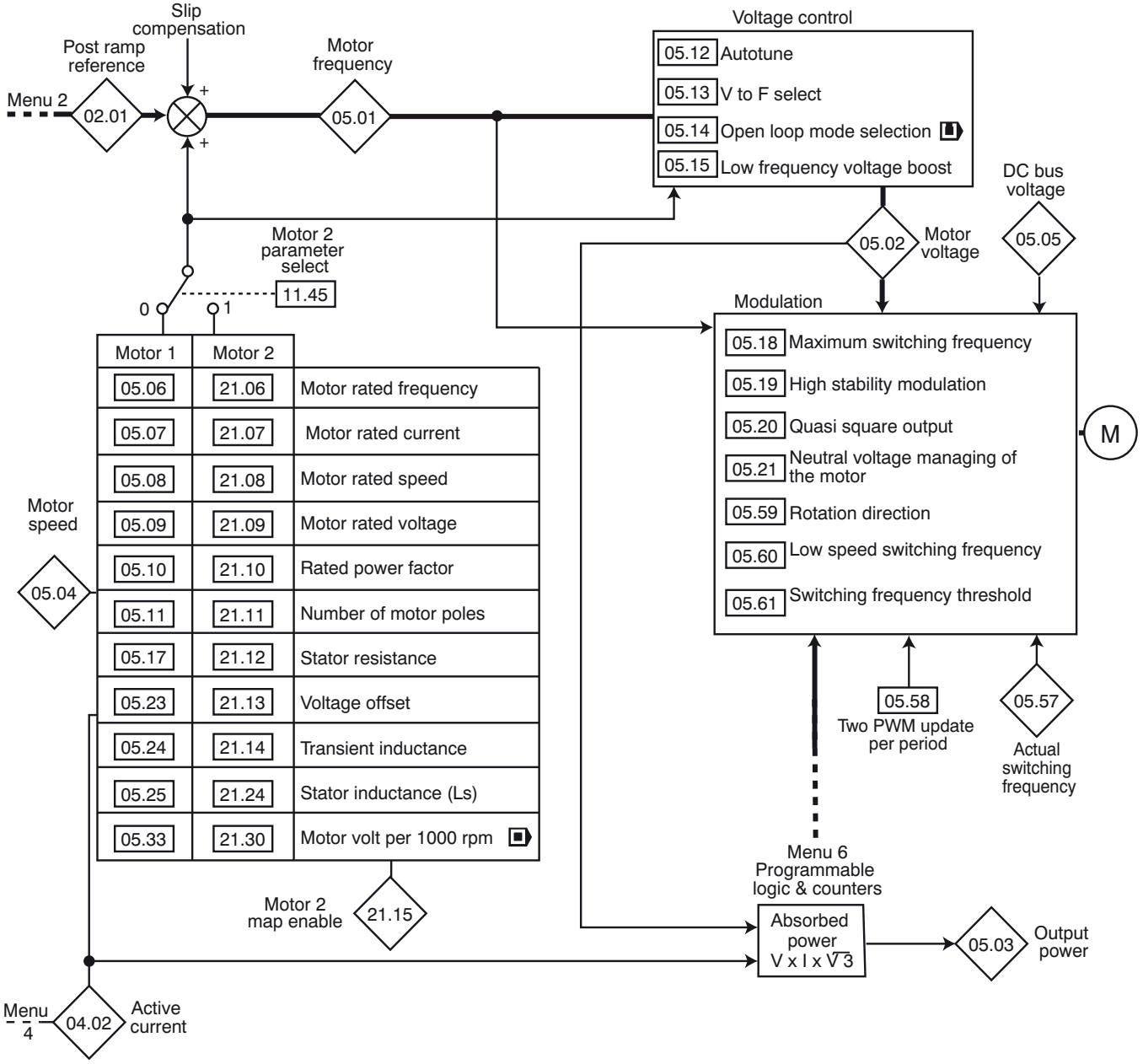
04.56 to **04.59** : **Not used**

04.60 : **Electromagnetic torque**

Adjustment range : -9999.99 to +9999.99 N.m
Format: 32 bits
Indicates the torque on the motor shaft, expressed directly in N.m.

5.6 - Menu 5: Motor control

5.6.1 - Menu 5 diagram



05.50	Motor ventilation	05.62	Torque/speed optimisation for synchronous motor
05.51	Q axis inductance (synchronous motor)	05.63	Optimal magnetising current
05.52	Starting current (synchronous motor)	05.64	Starting threshold (synchronous motor)
05.53	Flux installation time	05.65	Variable flux on mains voltage dip
05.54	Base Freq./nominal Freq. ratio	05.70	PTC validation

5.6.2 - Explanation of parameters in menu 5

05.01 : Output frequency

Adjustment range : ± 590.00 Hz
Format: 32 bits
Indicates the drive output frequency.

05.02 : Output voltage

Adjustment range : 0 to 999 V
Format: 16 bits
This is the rms voltage at the drive output.

05.03 : Output power

Adjustment range : $\pm$**11.33** x **11.32** x 2,22 x $\frac{\sqrt{3}}{1000}$ kW

Format: 32 bits
05.03 is the calculated motor active power.

05.03 = **04.01** x **05.02** x (**05.10** x $\frac{\sqrt{3}}{1000}$ 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 (max. drive current = 2.22 x **11.32**).

05.04 : Motor speed

Adjustment range : ± 2 x **01.06** rpm
Format: 32 bits
The motor speed is calculated from the output frequency **05.01** according to the formula:

$$\textbf{05.04}\ (\text{min}^{-1}) = \frac{60 \times \textbf{05.01}}{\text{number of pairs of motor poles}}$$

05.05 : DC bus voltage

Adjustment range : 0 to 1300 V
Format: 16 bits
Indicates the DC bus voltage measurement.

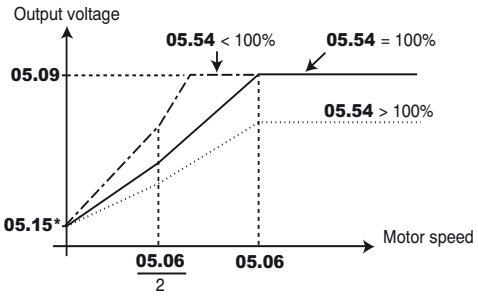
05.06 : Motor rated frequency
Adjustment range : 0.01 to 590.00 Hz
Factory setting : 50.00 Hz
Format: 32 bits
This is the point at which motor operation changes from constant torque to constant power.
During standard operation, it is the frequency indicated on the motor nameplate.

05.07 : Motor rated current
Adjustment range : 0.00 to 2.2 x **11.32**
Factory setting : 75% x **11.32**
Format: 32 bits
This is the value of the motor rated current indicated on the nameplate. The main purpose of the motor rated current is to define the motor temperature **04.19**.

05.08 : Motor rated speed
Adjustment range : 0.00 to 60000.00 rpm
Factory setting : 1500.00 rpm
Format: 32 bits
On-load speed of the motor indicated on the nameplate.

Note:
This value must take into account the slip of the asynchronous motor with respect to the synchronous speed. Under no circumstances must this slip be negative.

05.09 : Motor rated voltage
Adjustment range : 0 to 999 V
Factory setting : 400 V
Format: 16 bits
Enter the rated voltage indicated on the nameplate taking account of the normal power supply conditions.
Defines the voltage/frequency ratio as follows:



* If **05.14** = None: Linear U/F law with boost (2) or None: Square U/F law with boost (5), the boost value is set via **05.15**.

05.10 : Rated power factor
Adjustment range : 0.00 to 1.00
Factory setting : 0.85
Format: 8 bits
The power factor is measured automatically during a level 2 autotune phase (see **05.12**) and stored in this parameter. If it has not been possible to carry out this autotune procedure, enter the Cos φ value indicated on the motor nameplate.

05.11 : Number of motor poles

Adjustment range : Automatic (0), 2 Poles (1), 4 Poles (2), 6 Poles (3), 8 Poles (4), 10 Poles (5), 12 Poles (6), 14 Poles (7), 16 Poles (8)
Factory setting : Automatic (0)
Format: 8 bits

When this parameter is at 0 (Automatic), the drive automatically calculates the number of poles according to the rated speed (**05.08**) and the rated frequency (**05.06**). However, the value can be entered directly in accordance with the table below:

Number of poles	05.11
2	2 Poles (1)
4	4 Poles (2)
6	6 Poles (3)
8	8 Poles (4)
10	10 Poles (5)
12	12 Poles (6)
14	14 Poles (7)
16	16 Poles (8)

Note:
When the number of motor poles is higher than 16, set **05.11** to "Automatic".

05.12 : Autotune

Adjustment range : None (0), Stationary: motor data completed (1), Rotating: motor data incompleted (2), Encoder offset measure (3)
Factory setting : None (0)
Format: 8 bits

• During the autotune phase, brake control is disabled.
• Measurements taken when 05.12 = Rotating (2) must be performed with the motor uncoupled since the drive drives the motor at 2/3 of its rated speed. This "rotating" autotune is necessary only in closed loop operating mode ▣. Make sure that this operation does not present any safety risks, and that the motor is stopped before the autotune procedure.
• After modifying motor parameters, repeat autotuning.

None (0):
No autotune performed.
At the end of the autotune procedure, **05.12** reverts to "None".

Stationary: motor data completed (1):
- If **11.31** = "Induction motor in open loop mode" or "Induction motor in vector control mode": The stator resistance and the voltage offset are stored in **05.17** and **05.23**. The gain **04.13** is automatically updated.
- If **11.31** = "PM motor (Servo) in vector control mode": The stator resistance and the voltage offset are stored in **05.17** and **05.23** respectively.
The stator inductance is measured but not stored. An alarm is generated if its value is very different from the value entered in **05.24**. The gain **04.13** is automatically updated.

Procedure:
- Ensure that the motor parameters have been configured and that the motor is stopped.
- Enable the drive.
- Give a run command.
Wait until the procedure ends.
- Disable the drive and remove the run command.
The motor is then ready to operate normally.
Parameter **05.12** reverts to "None" as soon as autotuning is complete.

Rotating: motor data incompleted (2):
CAUTION:
In this mode, the motor runs at 2/3 of its rated speed or at 1000 rpm maximum.
- If **11.31** = "Induction motor in open loop mode": No action.
- If **11.31** = "Induction motor in vector control mode": The stator resistance and the voltage offset are stored in **05.17** and **05.23** respectively. Inductances **05.24** and **05.25** (or **21.14** and **21.24**) are also measured and stored. The power factor **05.10** and the gain **04.13** are automatically updated.
- If **11.31** = "PM motor (Servo) in vector control mode": The stator resistance and the voltage offset are stored in **05.17** and **05.23** respectively. The inductance **05.24** (or **21.14**) and the no-load EMF **05.33** (**21.30**) are measured and stored. An alarm is generated if their values are very different from the values entered in **05.24** (or **21.14**) and **05.33** (or **21.30**). The gain **04.13** is automatically updated.

Procedure:
- Ensure that the known motor parameters have been configured and that the motor is stopped.
- Enable the drive.
- If the drive is undersized in relation to the motor power, reduce the current limit **04.07** in order to avoid causing the drive to trip
- Give a run command. The motor is driven, then performs a freewheel stop when autotuning is complete.
- Wait until the procedure ends.
- Disable the drive and remove the run command.
The motor is then ready to operate normally.
Parameter **05.12** reverts to "None" as soon as autotuning is complete.

Encoder offset measure (3):
In this mode, the motor runs at very low speed so that the encoder offset can be measured.
This mode is only active if **03.38** is set to "U, V, W only", "Incremental UVW", "Hall effect sensor" or "Resolver", the encoder offset is automatically stored in **03.25**.

CAUTION:
If a stop command is given before the end of the autotune phase, an "Autotune" trip is generated.

05.13 : Flux optimization select
Adjustment range : Linear (0) or Dynamic (1)
Factory setting : Linear (0)
Format: 8 bits

Linear (0):
The U/F ratio is fixed and set by the base frequency (**05.06**).

Dynamic (1):
Dynamic U/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.

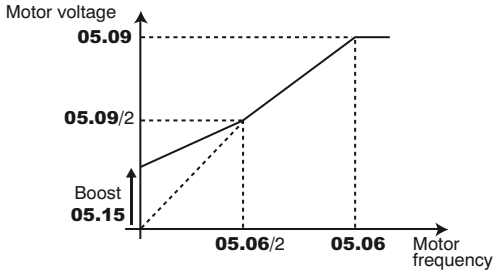
05.14 : Open loop mode select ( )
Adjustment range : Rs measured each run (0)
Rs not measured (1),
Linear U/F law with boost (2),
Rs measured after each factory setting (3),
Rs measured after each power up (4),
Square U/F law with boost (5)
Factory setting: Rs measured after each power up (4)
Format: 8 bits
Determines the open loop control mode. The "Rs measured each run (0)", "Rs not measured (1)", "Rs measured after each factory setting (3)" and "Rs measured after each power up (4)" modes are used for flux vector control of induction motors. These 4 modes are distinguished by the method used to identify the motor parameters, in particular the stator resistance. As these parameters vary with temperature and are essential for obtaining optimum performance, the machine cycle must be taken into account for selecting the most appropriate mode. The "Linear V TO F (2)" and "Square U/F law with boost (5)" modes correspond to control by U/F ratio modes for induction motors.

Rs measured each run (0):
The stator resistance **05.17** and voltage offset **05.23** are measured each time the drive receives a run command.
These measurements are valid only 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.

Rs not measured (1):
The stator resistance **05.17** and voltage offset **05.23** are not measured.
This mode is less effective than mode 0 but is compatible with all operating cycles. During commissioning, autotune when stopped should be carried out (**05.12**) so as to automatically fill in the **05.17** and **05.23** values.

Linear U/F law with boost (2):
Voltage-frequency ratio with fixed boost adjustable via parameters **05.15** and **05.09.**

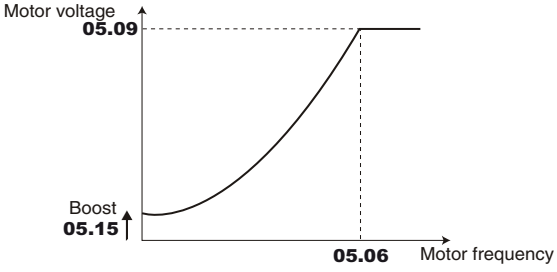
Note:
Use this mode to control several motors connected in parallel.



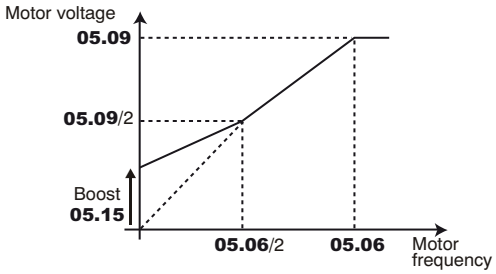
Rs measured after each factory setting (3):
After a return to factory settings, the stator resistance **05.17** and voltage offset **05.23** are measured the first time the drive is enabled (drive output active).

Rs measured after each power up (4):
The stator resistance **05.17** and voltage offset **05.23** are measured the first time the drive is enabled (drive output active) following each power-up.
CAUTION:
A voltage is briefly applied to the motor. For safety reasons, no electrical circuit must be accessible once the drive is powered up.

Square U/F law with boost (5):
Square law characteristic.



05.15 : Low frequency voltage boost
Adjustment range : 0.0 to 25.0% of motor Un (**05.09**)
Factory setting : 1.0% motor Un
Format: 16 bits
If **11.31** is set to "Induction motor in open loop mode" (1) and **05.14** to "Linear U/F law with boost (2)" or "Square U/F law with boost (5)" parameter **05.15** is used to overflux the motor at low speed so that it delivers more torque on starting. It is a percentage of the motor rated voltage (**05.09**).



05.16 : Not used

05.17 : Stator resistance
Adjustment range : 0.000 to 90000.000 mΩ
Factory setting : 0.000 mΩ
Format: 32 bits
This parameter stores the motor stator resistance for flux vector control mode (see parameter **05.14**).
If the stator resistance cannot be measured (motor not connected, value higher than the max. rating) a "Stator resistance" trip occurs.
During autotuning (**05.12** = Stationary (1) or Rotating (2)), the value of the stator resistance is stored automatically in **05.17.**

05.18 : Switching frequency
Adjustment range : 2 kHz (0) to 18 kHz (19)
Factory setting : 3 kHz (2) for the **POWERDRIVE MD2**
4 kHz (4) for the **POWERDRIVE FX**
Format: 8 bits
Sets the PWM switching frequency.

05.18	Frequency	05.18	Frequency
0	2 kHz	10	7 kHz
1	2.5 kHz	11	8 kHz
2	**3 kHz**	12	9 kHz
3	3.5 kHz	13	10 kHz
4	**4 kHz**	14	11 kHz
5	4.5 kHz	15	12 kHz
6	5 kHz	16	13 kHz
7	5.5 kHz	17	14 kHz
8	6 kHz	18	16 kHz
9	6.5 kHz	19	18 kHz

Note:
For frequencies higher than 6 kHz, please consult LEROY-SOMER.
The **POWERDRIVE FX** switching frequency must be ≥ 4 kHz (4).

CAUTION:
A high switching frequency reduces the magnetic noise, on the other hand it increases the drive losses. Refer to the installation manual to determine the drive derating according to the frequency.

05.19 : High stability modulation
Adjustment range : Disabled (0) or Enabled (1)
Factory setting : Disabled (0)
Format: 8 bits

Disabled (0):
Function disabled.

Enabled (1):
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.

05.20 : Quasi square output
Adjustment range : Disabled (0) or Enabled (1)
Factory setting : Enabled (1)
Format: 8 bits

Disabled (0):
Function disabled.

Enabled (1):
Allows the maximum value of the drive output voltage to be increased by 3%.
In the zone affected by the 3% additional voltage, the drive output voltage is no longer perfectly sinusoidal but contains approximately 2% harmonics of order 5 and 7.

05.21 : Management of the motor neutral voltage
Adjustment range : With Hv3 (0), Without Hv3 (1)
Randomize (2)
Factory setting : With Hv3 (0)
Format: 8 bits

Without Hv3 (0):
This setting is used to obtain maximum rms voltage at the drive output. This setting should be adopted when the load neutral point is not used (as with motors).

With Hv3 (1):
The maximum rms voltage level at the drive output is reduced by 15% compared to case 0. This setting should only be adopted in the specific example of a load with a connected neutral point.

Randomize (2):
Reserved.

05.22 : Not used

05.23 : Voltage offset
Adjustment range : 0.0 to 25.5 V
Factory setting : 0.0 V
Format: 16 bits
This voltage offset is measured by the drive (see parameter **05.14**). It is used to correct imperfections in the drive, especially voltage drops in the IGBTs and idle times. This parameter has an important role in low-speed operation, i.e. when the drive output voltage is low.
During autotuning (**05.12** = Stationary (1) or Rotating (2)), the value of the voltage offset is stored automatically in **05.23**.

05.24 : Transient inductance / Ld
Adjustment range : 0.000 to 9000.000 mH
Factory setting : 0.000 mH
Format: 32 bits
- Asynchronous motor: Value of the overall leakage inductance applied to the typical machine stator. The value of **05.24** is stored automatically during an autotune when running in flux vector mode (**05.12** = Rotating (2)).
- Synchronous motor: Value of the typical machine cyclical stator inductance. The value of **05.24** is used in permanent magnet motor sensorless control mode (**03.38** = Software encoder n°1 to Software encoder n° 4). Its value should be entered from the nameplate data by setting a value corresponding to 80% of the Ld value on the nameplate, or else using the autotune procedure (see **05.12**).

05.25 : Stator inductance (LS)
Adjustment range : 0.000 to 9000.000 mH
Factory setting : 0.000 mH
Format: 32 bits
- Asynchronous motor: Sum of the magnetising inductance and the leakage inductance at the motor rated flux.
The value of **05.25** is stored automatically during an autotune when running (**05.12** = Running (2)).
- Synchronous motor: This parameter is not relevant with a synchronous motor.

05.26 : Dynamic control enable
Reserved.

05.27 to 05.31 : Not used

05.32 : Motor torque per amp (Kt) ( )
Reserved.

05.33 : Motor volt per 1000 rpm (Ke) ( )
Adjustment range : 0 to 32000 V
Factory setting : 98 V
Format: 16 bits
Used to set the motor voltage per 1000 rpm.
The value of **05.33** is used in permanent magnet motor sensorless control mode (**03.38** = Software encoder n°1 to Software encoder n°5). Its value should be entered from the nameplate data (Ld value on the nameplate) or else using the autotune procedure.

05.34 to 05.49 : Not used

05.50 : Motor ventilation
Adjustment range : Not cooled (0), Self cooled (1)
Forced cooling (2)
Factory setting : Self cooled (1)
Format: 8 bits

Not cooled (0):
The motor has neither an internal fan nor a forced ventilation unit.

Self cooled (1):
The motor has a fan on the shaft.

Forced cooling (2):
The motor has a forced ventilation unit.

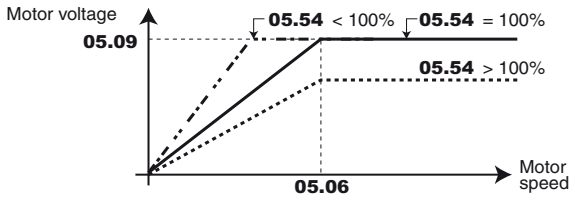
The value of parameter **05.50** combined with the values of parameters **04.15** (Motor thermal time constant), **05.07** (Motor rated current), **05.08** (Motor rated speed) and **11.31** (User drive mode) is used to estimate the machine thermal use percentage indicated in **04.19** (%).

05.51 : Q axis inductance (synchronous motor)
Adjustment range : 40 to 999% of **05.24**
Factory setting : 100%
Format: 16 bits
Used to set an inductance value in quadrature with the pole axis for synchronous motors with projecting poles.

05.52 : Starting current (synchronous motor)
Adjustment range : ± 120% of **05.07**
Factory setting : 20%
Format: 16 bits
With a synchronous motor (**11.31** = Servo (3)), this parameter is used to improve starting for permanent magnet motors controlled without a position sensor.
With an asynchronous motor (**11.31** = Closed Loop vector), this parameter is used to boost the magnetising current on machine starting for quicker flux installation.

05.53 : Flux establishment time
Adjustment range : 0.00 to 320.00 s
Factory setting : 0.25 s
Format: 16 bits
With a synchronous motor (**11.31** = Servo (3)) without a sensor, this parameter defines the "parking" time before motor rotation. With an asynchronous motor, after a run command, the flux is deemed to have been installed if **05.53** has elapsed or if 7/8 of the machine flux is obtained.

05.54 : Base Freq./nominal Freq. ratio
Adjustment range : 75 to 150%
Factory setting : 100%
Format: 16 bits
This parameter is used to adjust the level of flux in the induction motor.
The diagram below shows the influence of **05.54** on the change in the motor no-load voltage characteristic as a function of the speed of rotation.



05.55 : Motor overcurrent threshold
Adjustment range : 0 to 999%
Factory setting : 160%
Format: 16 bits
This threshold (% of **05.07**) defines the detection level for the "Motor overcurrent" trip. If this threshold expressed in A is higher than 1.6 x **11.32**, the "Overcurrent at drive output" trip will then override the "Motor overcurrent" trip.

05.56 :Not used

05.57 : Actual switching frequency
Adjustment range : 2 kHz to 18 kHz
Format: 8 bits
Displays the switching frequency actually used. Related parameters: **05.18**, **05.60** and **18.27**.

05.58 : Two PWM update per period

Adjustment range : No (0) or Yes (1)
Factory setting : Yes (1)
Format: 8 bits

No (0):
The frequency for calculating the motor control is the same as that displayed by **05.57**.

Yes (1):
The frequency for calculating the motor control is double that displayed by **05.57**. This option allows more precise motor control. It is not available when the user has chosen a switching frequency **05.18** higher than 8 kHz.

05.59 : Rotation direction

Adjustment range : Clockwise (0) or C/clockwise (1)
Factory setting : Clockwise (0)
Format: 8 bits
This parameter is used to modify the direction of rotation when viewed from the drive end, without changing the speed reference sign.
It is only taken into account when the drive is stopped.

05.60 : Low-speed switching frequency

Adjustment range : 2 kHz (0) to 18 kHz (19)
Factory setting : 3 kHz (2) for the **POWERDRIVE MD2**
4 kHz (4) for the **POWERDRIVE FX**
Format: 8 bits

05.60	Frequency	05.60	Frequency
0	2 kHz	10	7 kHz
1	2.5 kHz	11	8 kHz
2	**3 kHz**	12	9 kHz
3	3.5 kHz	13	10 kHz
4	**4 kHz**	14	11 kHz
5	4.5 kHz	15	12 kHz
6	5 kHz	16	13 kHz
7	5.5 kHz	17	14 kHz
8	6 kHz	18	16 kHz
9	6.5 kHz	19	18 kHz

Note:
For frequencies higher than 6 kHz, please consult LEROY-SOMER. For the **POWERDRIVE FX**, the switching frequency must be ≥ 4 kHz (4).
Used to set the switching frequency when the motor frequency/ speed has reached the threshold defined in **05.61**.

05.61 : Switching frequency threshold

Adjustment range : 0.00 to 590.00 Hz
Factory setting : 0.00 Hz
Format: 32 bits
If the motor frequency (speed) is below the threshold set by **05.61**, the switching frequency selected via **05.60** is used. Otherwise, the switching frequency **05.18** is used.
Reminder: F = (pp x N)/60, where F is the frequency in Hz, pp the number of pairs of poles and S the speed in rpm.

Note:
For the **POWERDRIVE FX**, when **05.60** < 4 kHz, the actual trip threshold is the smallest value between **05.61** and 1/15 of the motor rated frequency **05.06**

05.62 : Torque/speed optimisation for synchronous motor

Adjustment range : Standard (0), Fixed (1),
Optimized mode 1 (2), Optimized mode 2 (3)
Factory setting : Standard (0)
Format: 8 bits
This parameter is only active when **11.31** is on Servo (3).

Standard (0):
The drive regulates a zero magnetising current in the motor (corresponds to the majority of applications).

Fixed (1):
The drive imposes in line with the pole axis a current set by **05.63** (visible in **04.17**).

Optimized mode 1 (2):
The drive imposes in line with the pole axis a current proportional to the active current. The proportionality slope is set by **05.63** which corresponds to the demagnetising current desired at the motor rated current **05.07**.

Optimized mode 2 (3):
The drive imposes in line with the pole axis a current defined according to the typical motor parameters (**05.24**, **05.33**, **05.51**).
In all cases, when the drive output voltage reaches its limit (defluxing range), the pole axis current is then imposed by automatic defluxing.

Note:
Leave **05.62** = Standard (0) and only change after consulting LEROY-SOMER.

05.63 : Optimal magnetising current

Adjustment range : 0.00 to 2.2 x **11.32**
Factory setting : 0.00 A
Format: 32 bits

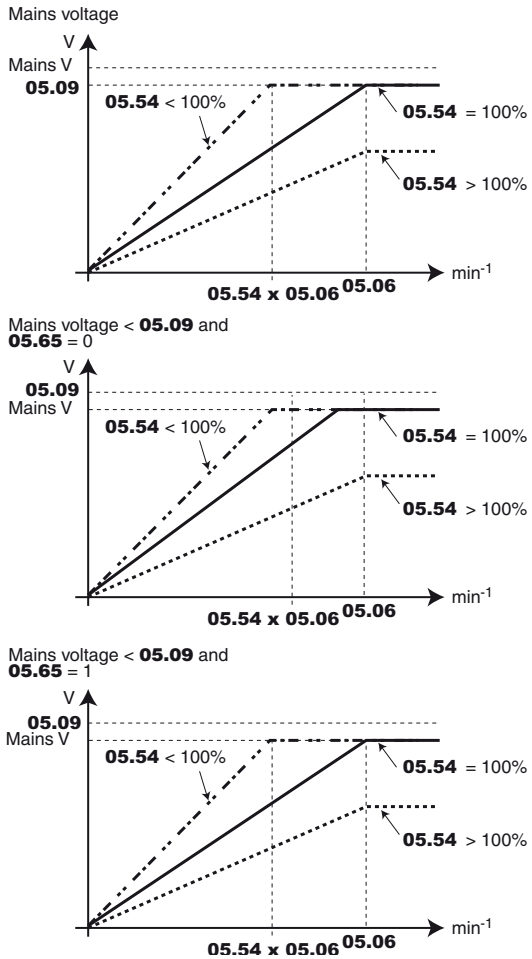
CAUTION:
This parameter is only active when 11.31 is on Servo (3).

When **05.62** equals Fixed (1) or Optimized mode 1 (2), **05.63** is used to set the optimum magnetising current for synchronous motors (see explanations in parameter **05.62**). When **05.62** is on Standard (0), the value programmed in **05.63** can be used to brake the motor more quickly by increasing the losses in the motor during braking phases. To do this, set **02.04** to Fixed ramp + (3) or Automatic ramp + (2).

05.64 : Starting threshold (synchronous motor)

Adjustment range : 0% to 100%
Factory setting : 10%
Format: 8 bits
Used to set the speed at which the injection of a current to help with starting a permanent magnet synchronous motor is cancelled (see **05.52**).

05.65 : Variable flux on mains voltage dip
Adjustment range : No (0) to Yes (1)
Factory setting : No (0)
Format: 8 bits
Management of the voltage-frequency ratio according to parameters **05.54** and **05.65**.

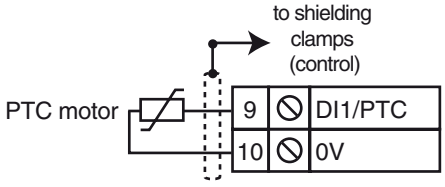


05.66 to 05.69 : Not used

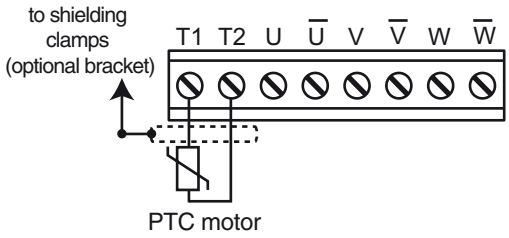
05.70 : PTC validation
Adjustment range : Disabled (0)
Drive terminal (1)
Encoder option terminal (2)
2 PTC inputs (3)
Factory setting : Disabled (0)
Format: 8 bits

Disabled (0):
PTC temperature sensors not managed by the drive.

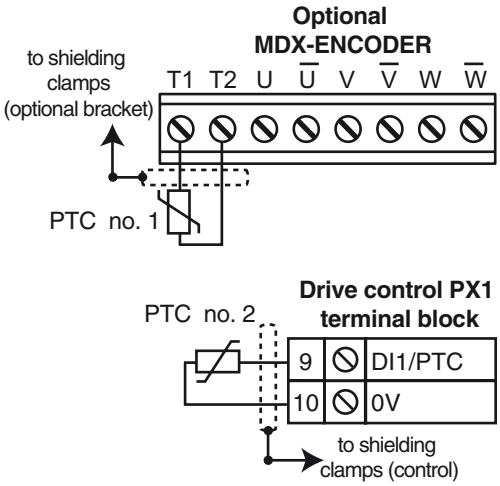
Drive terminal (1):
PTC sensor connected to DI1/PTC and drive control terminal block 0V is taken into account.



Encoder option terminal (2):
PTC sensor connected to T1 and T2 on the MDX-ENCODER option terminal block is taken into account.



2 PTC inputs (3):
2 PTC sensors connected to DI1/PTC and drive control terminal block 0V and to T1 and T2 on the MDX-ENCODER option terminal block respectively are taken into account.



CAUTION:
If 05.70 is set to 1 or 3, then digital input DI1 must not be used (do not assign 08.21).

05.71 to 05.79 : Not used

05.80 : Sine filter on drive output present
Reserved

05.81 : Sine filter inductance
Reserved

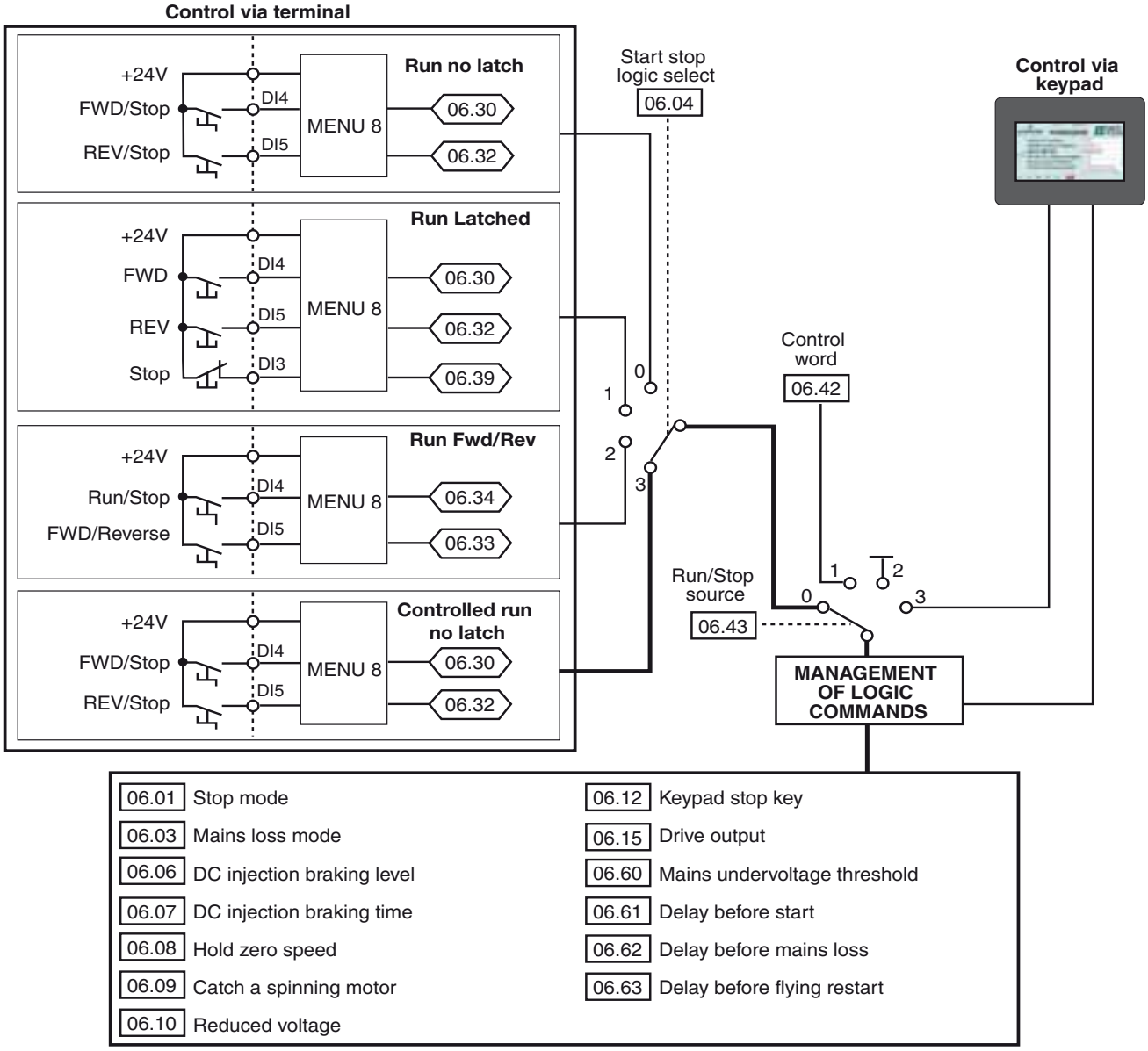
05.82 : Sine filter capacity
Reserved

05.83 : Sine filter damping resistor
Reserved

5.7 - Menu 6: Programmable logic and counters

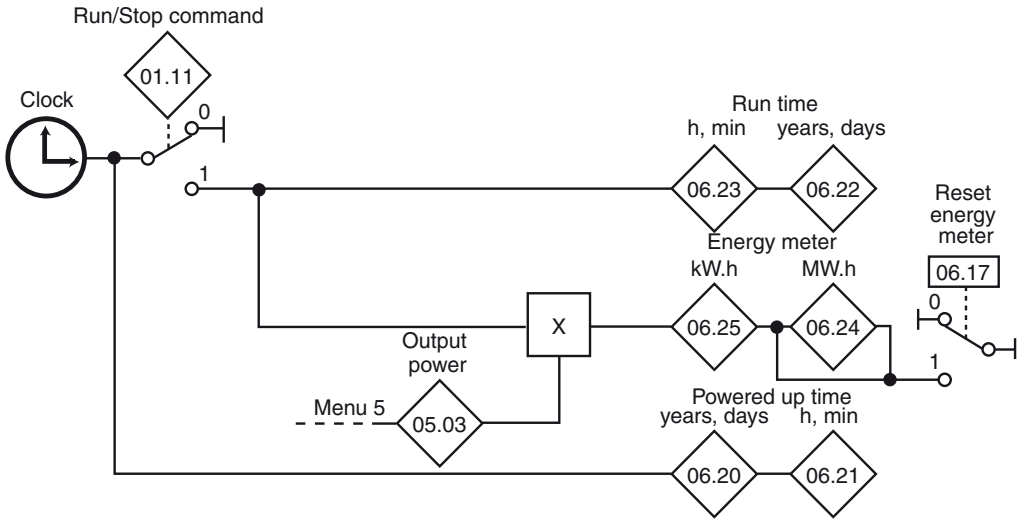
5.7.1 - Menu 6 diagrams

• Management of logic commands



06.01	Stop mode	06.12	Keypad stop key
06.03	Mains loss mode	06.15	Drive output
06.06	DC injection braking level	06.60	Mains undervoltage threshold
06.07	DC injection braking time	06.61	Delay before start
06.08	Hold zero speed	06.62	Delay before mains loss
06.09	Catch a spinning motor	06.63	Delay before flying restart
06.10	Reduced voltage		

• Timer, energy meter

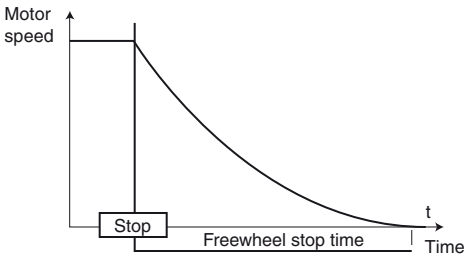


5.7.2 - Explanation of parameters in menu 6

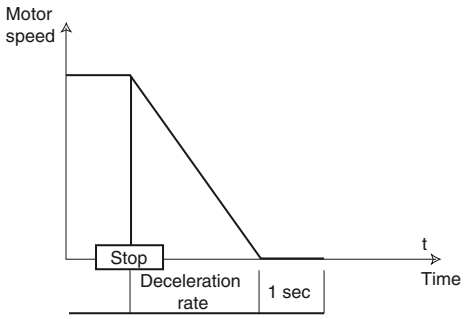
06.01 : Stop mode

Adjustment range : Coast (0), Ramp (1), Ramp + DC (2), Zero speed DC (3), Timed DC (4)
Factory setting : Ramp (1)
Format: 8 bits

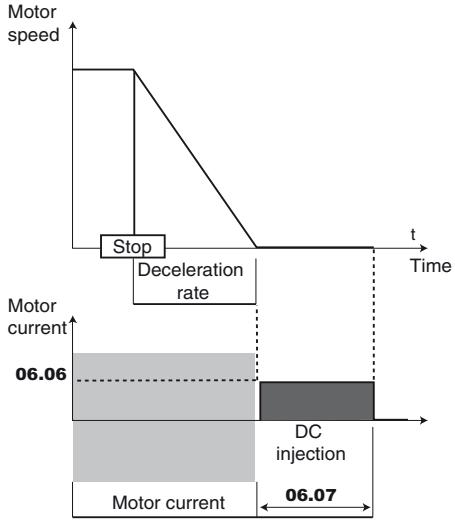
Coast (0):
The drive stops in freewheel mode.
The power bridge is deactivated as soon as the stop command is given.
The drive cannot receive another run command during the time programmed in **06.63**, the motor demagnetisation time. After this stopping time, the drive is "ready". The machine stopping time depends on its inertia.



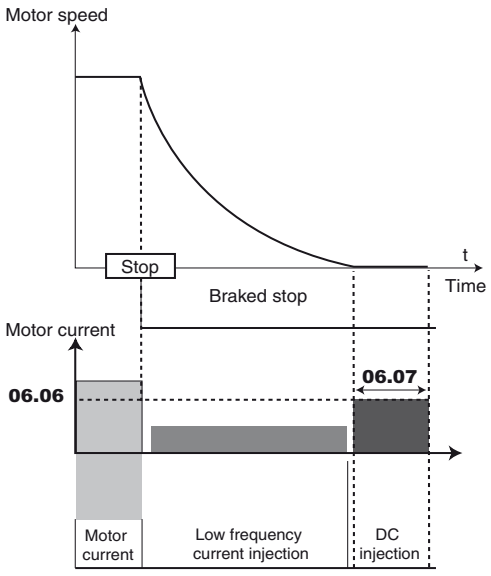
Ramp (1):
Stop on deceleration ramp.
The drive decelerates the motor according to the deceleration mode chosen in parameter **02.04**.
One second after the stop, the drive is "ready".



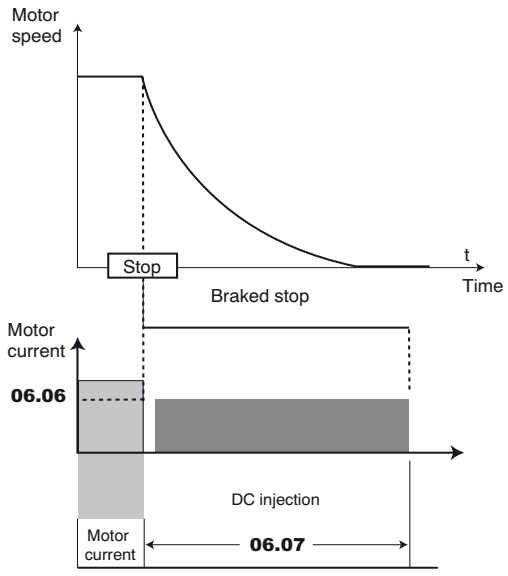
Ramp + DC (2) ( ):
Stop on deceleration ramp with DC injection for an imposed period of time.
The drive decelerates the motor according to the deceleration mode chosen in parameter **02.04**.
When zero frequency is reached, the drive injects DC with a magnitude which can be set in parameter **06.06** for a time defined by parameter **06.07**.
The drive is "ready".



Zero speed DC (3) ( ):
Stop by braking using low frequency current injection, then DC injection at zero speed.
The drive decelerates the motor by imposing a low frequency current until it reaches almost zero speed, which the drive detects automatically.
The drive then injects DC with a magnitude which can be set in parameter **06.06** for a time defined by parameter **06.07**.
No run command can be taken into account until the drive is "ready".



Timed DC (4) (▣):
Stop on DC injection with an imposed period of time.
The drive decelerates the motor by imposing a current defined by parameter **06.06** for a time defined by parameter **06.07**. No run command can be taken into account until the drive is "ready".

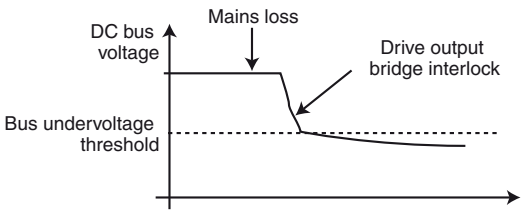


Note:
In closed loop mode (▣), the Ramp + DC (2), Zero speed DC (3) and Timed DC (4) stop modes are equivalent to the Ramp (1) stop mode.

06.02 : Not used

06.03 : Mains loss mode
Adjustment range : No detection (0), Full stop (1), Delayed stop (2)
Factory setting : No detection (0)
Format: 8 bits

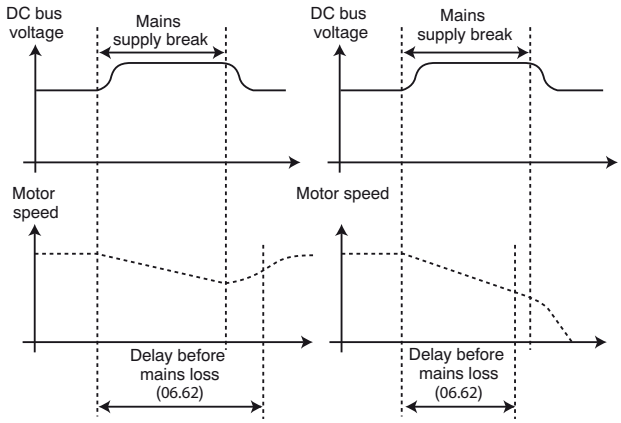
No detection (0):
The drive does not take account of mains supply breaks and continues to operate while there is sufficient voltage in the DC bus.



CAUTION:
The "Full stop (1)" and "Delayed stop (2)" cases can only work correctly if the energy stored in the application is more than the energy to be provided during the mains loss. Eligible applications: ventilation, centrifuging, etc.

Full stop (1):
If there is a mains supply break, the drive will decelerate on a ramp, which is automatically calculated by the drive, so that the motor feeds back the energy to the DC bus. When normal conditions return, deceleration continues until the motor stops, according to the stop mode programmed in **06.01**.
The drive trips on "Mains loss".

Delayed stop (2):
If there is a Mains trip (see **06.60**) or a mains supply break, the drive will decelerate on a ramp, which is automatically calculated by the drive, so that the motor feeds back the energy to the DC bus.
When normal conditions return:
- If the duration of the mains loss is less than parameter **06.62** "Delay before mains loss", the motor reaccelerates up to the reference speed.
- If the duration of the mains loss is greater than parameter **06.62** "Delay before mains loss", deceleration continues in freewheel mode. The drive trips on "Mains loss".

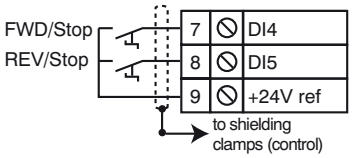


06.04 : Start stop logic select

Adjustment range : Run no latch (0), Run latched (1), Run Fwd/Rev (2), Controlled run no (latch) (3)
Factory setting : Controlled run no (latch) (3)
Format: 8 bits
Used to choose one of 4 Run/Stop command and rotation direction management modes.

Note:
Modifications to **06.04** must be made with the drive disabled.

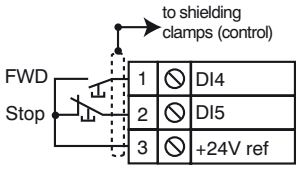
Run no latch (0):
Command for FWD/Stop and REV/Stop via stay-put contacts.
In its factory setting:
- Terminal DI4 preset to FWD/Stop.
- Terminal DI5 preset to REV/Stop.



On power-up or after a trip reset, if a Run command is already selected, the motor starts as soon as the speed reference appears.

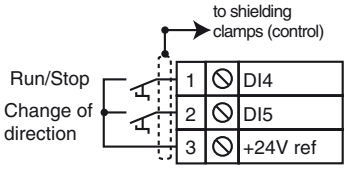
Run latched (1):
Command for Run and Stop via jog contacts.
In this mode, use DI5 to give the Stop command.
To do this, configure:
- **08.25** = **06.39** (DI5 assignment)
- **08.22** = **06.32** (DI2 assignment if necessary)

In its factory setting:
- Terminal DI4 preset to FWD.

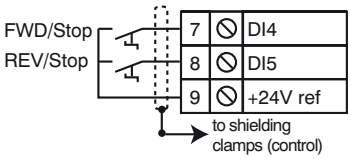


To change from FWD to REV or vice versa, go via a stop command.

Run Fwd/Rev (2):
Command for Run/Stop via stay-put contact.
In this mode, use DI4 as Run/Stop, and DI5 to give the direction of rotation.
To do this, configure:
- **08.24** = **06.34** (DI4 assignment)
- **08.25** = **06.33** (DI5 assignment)



Controlled run no (latch) (3):
Command for FWD/Stop and REV/Stop via stay-put contacts.
In its factory setting:
- Terminal DI4 preset to FWD/Stop.
- Terminal DI5 preset to REV/Stop.



On power-up or after a trip reset, if a run command is already selected, the motor does not start. The Run input (DI4 or DI5) must be cycled for the command to take effect.

06.05 : Not used

06.06 : Injection braking level

Adjustment range : 0.0 to 300.0%
Factory setting : 100.0%
Format: 16 bits
This parameter defines the level of current used for DC injection braking (see **06.01** and **06.08**).

CAUTION:
For efficient braking, the value of parameter 06.06 should be 60% minimum.
The values 04.05, 04.06 and 04.07 can limit the braking level defined in 06.06.

06.07 : Injection braking time

Adjustment range : 0.0 to 25.0 s
Factory setting : 1.0 s
Format: 16 bits
This parameter defines the DC injection braking time when **06.01** is at Ramp + DC (2), Zero speed DC (3) or Timed DC (4).

06.08 : Hold zero speed
Adjustment range : Disabled (0), Enabled (1), DC in RUN (2), DC in STOP (3)
Factory setting : Disabled (0)
Format: 8 bits

Disabled (0):
The drive output is deactivated at zero speed.

Enabled (1):
The drive output remains active while the speed is zero in order to hold the torque at standstill. The drive output is deactivated when **06.08** changes to 0.

Note:
When the drive is in the "Enabled" state and the Run command has not been activated after one minute, the drive returns to the "Disabled" state (drive output deactivated).

DC in RUN (2):
The motor speed is zero. When there is a Run command, the drive output is activated to maintain a permanent DC current for heating the motor. This current is defined by parameter **06.06**.

DC in STOP (3):
On a stop command, the drive output remains activated after the motor has stopped, in order to maintain a permanent DC current for heating the motor. This current is defined by parameter **06.06**.

06.09 : Catch a spinning motor
Adjustment range : Disabled (0), Enabled (1)
Factory setting : Disabled (0)
Format: 8 bits

• 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.

Disabled (0):
Catch a spinning motor disabled on a motor which is rotating.

Enabled (1):
If the drive output is inactive, the drive executes a procedure to calculate the motor frequency and direction of rotation. After the output bridge is reactivated, it will automatically recalibrate the output frequency to the measured value and reaccelerate the motor up to the reference frequency.
In some cases it may be necessary to increase the time delay before the catch a spinning motor procedure (required for motor demagnetisation). For details, see parameter **06.63**.
Note: Catch a spinning motor is not compatible with the S ramp (**02.06**) associated with brake control (**12.41** ≠ Disabled).

06.10 : Reduced voltage
Adjustment range : Disabled (0) or Enabled (1)
Factory setting : Disabled (0)
Format: 8 bits

Disabled (0): The DC bus undervoltage detection thresholds are unchanged.

Enabled (1): Used to modify the drive DC bus undervoltage detection thresholds, so as to be at the same levels as lower-voltage drives. This enables a 400 V (T) rating to be supplied with 230 V or a 690 V (TH) with 400 V, if necessary, without tripping the drive.
CAUTION:
The value 06.10 is taken into account only after repowering-up of the drive.

06.11 : Not used

06.12 : Keypad stop key
Adjustment range : Disabled (0) or Enabled (1)
Factory setting : Enabled (1)
Format: 8 bits
When the source of commands is not via the keypad (**06.43** ≠ 3), **06.12** is used to disable the "Stop" function of the parameter-setting interface (see section 2.2.5).
The RESET function is not affected by this parameter when the keypad is being used.

06.13 and 06.14 : Not used

06.15 : Drive output
Adjustment range : Disabled (0) or Enabled (1)
Factory setting : Enabled (1)
Format: 8 bits
If the drive is enabled via the terminals, the user can then disable or enable the drive via **06.15**.
CAUTION:
Disabling via the drive terminals overrides 06.15.

06.16 : Not used

06.17 : Reset energy meter
Adjustment range : Disabled (0) or Enabled (1)
Factory setting : Disabled (0)
Format: 8 bits
When this parameter is set to Enabled (1), the meters **06.24** and **06.25** are reset to 0, then **06.17** reverts to Disabled (0).

06.18 and 06.19 : Not used

06.20 : Powered-up time: years, days
Adjustment range : 0.000 to 9.364 a, j
Format: 16 bits
This parameter records for how many years and days the drive has been powered up.

06.21 : Powered-up time: hours, minutes

Adjustment range : 0.00 to 23.59 hrs, min
Format: 16 bits
This parameter records for how many hours and minutes the drive has been powered up.
After 23.59, **06.21** returns to 0 and **06.20** is incremented by one day.

06.22 : Run time: years, days

Adjustment range : 0.000 to 9.364 years, days
Format: 16 bits
This parameter records the number of years and days of operation since the drive was first commissioned.

06.23 : Run time: hours, minutes

Adjustment range : 0.00 to 23.59 hrs, min
Format: 16 bits
This parameter records the number of hours and minutes of operation since the drive was first commissioned.
After 23.59, **06.23** returns to 0 and **06.22** is incremented by one day.

06.24 : Energy meter: MW.h

Adjustment range : 0.0 to 999.9 MW.h
Format: 16 bits
This parameter records the drive energy consumption in MW.h.
This meter can be reset to 0 by changing parameter **06.17** to Enabled (1).

06.25 : Energy meter: kW.h

Adjustment range : 0.00 to 99.99 kW.h
Format: 16 bits
This parameter records the drive energy consumption in kW.h.
This meter can be reset to 0 by changing parameter **06.17** to Enabled (1).

06.26 to **06.29** : **Not used**

06.30 to 06.34 and 06.39 : Sequencing bits

Adjustment range : Disabled (0) or Enabled (1)
Factory setting : Disabled (0)
Format: 8 bits
The drive's logic command manager (**06.04**) uses these bits as inputs rather than referring directly to the terminals. This enables the user 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 Disabled (0).
06.30: Run forward
06.31: Jog
06.32: Run reverse
06.33: Forward/Reverse
06.34: Run/Stop
06.39: Stop

06.35 to **06.38** : **Not used**

06.40 and **06.41** : **Not used**

06.42 : Control word
Adjustment range : 0 to 32767
Factory setting : 0
Format: 16 bits
The control word is used to control the drive via a serial link.
Each function has a corresponding binary code:

Control word bits 06.42	Decimal conversion	Functions	Equivalent parameter
0	1	Drive output	**06.15**
1	2	Run forward	**06.30**
2	4	Jog	**06.31**
3	8	Run reverse	**06.32**
4	16	Forward/Reverse	**06.33**
5	32	Run/Stop	**06.34**
6	64	Reserved	
7	128	Manual/Auto	
8	256	Analog ref./ Preset ref.	**01.42**
9	512	Reserved	
10	1024	Reserved	
11	2048	Reserved	
12	4096	Reserved	
13	8192	Drive reset	**10.33**
14	16384	Reserved	

If the Manual/Auto bit is at 1 and **06.43** = 1, then the drive is controlled by bits 0 to 6 of control word **06.42**.
If the Manual/Auto bit is at 0 or **06.43** ≠ 1, then the drive is controlled by parameters **06.15**, **06.30**, **06.31**, **06.32**, **06.33**, **06.34**.

CAUTION:
For the control word to be taken into account, parameter 06.43 must be at 1.
06.42 should correspond to the binary sum of the commands to be given to the drive.

Note:
To enable the drive by validating **06.15** (bit 0), the enabling terminal of the terminal block must previously have been activated (see explanation of **06.15**).

06.43 : Run/Stop source
Adjustment range : Terminals (0), Fieldbus (1), Not active (2), LCD keypad (3)
Factory setting : Terminals (0)
Format: 8 bits

Terminals (0):
Commands come from the control terminal block.

Fieldbus (1):
Commands are given by the control word **06.42**.

Not active (2):
Not used.

LCD keypad (3):
Commands come from the connected parameter-setting interface (MDX-Powerscreen or MDX-KEYPAD).

• When 06.43 changes, control word 06.42 is not reset. When 06.43 is reset to 1 the drive can restart if the control word allows this.

06.44 to 06.59 : Not used

06.60 : Mains undervoltage threshold
Adjustment range : 100 to 600 V
Factory setting : 300 V
Format: 16 bits
Used to define the detection level for mains undervoltage.

06.61 : Delay before start
Adjustment range : 0.00 to 200.00 s
Factory setting : 0.00 s
Format: 16 bits
This function is used to delay the motor start-up following the run command.

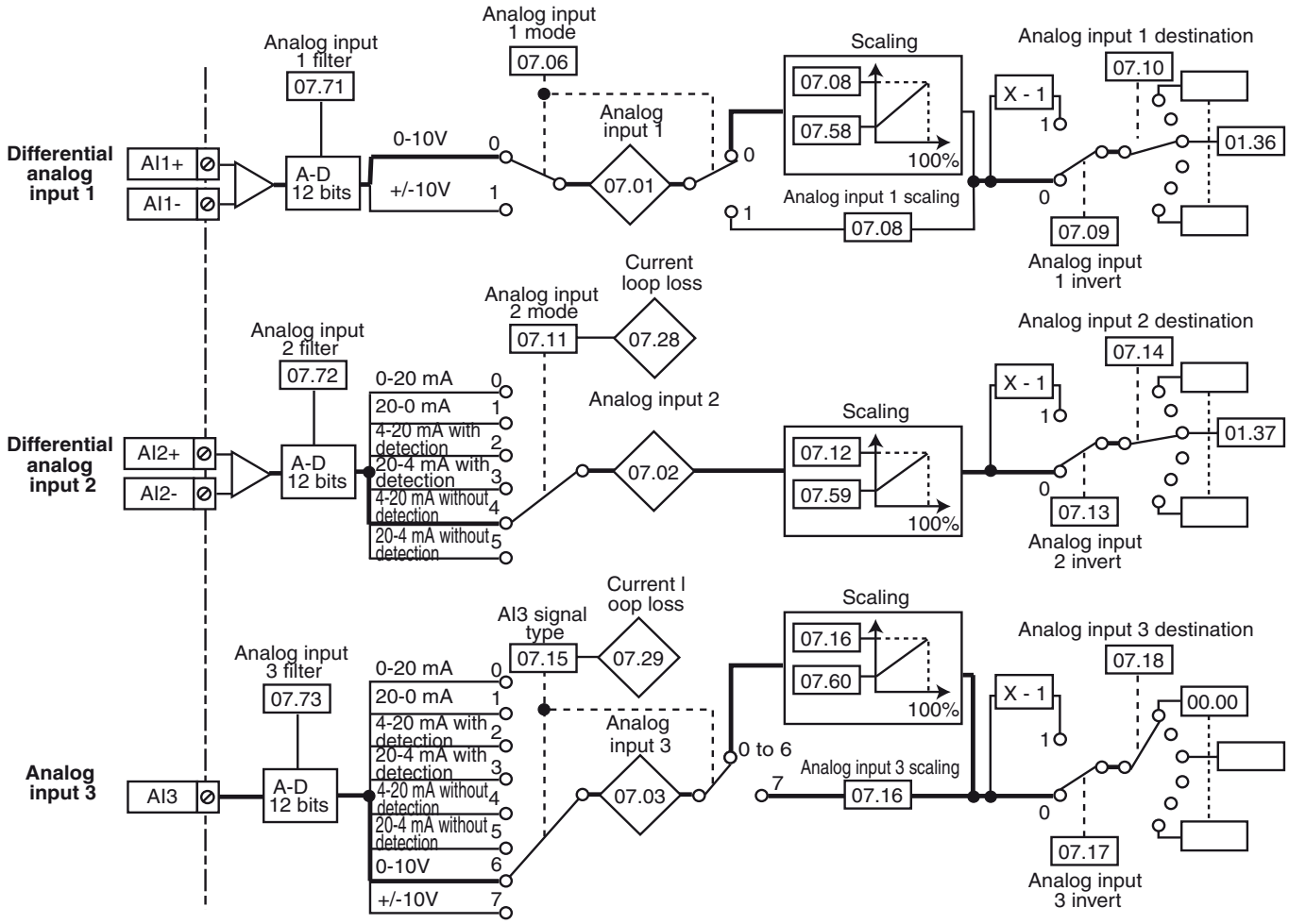
06.62 : Delay before mains loss
Adjustment range : 0.00 to 200.00 s
Factory setting : 0.50 s
Format: 16 bits
This parameter is used to set a mains loss time during which the drive will re-accelerate or decelerate until the motor stops when **06.03** = Delayed stop (2) (see explanation of **06.03**).

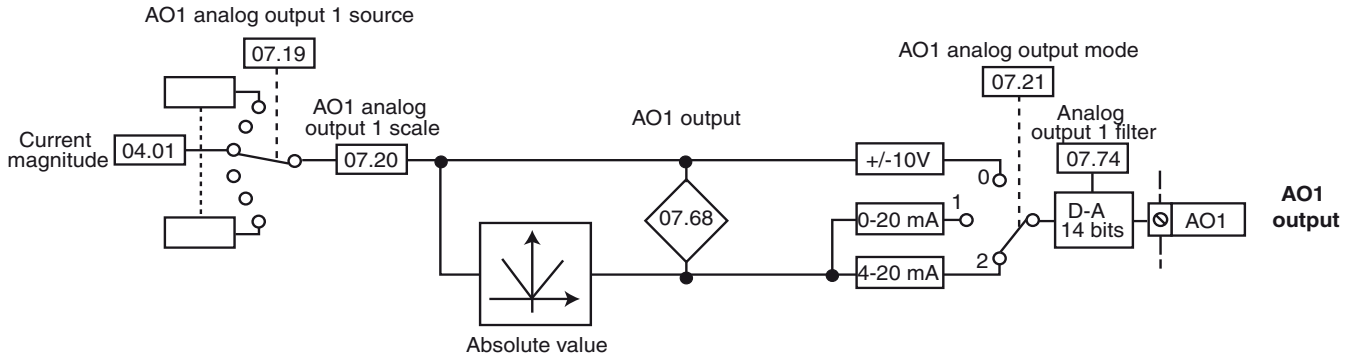
06.63 : Delay before flying restart
Adjustment range : 0.00 to 200.00 s
Factory setting : 2.00 s
Format: 16 bits
Defines the time required for motor demagnetisation before performing a flying restart procedure (see **06.09**). A setting of 2 seconds is generally sufficient.
If the flying restart does not take place correctly, increase the value of **06.63**.
This parameter also defines the minimum time between a stop command and the recognition of a new run command.

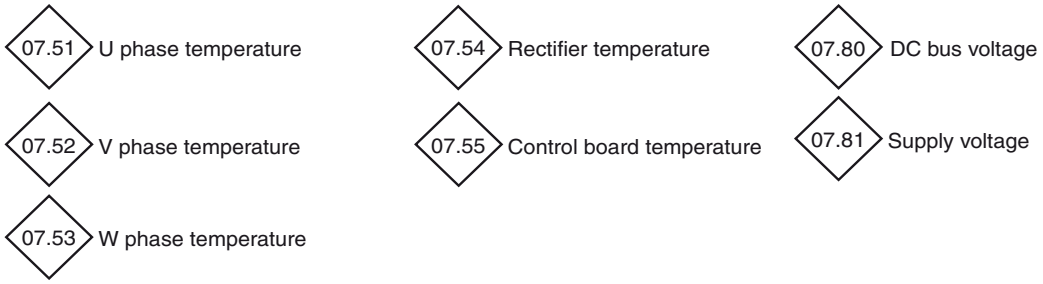
5.8 - Menu 7: Analog inputs/outputs

5.8.1 - Menu 7 diagrams

• Analog I/O







5.8.2 - Explanation of parameters in menu 7

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

07.01 : Analog input 1

Adjustment range : ± 100.00%
Format: 16 bits
Used to read the value of the differential analog voltage input 1. This input uses an analog/digital converter with 12-bit resolution.

07.02 : Analog input 2

Adjustment range : ± 100.00%
Format: 16 bits
Used to read the value of the analog current input 2.
This input uses an analog/digital converter with 12-bit resolution.

07.03 : Analog input 3

Adjustment range : ± 100.00%
Format: 16 bits
Used to read the non-differential analog input 3. This input uses an analog/digital converter with 12-bit resolution.

07.04 and 07.05 : Not used

07.06 : Analog input 1 mode
Adjustment range : 0-10 V (0) and ± 10 V (1)
Factory setting : 0-10 V (0)
Format: 8 bits

0-10 V (0):
Receives a voltage signal varying between 0 and +10 V.

± 10 V (1):
Receives a voltage signal varying between -10 V and +10 V.

07.07 : Not used

07.08 and 07.12 : Analog inputs 1 and 2 scaling
Adjustment range : 0.00 to 2.50
Factory setting : 1.00
Format: 16 bits
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.

07.09 and 07.13 : Analog inputs 1 and 2 invert
Adjustment range : Disabled (0) or Enabled (1)
Factory setting : Disabled (0)
Format: 8 bits
This parameter is used to invert the input signal.

Disabled (0):
Input signal not inverted.

Enabled (1):
Input signal inverted.

07.10 : Analog input 1 destination
Adjustment range : **00.00** to **21.51**
Factory setting : **01.36**: Analog reference 1
Format: 16 bits
This address should contain the number of the parameter which you wish to assign to input AI1.
Only numerical parameters can be assigned.
If an unsuitable parameter is programmed, no assignment will be taken into account.

07.11 : Analog input 2 mode
Adjustment range: 0-20 mA (0), 20-0 mA (1), 4-20 mA with detection (2), 20-4 mA with detection (3), 4-20 mA without detection (4), 20-4 mA without detection (5)
Factory setting : 4-20 mA without detection (4)
Format: 8 bits
Used to define the type of signal connected to the differential analog input AI2.
If a mode with detection is selected, the drive will cause a "AI2 current loop loss" trip on detection of signal break.

07.14 : Analog input 2 destination
Adjustment range : **00.00** to **21.51**
Factory setting : **01.37**: Analog reference 2
Format: 16 bits
This address should contain the number of the parameter which you wish to assign to input AI2.
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.

07.15 : AI3 signal type
Adjustment range: 0-20 mA (0), 20-0 mA (1),
4-20 mA with detection (2),
20-4 mA with detection (3),
4-20 mA without detection (4),
20-4 mA without detection (5),
0-10V (6), ± 10 V (7)
Factory setting: 0-10 V (6)
Format: 8 bits
Used to define the type of signal connected to the differential analog input AI3.
If a mode with detection is selected, the drive will cause a "AI3 current loop loss" trip on detection of signal break.

07.16 : Analog input 3 scaling
Adjustment range : Input: 0.00 to 2.50
Factory setting : 1.00
Format: 16 bits
This parameter is used, if necessary, to scale the analog input. However, this rarely proves necessary since the maximum input level (100%) automatically corresponds to the maximum value of the parameter which is assigned to it.

07.17 : Analog input 3 invert
Adjustment range : Disabled (0) or Enabled (1)
Factory setting : Disabled (0)
Format: 8 bits
Used to invert the input signal.

Disabled (0):
Input signal not inverted.

Enabled (1):
Input signal inverted.

07.18 : Analog input 3 destination
Adjustment range : **00.00** to **21.51**
Factory setting : **00.00**
Format: 16 bits
This address should contain the number of the parameter which you wish to assign to AI3. If AI3 is an analog input, only numerical parameters can be assigned.
If an unsuitable parameter is programmed, the corresponding input will take the value 0.

07.19 : AO1 analog output 1 source
Adjustment range : **00.00** to **21.51**
Factory setting : **04.01**
Format: 16 bits
This parameter is used to select the source which you wish to assign to analog output AO1.

07.20 : AO1 analog output 1 scale
Adjustment range : 0.000 to 4.000
Factory setting : 1.000
Format: 16 bits
This parameter is used to scale the AO1 output.

Note:
When **07.20** = 1.000, the maximum value of the analog output corresponds to the maximum value of the parameter which is assigned to it.

07.21 : AO1 analog output mode
Adjustment range : ± 10 V (0), 0-20 mA (1), 4-20 mA (2)
Factory setting : 4-20 mA (2)
Format: 8 bits
Used to define the type of signal on the analog output.

± 10 V (0):
± 10 V voltage output.

0-20 mA (1):
0 to 20 mA current output.

4-20 mA (2):
4 to 20 mA current output.

07.22 to 07.27 : Not used

07.28 and 07.29 : Current loop loss on inputs AI2 and AI3
Adjustment range : Active (0) or Lost (1)
Format: 8 bits
These parameters switch to 1 when in 4-20 mA or 20-4 mA current mode with or without detection of signal loss, the analog signal changes to less than 3 mA.

07.30 to 07.50 : Not used

07.51, 07.52 and 07.53 : U, V, W phase temperature
Adjustment range : 0 to 200°C
Format: 16 bits

07.54 : Rectifier temperature
Adjustment range : 0 to 200°C
Format: 16 bits

CAUTION:
If the product is a POWERDRIVE FX 33T to 50T, the rectifier temperature measurement is identical to that of the inverter.

07.55 : Control board temperature
Adjustment range : -40 to +125°C
Format: 16 bits

07.56 and 07.57 : Not used

07.58 : Minimum value of AI1
Adjustment range : 0.00 to 1.00
Factory setting : 0.00
Format: 16 bits
For an analog input value of 0, this parameter is used to set the minimum value of the destination parameter.
Value 0 = (**07.58** x destination parameter max. value) + destination parameter min. value.
Example: AI1 is assigned to a parameter with an adjustment range of 0 to 30000. If **07.58** = 0.01, 0 to 100% on AI1 corresponds to 300 to 30000.

07.59 : Minimum value of AI2
Adjustment range : 0.00 to 1.00
Factory setting : 0.00
Format: 16 bits
This parameter is a multiplication coefficient applied to the maximum value of the AI2 destination parameter. For a 0 value of the analog input, it is used to obtain a different value of the minimum value of the destination parameter.
Value 0 = (**07.59** x destination parameter max. value) + destination parameter min. value.
Example: AI2 is assigned to a parameter with an adjustment range of 0 - 30000. If **07.59** = 0.01, 0 - 100% on AI2 corresponds to 300 - 30000.
07.59 is not used when input AI2 is used as a +/- 10 V input or a digital input.

07.60 : Minimum value of AI3
Adjustment range : 0.00 to 1.00
Factory setting : 0.00
Format: 16 bits
This parameter is a multiplication coefficient applied to the max value of the AI3 destination parameter. With an analog input value of 0, it is used to obtain a different value from the destination parameter min value.
Value 0 = (**07.60** x destination parameter max. value) + destination parameter min. value.
Example: AI3 is assigned to a parameter with an adjustment range of 0 to 30000. If **07.60** = 0.01, 0 to 100% on AI3 corresponds to 300 to 30000.

07.61 to 07.67 : Not used

07.68 : AO1 output
Adjustment range : ± 100.00%
Format: 16 bits

07.69 and 07.70 : Not used

07.71 , 07.72 and 07.73 : Analog input filters 1, 2 and 3
Adjustment range : None (0), 4 ms (1), 8 ms (2), 16 ms (3), 32 ms (4)
Factory setting : 8 ms (2)
Format: 8 bits

None (0):
No filtering is applied to the corresponding analog input.

4 ms (1):
The input signal is filtered with a 4 ms time constant.

8 ms (2):
The input signal is filtered with an 8 ms time constant.

16 ms (3):
The input signal is filtered with a 16 ms time constant.

32 ms (4):
The input signal is filtered with a 32 ms time constant.

07.74 Analog output 1 filter
Adjustment range : None (0), 4 ms (1), 8 ms (2), 16 ms (3), 32 ms (4)
Factory setting : 8 ms (2)
Format: 8 bits

None (0):
No filtering is applied to the AO1 analog output.

4 ms (1):
The output signal is filtered with a 4 ms time constant.

8 ms (2):
The output signal is filtered with an 8 ms time constant.

16 ms (3):
The output signal is filtered with a 16 ms time constant.

32 ms (4):
The output signal is filtered with a 32 ms time constant.

07.75 to 07.79 : Not used

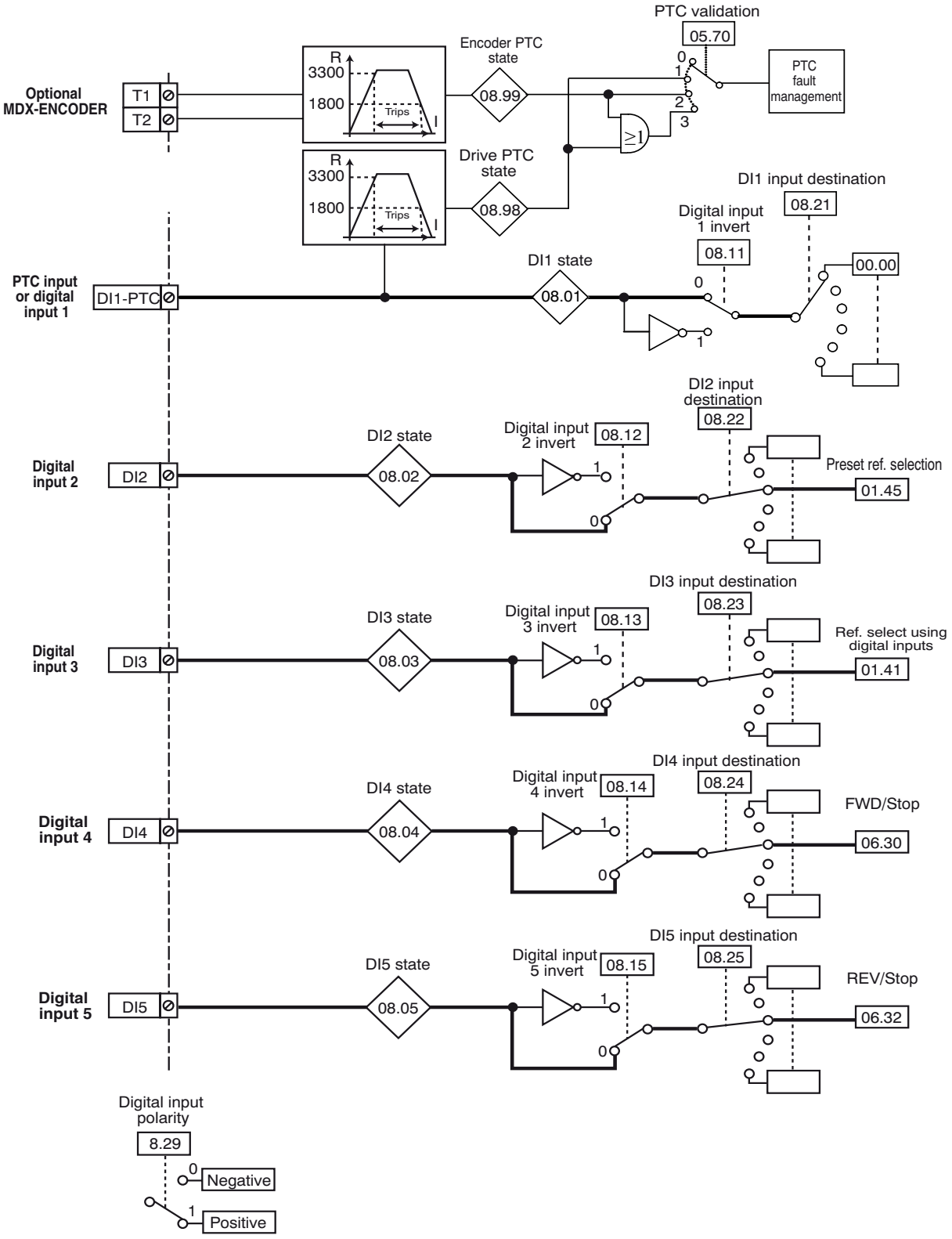
07.80 : DC bus voltage
Adjustment range : 0 to 1300 V
Format: 16 bits
Value of the DC bus voltage measured by the drive.

07.81 : Supply voltage
Adjustment range : 0 to 999 V
Format: 16 bits
Value of the mains voltage measured by the drive.

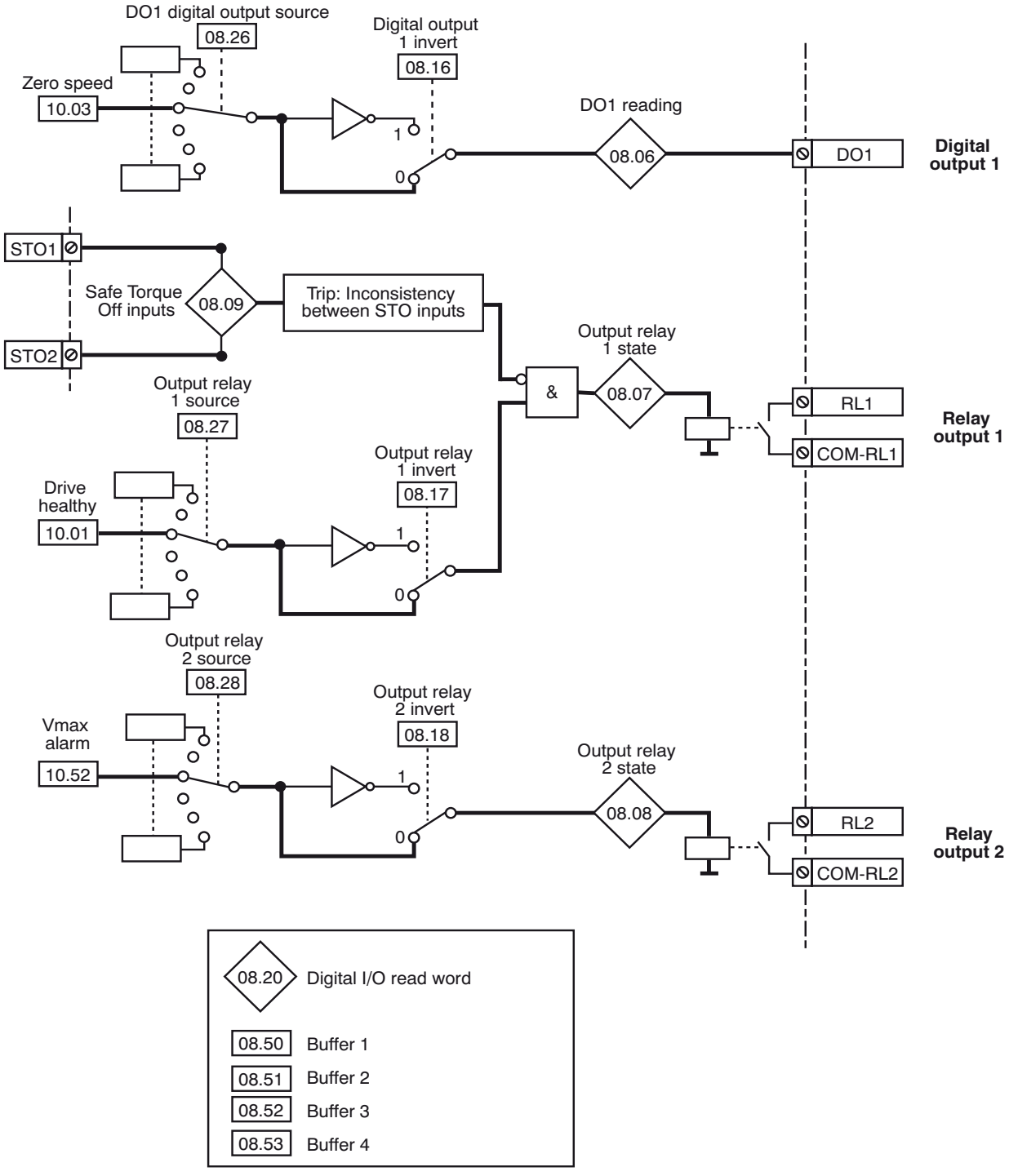
5.9 - Menu 8: Digital I/O

5.9.1 - Menu 8 diagrams

• Assignment of digital I/O



• Assignment of digital outputs and relay outputs



5.9.2 - Explanation of parameters in menu 8

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

08.01 to **08.05** : **DI1 to DI5 state**

Adjustment range : Disabled (0) or Enabled (1)
Format: 8 bits
These parameters indicate the state of digital inputs DI1 to DI5.

08.06 : **DO1 reading**

Adjustment range : Disabled (0) or Enabled (1)
Format: 8 bits

08.07 : **Output relay 1 state**

Adjustment range : Open (0) or Closed (1)
Format: 8 bits
This parameter indicates the state of the output relay.

Open (0):
RL1 open.

Closed (1):
RL1 closed.

08.08 : **Output relay 2 state**

Adjustment range : Open (0) or Closed (1)
Format: 8 bits
This parameter indicates the state of the output relay.

Open (0):
RL2 open.

Closed (1):
RL2 closed.

08.09 : **Safe Torque Off inputs**

Adjustment range : 0 to 3
Format: 8 bits
This parameter indicates the state of the "Safe Torque Off" inputs (at the terminal block), terminals STO1, STO2.

STO2 - STO1: 00 (0):
Drive disabled.

STO2 - STO1: 01 (1):
Tripped.

STO2 - STO1: 10 (2):
Tripped.

STO2 - STO1: 11 (3):
Drive enabled.

08.10 : **Not used**

08.11 to **08.15** : **Digital inputs 1 to 5 invert**

Adjustment range : Disabled (0) or Enabled (1)
Factory setting : Disabled (0)
Format: 8 bits
These parameters are used to invert the state of the digital input.

Disabled (0):
Not inverted.

Enabled (1):
Inverted.

08.16 : **Digital output 1 invert**

Adjustment range : Disabled (0) or Enabled (1)
Factory setting : Disabled (0)
Format: 8 bits
This parameter is used to invert the state of output DO1.

Disabled (0):
Not inverted.

Enabled (1):
Inverted.

08.17 :Output relay 1 invert

Adjustment range : Disabled (0) or Enabled (1)
Factory setting : Disabled (0)
Format: 8 bits
This parameter is used to invert the state of the relay 1 source.

Disabled (0):
Not inverted.

Enabled (1):
Inverted.

08.18 : **Output relay 2 invert**

Adjustment range : Disabled (0) or Enabled (1)
Factory setting : Disabled (0)
Format: 8 bits
This parameter is used to invert the state of relay 2.

Disabled (0):
Not inverted.

Enabled (1):
Inverted.

08.19 : **Not used**

08.20 : **Digital I/O read word**

Adjustment range : 0 to 511
Format: 16 bits
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 **08.01** to **08.09.**

Bit	8	7	6	5	4	3	2	1	0
State	**08.09**	**08.08**	**08.07**	-	**08.05**	**08.04**	**08.03**	**08.02**	**08.01**

E.g.
DI1 = 1 = 2^0 = 1
DI3 = 1 = 2^2 = 4
==>**08.20**= 5

08.21 : DI1 input destination
Adjustment range : **00.00** to **21.51**
Factory setting : **00.00**
Format: 16 bits
This parameter is used to select the destination of digital input 1.
Any non-protected "bit" type parameter can be assigned to the input.
If an unsuitable parameter is addressed, no assignment is taken into account.

CAUTION:
If 05.70 is set to "Drive terminal (1)" or "2 PTC inputs (3)", then digital input DI1 must not be used (do not assign 08.21).

08.22 : DI2 input destination
Adjustment range : **00.00** to **21.51**
Factory setting : **01.45**: Reference selection
Format: 16 bits
This parameter is used to select the destination of digital input 2.
Any non-protected "bit" type parameter can be assigned.
If an unsuitable parameter is addressed to the input or output, no assignment is taken into account.

08.23 : DI3 input destination
Adjustment range : **00.00** to **21.51**
Factory setting : **01.41**: Reference selection
Format: 16 bits
This parameter is used to select the destination of digital input 3.
Any non-protected "bit" type parameter can be assigned.
If an unsuitable parameter is addressed to the input or output, no assignment is taken into account.

08.24 : DI4 input destination
Adjustment range : **00.00** to **21.51**
Factory setting : **06.30**: FWD/Stop
Format: 16 bits
This parameter is used to select the destination of digital input 4.
Any non-protected "bit" type parameter can be assigned to the input.
If an unsuitable parameter is addressed, no assignment is taken into account.

08.25 : DI5 input destination
Adjustment range : **00.00** to **21.51**
Factory setting : **06.32**: Rev/Stop
Format: 16 bits
This parameter is used to select the destination of digital input 5.
Any non-protected "bit" type parameter can be assigned to the input.
If an unsuitable parameter is addressed, no assignment is taken into account.

08.26 : DO1 Digital Output source
Adjustment range : **00.00** to **21.51**
Factory setting : **10.03**: Zero speed
Format: 16 bits
This parameter is used to select the source which you wish to assign to digital output DO1.
Any non-protected "bit" type parameter can be assigned.
If an unsuitable parameter is addressed, no assignment is taken into account.

08.27 : Output relay 1 source
Adjustment range : **00.00** to **21.51**
Factory setting : **10.01**: Drive healthy
Format: 16 bits
This parameter is used to select the source for the output relay.
Any non-protected "bit" type parameter can be assigned.
If an unsuitable parameter is addressed, no assignment is taken into account.

08.28 : Output relay 2 source
Adjustment range : **00.00** to **21.51**
Factory setting : **10.52**: V_{max} alarm
Format: 16 bits
This parameter is used to select the source for the output relay.
Any non-protected "bit" type parameter can be assigned.
If an unsuitable parameter is addressed, no assignment is taken into account.

08.29 : Digital input polarity
Adjustment range : Negative (0) or Positive (1)
Factory setting : Positive (1)
Format: 8 bits
This parameter is used to change the polarity of digital inputs.

Negative (0):
Negative logic.

Positive (1):
Positive logic.

08.30 to 08.49 : Not used

08.50 to **08.53** : Buffers 1 to 4
Adjustment range : Inactive (0) or Active (1)
Factory setting : Inactive (0)
Format: 8 bits
Binary parameters that can be used as buffer variables.

CAUTION:
At each power-up, parameters 08.50 to 08.53 revert to (0).

08.54 to 08.97 : Not used

08.98 : Drive PTC state

Adjustment range : Not triggered (0) or Triggered (1)
Format: 8 bits
Indicates the state of the PTC sensor.
When **08.98** goes to (1), the "Motor PTC" trip is triggered.

Not triggered (0):
The PTC sensor is not triggered.

Triggered (1):
The PTC sensor is triggered.

08.99 : Encoder PTC state

Adjustment range : Not triggered (0) or Triggered (1)
Format: 8 bits
Indicates the state of the MDX-ENCODER PTC sensor if **05.70** is on 2.
When **08.99** goes to (1), the "Motor PTC" trip is triggered.

Not triggered (0):
The PTC sensor connected to MDX-ENCODER is not triggered.

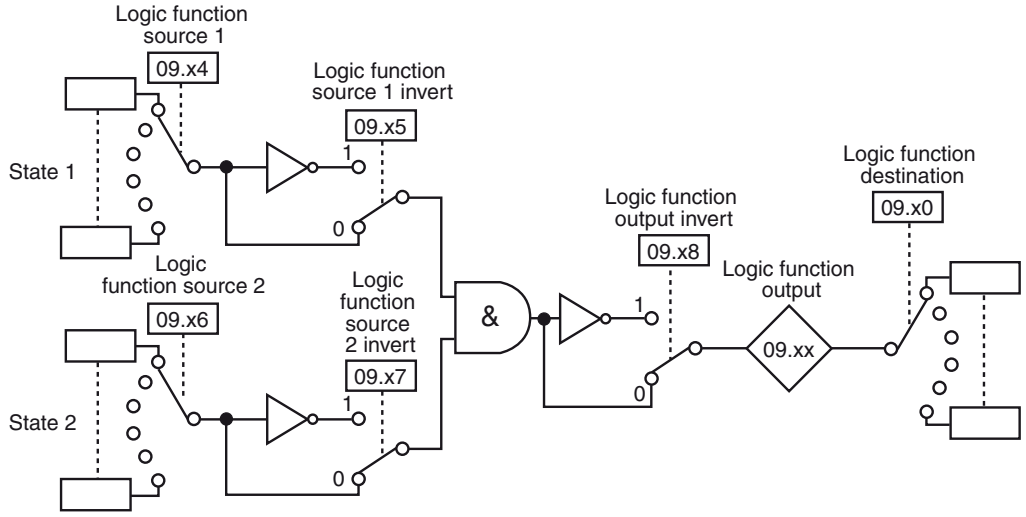
Triggered (1):
The PTC sensor connected to MDX-ENCODER is triggered.

Notes

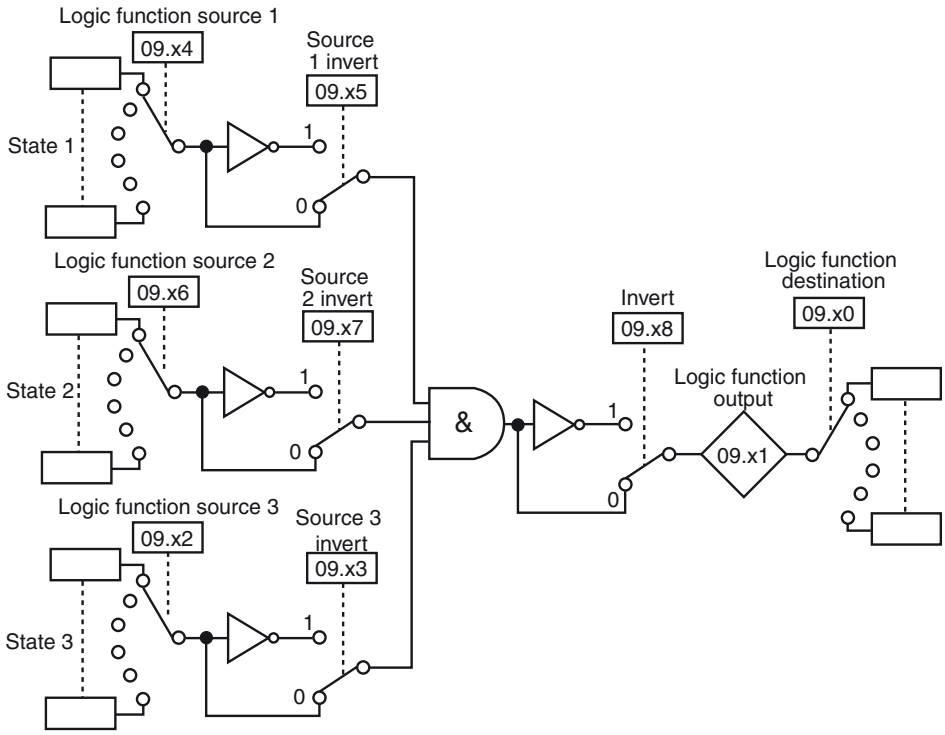
5.10 - Menu 9: Logic functions

5.10.1 - Menu 9 diagrams

• Logic functions

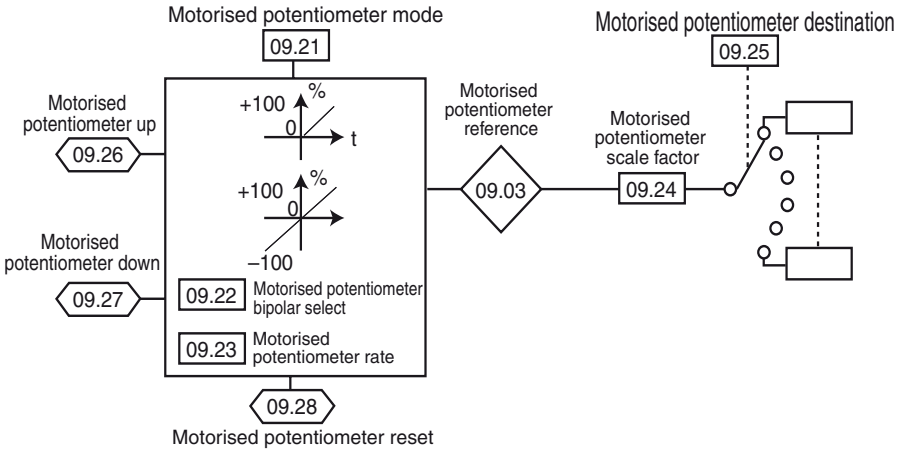


	Source 1	Source 2	Source 1 invert	Source 2 invert	Output invert	Output	Source destination
Function 1	**09.04**	**09.06**	**09.05**	**09.07**	**09.08**	**09.01**	**09.10**
Function 2	**09.14**	**09.16**	**09.15**	**09.17**	**09.18**	**09.02**	**09.20**
Function 3	**09.64**	**09.66**	**09.65**	**09.67**	**09.68**	**09.61**	**09.60**
Function 4	**09.74**	**09.76**	**09.75**	**09.77**	**09.78**	**09.71**	**09.70**

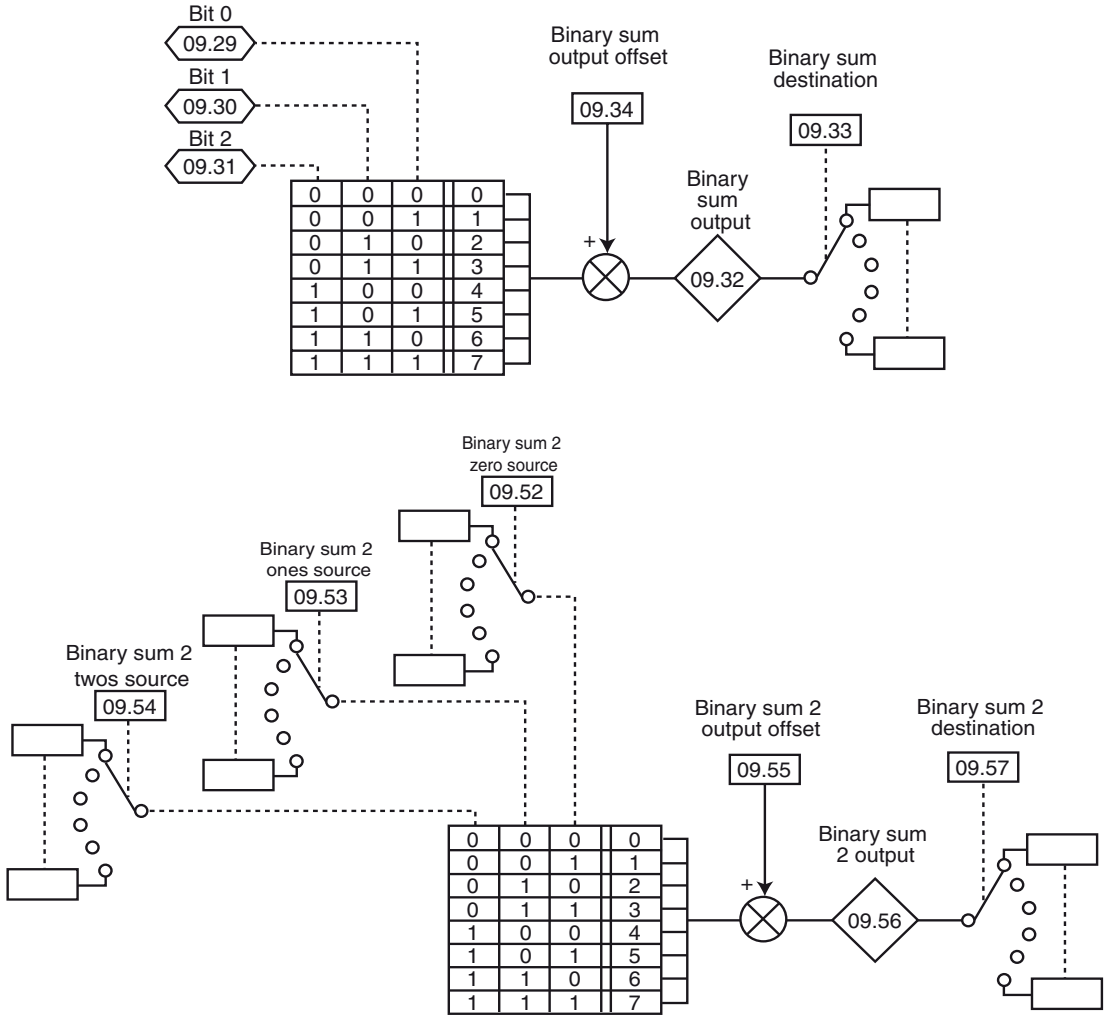


	Source 1	Source 2	Source 3	Source 1 invert	Source 2 invert	Source 3 invert	Output invert	Output	Destination
Function 5	**09.84**	**09.86**	**09.82**	**09.85**	**09.87**	**09.83**	**09.88**	**09.81**	**09.80**
Function 6	**09.94**	**09.96**	**09.92**	**09.95**	**09.97**	**09.93**	**09.98**	**09.91**	**09.90**

• Motorised potentiometer function



• Binary sum functions



5.10.2 - Explanation of parameters in menu 9

09.01 : Logic function 1 output

09.02 : Logic function 2 output

Adjustment range : Disabled (0) or Enabled (1)
Format: 8 bits
Indicate the state of the output of logic functions 1 and 2.

09.03 : Motorised potentiometer reference

Adjustment range : ± 100.0%
Format: 16 bits
Indicates the motorised potentiometer reference level.

09.04 : Logic function 1 source 1
Adjustment range : **00.00** to **21.51**
Factory setting : **00.00**
Format: 16 bits
This parameter is used to select source 1 for logic function 1.
Only "bit" type parameters can be used on this input.
If an unsuitable parameter is addressed, the input will be frozen at 0.

09.05 : Logic function 1 source 1 invert
Adjustment range : Disabled (0) or Enabled (1)
Factory setting : Disabled (0)
Format: 8 bits
This parameter is used to invert source 1 of logic function 1.

Disabled (0):
Source 1 not inverted.

Enabled (1):
Source 1 inverted.

09.06 : Logic function 1 source 2
Adjustment range : **00.00** to **21.51**
Factory setting : **00.00**
Format: 16 bits
This parameter is used to select source 2 for logic function 1.
Only "bit" type parameters can be used on this input.
If an unsuitable parameter is addressed, the input will be frozen at 0.

09.07 : Logic function 1 source 2 invert
Adjustment range : Disabled (0) or Enabled (1)
Factory setting : Disabled (0)
Format: 8 bits
This parameter is used to invert source 2 of logic function 1.

Disabled (0):
Source 2 not inverted.

Enabled (1):
Source 2 inverted.

09.08 : Logic function 1 output invert
Adjustment range : Disabled (0) or Enabled (1)
Factory setting : Disabled (0)
Format: 8 bits
This parameter is used to invert the output of logic function 1.

Disabled (0):
Output not inverted.

Enabled (1):
Output inverted.

09.09 : Not used

09.10 : Logic function 1 output destination
Adjustment range : **00.00** to **21.51**
Factory setting : **00.00**
Format: 16 bits
This parameter defines the internal parameter which will be assigned by the output of logic function 1.
Only non-protected "bit" type parameters can be addressed.
If an unsuitable parameter is programmed, the destination will not be taken into account.

09.11 to 09.13 : Not used

09.14 : Logic function 2 source 1
Adjustment range : **00.00** to **21.51**
Factory setting : **00.00**
Format: 16 bits
This parameter is used to select source 1 for logic function 2.
Only "bit" type parameters can be used on this input.
If an unsuitable parameter is addressed, the input will be frozen at 0.

09.15 : Logic function 2 source 1 invert
Adjustment range : Disabled (0) or Enabled (1)
Factory setting : No (0)
Format: 8 bits
This parameter is used to invert source 1 of logic function 2.

Disabled (0):
Source 1 not inverted.

Enabled (1):
Source 1 inverted.

09.16 : Logic function 2 source 2
Adjustment range : **00.00** to **21.51**
Factory setting : **00.00**
Format: 16 bits
This parameter is used to select source 2 for logic function 2.
Only "bit" type parameters can be used on these inputs.
If an unsuitable parameter is addressed, the input will be frozen at 0.

09.17 : Logic function 2 source 2 invert
Adjustment range : Disabled (0) or Enabled (1)
Factory setting : Disabled (0)
Format: 8 bits
This parameter is used to invert source 2 of logic function 2.

Disabled (0):
Source 2 not inverted.

Enabled (1):
Source 2 inverted.

09.18 : Logic function 2 output invert
Adjustment range : Disabled (0) or Enabled (1)
Factory setting : Disabled (0)
Format: 8 bits
This parameter is used to invert the output of logic function 2.

Disabled (0):
Output not inverted.

Enabled (1):
Output inverted.

09.19 : Not used

09.20 : Logic function 2 output destination
Adjustment range : **00.00** to **21.51**
Factory setting : **00.00**
Format: 16 bits
This parameter defines the internal parameter which will be assigned by the output of logic function 2.
Only non-protected "bit" type parameters can be addressed.
If an unsuitable parameter is programmed, the destination will not be taken into account.

09.21 : Motorised potentiometer mode
Adjustment range : Reset/Enable (0), Previous/Enable (1), Reset/Disable (2), Previous/Disable (3), Min. Ref/Enable (4), Min. Ref/Disable (5)
Factory setting : Reset/Disable (2)
Format: 8 bits

Reset/Enable (0):
The reference is reset to 0 on each power-up. The up/down and reset inputs are active at all times.

Previous/Enable (1):
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.

Reset/Disable (2):
The reference is reset to 0 on each power-up. The up/down inputs are only active when the drive output is active. The reset input is active at all times.

Previous/Disable (3):
On power-up, the reference is at the same level as before power-down. The up/down inputs are only active when the drive output is active. The reset input is active at all times.

Min. Ref/Enable (4):
On power-up, the reference value equals the minimum speed (**01.07**). The up/down and reset inputs are active at all times.Min. Ref/Disable (5):
On power-up, the reference value equals the minimum speed (**01.07**). The up/down inputs are only active when the drive output is active. The reset input is active at all times.

09.22 : Motorised potentiometer bipolar select
Adjustment range : Positive (0) or Bipolar (1)
Factory setting : Positive (0)
Format: 8 bits

Positive (0):
The motorised potentiometer reference is limited to positive values (0 to 100.0%).

Bipolar (1):
The motorised potentiometer reference can change from -100% to +100%.

09.23 : Motorised potentiometer rate
Adjustment range : 0 to 250 s
Factory setting : 20 s
Format: 16 bits
This parameter defines the time it takes for the motorised potentiometer 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.

09.24 : Motorised potentiometer scale factor
Adjustment range : 0.00 to 2.50
Factory setting : 1.00
Format: 16 bits
The maximum value of the up/down potentiometer 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 motorised potentiometer reference to the maximum value required by the application.
Example:
- The motorised potentiometer reference is addressed to a preset reference with the adjustment range ±**01.06**.
- If **01.06** = 1500 rpm, so that the maximum value of the motorised potentiometer reference corresponds to 1000 rpm :

$$\Rightarrow \textbf{09.24} = \frac{1000}{\textbf{Spd.01}} = 0{,}67$$

09.25 : Motorised potentiometer destination
Adjustment range : **00.00** to **21.51**
Factory setting : **00.00**
Format: 16 bits
This parameter is used to define the numerical parameter which the motorised potentiometer reference will control.
Example: The motorised potentiometer reference acts as a speed reference. The motorised potentiometer reference can be sent to a preset reference (eg: **01.21:** RP1: Preset reference)

09.26 : Motorised potentiometer up
Adjustment range : Disabled (0) or Enabled (1)
Format: 8 bits
A digital input must be assigned to this parameter for controlling the motorised potentiometer up function.

09.27 : Motorised potentiometer down
Adjustment range : Disabled (0) or Enabled (1)
Format: 8 bits
A digital input must be assigned to this parameter for controlling the motorised potentiometer down function.

09.28 : Motorised potentiometer reset
Adjustment range : Disabled (0) or Enabled (1)
Factory setting : Disabled (0)
Format: 8 bits
When this parameter is at Enabled (1), the motorised potentiometer reference is reset to zero.

09.29 to 09.31 : Binary sum inputs

Adjustment range : Disabled (0) or Enabled (1)
Format: 8 bits
Used to modify, using a combination of digital inputs, a parameter whose selection includes more than 2 possible choices.
09.29: Binary sum zero input.
09.30: Binary sum ones input.
09.31: Binary sum twos input.

09.31 (bit 2)	09.30 (bit 1)	09.29 (bit 0)	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

09.32 : Binary sum output

Adjustment range : 0 to 39
Format: 8 bits
Used to read the decimal value of the binary sum output.

09.33 : Binary sum destination

Adjustment range : **00.00** to **21.51**
Factory setting : **00.00**
Format: 16 bits
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.

09.34 : Binary sum output offset
Adjustment range : 0 to 32
Factory setting : 0
Format: 8 bits
Used to add an offset to the binary sum output.

09.35 to 09.51 : Not used

09.52 to 09.54 : Binary sum 2 sources
Adjustment range : **00.00** to **21.51**
Factory setting : **00.00**
Format: 16 bits
Used to modify, using a combination of binary parameters, a parameter whose selection includes more than 2 possible choices.
09.52 : Binary sum 2 zero source.
09.53: Binary sum 2 ones source.
09.54 : Binary sum 2 twos source.

09.54 (bit 2)	09.53 (bit 1)	09.52 (bit 0)	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

09.55 : Binary sum 2 output offset
Adjustment range : 0 to 32
Factory setting : 0
Format: 8 bits
Used to add an offset to the binary sum 2 output.

09.56 : Binary sum 2 output

Adjustment range : 0 to 39
Format: 8 bits
Used to read the decimal value of binary sum 2 output.

09.57 : Binary sum 2 destination

Adjustment range : **00.00** to **21.51**
Factory setting : **00.00**
Format: 16 bits
Used to define the parameter that binary sum 2 output will control. Any bit, switch or numerical type parameter can be assigned to the binary sum 2 output.

09.58 and 09.59 : Not used

09.60 : Logic 3 output destination
Adjustment range : **00.00** to **21.51**
Factory setting : **00.00**
Format: 16 bits
This parameter defines the internal parameter which will be assigned by the output of logic function 3.
Only non-protected "bit" type parameters can be addressed.
If an unsuitable parameter is programmed, the destination will not be taken into account.

09.61 : Logic function 3 out

Adjustment range : Disabled (0) or Enabled (1)
Format: 8 bits
Indicates the state of the output of logic function 3.

09.62 and 09.63 : Not used

09.64 : Logic function 3 source 1
Adjustment range : **00.00** to **21.51**
Factory setting : **00.00**
Format: 16 bits
This parameter is used to select source 1 for logic function 3.
Only "bit" type parameters can be used on these inputs.
If an unsuitable parameter is addressed, the input will be frozen at 0.

09.65 : Logic function 3 source 1 invert
Adjustment range : Disabled (0) or Enabled (1)
Factory setting : Disabled (0)
Format: 8 bits
This parameter is used to invert source 1 of logic function 3.

Disabled (0):
Source 1 not inverted.

Enabled (1):
Source 1 inverted.

09.66 : Logic function 3 source 2
Adjustment range : **00.00** to **21.51**
Factory setting : **00.00**
Format: 16 bits
This parameter is used to select source 2 for logic function 3.
Only "bit" type parameters can be used on these inputs.
If an unsuitable parameter is addressed, the input will be frozen at 0.

09.67 : Logic 3 source 2 invert
Adjustment range : Disabled (0) or Enabled (1)
Factory setting : Disabled (0)
Format: 8 bits
This parameter is used to invert source 2 of logic function 3.

Disabled (0):
Source 2 not inverted.

Enabled (1):
Source 2 inverted.

09.68 : Logic function 3 output invert
Adjustment range : Disabled (0) or Enabled (1)
Factory setting : Disabled (0)
Format: 8 bits
This parameter is used to invert the output of logic function 3.

Disabled (0):
Output not inverted.

Enabled (1):
Output inverted.

09.69 : Not used

09.70 : Logic 4 output destination
Adjustment range : **00.00** to **21.51**
Factory setting : **00.00**
Format: 16 bits
This parameter defines the internal parameter which will be assigned by the output of logic function 4.
Only non-protected "bit" type parameters can be addressed.
If an unsuitable parameter is programmed, the destination will not be taken into account.

09.71 : Logic function 4 out

Adjustment range : Disabled (0) or Enabled (1)
Format: 8 bits
Indicates the state of the output of logic function 4.

09.72 and 09.73 : Not used

09.74 : Logic function 4 source 1
Adjustment range : **00.00** to **21.51**
Factory setting : **00.00**
Format: 16 bits
This parameter is used to select source 1 for logic function 4.
Only "bit" type parameters can be used on these inputs.
If an unsuitable parameter is addressed, the input will be frozen at 0.

09.75 : Logic function 4 source 1 invert
Adjustment range : Disabled (0) or Enabled (1)
Factory setting : Disabled (0)
Format: 8 bits
This parameter is used to invert source 1 of logic function 4.

Disabled (0):
Source 1 not inverted.

Enabled (1):
Source 1 inverted.

09.76 : Logic function 4 source 2
Adjustment range : **00.00** to **21.51**
Factory setting : **00.00**
Format: 16 bits
This parameter is used to select source 2 for logic function 4.
Only "bit" type parameters can be used on these inputs.
If an unsuitable parameter is addressed, the input will be frozen at 0.

09.77 : Logic function 4 source 2 invert
Adjustment range : Disabled (0) or Enabled (1)
Factory setting : Disabled (0)
Format: 8 bits
This parameter is used to invert source 2 of logic function 4.

Disabled (0):
Source 2 not inverted.

Enabled (1):
Source 2 inverted.

09.78 : Logic function 4 output invert
Adjustment range : Disabled (0) or Enabled (1)
Factory setting : Disabled (0)
Format: 8 bits
This parameter is used to invert the output of logic function 4.

Disabled (0):
Output not inverted.

Enabled (1):
Output inverted.

09.79 : Not used

09.80 : Logic 5 output destination
Adjustment range : **00.00** to **21.51**
Factory setting : **00.00**
Format: 16 bits
This parameter defines the internal parameter which will be assigned by the output of logic function 5.
Only non-protected "bit" type parameters can be addressed.
If an unsuitable parameter is programmed, the destination will not be taken into account.

09.81 : Logic function 5 out
Adjustment range : Disabled (0) or Enabled (1)
Format: 8 bits
Indicates the state of the output of logic function 5.

09.82 : Logic function 5 source 3
Adjustment range : **00.00** to **21.51**
Factory setting : **00.00**
Format: 16 bits
This parameter is used to select source 3 for logic function 5.
Only "bit" type parameters can be used on this input.
If an unsuitable parameter is addressed, the input will be frozen at 0.

09.83 : Logic function 3 source 3 invert
Adjustment range : Disabled (0) or Enabled (1)
Factory setting : Disabled (0)
Format: 8 bits
This parameter is used to invert source 3 of logic function 5.

Disabled (0):
Source 3 not inverted.

Enabled (1):
Source 3 inverted.

09.84 : Logic function 5 source 1
Adjustment range : **00.00** to **21.51**
Factory setting : **00.00**
Format: 16 bits
This parameter is used to select source 1 for logic function 5.
Only "bit" type parameters can be used on this input.
If an unsuitable parameter is addressed, the input will be frozen at 0.

09.85 : Logic function 5 source 1 invert
Adjustment range : Disabled (0) or Enabled (1)
Factory setting : Disabled (0)
Format: 8 bits
This parameter is used to invert source 1 of logic function 5.

Disabled (0):
Source 1 not inverted.

Enabled (1):
Source 1 inverted.

09.86 : Logic function 5 source 2
Adjustment range : **00.00** to **21.51**
Factory setting : **00.00**
Format: 16 bits
This parameter is used to select source 2 for logic function 5.
Only "bit" type parameters can be used on this input.
If an unsuitable parameter is addressed, the input will be frozen at 0.

09.87 : Logic function 5 source 2 invert
Adjustment range : Disabled (0) or Enabled (1)
Factory setting : Disabled (0)
Format: 8 bits
This parameter is used to invert source 2 of logic function 5.

Disabled (0):
Source 2 not inverted.

Enabled (1):
Source 2 inverted.

09.88 : Logic function 5 output invert
Adjustment range : Disabled (0) or Enabled (1)
Factory setting : Disabled (0)
Format: 8 bits
This parameter is used to invert the output of logic function 5.

09.89 : Not used

09.90 : Logic function 6 destination
Adjustment range : **00.00** to **21.51**
Factory setting : **00.00**
Format: 8 bits
This parameter defines the internal parameter which will be assigned by the output of logic function 6.
Only non-protected "bit" type parameters can be addressed.
If an unsuitable parameter is programmed, the destination will not be taken into account.

09.91 : Logic function 6 out
Adjustment range : Disabled (0) or Enabled (1)
Format: 8 bits
Indicates the state of the output of logic function 6.

09.92 : Logic function 6 source 3
Adjustment range : **00.00** to **21.51**
Factory setting : **00.00**
Format: 16 bits
This parameter is used to select source 3 for logic function 6.
Only "bit" type parameters can be used on this input.
If an unsuitable parameter is addressed, the input will be frozen at 0.

09.93 : Logic function 6 source 3 invert
Adjustment range : Disabled (0) or Enabled (1)
Factory setting : Disabled (0)
Format: 8 bits
This parameter is used to invert source 3 of logic function 6.

Disabled (0):
Source 3 not inverted.

Enabled (1):
Source 3 inverted.

09.94 : Logic function 6 source 1
Adjustment range : **00.00** to **21.51**
Factory setting : **00.00**
Format: 16 bits
This parameter is used to select source 1 for logic function 6.
Only "bit" type parameters can be used on this input.
If an unsuitable parameter is addressed, the input will be frozen at 0.

09.95 : Logic function 6 source 1 invert
Adjustment range : Disabled (0) or Enabled (1)
Factory setting : Disabled (0)
Format: 8 bits
This parameter is used to invert source 1 of logic function 6.

Disabled (0):
Source 1 not inverted.

Enabled (1):
Source 1 inverted.

09.96 : Logic function 6 source 2
Adjustment range : **00.00** to **21.51**
Factory setting : **00.00**
Format: 16 bits
This parameter is used to select source 2 for logic function 6.
Only "bit" type parameters can be used on this input.
If an unsuitable parameter is addressed, the input will be frozen at 0.

09.97 : Logic function 6 source 2 invert
Adjustment range : Disabled (0) or Enabled (1)
Factory setting : Disabled (0)
Format: 8 bits
This parameter is used to invert source 2 of logic function 6.

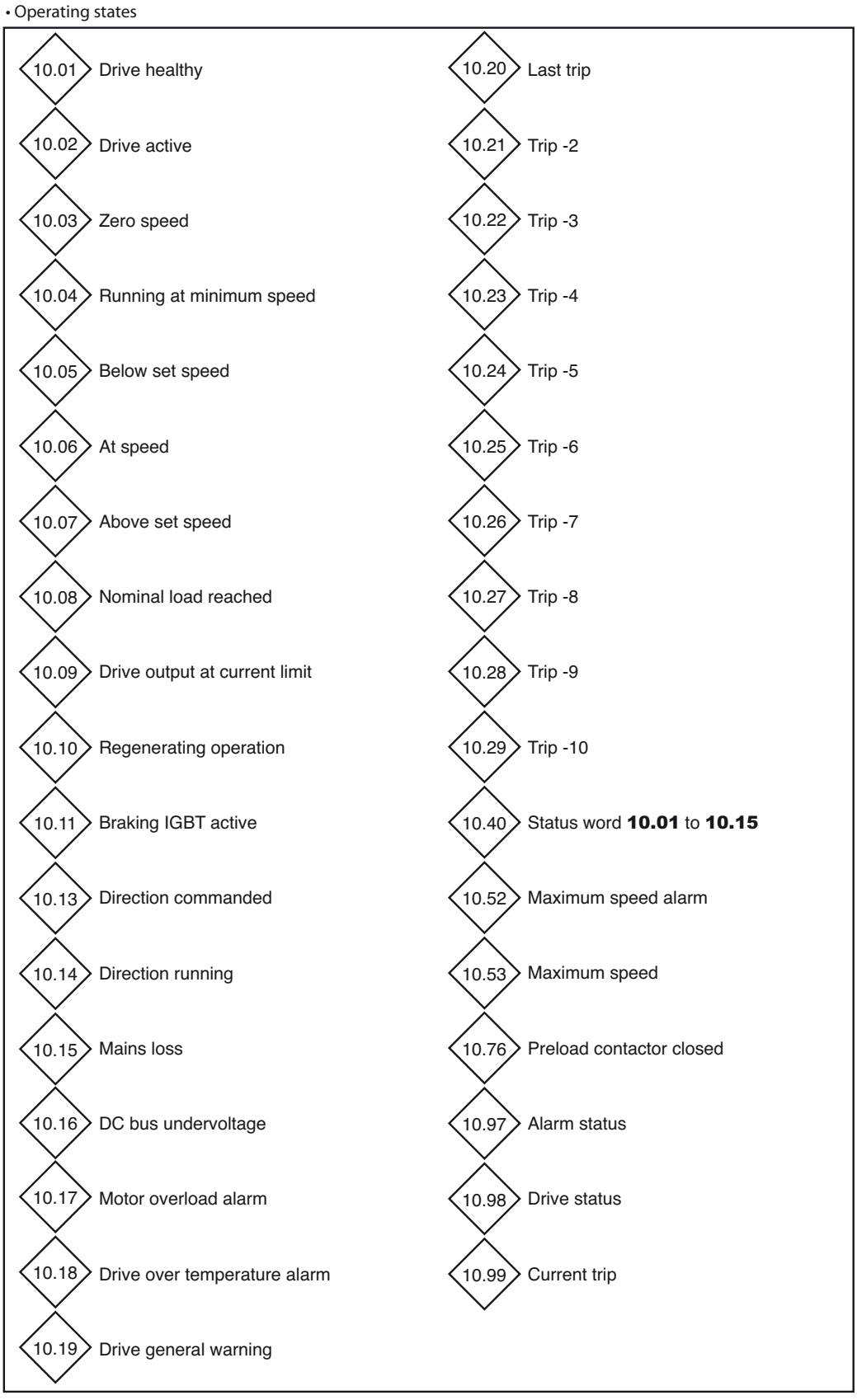
Disabled (0):
Source 2 not inverted.

Enabled (1):
Source 2 inverted.

09.98 : Logic function 6 output invert
Adjustment range : Disabled (0) or Enabled (1)
Factory setting : Disabled (0)
Format: 8 bits
This parameter is used to invert the output of logic function 6.

5.11 - Menu 10: Trip management drive states

5.11.1 - Menu 10 diagrams



• Braking IGBT active

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

• Trip management

10.33	Drive reset
10.34	No. of autoreset attempts
10.35	Auto reset delay
10.36	Drive healthy if auto resets
10.37	:Braking IGBT present & Minor trip stop mode
10.38	Serial link user trip
10.54	User alarm 1
10.55	User alarm 2
10.56	User alarm 3
10.57	User alarm 4
10.59	Motor phase missing trip validation
10.60	I imbalanced trip validation
10.61	User trip 1
10.63	User trip 2
10.65	User trip 3
10.67	User trip 4
10.69	Trip enable to off
10.80	Auto reset type
10.81	Special trip n°1
10.82	Special trip n°2
10.83	Special trip n°3
10.84	Special trip n°4

• Miscellaneous

10.74	Preload time
10.75	Powered by DC bus
10.77	4Q rectifier disable

5.11.2 - Explanation of parameters in menu 10

10.01 : Drive healthy

Adjustment range : No (0) or Yes (1)
Format: 8 bits
This parameter indicates Yes (1) when the drive is not tripped. If parameter **10.36** indicates Yes (1), this bit will remain at Yes (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.
If **10.01** indicates No (0), **10.99** provides information about the current trip.

10.02 : Drive active

Adjustment range : No (0) or Yes (1)
Format: 8 bits
This parameter indicates Yes (1) when the drive output is active.

10.03 : Zero speed

Adjustment range : No (0) or Yes (1)
Format: 8 bits
This parameter indicates Yes (1) when the absolute value of the speed is less than or equal to the threshold defined by parameter **03.05**.
10.03 indicates No (0) when the speed becomes greater than **03.05** + 10 rpm.

10.04 : Running at minimum speed

Adjustment range : No (0) or Yes (1)
Format: 8 bits
In bipolar mode (**01.10** = Yes (1)), the operation of this parameter is identical to that of parameter **10.03**.
In unipolar mode (**01.10** = No), this parameter indicates Yes (1) if the absolute value of the ramp output is at or below the minimum speed **01.07** + (30 rpm/number of pairs of motor poles).
10.04 indicates No (0) when the speed becomes greater than [**01.07** + (30 rpm/number of pairs of poles) + 10 rpm].
The minimum speed is defined by parameter **01.07**.

10.05 : Below set speed

Adjustment range : No (0) or Yes (1)
Format: 8 bits
This parameter indicates Yes (1) when the absolute value of the motor speed is less than **01.03** - (**03.06** ÷ 2).
10.05 indicates No (0) when the speed becomes greater than [**01.03** - (**03.06** ÷ 2) + 10 rpm].

CAUTION:
If 03.06 < 20 rpm, the speed may be situated in the hysteresis dead band.

10.06 : At speed

Adjustment range : No (0) or Yes (1)
Format: 8 bits
This parameter indicates Yes (1) when the absolute value of the motor speed is between **01.03** - (**03.06** ÷ 2) and **01.03** + (**03.06** ÷ 2).

10.07 : Above set speed

Adjustment range : No (0) or Yes (1)
Format: 8 bits
This parameter indicates Yes (1) when the absolute value of the motor speed is greater than **01.03** + (**03.06** ÷ 2).
10.07 indicates No (0) when the speed becomes less than [**01.03** + (**03.06** ÷ 2) -10 rpm].

CAUTION:
If 03.06 < 20 rpm, the speed may be situated in the hysteresis dead band.

10.08 : Nominal load reached

Adjustment range : No (0) or Yes (1)
Format: 8 bits
This parameter indicates Yes (1) when the active current **04.02** is greater than or equal to the rated active current.
Rated active current = **05.07** x **05.10**.

10.09 : Drive output at current limit

Adjustment range : No (0) or Yes (1)
Format: 8 bits
This parameter indicates Yes (1) when drive current limiting is active.

10.10 : Regenerating operation

Adjustment range : No (0) or Yes (1)
Format: 8 bits
This parameter indicates Yes (1) when the power is being transferred from the motor to the DC bus (driving load).

10.11 : Braking IGBT active

Adjustment range : No (0) or Yes (1)
Format: 8 bits
This parameter indicates Yes (1) when the power is dissipated into the optional braking resistor (if this is connected).

10.12 : Braking resistor alarm

Adjustment range : No (0) or Yes (1)
Format: 8 bits
This parameter indicates Yes (1) when the integration parameter for the braking resistor load becomes greater than 75%.

10.13 : Direction commanded

Adjustment range : Forward (0) or Reverse (1)
Format: 8 bits
This parameter indicates Reverse (1) if the pre-ramp reference is negative.
It indicates Forward (0) if the pre-ramp reference is positive.

10.14 : Direction running

Adjustment range : Forward (0) or Reverse (1)
Format: 8 bits
This parameter indicates Reverse (1) if the post-ramp reference is negative.
It indicates Forward (0) if the post-ramp reference is positive.

10.15 : Mains loss

Adjustment range : No (0) or Yes (1)
Format: 8 bits
This parameter indicates Yes (1) during loss of the AC mains power supply. This parameter is only enabled when parameter **06.03** is not set to No detection (0).

10.16 : DC bus undervoltage

Adjustment range : No (0) or Yes (1)
Format: 8 bits
This parameter indicates Yes (1) when the bus voltage level is too low.

10.17 : Motor overload alarm

Adjustment range : No (0) or Yes (1)
Format: 8 bits
This parameter indicates Yes (1) when parameter **04.19** "Motor thermal state" becomes greater than 100%.
It indicates No (0) when the value is < 95%.

10.18 : Drive overtemperature alarm

Adjustment range : No (0) or Yes (1)
Format: 8 bits
This parameter indicates Yes (1) when one of the temperatures displayed for **07.51** to **07.55** exceeds 95% of the max permitted value.

10.19 : Drive general warning

Adjustment range : Disabled (0) or Enabled (1)
Format: 8 bits
This parameter indicates Enabled (1) when at least one of the alarms **10.12**, **10.17** or **10.18** or the "Current limit" alarm is activated. This alarm is activated if the drive rated current is exceeded for a time greater than the specifications (see installation manual for the drive concerned).

10.20 to 10.29 : Last 10 trips stored

Adjustment range : 0 to 102
Format: 8 bits
Contains the last 10 drive trips.
10.20: Indicates the most recent trip.
10.29: Indicates the oldest trip.
The possible trips are:

No.	Name	Reason for trip
0	None	
1	DC UnderVolt	DC bus undervoltage
2	DC over volt	DC bus overvoltage
3	Over current	Overcurrent at drive output
4	Brak. IGBT	Braking IGBT transistor overcurrent for the **POWERDRIVE MD2**
5	I IMBALANCED	Motor current imbalance: Vectorial sum of the 3 motor currents not zero
6	Out Ph. loss of a motor phase	Loss of a motor phase
7	Over speed	The speed is greater than (1.3 x **01.06**) or (**01.06** + 1000 rpm)
8	Drive overload Ixt	The drive overload level exceeds the conditions defined in section 1.4.2 of the installation manual
9	IGBT U	Protection of phase U IGBTs
10	RECTIFIER Th	Rectifier heatsink temperature too high
11	Encoder rot	The measured position does not vary (only if the MDX-ENCODER option is present)
13	UVW reversed	The encoder U, V, W signals are reversed (only if the encoder option is present)
14	TUNE U Encod	During the autotune phase, one of the U,V,W commutation channels is missing
15	TUNE V Encod	
16	TUNE W Encod	
18	Autotun. fail	Problem detected during the autotune phase
19	Brak. resist.	Braking resistor overload I x t: **10.39** = 100%
21	Th IGBT U	• Overheating of phase U IGBTs • Load too high
24	Motor PTC	Opening of the DI1/PTC input of the drive PX1 terminal block or T1/T2 inputs of the MDX-ENCODER option
26	24V over ld	Overload on the +24V power supply or digital outputs
28	AI2 loss	Loss of the current reference on analog input AI2
29	AI3 loss	Loss of the current reference on input AI3
30	COM loss	Loss of communication on the P2 connector serial link

No.	Name	Reason for trip
31	EEPROM fail.	Number of write cycles to EEPROM exceeded (> 1,000,000)
33	Stator resistance	Problem during the measurement of the stator resistance
34	Fieldbus loss	Disconnection of the fieldbus during operation or timing error
35	STO inputs	Simultaneous opening of both STO (Safe Torque Off) inputs during operation
37	Encoder break	Loss of one of the encoder commutation channels
38	Breakdown	Breakdown of synchronous motor in sensorless closed loop mode
39	Mains synchro	The rectifier cannot synchronise with the mains supply (**Powerdrive FX** and **MD2R** only)
40	Encoder board	Loss of exchanges between the control board and the MDX-ENCODER module
41	User 1	User trip 1 triggered by state 1 of **10.61**.
42	User 2	User trip 2 triggered by state 1 of **10.63**.
43	User 3	User trip 3 triggered by state 1 of **10.65**.
44	User 4	User trip 4 triggered by state 1 of **10.67**.
45	User 5	User trip 5 triggered by the serial link **10.38** =45
46	User 6	User trip 6 triggered by the serial link **10.38** =46
47	User 7	User trip 7 triggered by the serial link **10.38** =47
48	User 8	User trip 8 triggered by the serial link **10.38** =48
49	User 9	User trip 9 triggered by the serial link **10.38** =49
50	User 10	User trip 10 triggered by the serial link **10.38** =50
54	Internal serial link	Communication problem between the drives
56	IGBT V	Internal protection of phase V IGBTs
57	IGBT W	Internal protection of phase W IGBTs
58	Th IGBT V	• Overheating of phase V IGBTs • Load too high
59	Th IGBT W	• Overheating of phase W IGBTs • Load too high
60	DIAGNOSTIC	Problem detected during the control and interface board test, the power module test or the self-test
63	Inconsistency between STO inputs	The STO and STO2 inputs have had a different state for more than 100 ms
65	10V over Id	Overload on the +10 V power supply
66	DO1 over Id	The DO1 output load current is > 200 mA
67	Internal ventilation	The internal ventilation is no longer working. Contact LEROY-SOMER. Trip only valid for the **POWERDRIVE FX** 50T and 100T)
68	Motor overcurrent	The current has exceeded the limit programmed in **05.55**. The load is too high for the setting.
101	MAINS LOSS	Loss of AC supply
102	Rectifier	Loss of rectifier synchronisation with the mains (**POWERDRIVE FX** only)

Note: Some trips are not displayed at standstill (see **10.69**) and no trips at standstill are stored.

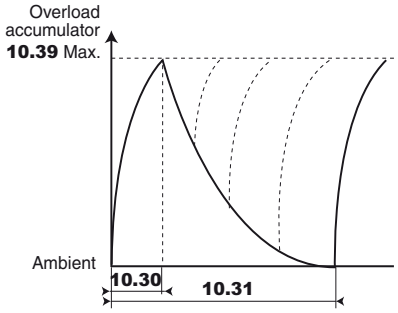
10.30 : Full power braking time
Adjustment range : 0.0 to 400.0 s
Factory setting : 0.0 s
Format: 16 bits
This parameter defines for how long the braking resistor can withstand the maximum braking voltage (735 V for **POWERDRIVE MD2** version T and 1100 V for **POWERDRIVE MD2** version TH) without damage. It is used to determine the time before the drive trips due to braking overload.

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

10.31 : Operating mode

Adjustment range : 0.0 to 25.0 mn
Factory setting : 0.0 mn
Format: 16 bits

This parameter defines the time interval that 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.



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

Note:
This parameter is not used with the **POWERDRIVE FX.**

10.32 : Not used

10.33 : Drive reset

Adjustment range : Disabled (0) or Enabled (1)
Factory setting : Disabled (0)
Format: 8 bits

A change in this parameter from Disabled (0) to Enabled (1) 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 (Brak. IGBT), either at the output bridge (Over current) or the braking transistor, the drive cannot be reset for 10 seconds (IGBT recovery time).

10.34 : No. of autoreset attempts

Adjustment range : None (0), 1 reset (1),
2 resets (2), 3 resets (3)
4 resets (4), 5 resets (5)
Factory setting : 5 resets (5)
Format: 8 bits

None (0):
There will be no automatic reset even when the **10.80** is not 0.

1 reset to 5 resets (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 is disabled and will not auto-reset. This last trip can only be reset via a command.
If no trips occur, the counter is decremented by one value every 5 minutes the drive is disabled or enabled.

10.35 : Auto reset delay

Adjustment range : 0.0 to 25.0 s
Factory setting : 1.0 s
Format: 16 bits

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 : Drive healthy if auto resets

Adjustment range : No (0) or Yes (1)
Factory setting : No (0)
Format: 8 bits

No (0):
10.01 (drive healthy) is reset to No (0) each time the drive trips, without taking account of any auto-resets that might occur.

Yes (1):
Parameter **10.01** is held at Yes (1) during the trip phases which are reset automatically.

10.37 : Braking IGBT present & Minor trip stop mode

Adjustment range : Yes, freewheel (0), Yes, controlled (1),
No, freewheel (2),
No, controlled (3)
Factory setting : No, freewheel (2)
Format: 8 bits

Yes, freewheel (0):
Enabling of the "Brak. IGBT" trip and freewheel stop on a minor trip.
In the event of a problem on the braking IGBT, the drive trips on "Brak. IGBT".
(Used with the braking transistor option.)

Note:
Do not use this value with the **POWERDRIVE FX.**

Yes, controlled (1):
Enabling of the "Brak. IGBT" trip and controlled stop on a minor trip (deceleration before tripping of the drive).
In the event of a problem on the braking IGBT, the drive trips on "Brak. IGBT".

Note:
Do not use this value with the **POWERDRIVE FX.**

No, freewheel (2):
Disabling of "Brak. IGBT" trip and freewheel stop on a minor trip.

No, controlled (3):
Disabling of the "Brak. IGBT" trip and controlled stop on a minor trip (deceleration before tripping of the drive).

Note:
Minor trips: Th IGBT U or V or W, Motor PTC, 24 V over ld, AI2 loss, AI2 loss, Drive overload Ixt, COM loss, EEPROM fail., Fieldbus loss, User 1 to 10, Internal ventilation.

10.38 : Serial link user trip

Adjustment range : 0 to 50
Factory setting : 0
Format: 8 bits
This parameter is used to generate user trips, via the serial link. Trips generated by the user will be indicated by trips 45 to 50. Trips 45 to 50 correspond respectively to the "user 5" to "user 10" trips. Set **10.38** back to 0 before resetting the trip.

10.39 : Braking energy overload accumulator

Adjustment range : 0.0 to 100.0%
Format: 16 bits
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).

Note:
This parameter is not used with the **POWERDRIVE FX.**

10.40 : Status word 10.01 to 10.15

Adjustment range : 0 to 32767
Format: 16 bits
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}
- **10.15** = 2^{14}

10.41 to 10.51 : Not used

10.52 : Maximum speed alarm

Adjustment range : Disabled (0) or Enabled (1)
Format: 8 bits
Changes to Enabled (1) when the motor speed (**05.04**) > V_{max} (**01.06** or **21.01**) - **03.52** in open loop mode or speed (**03.02**) > V_{max} (**01.06** or **21.01**) - **03.52** in closed loop mode.
10.52 changes to Disabled (0) when the speed is less than (**05.04**) > V_{max} (**01.06** or **21.01**) - **03.52** - 10 rpm in open loop, or (**03.02**) > V_{max} (**01.06** or **21.01**) - **03.52** - 10 rpm.

10.53 : Maximum speed

Adjustment range : Disabled (0) or Enabled (1)
Format: 8 bits
Changes to Enabled (1) when the motor speed (**05.04**) > V_{max} (**01.06** or **21.01**) - 15 rpm.
10.53 changes back to Disabled (0) when the speed is less than (**05.04**) > V_{max} (**01.06** or **21.01**) - **03.53** - 25 rpm.

10.54 to 10.57 : User alarms 1 to 4

Adjustment range : Disabled (0) or Enabled (1)
Factory setting : Disabled (0)
Format: 8 bits
When these parameters change to Enabled (1), the drive goes into alarm mode (drive does not trip).

10.58 : Not used

10.59 : Motor phase missing trip validation

Adjustment range : No (0) or Yes (1)
Factory setting : No (0)
Format: 8 bits

No (0):
Output phase loss trip detection disabled.

Yes (1):
Output phase loss trip detection enabled.

Note:
If the brake is enabled, the output phase loss trip is taken into account regardless of the state of **10.59**.

10.60 : I imbalanced trip validation

Adjustment range : No (0) or Yes (1)
Factory setting : Yes (1)
Format: 8 bits
Used to enable the Current Imbalanced trip.

10.61 : User trip 1

Adjustment range : Disabled (0) or Enabled (1)
Factory setting : Disabled (0)
Format: 8 bits

Disabled (0):
The drive has not tripped.

Enabled (1):
The drive trips, decelerates in freewheel mode and generates a user trip 1 code.

10.62 : Not used

10.63 : User trip 2
Adjustment range : Disabled (0) or Enabled (1)
Factory setting : Disabled (0)
Format: 8 bits

Disabled (0):
The drive has not tripped.

Enabled (1):
The drive trips, decelerates in freewheel mode and generates a user trip 2 code.

10.64 : Not used

10.65 : User trip 3
Adjustment range : Disabled (0) or Enabled (1)
Factory setting : Disabled (0)
Format: 8 bits

Disabled (0):
The drive has not tripped.

Enabled (1):
The drive trips, decelerates in freewheel mode and generates a user trip 3 code.

10.66 : Not used

10.67 : User trip 4
Adjustment range : Disabled (0) or Enabled (1)
Factory setting : Disabled (0)
Format: 8 bits

Disabled (0):
The drive has not tripped.

Enabled (1):
The drive trips, decelerates in freewheel mode and generates a user trip 4 code.

10.68 : Not used

10.69 : TRIP ENABLE TO OFF
Adjustment range : Disabled (0) or Enabled (1)
Factory setting : Disabled (0)
Format: 8 bits
This parameter is used to make drive trips active at standstill. The trips concerned are: IGBT U, V and W, Autotune, I IMBALANCED, Encoder break, RECTIFIER Th, Motor PTC, AI2 loss, AI3 loss, Th IGBT U, V and W, Loss of a motor phase, UVW invert, Internal ventilation.

10.70 to 10.73 : Not used

10.74 : Preload time
Adjustment range : 1 to 15 s
Factory setting : 1 s
Format: 16 bits
Where the drive manages the preloading of capacitors on the DC bus (**10.75** = No (0)), this parameter sets the DC bus preload time. Used in the specific case of a rectifier supplying several inverters.

10.75 : Powered by DC bus
Adjustment range : No (0) or Yes (1)
Factory setting : No (0)
Format: 8 bits

No (0):
The drive is connected to an AC supply. The drive manages the preloading of capacitors on the DC bus.

Yes (1):
The drive is supplied directly on its DC bus. The preloading of capacitors on the DC bus must be managed externally.

Note:
• When **10.75** = Yes (1), reading of the rectifier temperature is disabled ("RECTIFIER Th" is no longer active).
• **10.75** must be set to Yes (1) for **POWERDRIVE Regen** (MD2R) units.

10.76 : Preload contactor closed
Adjustment range : No (0) or Yes (1)
Format: 8 bits

No (0):
Short-circuiting of the DC bus preload system is not permitted.

Yes (1):
Short-circuiting for the DC bus preload system may be permitted.

Note:
10.76 operates with **10.75** at yes (1). The relay switches when the bus level has reached approximately 90% of its final value.

10.77 : 4Q rectifier disable
(**POWERDRIVE FX** drive only)
Adjustment range : No (0) or Yes (1)
Factory setting : No (0)
Format: 8 bits
This parameter is used to disable the 4Q rectifier on **POWERDRIVE FX** drives.

No (0):
The rectifier can restore energy to the mains supply.

Yes (1):
The rectifier works as a simple diode bridge.

10.78 and 10.79 : Not used

10.80 : Auto reset type

Adjustment range : Controlled (0) or Automatic (1),
Auto for 1081, 1082, 1083, 1084 (2),
Auto except 1081, 1082, 1083, 1084 (3)
Factory setting : Controlled (0)
Format: 8 bits

Controlled (0):
Trip reset by a Reset command on the terminals or via the parameter-setting interface.

Automatic (1):
All trips automatically reset.

Auto for 1081, 1082, 1083, 1084 (2):
Selective reset of trips listed in **10.81**, **10.82**, **10.83** and **10.84**.

Auto except 1081, 1082, 1083, 1084 (3):
Selective reset of all trips except trips listed in **10.81**, **10.82**, **10.83** and **10.84**.

10.81 : Special trip n°1

Adjustment range : 0 to 102
Factory setting : 0
Format: 8 bits
Enter the number of the trip * which should or should not be reset automatically depending on the setting of **10.80**.

10.82 : Special trip n°2

Adjustment range : 0 to 102
Factory setting : 0
Format: 8 bits
Enter the number of the trip * which should or should not be reset automatically depending on the setting of **10.80**.

10.83 : Special trip n°3

Adjustment range : 0 to 102
Factory setting : 0
Format: 8 bits
Enter the number of the trip * which should or should not be reset automatically depending on the setting of **10.80**.

10.84 : Special trip n°4

Adjustment range : 0 to 102
Factory setting : 0
Format: 8 bits
Enter the number of the trip * which should or should not be reset automatically depending on the setting of **10.80**.

10.85 and 10.96 : Not used

10.97 : Alarm status

Adjustment range : 0 to 32767
Format: 8 bits
This parameter lists the status of the various drive alarms. The alarm appears in an orange banner at the top of the MDX-Powerscreen interface screen.

Value of 10.97	Function	Equivalent parameter
1	User alarm 1	**10.54**
2	User alarm 2	**10.55**
3	User alarm 3	**10.56**
4	User alarm 4	**10.57**
5	Braking resistor overheating	**10.12**
6	Motor overload	**10.17**
7	Drive over temperature	**10.18**
8	Microcontroller overoccupancy	
9	Rectifier	
10	Emergency operation	
	Reserved	
	Reserved	
	Reserved	
	Reserved	
	Reserved	
	Reserved	

* See the list of trips for parameters **10.20** to **10.29**.

10.98 : Drive status

Adjustment range : 0 to 37
Format: 8 bits
This parameter defines the drive operating status.
This information about the drive status is also available on the two digits on the control board.
(see explanations in Section 7)

Value	Name	Meaning
0	DISABLED	Disabled
1	ENABLED M	Enabled, motor (on load)
2	ENABLED G	Enabled, generator (driving load)
3	RAMP STOP >M	Stop on ramp, clockwise, motor
4	RAMP STOP >G	Stop on ramp, clockwise, generator
5	RAMP STOP <M	Stop on ramp, counter-clockwise, motor
6	RAMP STOP <G	Stop on ramp, counter-clockwise, generator
7	TLSP STOP >M	Stop by low-frequency current injection, clockwise, motor
8	TLSP STOP >G	Stop by low-frequency current injection, clockwise, generator
9	TLSP STOP <M	Stop by low-frequency current injection, counter-clockwise, motor
10	TLSP STOP <G	Stop by low-frequency current injection, counter-clockwise, generator
11	INDEX STOP >M	Indexed stop Clockwise, motor
12	INDEX STOP >G	Indexed stop Clockwise, generator
13	INDEX STOP <M	Indexed stop Counter-clockwise, motor
14	INDEX STOP <G	Indexed stop Counter-clockwise, generator
15	DC Inject.>M	DC injection, clockwise, motor
16	DC Inject.>G	DC injection, clockwise, generator
17	DC Inject.<M	DC injection, counter-clockwise, motor
18	DC Inject.<G	DC injection, counter-clockwise, generator
19	I LIMIT >M	Current limit, clockwise, motor
20	I LIMIT >G	Current limit, clockwise, generator
21	I LIMIT <M	Current limit, counter-clockwise, motor
22	I LIMIT <G	Current limit, counter-clockwise, generator
23	DC BUS Lim>M	BUS voltage limit, clockwise, motor
24	DC BUS Lim>G	BUS voltage limit, clockwise, generator
25	DC BUS Lim<M	BUS voltage limit, counter-clockwise, motor
26	DC BUS Lim<G	BUS voltage limit, counter-clockwise, generator
27	Fly. RESTART	Flying restart
28	Start. DELAY	Delay before starting
29	Delay before flying restart	Delay before flying restart
30	Ext. DISABLE	Drive disabled with run command present, but STO-1 and STO-2 not connected or **06.15** Drive output set to "Disabled" ⚠ **• Depending on the control logic selected in 06.04, the motor can start as soon as the drive is enabled.**
31	MAINS < Min.V	Mains voltage < Minimum voltage
32	READY	Drive healthy
33	AUTOTUNE	Autotune
34	REGEN MODE	Rectifier mode (Regen drives)
35	BOARDS TEST	Test of boards (control/interface)
36	POWER TEST	Test of the power
37	EMERGENCY OP.	Emergency operation enabled

10.99 : Current trip

Adjustment range : 0 to 102
Format: 8 bits
Contains the code for the current trip. See the list of trips for parameters **10.20** to **10.29**.
Value 0 indicates that the drive has not tripped.
The other values indicate the trip number.

5.12 - Menu 11: Drive configuration, Serial link

5.12.1 - Menu 11 diagram

• Menu 0 configuration

11.01	Assignment of **Apl.01**	11.11	Assignment of **Apl.11**
11.02	Assignment of **Apl.02**	11.12	Assignment of **Apl.12**
11.03	Assignment of **Apl.03**	11.13	Assignment of **Apl.13**
11.04	Assignment of **Apl.04**	11.14	Assignment of **Apl.14**
11.05	Assignment of **Apl.05**	11.15	Assignment of **Apl.15**
11.06	Assignment of **Apl.06**	11.16	Assignment of **Apl.16**
11.07	Assignment of **Apl.07**	11.17	Assignment of **Apl.17**
11.08	Assignment of **Apl.08**	11.18	Assignment of **Apl.18**
11.09	Assignment of **Apl.09**	11.19	Assignment of **Apl.19**
11.10	Assignment of **Apl.10**	11.20	Assignment of **Apl.20**

• Drive configuration

11.29	Drive software version	11.33	Drive voltage rating
11.31	User drive mode	11.60	Drive identification code
11.32	Drive current rating	11.60	Encoder module present
11.60	Option module present		

• Parameter setting

11.43	Factory settings	11.64	Save parameters to EEPROM
11.45	Motor parameter select	11.65	Menu to be saved
11.61	Advanced menu access code	11.66	Communication type between drives

• Serial link

11.23	Serial address	11.25	Baud rate
11.24	Serial mode	11.26	Min comms transmit delay
		11.27	Parity type, number of stop bits
		11.63	Standard serial link Timeout

• Miscellaneous

11.67	Coder module presence	11.68	Option module presence

5.12.2 - Explanation of parameters in menu 11

11.01 to **11.20** : **Assignment of parameters Apl.01 to Apl.20**

Adjustment range : **00.00** to **21.51**
Format: 16 bits
Factory setting : See table below.
These parameters can be used, in order, to assign parameters **Apl.01 to Apl.20** of the "Quick setup" menu.

Quick setup menu	Quick setup assignment	Factory setting If 11.43 = 1 (Centrifugal application)	Factory setting If 11.43 = 2 (Brake motor application)
11.01	Apl.01	09.21	12.41
11.02	Apl.02	09.23	12.42
11.03	Apl.03	09.24	12.43
11.04	Apl.04	09.25	12.44
11.05	Apl.05	12.74	12.45
11.06	Apl.06	12.77	12.46
11.07	Apl.07	12.78	12.47
11.08	Apl.08	12.84	03.05
11.09	Apl.09	12.87	00.00
11.10	Apl.10	12.88	00.00
11.11	Apl.11	14.03	00.00
11.12	Apl.12	14.04	00.00
11.13	Apl.13	14.08	00.00
11.14	Apl.14	14.16.	00.00
11.15	Apl.15	14.10	00.00
11.16	Apl.16	14.11	00.00
11.17	Apl.17	14.61	00.00
11.18	Apl.18	14.60	00.00
11.19	Apl.19	00.00	00.00
11.20	Apl.20	00.00	00.00

Note:
If **11.43** is set to "Disabled" (0) or "Other application" (3), the default value of parameters **11.01** to **11.20** and **Apl.01** to **Apl.20** will be 0.

11.21 and **11.22** : **Not used**

11.23 : **Serial address**

Adjustment range : 0 to 247
Factory setting : 1
Format: 16 bits
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.

Note:
This parameter is used only for the MODBUS RTU link of the drive's P2 connector. To configure the MODBUS RTU link of the MDX-MODBUS option, refer to the manual ref. 4580 of the MDX-MODBUS option.

11.24 : **Serial mode**

Adjustment range : LS NET (0), MODBUS RTU (1)
Format: 8 bits
This parameter indicates which protocol is being used for the current communication on the drive's P2 connector serial link.

LS NET (0):
LS Net protocol.

MODBUS RTU (1):
MODBUS RTU protocol.

11.25 : **Baud rate**

Adjustment range : 1200 (0) to 115200 (9)
Factory setting : 19200 (6)
Format: 8 bits
Used to select the data transfer speed for MODBUS RTU.

Speed (baud)	11.25
1200	0
1200	1
1200	2
2400	3
4800	4
9600	5
19200	6
38400	7
57600	8
115200	9

Note:
This parameter is used only for the MODBUS RTU link of the drive's P2 connector. To configure the MODBUS RTU link of the MDX-MODBUS option, refer to the manual ref. 4580 of the MDX-MODBUS option.

11.26 : **Min comms transmit delay**

Adjustment range : 0 to 100 ms
Factory setting : 2 ms
Format: 16 bits
As the serial link is 2-wire type, Rx is connected to Tx and Rx\ to Tx\. A communication-related trip may occur if the receiver responds to a request before the transmitter has had time to switch. Parameter **11.26** is used to introduce a time between reception and return of data. After transmission of a request, the drive needs 1.5 ms before receiving the next command. The adjustment is made in 2 ms intervals.

Note:
This parameter is used only for the MODBUS RTU link of the drive's P2 connector. To configure the MODBUS RTU link of the MDX-MODBUS option, refer to the manual ref. 4580 of the MDX-MODBUS option.

11.27 : Parity type, number of stop bits
Adjustment range : No parity, 2 stop bits (0), No parity, 1 stop bit (1), Even parity, 1 stop bit (2), Odd parity, 1 stop bit (3),
Factory setting : No parity, 2 stop bits (0)
Format: 8 bits

No parity, 2 stop bits (0):
No parity, 2 stop bits.

No parity, 1 stop bit (1):
No parity, 1 stop bit.

Even parity, 1 stop bit (2):
Even parity, 1 stop bit.

Odd parity, 1 stop bit (3):
Odd parity, 1 stop bit.

Note:
This parameter is used only for the MODBUS RTU link of the drive's P2 connector. To configure the MODBUS RTU link of the MDX-MODBUS option, refer to the manual ref. 4580 of the MDX-MODBUS option.

11.28 : Not used

11.29 : Drive software version
Adjustment range : ± 9.99
Format: 16 bits
Indicates the drive software version.

11.30 : Not used

11.31 : User drive mode
Adjustment range : Reserved (0), Induction motor in open loop mode (1), Induction motor in vector control mode (2), PM motor (Servo) in vector control mode (3), Active rectifier on Main power (4), Active rectifier for synchronous motor (5), Active rectifier for induction motor (6), DC/DC converter (7)
Factory setting : Induction motor in open loop mode (1)
Format: 8 bits

The operating mode can only be selected when the drive is stopped.

Reserved (0):
Reserved.

Induction motor in open loop mode (1) :
Asynchronous motor controlled in open loop mode (without speed feedback). See also parameter **05.14**.

Induction motor in vector control mode (2) :
Asynchronous motor controlled in closed loop mode with speed feedback or with the sensorless function (see also parameter **03.38**).

PM motor (Servo) in vector control mode (3) :
Permanent magnet motor controlled in closed loop mode with speed feedback or with the sensorless function (see also parameter **03.38**).

Active rectifier on Main power (4):
Reversible mode.

Synchronous variable speed Regen (5):
Reversible mode with variable speed synchronous generator.

Asynchronous variable speed Regen (6):
Reversible mode with variable speed asynchronous generator.

DC/DC converter (7):
Reserved

CAUTION:

If the mode is changed with a fieldbus option, reset the option (Pr 15.32 = ON).

11.32 : Drive current rating
Adjustment range : 1.50 to 3200.00 A
Format: 32 bits
Drive rated current when it is connected to a motor operating with reduced overload.

11.33 : Drive voltage rating
Adjustment range : 200 to 690 V
Format: 16 bits
This parameter indicates the rated voltage of the drive according to its rating and **06.10**.

11.34 to 11.42 : Not used

11.43 : Factory settings
Adjustment range : Disabled (0), Centrifugal application (1), Brake motor application (2), Other application (3)
Factory setting : Disabled (0)
Format: 8 bits

Disabled (0):
When the drive has completed the procedure for returning to factory settings, **11.43** returns to "Disabled".

Centrifugal application (1):
Return to factory settings of all parameters and adaptation of the "**Quick setup**" menu to a centrifugal application (quadratic torque). The "Additional settings 1" Apl menu becomes active (refer to section 4.2.5).

Brake motor application (2):
Return to factory settings of all parameters and adaptation of the "**Quick setup**" menu to an application with brake motor. The "Additional settings 2" Apl menu becomes active (refer to section 4.2.6).

Other application (3):
Return to factory settings of all parameters without adaptation of the "**Quick setup**" menu. The "Additional settings 1 & 2" Apl menus are inactive.

Note:
If the proposed configurations are not suitable, the user can adapt the "Additional settings" Apl menu to his application. In this case, refer to parameters **11.01** to **11.20**.

11.44 : Not used

11.45 : Motor parameter select
Adjustment range : Motor 1 (0) or Motor 2 (1)
Factory setting : Motor 1 (0)
Format: 8 bits
This parameter is used to select the set of parameters corresponding to the characteristics of motor 1 or 2.

11.45 = 0 (motor 1)	11.45 = 1 (motor 2)	Description
01.06	**21.01**	Maximum reference clamp
01.07	**21.02**	Minimum reference clamp
01.14	**21.03**	Reference selector
02.11	**21.04**	Acceleration rate 1
02.21	**21.05**	Deceleration rate 1
05.06	**21.06**	Motor rated frequency
05.07	**21.07**	Motor rated current
05.08	**21.08**	Motor rated speed
05.09	**21.09**	Motor rated voltage
05.10	**21.10**	Rated power factor
05.11	**21.11**	Number of motor poles
05.17	**21.12**	Stator resistance
05.23	**21.13**	Voltage offset
05.24	**21.14**	Motor Transient inductance / Ld
-	**21.15**	Motor 2 map enable
05.25	**21.24**	Stator inductance L_s
05.33	**21.30**	Motor volt per 1000 rpm (Ke)
05.51	**21.51**	Q axis inductance (synchronous motor)

CAUTION:
The drive must be disabled when switching from motor 1 to motor 2 (this does not apply to POWERDRIVE MD2).

11.46 to 11.59 : Not used

11.60 : Drive identification code
Adjustment range : 0 to 32000
Format: 16 bits
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 LEROY-SOMER contact.

11.61 : Advanced menu access code
Adjustment range : 0 to 9999
Factory setting : 149
Format: 16 bits
This parameter is used to limit access to menus 1 to 21 when setting the parameters via the parameter-setting interface.
If this parameter is not 0, the value of parameter **11.61** must be entered to enable switching to the advanced menu, such as for example to switch from the "**Quick setup**" menu to the "**Advanced setting**" menu.
In factory settings mode, simply enter the value 149 to access all menus.

11.62 : Not used

11.63 : Standard serial link Timeout
Adjustment range : 0.0 to 25.0 s
Factory setting : 0.0 s
Format: 16 bits
Used to generate the "COM loss" 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 P2 connector. The Timeout does not take effect until one minute after power-up.

11.64 : Save parameters to EEPROM
Adjustment range : No (0) or Yes (1)
Factory setting : No (0)
Format: 8 bits
This parameter is used to store in EEPROM the values of drive parameters that have been changed via the fieldbus.
1) Choose the menu(s) to be saved (**11.65** = 0 to save all menus)
2) Initiate the save operation, **11.64** = Yes (1)
3) The end of the save operation is indicated by **11.64** changing to No (0).

11.65 : Menu to be saved
Adjustment range : 0 to 21
Factory setting : 0
Format: 8 bits
This parameter is used to choose the menu(s) to be saved (**11.65** = 0 for all menus)

11.66 : Communication type between drives

Adjustment range : None (0), Inverter of Regen (1), Rectifier of Regen (2), Twin drive Master (3), Twin drive Slave (4), Synchro Master (5), Synchro Slave (6), Encoder Master (7), Encoder Slave (8)
Factory setting : None (0)
Format: 8 bits
This parameter defines the type of communication to be used when 2 or more control boards communicate via the dedicated internal serial link:

None (0):
No communication.

Inverter of Regen (1):
On an MD2R product, select this setting for the inverter connected to the motor or generator.

Rectifier of Regen (2):
On an MD2R product, select this setting for the inverter which is connected at the mains supply end.

Twin drive Master (3):
Reserved

Twin drive Slave (4):
Reserved

Synchro Master (5):
Reserved

Synchro Slave (6):
Reserved

Encoder Master (7):
Reserved

Encoder Slave (8):
Reserved

The modification is not taken into account until after the drive has been powered down.

11.67 : Coder module presence

Adjustment range : No (0), MDX-ENCODER (1), MDX-RESOLVER (2)
Format: 8 bits
Indicates the presence of an optional sensor feedback module, connected to the drive.

No (0):
No sensor feedback module.

MDX-ENCODER (1):
Presence of an optional MDX-ENCODER module, connected to the drive.

MDX-RESOLVER (2):
Presence of an optional MDX-RESOLVER module, connected to the drive.

11.68 : Option module presence

Adjustment range : No (0) or MDX-I/O (1)
Format: 8 bits
Indicates the presence of an optional MDX-I/O module, connected to the drive.

No (0):
No optional module.

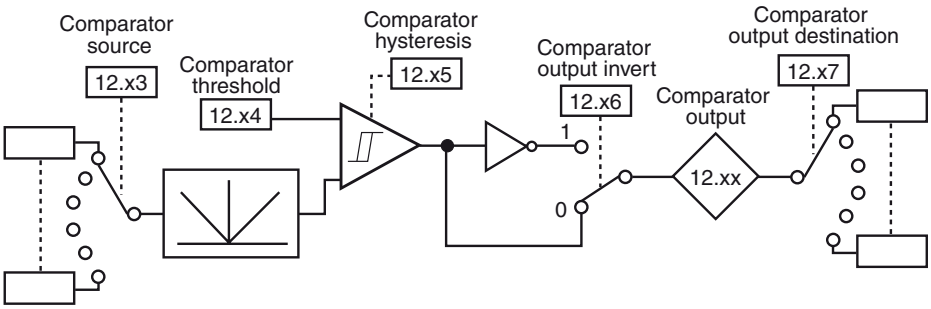
MDX-I/O (1):
Presence of an optional MDX-I/O module, connected to the drive.

Notes

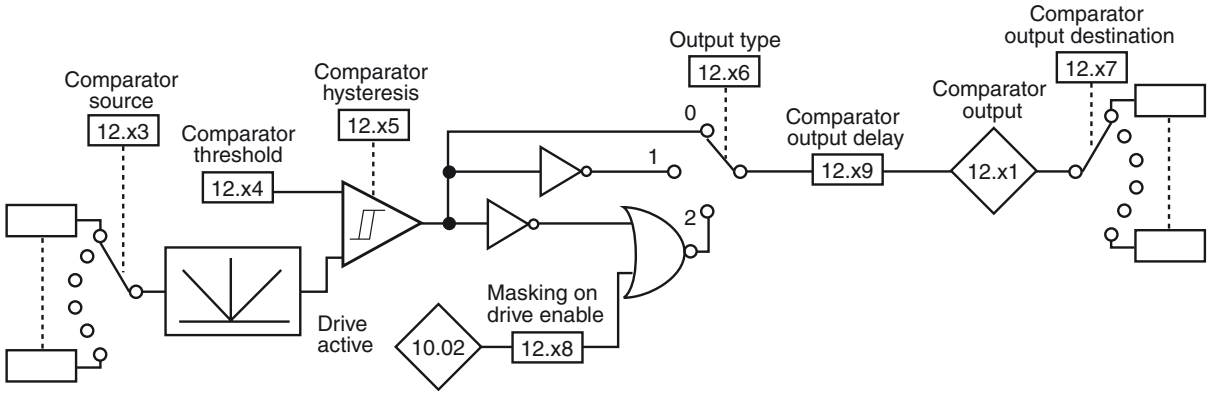
5.13 - Menu 12: Comparator and function blocks

5.13.1 - Menu 12 diagrams

• Comparators

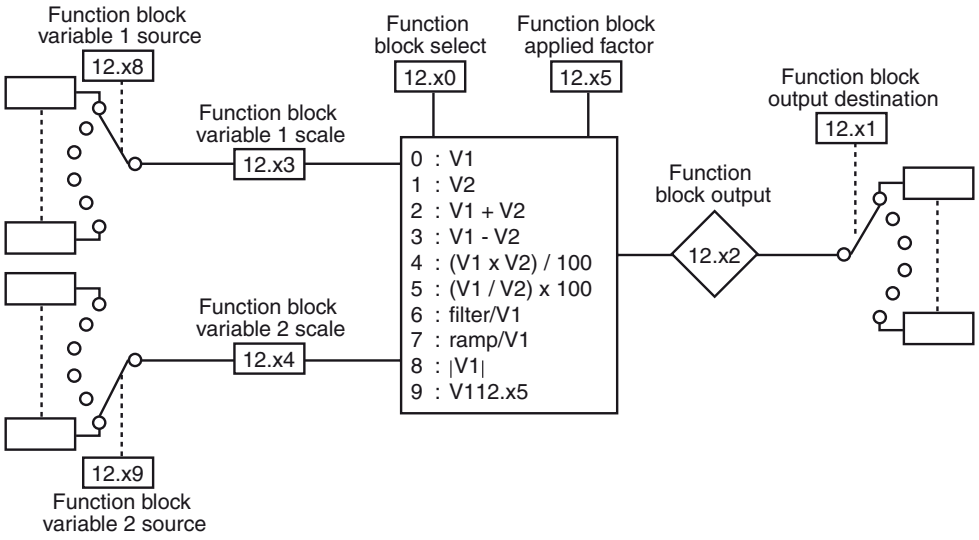


Comparator	Source	Threshold	Hysteresis	Output state	Invert	Destination
Comparator 1	**12.03**	**12.04**	**12.05**	**12.01**	**12.06**	**12.07**
Comparator 2	**12.23**	**12.24**	**12.25**	**12.02**	**12.26**	**12.27**



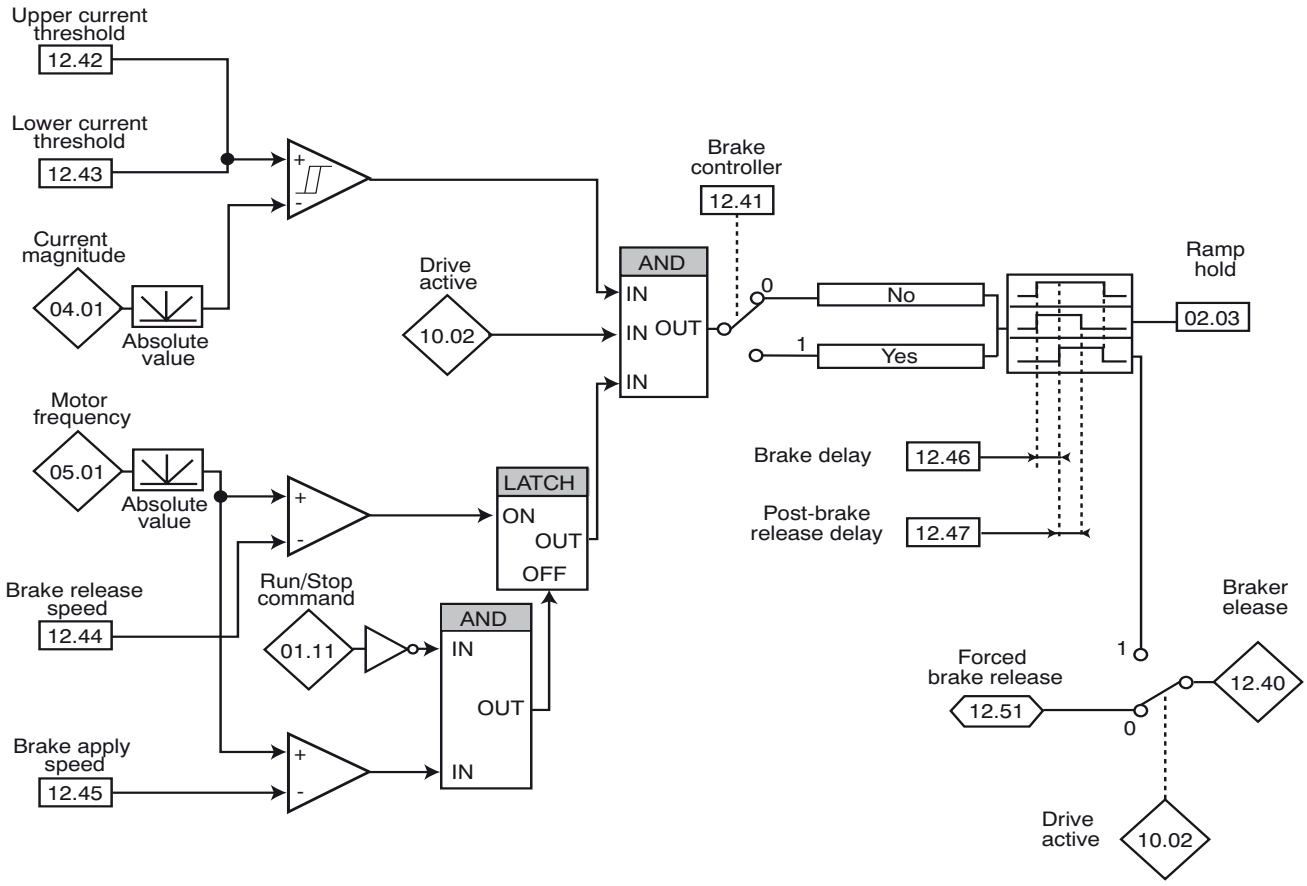
Comparator	Source	Threshold	Hysteresis	Masking	Type	Time delay	State	Destination
Comparator 3	**12.63**	**12.64**	**12.65**	**12.68**	**12.66**	**12.69**	**12.61**	**12.67**
Comparator 4	**12.73**	**12.74**	**12.75**	**12.78**	**12.76**	**12.79**	**12.71**	**12.77**
Comparator 5	**12.83**	**12.84**	**12.85**	**12.88**	**12.86**	**12.89**	**12.81**	**12.87**

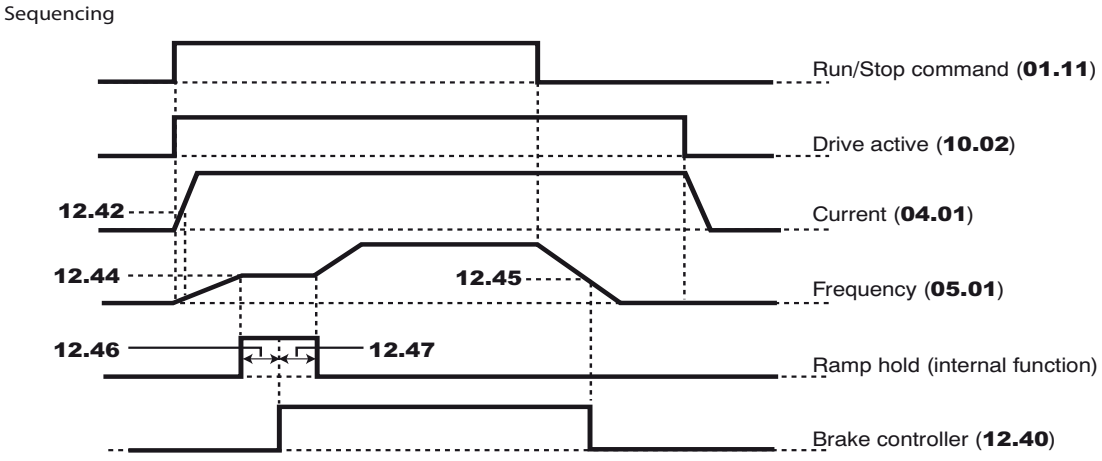
• Processing of internal variables



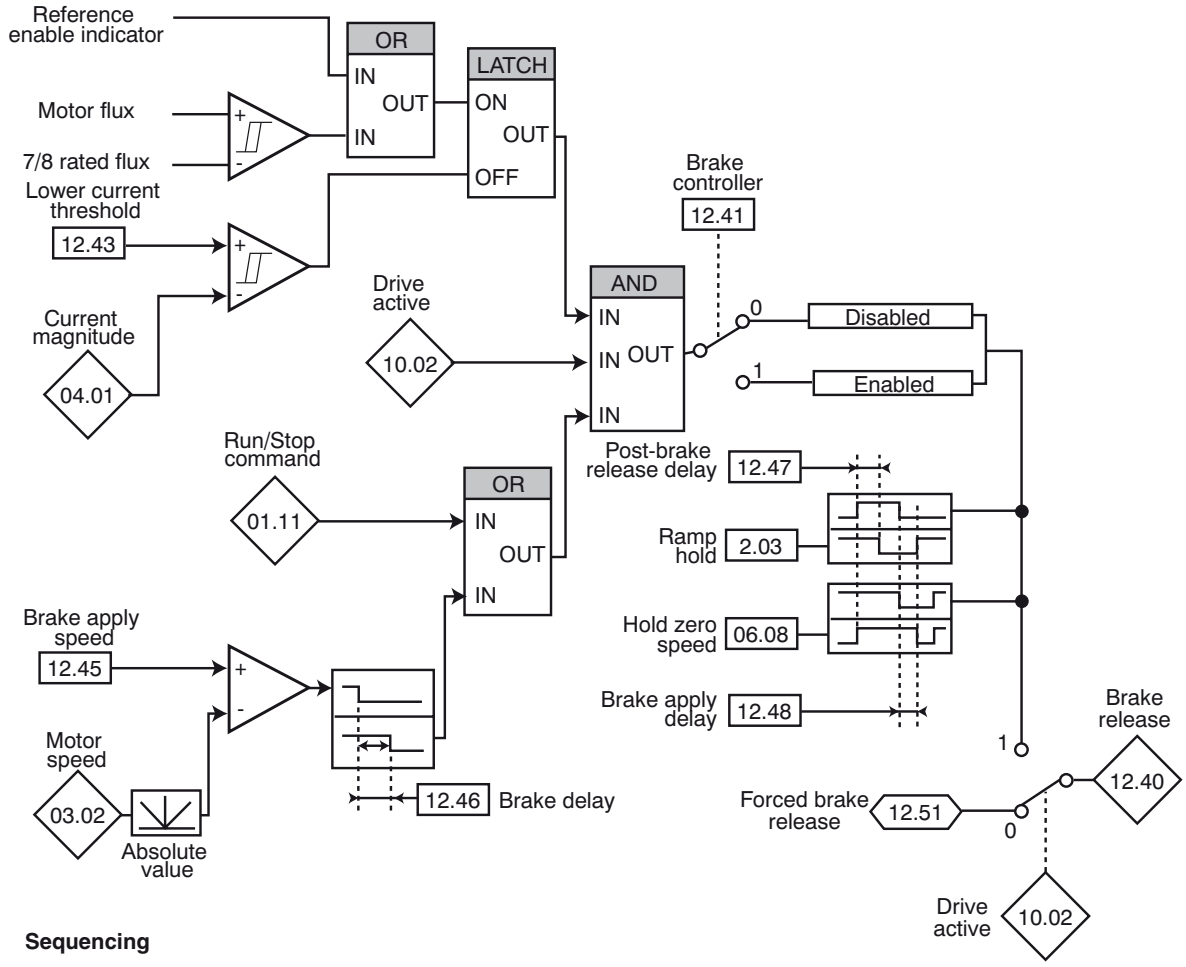
Block	Variable 1 source	Variable 1 scaling	Variable 2 source	Variable 2 scaling	Function selection	Applied factor	Output destination	Output
Block 1	**12.08**	**12.13**	**12.09**	**12.14**	**12.10**	**12.15**	**12.11**	**12.12**
Block 2	**12.28**	**12.33**	**12.29**	**12.34**	**12.30**	**12.35**	**12.31**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

• Brake control in open loop mode

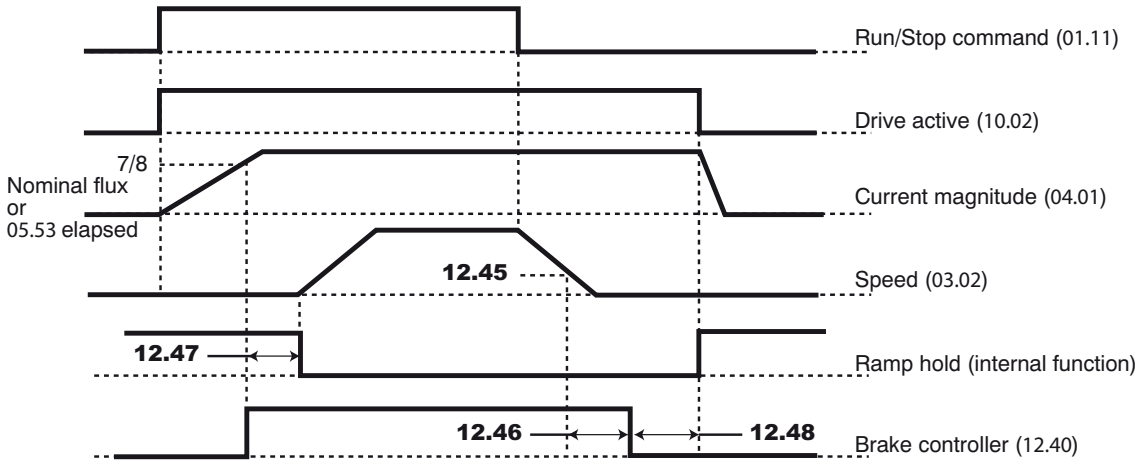




• Brake control in flux vector mode



Sequencing



5.13.2 - Explanation of parameters in menu 12

12.01 : Comparator 1 output

12.02 : Comparator 2 output

Adjustment range : Disabled (0) or Enabled (1)
Format: 8 bits

Disabled (0):
The input variable is less than or equal to the comparator threshold.

Enabled (1):
The input variable is greater than the comparator threshold.

12.03 : Comparator 1 source
Adjustment range : **00.00** to **21.51**
Factory setting : **00.00**
Format: 16 bits
This parameter defines the variable that is to be compared to the configured threshold.
The absolute value of the variable is used.

12.04 : Comparator 1 threshold
Adjustment range : 0.0 to 100.0%
Factory setting : 0.0%
Format: 16 bits
This parameter is 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
Adjustment range : 0.0 to 25.0%
Factory setting : 0.0%
Format: 16 bits
This parameter defines the window within which the comparator output will not change state.
The output will change to Enabled (1) when the variable reaches the value of the threshold + (hysteresis/2).
The output will change to Disabled (0) when the variable goes below the value of the threshold - (hysteresis/2).
The hysteresis is expressed as a percentage of the maximum value of the compared variable.

12.06 : Comparator 1 output invert
Adjustment range : Disabled (0) or Enabled (1)
Factory setting : Disabled (0)
Format: 8 bits
This parameter is used to invert the comparator output.

Disabled (0):
Output not inverted.

Enabled (1):
Output inverted.

12.07 : Comparator 1 output destination
Adjustment range : **00.00** to **21.51**
Factory setting : **00.00**
Format: 16 bits
This parameter defines 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 anywhere.

12.08 : Function 1 variable 1 source
Adjustment range : **00.00** to **21.51**
Factory setting : **00.00**
Format: 16 bits
This parameter defines the source parameter for variable 1 to be processed.
Only "numerical" parameters can be assigned.
If an unsuitable parameter is selected, the value of the variable will be 0.

12.09 : Function 1 variable 2 source
Adjustment range : **00.00** to **21.51**
Factory setting : **00.00**
Format: 16 bits
This parameter defines the source parameter for variable 2 to be processed.
Any "numerical" parameter can be assigned.
If an unsuitable parameter is selected, the value of the variable will be 0.

12.10 : Function block 1 select
Adjustment range : See table below
Factory setting : O = V1 (0)
Format: 8 bits
This parameter is used to define the function of the internal variables processing block.

	HMI name	Output	Comment
0	**O = V1**	**= V1**	Used to transfer an internal variable
1	O = V2	= V2	Used to transfer an internal variable
2	O=V1+V2	= V1 + V2	Addition of 2 variables
3	O=V1-V2	= V1 - V2	Subtraction of 2 variables
4	=V1xV2/100	= (V1 x V2) ÷ 100	Multiplication of 2 variables
5	=V1/V2x100	= (V1 x 100) x V2	Division of 2 variables
6	=filter/V1	$=V1(1 - e^{\frac{-t}{\mathbf{12.15}}})$	Creation of a first-order filter
7	O= ramp/V1	= ramped V1	Creation of a linear ramp. **12.15** is used to adjust the value of the ramp
8	O = abs (V1)	= |V1|	Absolute value
9	O = V1^(**12.15**)	$= V1^{\mathbf{12.15}}$	V1 to the power **12.15**

• If 12.10 equals 2, 3, 4 or 5:
When the result of the calculation is greater than or equal to 32767, output **12.11** is limited to 32767.
When the result of the calculation is greater than or equal to -32768, output **12.11** is limited to -32768.

• If 12.10 equals 5:
To avoid a calculation error if V2 = 0, the result of the operation will be 0.

• If 12.10 equals 9:
To avoid a calculation error, the absolute value of the signal V1 is taken before calculating its square root or cube root.

12.11 : Function 1 output destination
Adjustment range : **00.00** to **21.51**
Factory setting : **00.00**
Format: 16 bits
This parameter is used to select the destination of the processed variable.
Any non-protected "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
Adjustment range : ± 100.00%
Format: 16 bits
Indicates the value of the function output as a percentage of the adjustment range of the destination parameter.

12.13 : Function 1 variable 1 scale
Adjustment range : ± 4.000
Factory setting : 1.000
Format: 16 bits
Used to scale variable 1 before processing.
CAUTION:
The value at the output of the scaling 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
Adjustment range : ± 4.000
Factory setting : 1.000
Format: 16 bits
Used to scale variable 2 before processing.
CAUTION:
The value of the scaling output can only be between -32767 and +32767. Take this into account depending on the adjustment range of the source parameter.

12.15 : Function 1 applied factor
Adjustment range : 0.00 to 100.00
Factory setting : 0.00
Format: 16 bits
Depending on its function, the internal variables processing block may require an associated parameter.
If the block is used to create a first-order filter, the associated parameter is used as a time constant; if it is used to generate a ramp, this parameter is used to adjust the ramp value (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 a 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

12.23 : Comparator 2 source
Adjustment range : **00.00** to **21.51**
Factory setting : **00.00**
Format: 16 bits
This parameter defines the variable that is to be compared to the configured threshold.
The absolute value of the variable is used. Only non-bit parameters can be programmed as the source.
If an unsuitable parameter is programmed, the input value is taken as equal to 0.

12.24 : Comparator 2 threshold
Adjustment range : 0.0 to 100.0%
Factory setting : 0.0%
Format: 16 bits
This parameter is used to set the comparator trip threshold.
The threshold is expressed as a percentage of the maximum value of the compared variable.

12.25 : Comparator 2 hysteresis
Adjustment range : 0.0 to 25.0%
Factory setting : 0.0%
Format: 16 bits
This parameter defines the window within which the comparator output will not change state.
The output will change to Enabled (1) when the variable reaches the value of the threshold + (hysteresis/2).
The output will change to Disabled (0) when the variable goes below the value of the threshold - (hysteresis/2).
The hysteresis is expressed as a percentage of the maximum value of the compared variable.

12.26 : Comparator 2 output invert
Adjustment range : Disabled (0) or Enabled (1)
Factory setting : Disabled (0)
Format: 8 bits
This parameter is used to invert the comparator output.

Disabled (0):
Output not inverted.

Enabled (1):
Output inverted.

12.27 : Comparator 2 output destination
Adjustment range : **00.00** to **21.51**
Factory setting : **00.00**
Format: 16 bits
This parameter defines 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 anywhere.

12.28 : Function 2 variable 1 source
Adjustment range : **00.00** to **21.51**
Factory setting : **00.00**
Format: 16 bits
This parameter defines the source parameter for variable 1 to be processed.
Only "numerical" parameters can be assigned.
If an unsuitable parameter is selected, the value of the variable will be 0.

12.29 : Function 2 variable 2 source
Adjustment range : **00.00** to **21.51**
Factory setting : **00.00**
Format: 16 bits
This parameter defines the source parameter for variable 2 to be processed.
Any "numerical" parameter can be assigned.
If an unsuitable parameter is selected, the value of the variable will be 0.

12.30 : Function block 2 select
Adjustment range : See table below
Factory setting : O = V1 (0)
Format: 8 bits
This parameter is used to define the function of the internal variables processing block.

	HMI name	Output	Comment
0	**O = V1**	**= V1**	Used to transfer an internal variable
1	O = V2	= V2	Used to transfer an internal variable
2	O=V1+V2	= V1 + V2	Addition of 2 variables
3	O=V1-V2	= V1 - V2	Subtraction of 2 variables
4	=V1xV2/100	= (V1 x V2) ÷ 100	Multiplication of 2 variables
5	=V1/V2x100	= (V1 x 100) x V2	Division of 2 variables
6	=filter/V1	$=V1(1 - e^{\frac{-t}{\mathbf{12.35}}})$	Creation of a first-order filter
7	O= ramp/V1	= ramped V1	Creation of a linear ramp. **12.35** is used to adjust the value of the ramp
8	O = abs (V1)	= |V1|	Absolute value
9	O = V1^**12.35**	$= V1^{\mathbf{12.35}}$	V1 to the power **12.35**

• If 12.30 equals 2, 3, 4 or 5:
When the result of the calculation is greater than or equal to 32767, output **12.31** is limited to 32767.
When the result of the calculation is greater than or equal to -32768, output **12.31** is limited to -32768.

• If 12.30 equals 5:
To avoid a calculation error if V2 = 0, the result of the operation will be 0.

• If 12.30 equals 9:
To avoid a calculation error, it is the absolute value of the V1 signal which is taken into account before calculating its square root or cube root.

12.31 : Function 2 output destination
Adjustment range : **00.00** to **21.51**
Factory setting : **00.00**
Format: 16 bits
This parameter is used to select the destination of the processed variable.
Any non-protected "non-bit" parameter can be assigned.
If an unsuitable parameter is selected, the value of the variable taken into account is zero.

12.32 : Function block 2 output

Adjustment range : ± 100.00%
Format: 16 bits
Indicates the value of the function output as a percentage of the adjustment range of the destination parameter.

12.33 : Function 2 variable 1 scale

Adjustment range : ± 4.000
Factory setting : 1.000
Format: 16 bits
Used to scale variable 1 before processing.
CAUTION:
The value of the scaling output can only be between -32767 and +32767. Take this into account depending on the adjustment range of the source parameter.

12.34 : Function 2 variable 2 scale

Adjustment range : ± 4.000
Factory setting : 1.000
Format: 16 bits
Used to scale variable 2 before processing.
CAUTION:
The value of the scaling output can only be between -32767 and +32767. Take this into account depending on the adjustment range of the source parameter.

12.35 : Function 2 applied factor

Adjustment range : 0.00 to 100.00
Factory setting : 0.00
Format: 16 bits
Depending on its function, the internal variables processing block may require an associated parameter.
If the block is used to create a first-order filter, the associated parameter is used as a time constant; if it is used to generate a ramp, this parameter is used to adjust the ramp value (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 a 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

12.36 to 12.39 : Not used

12.40 : Brake release

Adjustment range : Disabled (0) or Enabled (1)
Format: 8 bits
Indicates the state of the brake control output.

Disabled (0):
The brake is applied.

Enabled (1):
The brake is released.

12.41 : Brake controller

Adjustment range : Disabled (0) or Enabled (1)
Factory setting : Disabled (0)
Format: 8 bits

Disabled (0):
Brake control is not enabled.

Enabled (1):
Brake control is enabled. The output is not assigned automatically; it is up to the user to select the destination for parameter **12.40**

Note:
Enabling brake control imposes a stop on ramp mode **06.01** = Ramp (1).
The flying restart function (**06.09** = Disabled (0)) is not compatible with the brake control function (see **06.09**).

12.42 : Upper current threshold ( )

Adjustment range : 0 to 200%
Factory setting : 30%
Format: 16 bits
Used to set the current threshold at which the brake will be controlled. This current level should ensure sufficient torque at the time the brake is released.

12.43 : Lower current threshold

Adjustment range : 0 to 200%
Factory setting : 10%
Format: 16 bits
Used to set the current threshold below which brake control will be disabled. It should be set so that loss of the motor power supply is detected.

12.44 : Brake release speed

Adjustment range : 0.00 to 100.00 rpm
Factory setting : 30.00 rpm
Format: 16 bits
Used to set the speed threshold at which the brake will be controlled. This speed level should ensure sufficient torque is provided to drive the load in the right direction when the brake is released. In general, this threshold is set at a value slightly above the motor slip expressed in rpm.
Example:
- 1500 rpm = 50 Hz
- Rated on-load speed = 1470 rpm
- Slip = 1500 - 1470 = 30 rpm

12.45 : Brake apply speed

Adjustment range : 0.00 to 100.00 rpm
Factory setting : 5.00 rpm
Format: 16 bits
Used to set the 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 : Brake delay
Adjustment range : 0.00 to 25.00 s
Factory setting : 0.30 s
Format: 16 bits
: 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 flux in the motor and to ensure that the slip compensation function has become fully active. When this time delay has elapsed, brake control is enabled (**12.40** = Enabled (1)).
During the whole of this time delay, the ramp applied to the reference is held constant (**02.03** = Yes (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 : 0.00 to 25.00 s
Factory setting : 1.00 s
Format: 16 bits
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 (**02.03** = No).

12.48 : Brake apply delay ( )
Adjustment range : 0.00 to 25.00 s
Factory setting : 1.00 s
Format: 16 bits
This time delay is used to maintain the torque at standstill while the brake is applied. When this time delay has elapsed, the drive output is deactivated.

12.49 and 12.50 : Not used

12.51 : Forced brake release
Adjustment range : Disabled (0) or Enabled (1)
Factory setting : Disabled (0)
Format: 8 bits
When the drive output is active (**10.02** = Yes (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 Enabled (1) if **12.51** is at Enabled (1).
12.51 can be assigned to a digital input but cannot be written to.

12.52 to 12.60 : Not used

12.61 : Comparator 3 output
Adjustment range : Disabled (0) or Enabled (1)
Format: 8 bits

Disabled (0):
The input variable is less than or equal to the comparator threshold.

Enabled (1):
The input variable is greater than the comparator threshold.

12.62 : Not used

12.63 : Comparator 3 source
Adjustment range : **00.00** to **21.51**
Factory setting : **00.00**
Format: 16 bits
This parameter defines the variable that is to be compared to the configured threshold.
The absolute value of the variable is used. Only non-bit parameters can be programmed as the source.
If an unsuitable parameter is programmed, the input value equals 0.

12.64 : Comparator 3 threshold
Adjustment range : 0.00 to 60000.00 *
Factory setting : 0.00 *
Format: 32 bits
This parameter is used to set the comparator trip threshold.
The threshold is expressed in the unit (rpm, A, V, etc) of the relevant value.

12.65 : Comparator 3 hysteresis
Adjustment range : 0.00 to 60000.00 *
Factory setting : 0.00 *
Format: 32 bits
This parameter defines the window within which the comparator output will not change state.
The output will change to Enabled (1) when the variable reaches the value of **12.64** + **12.65**/2. The output will change to Disabled (0) when the variable goes below the value of **12.64** - **12.65**/2.

12.66 : Comparator 3 level type
Adjustment range : Over level (0), Under level (1), Masked under level (2)
Factory setting : Over level (0)
Format: 8 bits

Over level:
Output not inverted.

Under level (1):
Output inverted.

Masked under level (2):
Output inverted with masking on drive enable.

12.67 : Comparator 3 output destination
Adjustment range : **00.00** to **21.51**
Factory setting : **00.00**
Format: 16 bits
This parameter defines 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 anywhere.

* The unit is defined by the one used for the source parameter of the relevant comparator.

12.68 : Comparator 3 masking
Adjustment range : 0.0 to 255.0 s
Factory setting : 30.0 s
Format: 16 bits
This masking is used, when the threshold type = 1 (under level), to delay detection when the drive is enabled in order to avoid detection on starting.

12.69 :Comparator 3 output delay
Adjustment range : 0.0 to 255.0 s
Factory setting : 1.0 s
Format: 16 bits
This time delay can avoid tripping on a transient event.

12.70 : Not used

12.71 : Comparator 4 output
Adjustment range : Disabled (0) or Enabled (1)
Format: 8 bits

Disabled (0):
The input variable is less than or equal to the comparator threshold.

Enabled (1):
The input variable is greater than the comparator threshold.

12.72 : Not used

12.73 : Comparator 4 source
Adjustment range : **00.00** to **21.51**
Factory setting : **05.03**
Format: 16 bits
This parameter defines the variable that is to be compared to the configured threshold.
The absolute value of the variable is used. Only non-bit parameters can be programmed as the source.
If an unsuitable parameter is programmed, the input value equals 0.

Note:
Comparator 4 is configured as standard to generate an underload.

12.74 : Comparator 4 threshold (Underload in kW)
Adjustment range : 0.00 to 60000.00 *
Factory setting : 0.00 *
Format: 32 bits
This parameter is used to set the comparator trip threshold.
The threshold is expressed in the unit (rpm, A, V, etc) of the relevant value.

* The unit is defined by the one used for the source parameter of the relevant comparator.

12.75 : Comparator 4 hysteresis
Adjustment range : 0.00 to 60000.00 *
Factory setting : 10.00 *
Format: 32 bits
This parameter defines the window within which the comparator output will not change state.
The output will change to Enabled (1) when the variable reaches the value of **12.74** + **12.75**/2. The output will change to Disabled (0) when the variable goes below the value of **12.74** - **12.75**/2.

12.76 : Comparator 4 output invert
Adjustment range : Over level (0), Under level (1), Masked under level (2)
Factory setting : Masked under level (2)
Format: 8 bits

Over level (0):
Output not inverted.

Under level (1):
Output inverted.

Masked under level (2):
Output inverted with masking on drive enable.

12.77 : Comparator 4 output destination
Adjustment range : **00.00** to **21.51**
Factory setting : **00.00**
Format: 16 bits
This parameter defines 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 anywhere.

12.78 : Comparator 4 masking
Adjustment range : 0.0 to 255.0 s
Factory setting : 30.0 s
Format: 16 bits
This masking is used, when the threshold type = 2 (under level with masking), to delay detection when the drive is enabled in order to avoid detection on starting.

12.79 : Comparator 4 output delay
Adjustment range : 0.0 to 255.0 s
Factory setting : 1.0 s
Format: 16 bits
This time delay can avoid tripping on a transient event.

12.80 : Not used

12.81 : Comparator 5 output
Adjustment range : Disabled (0) or Enabled (1)
Format: 8 bits

Disabled (0):

The input variable is less than or equal to the comparator threshold.

Enabled (1):
The input variable is greater than the comparator threshold.

12.82 : Not used

12.83 : Comparator 5 source
Adjustment range : **00.00** to **21.51**
Factory setting : **05.04**
Format: 16 bits
This parameter defines the variable that is to be compared to the configured threshold.
The absolute value of the variable is used. Only non-bit parameters can be programmed as the source.
If an unsuitable parameter is programmed, the input value equals 0.

Note:
Comparator 5 is configured as standard to generate an underspeed.

12.84 : Comparator 5 threshold
Adjustment range : 0.00 to 60000.00 *
Factory setting : 200.00 *
Format: 32 bits
This parameter is used to set the comparator trip threshold.
The threshold is expressed in the unit (rpm, A, V, etc) of the relevant value.

12.85 : Comparator 5 hysteresis
Adjustment range : 0.00 to 60000.00 *
Factory setting : 50.00 *
Format: 32 bits
This parameter defines the window within which the comparator output will not change state.
The output will change to Enabled (1) when the variable reaches the value of **12.84** + **12.85**/2. The output will change to Disabled (0) when the variable goes below the value of **12.84** - **12.85**/2.

12.86 : Comparator 5 output invert
Adjustment range : Over level (0), Under level (1), Masked under level (2)
Factory setting : Masked under level (2)
Format: 8 bits

Over level (0):
Output not inverted.

Under level (1):
Output inverted.

Masked under level (2):
Output inverted with masking on drive enable.

12.87 : Comparator 5 output destination
Adjustment range : **00.00** to **21.51**
Factory setting : **00.00**
Format: 16 bits
This parameter defines 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 anywhere.

* The unit is defined by the one used for the source parameter of the relevant comparator.

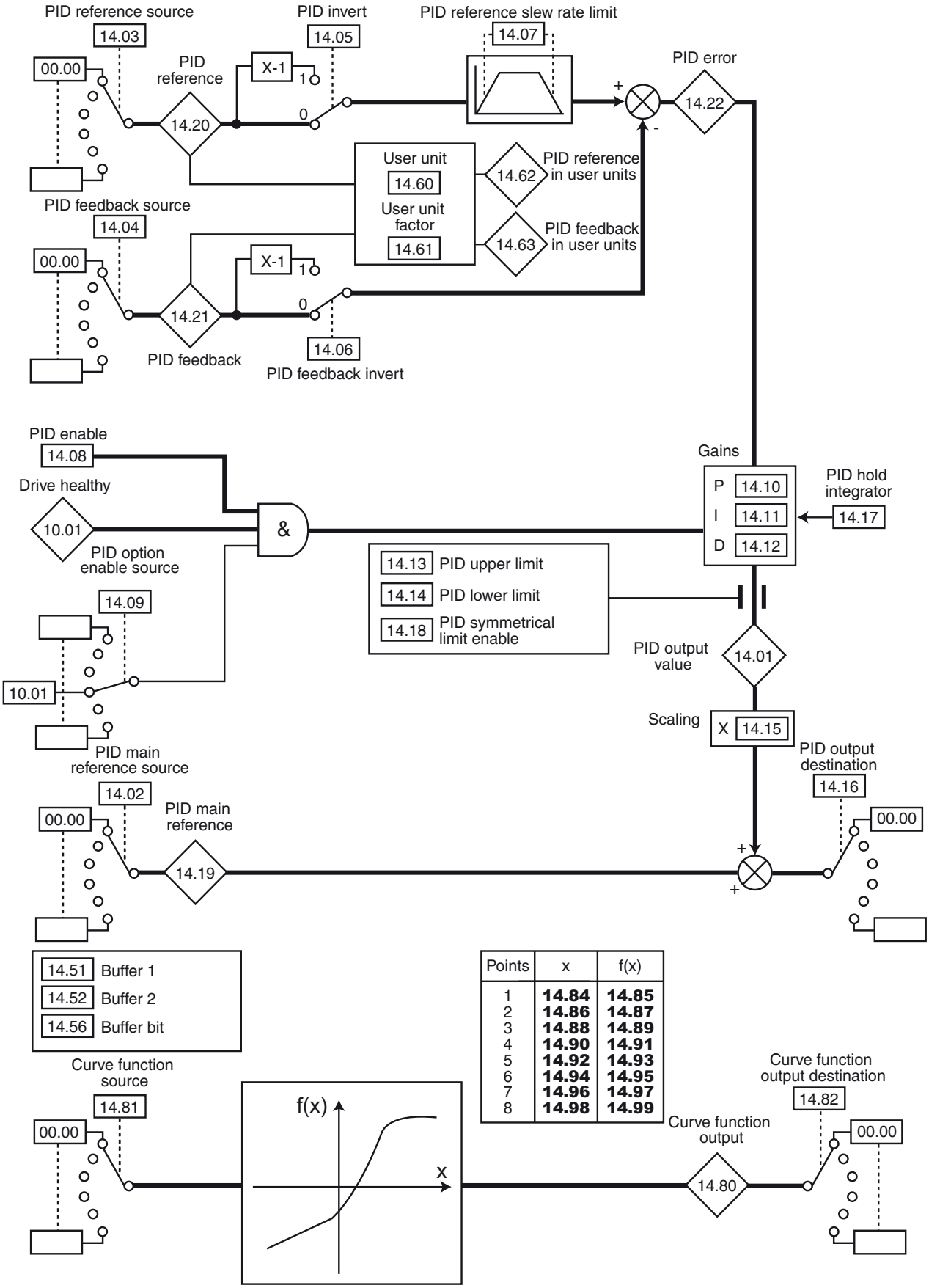
12.88 : Comparator 5 masking
Adjustment range : 0.0 to 255.0 s
Factory setting : 30.0 s
Format: 16 bits
This masking is used, when the threshold type = 2 (under level with masking), to delay detection when the drive is enabled in order to avoid detection on starting.

12.89 : Comparator 5 output delay
Adjustment range : 0.0 to 255.0 s
Factory setting : 1.0 s
Format: 16 bits
This time delay can avoid tripping on a transient event.

5.14 - MENU 13: Reserved

5.15 - Menu 14: PID controller

5.15.1 - Menu 14 diagram



5.15.2 - Explanation of parameters in menu 14

14.01 : PID output value

Adjustment range : ± 100.0%
Format: 16 bits
This parameter indicates the level of the PID controller output before scaling.

14.02 : PID main reference source
Adjustment range : **00.00** to **21.51**
Factory setting : **00.00**
Format: 16 bits
This parameter defines the variable which acts as the main reference for the PID controller.
All the 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 : **00.00** to **21.51**
Factory setting : **00.00**
Format: 16 bits
This parameter defines the variable which acts as a reference on the PID controller.
All the 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 : **00.00** to **21.51**
Factory setting : **00.00**
Format: 16 bits
This parameter defines the variable which acts as a feedback on the PID controller.
All the 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/PID feedback invert
Adjustment range : Disabled (0) or Enabled (1)
Factory setting : Disabled (0)
Format: 8 bits
These parameters are used to invert the sign of the PID reference and feedback.

Disabled (0)
Input not inverted.

Enabled (1):
Input inverted.
14.05: PID invert.
14.06: PID feedback invert.

14.07 : PID reference slew rate limit
Adjustment range : 0.0 to 600.0 s
Factory setting : 0.0 s
Format: 16 bits
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 from -100.0% to +100.0% will take twice as long.

14.08 : PID enable
Adjustment range : Disabled (0) or Enabled (1)
Factory setting : Disabled (0)
Format: 8 bits

Disabled (0):
The PID controller is disabled.

Enabled (1):
The PID controller is enabled.

14.09 : PID option enable source
Adjustment range : **00.00** to **21.51**
Factory setting : **10.01**
Format: 16 bits
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.

14.10 : PID proportional gain
Adjustment range : 0.000 to 32.000
Factory setting : 1.000
Format: 16 bits
This is the proportional gain applied to the PID error.

14.11 : PID integral gain
Adjustment range : 0.000 to 32.000
Factory setting : 0.500
Format: 16 bits
This is the integral gain applied to the PID error before integration.

14.12 : PID derivative gain
Adjustment range : 0.000 to 32.000
Factory setting : 0.000
Format: 16 bits
This is the derivative gain applied to the PID error before derivation.

14.13 : PID upper limit
Adjustment range : ± 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%
Format: 16 bits
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** = Enabled (1) (see **14.18**).

14.15 : PID output scaling
Adjustment range : 0.00 to 2.50
Factory setting : 1.00
Format: 16 bits
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 : **00.00** to **21.51**
Factory setting : **00.00**
Format: 16 bits
Used to define the parameter to which 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 : Disabled (0) or Enabled (1)
Factory setting : Disabled (0)
Format: 8 bits

Disabled (0):
Integration occurs normally when the PID loop is active.

Enabled (1):
The integrator value is frozen and remains at this value until **14.17** changes back to Disabled (0).
In both cases, when the PID controller has been disabled, the integrator value is reset to Disabled (0).

14.18 : PID symmetrical limit enable
Adjustment range : Disabled (0) or Enabled (1)
Factory setting : Disabled (0)
Format: 8 bits
When **14.18** is set to Enabled (1), **14.13** and **14.14** take the same value and **14.13** is the parameter that takes effect.

14.19 : PID main reference
Adjustment range : ± 100.0%
Format: 16 bits
This parameter indicates the value of the main reference.

14.20 : PID reference
Adjustment range : ± 100.0%
Format: 16 bits
This parameter indicates the value of the PID reference.

14.21 : PID feedback
Adjustment range : ± 100.0%
Format: 16 bits
This parameter indicates the value of the PID feedback.

14.22 : PID error
Adjustment range : ± 100.0%
Format: 16 bits
This parameter indicates the error between the main reference and the feedback.

14.23 to 14.50 : Not used

14.51 : Buffer 1
Adjustment range : ± 100.00%
Factory setting : 0.00%
Format: 16 bits
This parameter is used to assign an analog input to the PID reference or feedback.

14.52 : Buffer 2
Adjustment range : ± 100.00%
Factory setting : 0.00%
Format: 16 bits
This parameter is used to assign an analog input to the PID feedback or reference.

14.53 to 14.55 : Not used

14.56 : Buffer bit
Adjustment range : 0 or 1
Factory setting : 0
Format: 8 bits
Binary parameter that can be used as buffer variable.

14.57 to 14.59 : Not used

14.60 : User unit
Adjustment range : % (0), bar (1), mbar (2), Pa (3), PSI (4), °C (5), °F (6), m^3/s (7), m^3/min (8), m^3/h (9), l/min (10)
Factory setting : % (0)
Format: 8 bits
This parameter selects the unit which will be displayed for parameters **14.62** and **14.63**.

14.61 : User unit factor
Adjustment range : ± 200.00
Factory setting : 1.00
Format: 32 bits
This parameter is a multiplication coefficient allowing the PID reference and PID feedback to be displayed as a user-defined value (**14.62** and **14.63**).

14.62 : PID reference in user units
Adjustment range : ± 20000.00
Format: 32 bits
This parameter indicates the value of the PID reference in user units (scaled using **14.61**).

14.63 : PID feedback in user units
Adjustment range : ± 20000.00
Format: 32 bits
This parameter indicates the value of the PID feedback in user units (scaled using **14.61**).
Parameters **14.62** and **14.63** must appear in the read menu.

14.64 to 14.79 : Not used

14.80 : Curve function output

Adjustment range : ± 20000.00
Format: 32 bits
This parameter indicates the value of the function output.

14.81 : Curve function source
Adjustment range : **00.00** to **21.51**
Factory setting : **00.00**
Format: 16 bits
This parameter defines the source parameter for variable to be processed. Only "numerical" parameters can be assigned. If an unsuitable parameter is selected, the value of the variable will be 0.

14.82 : Curve function output destination
Adjustment range : **00.00** to **21.51**
Factory setting : **00.00**
Format: 16 bits
This parameter selects the destination of the variable to be processed. Only non-protected "non-bit" parameter can be assigned. If an unsuitable parameter is selected, the value of the variable taken into account is 0.

14.83 : Not used

14.84, **14.86**, **14.88**, **14.90**, **14.92**, **14.94**, **14.96**, **14.98** : **Abscissas of points 1 to 8 of the curve function**
Adjustment range : ± 20000.00
Factory setting : 0.00
Format: 32 bits

14.85, **14.87**, **14.89**, **14.91**, **14.93**, **14.95**, **14.97**, **14.99** : **Ordinates of points 1 to 8 of the curve function**
Adjustment range : ± 20000.00
Factory setting : 0.00
Format: 32 bits
- **14.85** represents the ordinate of abscissa point **14.84**.
- **14.87** represents the ordinate of abscissa point **14.86**.
- **14.89** represents the ordinate of abscissa point **14.88**.
- **14.91** represents the ordinate of abscissa point **14.90**.
- **14.93** represents the ordinate of abscissa point **14.92**.
- **14.95** represents the ordinate of abscissa point **14.94**.
- **14.97** represents the ordinate of abscissa point **14.96**.
- **14.99** represents the ordinate of abscissa point **14.98**.

Description of the function:
- The function is used to generate a curve from a table of x abscissa points which has a corresponding table of f(x) ordinate points.
- The points in the table can be in any order.
- Between two consecutive abscissa points, the f(x) ordinate points are interpolated linearly.
- If the abscissa defined by the source parameter is less than the smallest abscissa point value of parameters **14.84** to **14.98**, then **14.80** will equal the ordinate corresponding to the smallest abscissa point value of parameters **14.84** to **14.98**.
- If the abscissa defined by the source parameter is greater than the largest abscissa point value of parameters **14.84** to **14.98**, then **14.80** will equal the ordinate corresponding to the largest abscissa point value of parameters **14.84** to **14.98**.

Note:
The ordinate parameters should be configured in the same format as the assignment parameters.

5.16 - Menu 15: Fieldbus options

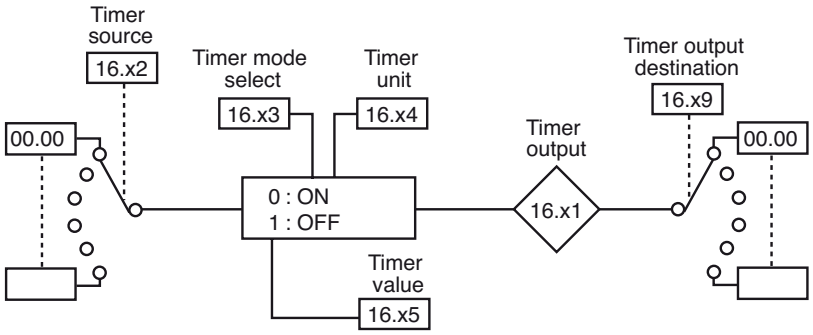
(Please consult the manuals for the corresponding options)

Notes

5.17 - Menu 16: PLC functions

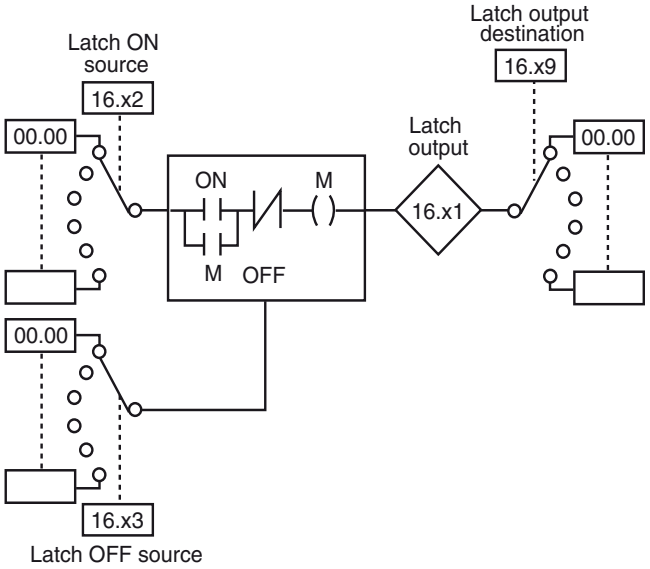
5.17.1 - Menu 16 diagrams

• Timer relays



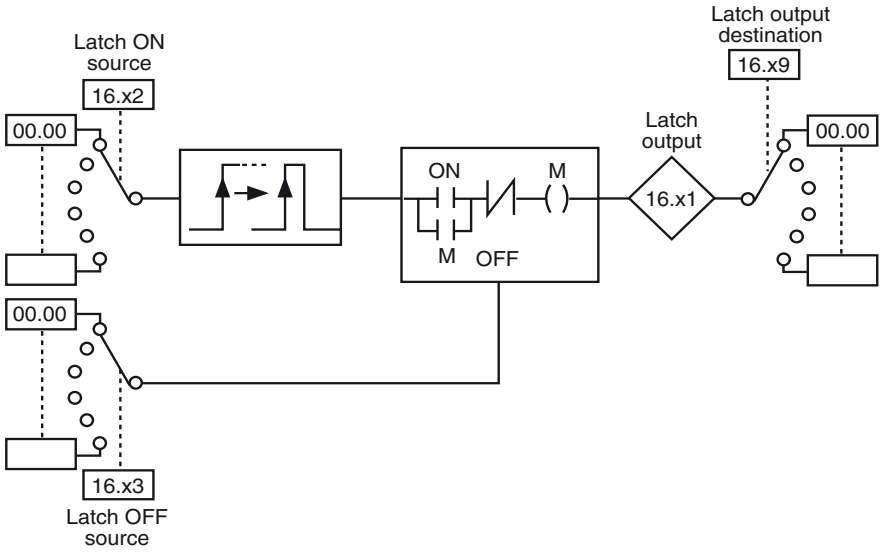
Timer	Source	Timer type	Time delay	Unit of time	Output state	Destination
Timer 1	**16.02**	**16.03**	**16.05**	**16.04**	**16.01**	**16.09**
Timer 2	**16.12**	**16.13**	**16.15**	**16.14**	**16.11**	**16.19**
Timer 3	**16.22**	**16.23**	**16.25**	**16.24**	**16.21**	**16.29**
Timer 4	**16.32**	**16.33**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

• Latching relays 1 and 2



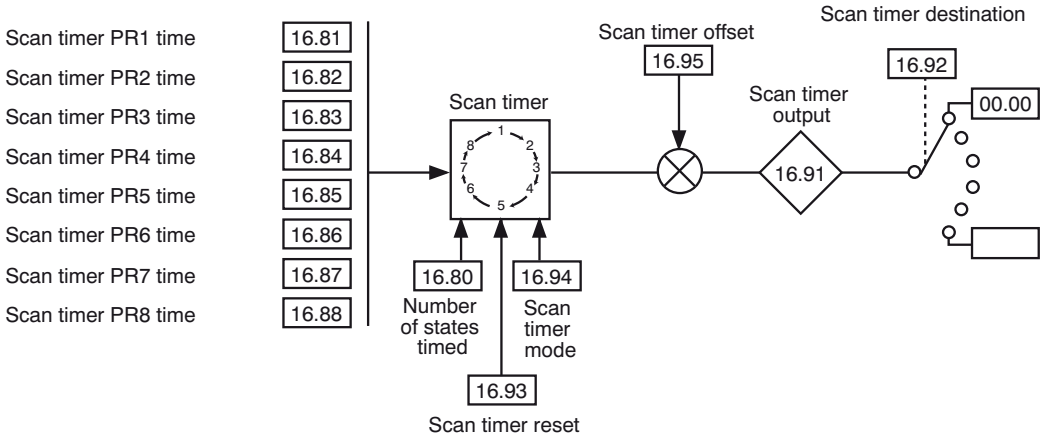
Latching	ON source	OFF source	Output	Output destination
LR 1	**16.42**	**16.43**	**16.41**	**16.49**
LR 2	**16.52**	**16.53**	**16.51**	**16.59**

• Latching relays 3 and 4



Latching	ON source	OFF source	Output	Output destination
LR 3	**16.62**	**16.63**	**16.61**	**16.69**
LR 4	**16.72**	**16.73**	**16.71**	**16.79**

• Scan timer



5.17.2 - Explanation of parameters in menu 16

16.01 : Timer 1 output

Adjustment range : Disabled (0) or Enabled (1)
Format: 8 bits
This parameter indicates the state of the output of timer 1.

16.02 : Timer 1 source
Adjustment range : **00.00** to **21.51**
Factory setting : **00.00**
Format: 16 bits
This parameter is used to select the input source for timer relay 1.
Only "bit" type parameters can be assigned to these inputs. If an unsuitable parameter is addressed, the input will be frozen at 0.

16.03 : Timer 1 mode select
Adjustment range : ON timer (0) or OFF timer (1)
Factory setting : ON timer (0)
Format: 8 bits

ON timer (0):
The relay is used for on-delay timing. The output changing to Enabled (1) is delayed in relation to the input changing to 1.

OFF timer (1):
The relay is used for off-delay timing. The output changing to Disabled (0) is delayed in relation to the input changing to 0.

Note:
Powering-up of the drive is not taken into account as a transition of the input; the timer is therefore not activated.

16.04 : Timer 1 unit
Adjustment range : Second (0), Minute (1), Hour (2)
Factory setting : Second (0)
Format: 8 bits

Second (0):
The unit of time for the timer relay is the second.

Minute (1):
The unit of time for the timer relay is the minute.

Hour (2):
The unit of time for the timer relay is the hour.

16.05 : Timer 1 value
Adjustment range : 0.0 to 60.0
Factory setting : 0.0
Format: 16 bits
This parameter is used to set the delay period for timer 1. The unit depends on the setting of **16.04**.

16.06 to 16.08 : Not used

16.09 : Timer 1 output destination
Adjustment range : **00.00** to **21.51**
Factory setting : **00.00**
Format: 16 bits
This parameter is used to select the destination of the output for timer 1.
Only "bit" type parameters can be assigned to these outputs. If an unsuitable parameter is addressed, the output will be frozen at 0.

16.10 : Not used

16.11 : Timer 2 output

Adjustment range : Disabled (0) or Enabled (1)
Format: 8 bits
This parameter indicates the state of the output of timer 2.

16.12 : Timer 2 source
Adjustment range : **00.00** to **21.51**
Factory setting : **00.00**
Format: 16 bits
This parameter is used to select the input source for timer relay 2.
Only "bit" type parameters can be assigned to these inputs. If an unsuitable parameter is addressed, the input will be frozen at 0.

16.13 : Timer 2 mode select
Adjustment range : ON timer (0) or OFF timer (1)
Factory setting : ON timer (0)
Format: 8 bits

ON timer (0):
The relay is used for on-delay timing. The output changing to Enabled (1) is delayed in relation to the input changing to 1.

OFF timer (1):
The relay is used for off-delay timing. The output changing to Disabled (0) is delayed in relation to the input changing to 0.

Note:
Powering-up of the drive is not taken into account as a transition of the input; the timer is therefore not activated.

16.14 : Timer 2 unit
Adjustment range : Second (0), Minute (1), Hour (2)
Factory setting : Second (0)
Format: 8 bits

Second (0):
The unit of time for the timer relay is the second.

Minute (1):
The unit of time for the timer relay is the minute.

Hour (2):
The unit of time for the timer relay is the hour.

16.15 : Timer 2 value
Adjustment range : 0.0 to 60.0
Factory setting : 0.0
Format: 16 bits
This parameter is used to set the delay period for timer 2. The unit depends on the setting of **16.14**.

16.16 to 16.18 : Not used

16.19 : Timer 2 output destination
Adjustment range : **00.00** to **21.51**
Factory setting : **00.00**
Format: 16 bits
This parameter is used to select the destination of the output for timer 2.
Only "bit" type parameters can be assigned to these outputs. If an unsuitable parameter is addressed, the output will be frozen at 0.

16.20 : Not used

16.21 : Timer 3 output
Adjustment range : Disabled (0) or Enabled (1)
Format: 8 bits
This parameter indicates the state of the output of timer 3.

16.22 : Timer 3 source
Adjustment range : **00.00** to **21.51**
Factory setting : **00.00**
Format: 168 bits
This parameter is used to select the input source for timer relay 3.
Only "bit" type parameters can be assigned to these inputs. If an unsuitable parameter is addressed, the input will be frozen at 0.

16.23 : Timer 3 mode select
Adjustment range : ON timer (0) or OFF timer (1)
Factory setting : ON timer (0)
Format: 8 bits

ON timer (0):
The relay is used for on-delay timing. The output changing to Enabled (1) is delayed in relation to the input changing to 1.

OFF timer (1):
The relay is used for off-delay timing. The output changing to Disabled (0) is delayed in relation to the input changing to 0.

Note:
Powering-up of the drive is not taken into account as a transition of the input; the timer is therefore not activated.

16.24 : Timer 3 unit
Adjustment range : Second (0), Minute (1), Hour (2)
Factory setting : Second (0)
Format: 8 bits

Second (0):
The unit of time for the timer relay is the second.

Minute (1):
The unit of time for the timer relay is the minute.

Hour (2):
The unit of time for the timer relay is the hour.

16.25 : Timer 3 value
Adjustment range : 0.0 to 60.0
Factory setting : 0.0
Format: 16 bits
This parameter is used to set the delay period for timer 3. The unit depends on the setting of **16.24**.

16.26 to 16.28 : Not used

16.29 : Timer 3 output destination
Adjustment range : **00.00** to **21.51**
Factory setting : **00.00**
Format: 16 bits
This parameter is used to select the destination of the output for timer 3.
Only "bit" type parameters can be assigned to these outputs. If an unsuitable parameter is addressed, the output will be frozen at 0.

16.30 : Not used

16.31 : Timer 4 output
Adjustment range : Disabled (0) or Enabled (1)
Format: 8 bits
This parameter indicates the state of the output of timer 4.

16.32 : Timer 4 source
Adjustment range : **00.00** to **21.51**
Factory setting : **00.00**
Format: 16 bits
This parameter is used to select the input source for timer relay 4.
Only "bit" type parameters can be assigned to these inputs. If an unsuitable parameter is addressed, the input will be frozen at 0.

16.33 : Timer 4 mode select
Adjustment range : ON timer (0) or OFF timer (1)
Factory setting : ON timer (0)
Format: 8 bits

ON timer (0):
The relay is used for on-delay timing. The output changing to Enabled (1) is delayed in relation to the input changing to 1.

OFF timer (1):
The relay is used for off-delay timing. The output changing to Disabled (0) is delayed in relation to the input changing to 0.

Note:
Powering-up of the drive is not taken into account as a transition of the input; the timer is therefore not activated.

16.34 : Timer 4 unit
Adjustment range : Second (0), Minute (1), Hour (2)
Factory setting : Second (0)
Format: 8 bits

Second (0):
The unit of time for the timer relay is the second.

Minute (1):
The unit of time for the timer relay is the minute.

Hour (2):
The unit of time for the timer relay is the hour.

16.35 : Timer 4 value
Adjustment range : 0.0 to 60.0
Factory setting : 0.0
Format: 16 bits
This parameter is used to set the delay period for timer 4. The unit depends on the setting of **16.34**.

16.36 to 16.38 : Not used

16.39 : Timer 4 output destination
Adjustment range : **00.00** to **21.51**
Factory setting : **00.00**
Format: 16 bits
This parameter is used to select the destination of the output for timer 4.
Only "bit" type parameters can be assigned to these outputs. If an unsuitable parameter is addressed, the output will be frozen at 0.

16.40 : Not used

16.41 : Latch 1 output
Adjustment range : Disabled (0) or Enabled (1)
Format: 8 bits
This parameter indicates the state of the output of latching relay 1.

16.42 : Latch 1 ON source
Adjustment range : **00.00** to **21.51**
Factory setting : **00.00**
Format: 16 bits
This parameter is used to select the enable source for latching relay 1. A pulse or logic state 1 on the input causes the output to change to Enabled (1).
Only "bit" type parameters can be assigned to this input. If an unsuitable parameter is addressed, the input will be frozen at 0.

16.43 : Latch 1 OFF source
Adjustment range : **00.00** to **21.51**
Factory setting : **00.00**
Format: 16 bits
This parameter is used to select the disable source for latching relay 1. A pulse or logic state 1 on the input causes the output to change to Disabled (0).
Only "bit" type parameters can be assigned to this input. If an unsuitable parameter is addressed, the input will be frozen at 0.

16.44 to 16.48 : Not used

16.49 : Latch 1 output destination
Adjustment range : **00.00** to **21.51**
Factory setting : **00.00**
Format: 16 bits
This parameter is used to select the destination of the output of latching relay 1.
Only "bit" type parameters can be assigned to this output. If an unsuitable parameter is addressed, the output will be frozen at 0.

16.50 : Not used

16.51 : Latch 2 output
Adjustment range : Disabled (0) or Enabled (1)
Format: 8 bits
This parameter indicates the state of the output of latching relay 2.

16.52 : Latch 2 ON source
Adjustment range : **00.00** to **21.51**
Factory setting : **00.00**
Format: 16 bits
This parameter is used to select the enable source for latching relay 2. A pulse or logic state 1 on the input causes the output to change to Enabled (1).
Only "bit" type parameters can be assigned to this input. If an unsuitable parameter is addressed, the input will be frozen at 0.

16.53 : Latch 2 OFF source
Adjustment range : **00.00** to **21.51**
Factory setting : **00.00**
Format: 16 bits
This parameter is used to select the disable source for latching relay 2. A pulse or logic state 1 on the input causes the output to change to Disabled (0).
Only "bit" type parameters can be assigned to this input. If an unsuitable parameter is addressed, the input will be frozen at 0.

16.54 to 16.58 : Not used

16.59 : Latch 2 output destination
Adjustment range : **00.00** to **21.51**
Factory setting : **00.00**
Format: 16 bits
This parameter is used to select the destination of the output of latching relay 2.
Only "bit" type parameters can be assigned to this output. If an unsuitable parameter is addressed, the output will be frozen at 0.

16.61 : Latch 3 output
Adjustment range : Disabled (0) or Enabled (1)
Format: 8 bits
This parameter indicates the state of the output of latching relay 3.

16.62 : Latch 3 ON source
Adjustment range : **00.00** to **21.51**
Factory setting : **00.00**
Format: 16 bits
This parameter is used to select the enable source for latching relay 3. Only a pulse on the input causes the output to change to Enabled (1).
Only "bit" type parameters can be assigned to this input. If an unsuitable parameter is addressed, the input will be frozen at 0.

16.63 : Latch 3 OFF source
Adjustment range : **00.00** to **21.51**
Factory setting : **00.00**
Format: 16 bits
This parameter is used to select the disable source for latching relay 3. A pulse or logic state 1 on the input causes the output to change to Disabled (0).
Only "bit" type parameters can be assigned to this input. If an unsuitable parameter is addressed, the input will be frozen at 0.

16.64 to 16.68 : Not used

16.69 : Latch 3 output destination
Adjustment range : **00.00** to **21.51**
Factory setting : **00.00**
Format: 16 bits
This parameter is used to select the destination of the output of latching relay 3.
Only "bit" type parameters can be assigned to this output. If an unsuitable parameter is addressed, the output will be frozen at 0.

16.70 : Not used

16.71 : Latch 4 output
Adjustment range : Disabled (0) or Enabled (1)
Format: 8 bits
This parameter indicates the state of the output of latching relay 4.

16.72 : Latch 4 ON source
Adjustment range : **00.00** to **21.51**
Factory setting : **00.00**
Format: 16 bits
This parameter is used to select the enable source for latching relay 4. Only a pulse on the input causes the output to change to Enabled (1).
Only "bit" type parameters can be assigned to this input. If an unsuitable parameter is addressed, the input will be frozen at 0.

16.73 : Latch 4 OFF source
Adjustment range : **00.00** to **21.51**
Factory setting : **00.00**
Format: 16 bits
This parameter is used to select the disable source for latching relay 4. A pulse or logic state 1 on the input causes the output to change to Disabled (0).
Only "bit" type parameters can be assigned to this input. If an unsuitable parameter is addressed, the input will be frozen at 0.

16.74 to 16.78 : Not used

16.79 : Latch 4 output destination
Adjustment range : **00.00** to **21.51**
Factory setting : **00.00**
Format: 16 bits
This parameter is used to select the destination of the output of latching relay 4.
Only "bit" type parameters can be assigned to this output. If an unsuitable parameter is addressed, the output will be frozen at 0.

16.80 : Number of states timed
Adjustment range : 0 to 8
Factory setting : 0
Format: 8 bits

0 :
Scan timer disabled.

1 to 8:
Used to configure the number of scan timer states.
For example, if **16.80** = 3, the scan timer will run a scan 1 --> 2 --> 3 --> 1 ...

16.81 : Scan timer PR1 time
Adjustment range : 0 to 9999 s
Factory setting : 0 s
Format: 16 bits
Determines how long the scan timer stays at state 1.

16.82 : Scan timer PR2 time
Adjustment range : 0 to 9999 s
Factory setting : 0 s
Format: 16 bits
Determines how long the scan timer stays at state 2.

16.83 : Scan timer PR3 time
Adjustment range : 0 to 9999 s
Factory setting : 0 s
Format: 16 bits
Determines how long the scan timer stays at state 3.

16.84 : Scan timer PR4 time
Adjustment range : 0 to 9999 s
Factory setting : 0 s
Format: 16 bits
Determines how long the scan timer stays at state 4.

16.85 : Scan timer PR5 time
Adjustment range : 0 to 9999 s
Factory setting : 0 s
Format: 16 bits
Determines how long the scan timer stays at state 5.

16.86 : Scan timer PR6 time
Adjustment range : 0 to 9999 s
Factory setting : 0 s
Format: 16 bits
Determines how long the scan timer stays at state 6.

16.87 : Scan timer PR7 time
Adjustment range : 0 to 9999 s
Factory setting : 0 s
Format: 16 bits
Determines how long the scan timer stays at state 7.

16.88 : Scan timer PR8 time
Adjustment range : 0 to 9999 s
Factory setting : 0 s
Format: 16 bits
Determines how long the scan timer stays at state 8.

16.89 and 16.90 : Not used

16.91 : Scan timer output
Adjustment range : -127 to +135
Format: 16 bits
Indicates the scan timer state.

16.92 : Scan timer destination
Adjustment range : **00.00** to **21.51**
Factory setting : **00.00**
Format: 16 bits
Used to define the parameter to which the scan timer state is addressed.
For example, to scan several speeds, choose **01.15** as destination.

16.93 : Scan timer reset
Adjustment range : No (0) or Yes (1)
Factory setting : No (0)
Format: 8 bits
When this parameter changes to Yes (1), the scan timer is reset to 0. In this case, the scan timer returns to state 1. Can be used to control cycle starting via a digital input.

16.94 : Scan timer mode
Adjustment range : 1st state at start order (0),
Always running (including in stop) (1),
Last state at start order (2),
Factory setting : 1st state at start order (0)
Format: 8 bits

1st state at start order (0):
On the run command, the scan timer is initialised on state 1.

Always running (including in stop) (1):
The scan timer runs permanently, even at standstill (1)

Last state at start order (2):
On the run command, the scan timer reverts to the previous state.

16.95 : Scan timer offset
Adjustment range : ± 127
Factory setting : 0
Format: 16 bits
Used to add an offset with the value from the scan timer.

5.18 - Menu 17: Diagnostics

Parameters **17.01** to **17.09** are only available on MD2S or MD2CS units.

17.01 : Control and interface board test
Adjustment range : No (0) or Yes (1)
Factory setting : No (0)
Format: 8 bits
This test consists of checking that the control and interface boards are working correctly. Before enabling the test:
- If an external power supply is being used, disconnect the power module and leave only the supply to the electronics.
- If an internal power supply is being used for the electronics, disconnect the internal wiring and connect an external power supply, so as to disconnect the power module and leave only the electronics supplied with power. (For this connection, refer to the installation manual, sections 1 and 3 for the drive concerned.)
All I/O and relays must also be disconnected, apart from the Safe Torque Off input (terminals STO1 and STO2), which must be closed. The test only starts if the bus voltage is less than 50 V. The test result is displayed in parameter **17.05**.
At the end of the test, an automatic reset is carried out (equivalent to the reset when the drive is powered down and then powered up again), in particular a reset to zero of parameters **17.33** to **17.39**, **17.42** to **17.49**, and **17.52** to **17.59**).
After the test, reconnect everything.

No (0):
The board test is not enabled.

Yes (1):
The board test is enabled.

17.02 : Power module test
Adjustment range : No (0) or Yes (1)
Factory setting : No (0)
Format: 8 bits

• During this test, current is flowing in the motor.

Note: This test is available only for POWERDRIVE MD2S or MD2CS versions (the drive must control the preloading of capacitors on the DC bus, therefore 10.75 must be set to No (0)).

This test consists of checking that the power circuits are working correctly.

No (0):
The power test is not enabled.

Yes (1):
The power test is enabled. If the bus voltage is higher than 70 V, the drive waits for the bus to discharge naturally (this can take over 5 minutes). For the test to work, the Safe Torque Off inputs must be closed. If this is not the case, a "Diagnostic" trip is generated and the test result **17.06** indicates "Error STO not connected".

17.03 : Power module autotest
Adjustment range : No (0) or Yes (1)
Factory setting : Yes (1)
Format: 8 bits

• Caution, during this test, current is flowing in the motor.

Note: This self-test is available only for standard POWERDRIVE MD2S or MD2CS versions (the drive must control the preloading of capacitors on the DC bus, therefore 10.75 must be set to No (0)).
This self-test is recommended for checking the power components on each power-up. It lasts for less than 5 seconds since, in this instance, the bus is not loaded. It is the same test as in **17.02**.

No (0):
The power self-test is not enabled.

Yes (1):
Enabling of the power module test, which will be performed each time the drive is powered up.
To work, the STO inputs must be closed.
At the end of the test, if a "Diagnostic" trip appears, read the result of the power module test in 17.06, and then get in touch with your usual LEROY-SOMER contact.

17.04 : Not used

17.05 : Control and interface board test result
Adjustment range : Processing (0), Passed (1),
Error control board (2),
Error interface board (3), None (4)
Format: 8 bits

Processing (0):
The test is in progress. If this state lasts for several seconds, check that the power module has been disconnected (only the electronics should still be supplied with power) and that the bus voltage is less than 50 V.

Passed (1):
The test has been performed successfully, or has not yet been enabled.

Error control board (2):
A problem has been detected on the control board. The "Diagnostic" trip is triggered. Check that the conditions given in **17.01** have been complied with. If so, note the values of **17.08** and **17.09** and get in touch with your usual LEROY-SOMER contact.

Error interface board (3):
A problem has been detected on the interface board. The "Diagnostic" trip is triggered. Check that the conditions given in **17.01** have been complied with. If so, note the values of **17.08** and **17.09** and get in touch with your usual LEROY-SOMER contact.

None (4):
No test has been performed.

17.06 : Power module test result

Adjustment range : Processing (0), Passed (1), Error U phase (2), Error V phase (3), Error W phase (4), Error rectifier (5), Error motor (6), Error U and V phase (7), Error V and W phase (8), Error U and W phase (9), Error STO not connected (10), None (15)

Format: 8 bits

If **17.06** is not set to "Passed (1)", refer to the table below for more information.

17.06	17.08	Comment/Description of the problem
Processing (0)	-	The test is in progress.
Passed (1)	-	The test has been performed successfully.
Error U phase (2) **Error V phase (3)** **Error W phase (4)**	00013 00014 00015	- Trip on the IGBT or "Driver" board in the output module U (**17.06** = 2); V (**17.06** = 3); W (**17.06** = 4) - Connection problem between boards in the output module U (**17.06** = 2); V (**17.06** = 3); W (**17.06** = 4) - Short-circuit between phases at the drive output or motor insulation problem
	00004 00005 00008 00009 00001	- No control signal on output module U (**17.06** = 2); V (**17.06** = 3); W (**17.06** = 4) - Motor cables wrongly connected
	00020 00021 00022	- Incorrect reading of the temperature on module U (**17.06** = 2); V (**17.06** = 3); W (**17.06** = 4)
Error rectifier (5)	00017	- Line reactor cables wrongly connected - DC BUS preloading circuit faulty - One or both fuses for measuring the DC bus voltage blown
	00011	- DC BUS voltage measurement incorrect - Rectifier module faulty
	00007	- DC bus DC voltage measurement incorrect - DC BUS discharge time too long
	00019	- Incorrect rectifier temperature reading.
Motor failure (6):	00012	- Short-circuit between 2 drive output phases
	00016	- Short-circuit between one drive output phase and earth - One of the fuses for measuring the DC bus voltage blown
Error U and V phase (7) **Error V and W phase (8)** **Error U and W phase (9)**	00010 00002	- Current sensor faulty
	00013	- Power supply board malfunction
	00023	- Incorrect reading of the temperature on module U (**17.06** = 2); V (**17.06** = 3); W(**17.06** = 4)
Error STO open (10)	00018	The STO inputs are not active. Check that terminals STO1 and STO2 are connected correctly and restart the test.
None (15)	None	- No test has been performed - Mains phase missing - Problem reading the mains voltage on the rectifier bridge

If a problem persists, read the value of **17.08**. Then run a control and interface board test, and note the new values of **17.08** and **17.09** before getting in touch with your usual LEROY-SOMER contact.

17.07 : **Not used**

17.08 : **Error code 1**

Adjustment range : 0 to 65535
Format: 16 bits
An internal code, for more accurately determining the problems on the control and interface board or power test. Make a note of this before getting in touch with your usual LEROY-SOMER contact.

17.09 : **Error code 2**

Adjustment range : 0 to 65535
Format: 16 bits
An internal code, for more accurately determining the problems on the control and interface board test. Make a note of this before getting in touch with your usual LEROY-SOMER contact.

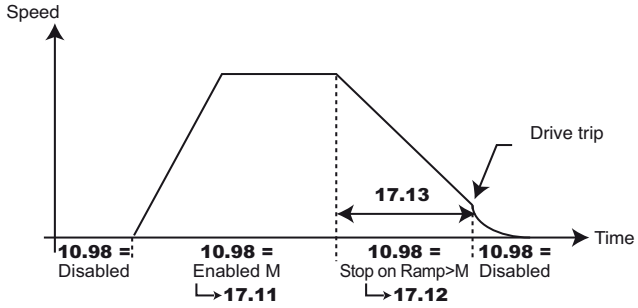
17.10 : **Not used**

17.11 : **Status preceding 17.12 status**

Adjustment range : 0 to 37 (see **10.98**)
Format: 8 bits
This is the drive status before the trip.

17.12 : **Status at fault**

Adjustment range : 0 to 37 (see **10.98**)
Format: 8 bits
This is the drive status at the time of the trip.



17.13 : **Time between states**

Adjustment range : 0.000 to 6000.000 s
Format: 32 bits
Indicates the time that has elapsed between drive states **17.11** and **17.12**. This time is a multiple of 2 ms. If the parameter displays 6000,000 s, this indicates that the elapsed time exceeds the display capacity.

17.14 to **17.17** : **Not used**

17.18 and **17.19** : **Counter duration fault - 1**

Adjustment range : 0.000 to 9.364 (a, j) (**17.18**)
Adjustment range : 00.00 to 23.59 (h, m) (**17.19**)
Format: 16 bits

17.20 and **17.21** : **Counter duration fault - 2**

Adjustment range : 0.000 to 9.364 (a, j) (**17.20**)
Adjustment range : 00.00 to 23.59 (h, m) (**17.21**)
Format: 16 bits

17.22 and **17.23** : **Counter duration fault - 3**

Adjustment range : 0.000 to 9.364 (a, j) (**17.22**)
Adjustment range : 00.00 to 23.59 (h, m) (**17.23**)
Format: 16 bits

17.24 and **17.25** : **Counter duration fault - 4**

Adjustment range : 0.000 to 9.364 (a, j) (**17.20**)
Adjustment range : 00.00 to 23.59 (h, m) (**17.25**)
Format: 16 bits

17.26 and **17.27** : **Counter duration fault - 5**

Adjustment range : 0.000 to 9.364 (a, j) (**17.26**)
Adjustment range : 00.00 to 23.59 (h, m) (**17.27**)
Format: 16 bits
These counters indicate the operating time since the drive was first commissioned until the occurrence of trip -5 (see **06.22** and **06.23**).

Note:
Trip -5 corresponds to the trip displayed in **10.24**.

17.28 : **Not used**

17.29 : **Reset of measured maximum**

Adjustment range : No (0) or Yes (1)
Factory setting : No (0)
Format: 8 bits

No (0):
Values of parameters **17.30** to **17.34** not reset.

Yes (1):
Values of parameters **17.30** to **17.34** are reset.

17.30 : **Maximum supply voltage**

Adjustment range : 0 to 999 V
Format: 16 bits
The maximum of the average **17.37** equals 0 after a reset (**17.29**) so long as no run command is given.

17.31 : Minimum supply voltage

Adjustment range : 0 to 999 V
Format: 16 bits
The minimum of the average **17.37** equals 999 after a reset (**17.29**) so long as no run command is given.

17.32 : Maximum motor current

Adjustment range : 0.00 to 2.2 x **11.32**
Format: 32 bits
The maximum of the average **17.40** equals 0 after a reset (**17.29**) so long as no run command is given.

17.33 : Maximum control board temperature

Adjustment range : 0 to 200°C
Format: 16 bits
The maximum of **17.46** equals 0 after a reset (**17.29**) so long as no run command is given.

17.34 : Maximum U,V,W phase temperature

Adjustment range : 0 to 200°C
Format: 16 bits
The maximum of the instant value of **17.42**, **17.43** and **17.44** equals 0 after a reset (**17.29**) so long as no run command is given.

17.35 : Not used

17.36 : Time constant

Adjustment range : 32 ms (0), 64 ms (1), 128 ms (2), 256 ms (3), 512 ms (4), 1 s (5), 2 s (6)
Factory setting : 32 ms (0)
Format: 8 bits
Used to set the time constant of the filter to the average of the average values given in **17.37**, **17.38**, **17.39** and **17.40**.

17.37 : Average supply voltage

Adjustment range : 0 to 999 V
Format: 16 bits
Average supply voltage at the time of the last drive trip, filtered by **17.36**.

17.38 : Average DC bus

Adjustment range : 0 to 1300 V
Format: 16 bits
Average bus voltage at the time of the last drive trip, filtered by **17.36**.

17.39 : Average motor speed

Adjustment range : ± 60000 rpm
Format: 32 bits
Average speed filtered by **17.36** at the time of the last trip.

17.40 : Average motor current

Adjustment range : 0 to 2.22 x **11.32**
Format: 32 bits
Average motor current at the time of the last trip, filtered by **17.36**.

17.41 : Not used

17.42 : Average U phase temperature

Adjustment range : 0 to 200°C
Format: 16 bits
Average temperature of module U at the time of the last drive trip, filtered at 128 ms.

17.43 : Average V phase temperature

Adjustment range : 0 to 200°C
Format: 16 bits
Average temperature of module V at the time of the last drive trip, filtered at 128 ms.

17.44 : Average W phase temperature

Adjustment range : 0 to 200°C
Format: 16 bits
Average temperature of module W at the time of the last drive trip, filtered at 128 ms.

17.45 : Average rectifier bridge temperature

Adjustment range : 0 to 200°C
Format: 16 bits
Average rectifier temperature at the time of the last drive trip, filtered at 128 ms.

17.46 : Average control board temperature

Adjustment range : 0 to 200°C
Format: 16 bits
Average temperature of the control board at the time of the last drive trip, filtered at 128 ms.

17.47 : Not used

17.48 to 17.54 : 7 last values of the supply voltage at trip

Adjustment range : 0 to 999 V
Format: 16 bits

17.48: Supply voltage at trip
17.49: Supply voltage at T-4ms
17.50: Supply voltage at T-8ms
17.51: Supply voltage at T-12ms
17.52: Supply voltage at T-16ms
17.53: Supply voltage at T-20ms
17.54: Supply voltage at T-24ms

17.55 : Not used

17.56 to 17.62 : 7 last values of the motor speed at trip

Adjustment range : ± 60000 rpm
Format: 32 bits

17.56 : Motor speed at trip
17.57 : Motor speed at T-4ms
17.58 : Motor speed at T-8ms
17.59 : Motor speed at T-12ms
17.60 : Motor speed at T-16ms
17.61 : Motor speed at T-20ms
17.62 : Motor speed at T-24ms

17.63 : Not used

17.64 : DC bus and motor current sampling

Adjustment range : 1 to 4
Factory setting : 1
Format: 8 bits
Used to define the acquisition time base.

17.65 to 17.81 : 17 last values of the DC bus at T0 (trip)

Adjustment range : 0 to 1300 V
Format: 16 bits
Fd = Switching frequency

17.65 : DC bus value at T-1 x **17.64**/fd
17.66 : DC bus value at T-1 x **17.64**/fd
17.67 : DC bus value at T-2 x **17.64**/fd
17.68 : DC bus value at T-3 x **17.64**/fd
17.69 : DC bus value at T-4 x **17.64**/fd
17.70 : DC bus value at T-5 x **17.64**/fd
17.71 : DC bus value at T-6 x **17.64**/fd
17.72 : DC bus value at T-7 x **17.64**/fd
17.73 : DC bus value at T-8 x **17.64**/fd
17.74 : DC bus value at T-9 x **17.64**/fd
17.75 : DC bus value at T-10 x **17.64**/fd
17.76 : DC bus value at T-11 x **17.64**/fd
17.77 : DC bus value at T-12 x **17.64**/fd
17.78 : DC bus value at T-13 x **17.64**/fd
17.79 : DC bus value at T-14 x **17.64**/fd
17.80 : DC bus value at T-15 x **17.64**/fd
17.81 : DC bus value at T-16 x **17.64**/fd

17.82 : Not used

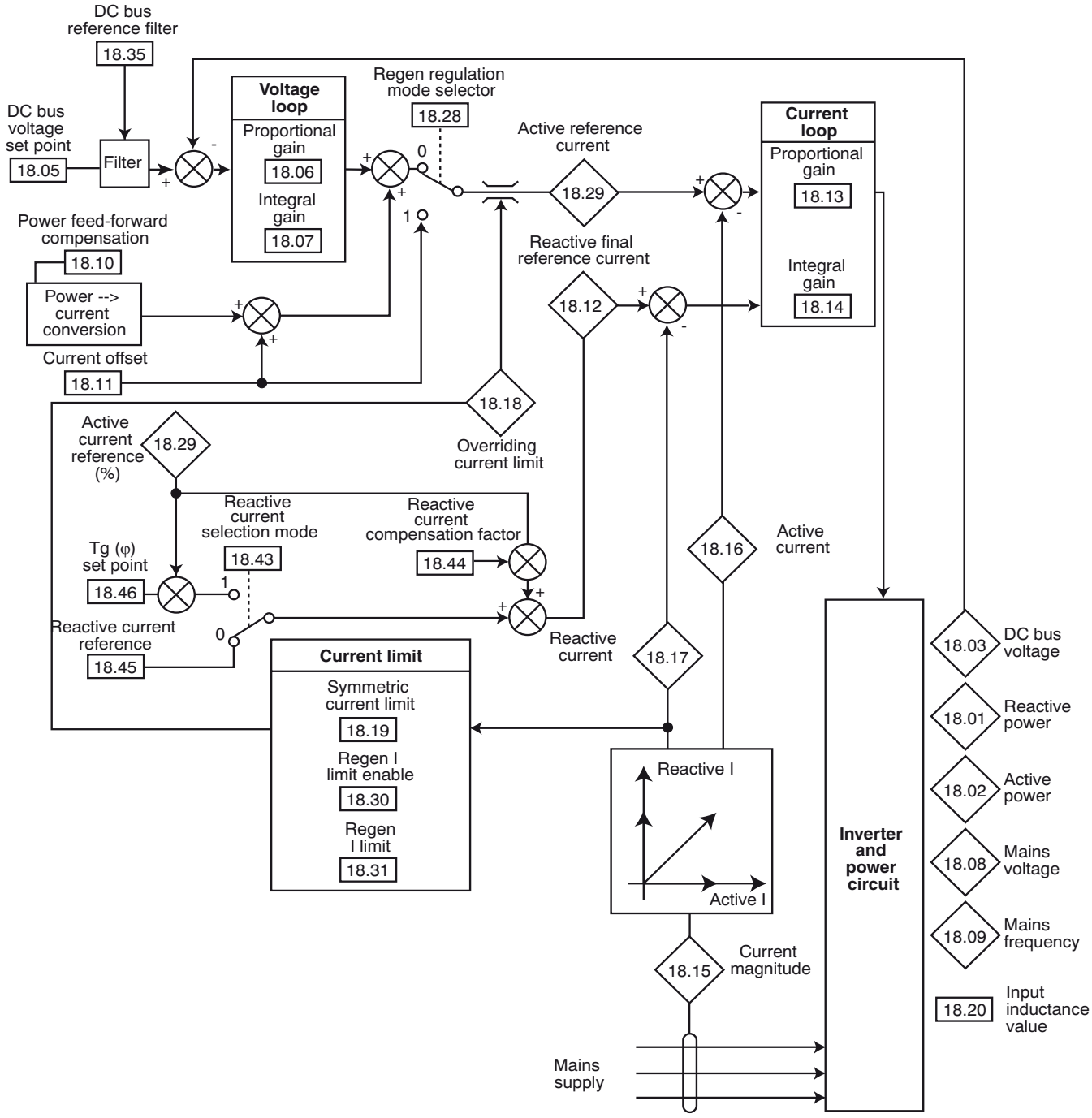
17.83 to 17.99 : 17 last values of the motor current at trip

Adjustment range : 0.00 to 2.2 x **11.32**
Format: 32 bits
Fd = Switching frequency

17.83 : Motor current value at T0 (trip)
17.84 : Motor current value at T-1 x **17.64**/fd
17.85 : Motor current value at T-2 x **17.64**/fd
17.86 : Motor current value at T-3 x **17.64**/fd
17.87 : Motor current value at T-4 x **17.64**/fd
17.88 : Motor current value at T-5 x **17.64**/fd
17.89 : Motor current value at T-6 x **17.64**/fd
17.90 : Motor current value at T-7 x **17.64**/fd
17.91 : Motor current value at T-8 x **17.64**/fd
17.92 : Motor current value at T-9 x **17.64**/fd
17.93 : Motor current value at T-10 x **17.64**/fd
17.94 : Motor current value at T-11 x **17.64**/fd
17.95 : Motor current value at T-12 x **17.64**/fd
17.96 : Motor current value at T-13 x **17.64**/fd
17.97 : Motor current value at T-14 x **17.64**/fd
17.98 : Motor current value at T-15 x **17.64**/fd
17.99 : Motor current value at T-16 x **17.64**/fd

5.19 - Menu 18: Regen mode

5.19.1 - Menu 18 diagram



5.19.2 - Explanation of parameters in menu 18

• Menu reserved for POWERDRIVE MD2R drives.

Before changing settings in menu 18:
- Drive powered down, connect the keypad or parameter-setting interface to the rectifier, power up the **POWERDRIVE** then:
- Set **11.66** = Rectifier of Regen (2)
- Check that **11.31** = Active rectifier on Main power (4) and **10.75** = Yes (1)
- Power down the drive, connect the HMI to the inverter, power it up again, then:
- Then set **11.66** = Inverter of Regen (1)
- Set **11.31** in the desired operating mode (Induction motor in open loop mode (1) ▣, Induction motor in vector control mode (2) ▣, or PM motor (Servo) in vector control mode (3) ▣)
- Leave **10.75** = Yes (1)
- Power down the drive, then power it up again
- Then configure menu 18

For any further information, please get in touch with your usual LEROY-SOMER contact.

18.01 : Reactive power

Adjustment range : ± 3200.00 kVA
Format: 32 bits

If the parameter is positive, the current is lagging the voltage.
If the parameter is negative, the current is leading the voltage.

18.02 : Active power

Adjustment range : ± 3200.00 kW
Format: 32 bits

18.02 is the absorbed active power measured by the drive.
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).

18.03 : DC bus voltage

Adjustment range : 0 to 1300 V
Format: 16 bits
Indicates the DC bus voltage measurement in Regen mode only.

18.04 : Regen restart mode

Adjustment range : Synchro x3 (0), Synchro x1 (1), Without synchro (2)
Factory setting : Synchro x1 (1)
Format: 8 bits
Defines the start mode when enabled.

Synchro x3 (0):
Three attempts to resynchronise. Then, in the event of failure, the "Mains synchro" trip is generated.

Synchro x1 (1):
Only one attempt to synchronise. In the event of failure, the "Mains synchro" trip is generated immediately.

Without Synchro (2):
Reserved.

18.05 : DC bus voltage set point

Adjustment range : 0 to 1300 V
Factory setting : 660 V
Format: 16 bits
The sinusoidal rectifier sets the DC bus to the level specified by this parameter. The bus voltage must always be greater than the supply voltage between phases x √2.
Recommended values:
Mains supply 400 V: 660 V
Mains supply 460 V: 740 V
Mains supply 480 V: 760 V
Mains supply 690 V: 1070 V

18.06 : Voltage loop proportional gain

Adjustment range : 0 to 32000
Factory setting : 1000
Format: 16 bits

18.07 : Voltage loop integral gain

Adjustment range : 0 to 32000
Factory setting : 20
Format: 16 bits

18.08 : Mains voltage

Adjustment range : 0 to 999 V
Format: 16 bits
This is the rms voltage at the Regen drive input.

18.09 : Mains frequency

Adjustment range : ± 400.0 Hz
Format: 16 bits
Indicates the mains frequency.

18.10 : Power feed forward compensation

Adjustment range : 0.00 to 100.00%
Factory setting : 0.00%
Format: 16 bits
This parameter can be used to reduce the transient voltages of the DC bus in the event of load power impacts.

18.11 : Current offset

Adjustment range : ± 300.0%
Factory setting : 0.0%
Format: 16 bits
This parameter is used as the active current reference when the drive is configured for current control (**18.28**). Specify a positive reference for the power to be absorbed from the mains supply to the drive and a negative reference for the power to flow from the drive to the mains supply.

18.12 : Reactive final reference current

Adjustment range : ± 300.0%
Format: 16 bits
Reading of the reactive reference current after application of compensations.

18.13 : Current loop proportional gain

18.14 : Current loop integral gain

Adjustment range : 0 to 250
Factory setting : **18.13** = 30
18.14 = 40
Format: 16 bits
Due to a number of factors internal to the drive, 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 **18.13**
- Then reduce the integral gain **18.14**

18.15 : Current magnitude

Adjustment range : 0.00 to 2.2 x **11.32**
Format: 32 bits
Reading of the rms current in each drive input phase. This is the result of the vectorial sum of the reactive current and the active current.

Note:
The adjustment range of **18.15** is limited by the max. drive current (drive I_{max} = 2.22 x **11.32**).

18.16 : Active current

Adjustment range : ± 2.2 x **11.32**
Format: 32 bits
Reading of the active current absorbed by the drive. The active current reflects the drive load. A negative value indicates that power is returned to the mains supply, whilst a positive value indicates that the drive absorbs the power from the mains supply.

Note:
Max. drive current = 2.22 x **11.32**

18.17 : Reactive current

Adjustment range : ± 2.2 x **11.32**
Format: 32 bits
Reading of the reactive current on the mains supply side: This current is not directly linked to the load level and is used to vary the power factor (cos φ):
- If the parameter is positive, the absorbed current lags the supply voltage
- If the parameter is negative, the absorbed current leads the supply voltage

Note:
Max. drive current = 2.22 x **11.32**.

18.18 : Overriding current limit

Adjustment range : 0 to 300%
Format: 16 bits
Indication of the rms current limit value of the Regen drive. This value depends on **18.19** and limits internal to the drive.

18.19 : Symmetric current limit

Adjustment range : 0.0 to 300.0%
Factory setting : 150.0%
Format: 16 bits
Used to set the maximum permanent current limit permitted when both absorbing and returning power.
The **18.19** current limit depends on **18.26**.

18.20 : Input inductance value

Reserved

18.21 : Regen healthy

Adjustment range : Disabled (0) or Enabled (1)
Format: 8 bits
Indicates whether the drive is synchronised with the mains supply in regenerative mode. In this mode, after a run command, the drive first detects the mains supply phase and synchronises with it. Until this synchronisation is achieved, this parameter indicates "Disabled". Once it is finished, the parameter changes to "Enabled" and load can be applied to the DC bus.

18.22 : Binary statuses 10.01 to 10.15 in Regen

Adjustment range : 0 to 32767
Format: 16 bits
Binary state of parameters **10.01** to **10.15** of the Regen drive. A copy of parameter **10.40** of the Regen drive.

18.23 : Regen drive status

Adjustment range : 0 to 36
Format: 8 bits
A copy of parameter **10.98** of the Regen drive.

18.24 : Regen current trip

Adjustment range : 0 to 102
Format: 8 bits
Contains the code for the current trip. See the list of trips for parameters **10.20** to **10.29**. Value 0 indicates that the drive has not tripped. The other values indicate the trip number.

18.25 : Not used

18.26 : Regen rated current

Adjustment range : 0.00 to 2.2 x **11.32**
Factory setting : 0.00 A
Format: 32 bits
Regen drive rated current value. See section 5.6.3 according to the drive rating (**18.26** is equivalent to **05.07**).
The **18.19** current limit depends on **18.26**.

18.27 : Regen switching frequency

Adjustment range : 2 kHz (0) to 18 kHz (19)
Factory setting : 3 kHz (2) for the MD2
4 kHz (4) for the FX
Format: 8 bits
Sets the PWM switching frequency.

18.27	Frequency	18.27	Frequency
0	2 kHz	10	7 kHz
1	2.5 kHz	11	8 kHz
2	**3 kHz**	12	9 kHz
3	3.5 kHz	13	10 kHz
4	**4 kHz**	14	11 kHz
5	4.5 kHz	15	12 kHz
6	5 kHz	16	13 kHz
7	5.5 kHz	17	14 kHz
8	6 kHz	18	16 kHz
9	6.5 kHz	19	18 kHz

Note:
For frequencies higher than 6 kHz, please consult LEROY-SOMER.
For the **POWERDRIVE FX**, the switching frequency must be ≥ 4 kHz (4).

CAUTION:
A high switching frequency reduces the magnetic noise, however it increases the motor temperature rise and the level of radio-frequency interference emission, and reduces the starting torque.
Refer to the installation manual to determine the drive derating according to the frequency.

18.28 : Regen regulation mode selector

Adjustment range : Voltage (0) or Current (1)
Factory setting : Voltage (0)
Format: 8 bits
Sets the control mode of the Regen drive.

Voltage (0):
In this mode, the drive sets the voltage at the DC bus terminals to the reference specified in **18.05**.

Current (1):
In this mode, the drive is controlled by the current value defined in **18.11**: This enables, for example, two Regen inverters to operate simultaneously; a master sets the voltage at the common DC bus terminals and a slave shares the current reference with the master.

18.29 : Active reference current

Adjustment range : ± 300.0%
Format: 16 bits
This parameter indicates the current reference for the drive in Regen mode, coming from the DC voltage regulation when **18.28** is in voltage regulation mode or from the current offset **18.11** when **18.28** is in current control mode. It is expressed as a percentage of the Regen rated current **18.26**. Output via analog channel or serial link assigned to the current reference of another Regen, it can be used to operate two rectifiers in tandem, the master controlling the DC bus voltage, and the slave controlling the current reference **18.29**.
CAUTION:
This tandem operation requires the rectifiers to be connected in a specific manner. Please consult LEROY-SOMER.

18.30 : Regenerating I limit enable

Adjustment range : Disabled (0) or Enabled (1)
Factory setting : Disabled (0):
Format: 8 bits
This parameter is used to define whether or not the Regenerating current limit **18.31** is used.

18.31 : Regenerating I limit

Adjustment range : 0.0 to 300.0%
Factory setting : 150,0%
Format: 16 bits
If **18.30** = Enabled (1) this parameter is used to set the maximum permanent current limit permitted when returning power (from the DC bus to the mains). In this case, parameter **18.19** becomes the absorption limit (from the mains to the DC bus).
If **18.30** = Disabled (0), **18.31** has no effect.

18.32 to 18.34 : Not used

18.35 : DC bus reference filter

Adjustment range : 0 to 10
Factory setting : 0
Format: 8 bits
This parameter is used to insert a filter in the bus voltage reference, such that:
time constant = $2^{18.35}$ ms.

18.36 to **18.39** :Not used

18.40 : Start order for the Regen

Adjustment range : No (0) or Yes (1)
Format: 8 bits
Indicates to the synchronous rectifier the start and stop order in the case where the start order for the synchronous rectifier is controlled automatically by the output inverter.
18.40 = **01.11** (inverter start order) or **10.02** (inverter output activated).

18.41 : Inverter healthy

Adjustment range : No (0) or Yes (1)
Format: 8 bits
Indicates to the input synchronous rectifier that the output inverter bridge is tripped No (0) or healthy Yes (1).

18.42 : Regen mains alarm

Adjustment range : No (0) or Yes (1)
Format: 8 bits
Information about disappearance of the mains. This information can be used by the inverter to manage mains supply breaks.
When **18.42** is at "Yes", this information is transmitted to the inverter bridge to archive the delayed stop mode in parameter **06.03.**

18.43 : Reactive current selection mode

Adjustment range : Set by **18.45** (0) or Set by **18.46** (1)
Factory setting : Set by **18.45** (0)
Format: 8 bits

Set by 18.45 (0):
The reactive current of the Regen inverter is set directly by parameter **18.45**.

Set by 18.46 (1):
The Tg (φ) (Reactive power/Active power) of the Regen inverter is set by the value of parameter **18.46**.

18.44 : Reactive current compensation factor

Adjustment range : ± 20.00%
Factory setting : 0.00%
Format: 16 bits
Used to compensate the reactive current drawn by the mains filter.

18.45 : Reactive reference current

Adjustment range : ± 100.0%
Factory setting : 0.0%
Format: 16 bits
This parameter is used as the reactive current reference. With a value of zero, the input power factor is around 1. A value not equal to zero enables reactive current to be absorbed or produced:
- If the parameter is positive, the absorbed current will lag the supply voltage
- If the parameter is negative, the absorbed current will lead the supply voltage

18.46 : Tg (φ) set point

Adjustment range: -20.000 to 20.000
Factory setting : 0
Format: 16 bits
Depending on the value selected in **18.43**, the value of **18.46** acts as the Tg reference (φ) at the Regen drive input bridge.

18.47 to 18.49 : Not used

18.50 : Regulated voltage selector
Reserved.

18.51 : Output charge/discharge
Reserved

18.52 : Output voltage (Vout)
Reserved

18.53 : Output voltage set point
Reserved

18.54 : Output voltage max
Reserved

18.55 : Output voltage min
Reserved

18.56 : DC bus max
Reserved

18.57 : DC bus min
Reserved

18.58 : Vout > Vmax
Reserved

18.59 : Vout < Vmin
Reserved

18.60 : DC bus > Vmax
Reserved

18.61 : DC bus < Vmin
Reserved

18.62 : Simulated resistance
Reserved

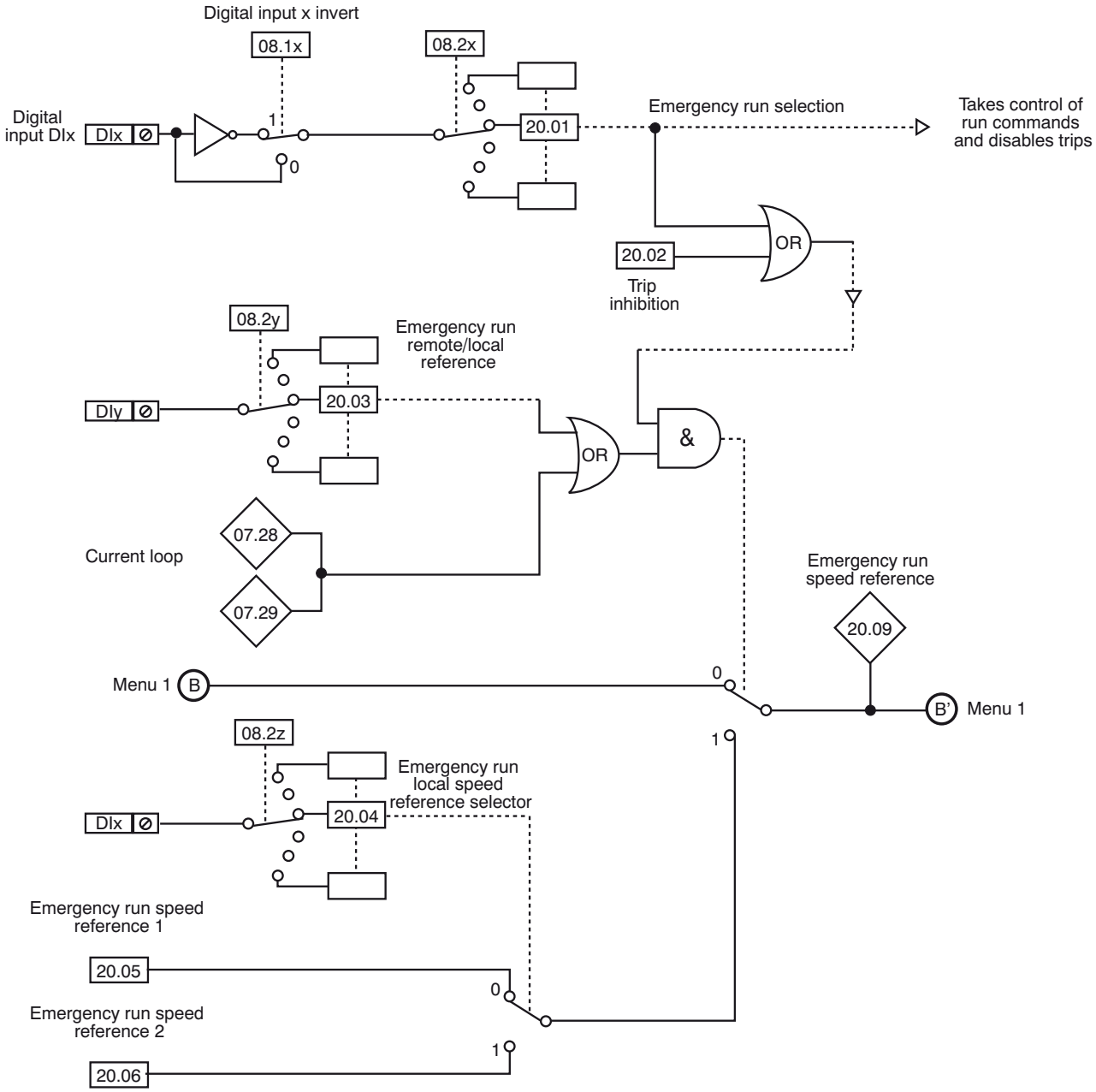
5.20 - Menu 19: Additional I/O options

Refer to the manual for the corresponding option.

5.21 - Menu 20: Specific applications

5.21.1 - Menu 20 diagram

Emergency operation



5.21.2 - Explanation of parameters in menu 20

20.01 : Emergency run selection

Adjustment range : No (0) or Yes (1)
Factory setting : No (0)
Format: 8 bits

No (0):
Normal operation.

Yes (1):
Emergency run mode is enabled.

Note:
If **20.01** is at Yes, digital inputs are forced to positive logic (**08.29** = Positive).

When **20.01** is at Yes (1), and the STO1 and STO2 inputs are closed, the drive operates in emergency run mode.
It is advisable to use an inverted digital input as source for **20.01** so that in the event of accidental opening **20.01** switches to 1 and activates emergency operation.

In emergency run mode:
- The drive starts in **forward only** at the speed selected by parameters **20.03** and **20.04**
- The run/stop commands defined by parameter **06.43** are ignored.
- The drive enable parameter **06.15** is ignored.
- The power diagnostic sequences are not performed.
- The drive ignores all commands from the keypad.
- Trips relating to the software are disabled, but alarm 10 is active to indicate their presence.
- The other trips are reset automatically, independently of **10.80** (no limiting by **10.34**).
- Flying restart mode is activated independently of **06.09** and remains enabled for future operations.
- Autotuning is not performed on the run command.

20.02 : Trip inhibition

Adjustment range: No (0) or Yes (1)
Factory setting: No (0)
Format: 8 bits

No (0):
Normal operation

Yes (1):
Software trips (see list in **20.15**) are not taken into account but alarm 10 is active to indicate their presence. Other trips are reset automatically independently of **10.80** (no limiting by **10.34**)

20.03 : Emergency run remote/local reference

Adjustment range : Remote (menu 1) (0) or Local (menu 20) (1)
Factory setting : Remote (menu 1) (0)
Format: 8 bits

Remote (menu 1) (0):
The drive speed reference is equal to the reference for item B in menu 1. If a 4-20 mA trip is detected on one of analog inputs 2 or 3, the speed reference will be determined by **20.04**.

Local (menu 20) (1):
The drive speed reference is defined by parameter **20.05** if **20.04** is at 0 or by parameter **20.06** if **20.04** is at 1.

.

20.04 : Emergency run local speed reference selector

Adjustment range : Ref 1 (**20.05**) (0) or Ref 2 (**20.06**) (1)
Factory setting : Ref 1 (**20.05**) (0)
Format: 8 bits

Ref. 1 (20.05) (0) :
The emergency run mode speed reference equals **20.05**.

Ref. 2 (20.06)(1) :
In emergency run mode speed reference equals **20.06**.

CAUTION:
The 07.28 and 07.29 parameters "4/20 mA current loop" are always displayed even when AI2 is set to "4/20 mA without detection" (factory setting).
If input AI2 is not used, set 07.11 to 0/20 mA.

20.05 : Emergency run speed reference 1

Adjustment range : ± **01.06**
Factory setting : 0.00 rpm
Format: 32 bits
Emergency run speed reference.

20.06 : Emergency run speed reference 2

Adjustment range : ± **01.06**
Factory setting : 0.00 rpm
Format: 32 bits
Emergency run speed reference.

20.09 : Emergency run speed reference

Adjustment range : ± **01.06**
Format: 32 bits
Emergency run speed reference taken into account.

• keypad control (06.43 = LCD keypad) is not suitable for emergency run mode.

20.10 to 20.14 : Not used

20.15 to **20.19** **5 last masked trips**

Adjustment range : 0 to 102 (see **10.20**)
Format: 8 bits
These parameters contain the 5 last drive trips not taken into account by emergency run mode.
20.15 Indicates the most recent trip
20.19 Indicates the oldest trip

The trips that are disabled in emergency operation are:

No.	Name	Reason for trip
4	Brak. IGBT	Braking IGBT transistor overcurrent for the **POWERDRIVE MD2**
5	I IMBALANCED	Motor current imbalance: vectorial sum of the 3 motor currents not zero
8	Drive overload Ixt	The drive overload level exceeds the conditions defined in section 1.4.2 of the installation manual
10	RECTIFIER Th	Rectifier heatsink temperature too high
19	Brak. resist.	Braking resistor overload I x t: **10.39** = 100%
21	Th IGBT U	Overheating of phase U IGBTs
24	Motor PTC	Opening of the DI1/PTC input of the drive PX1 terminal block or T1/T2 inputs of the MDX-ENCODER option
28	AI2 loss	Loss of the current reference on analog input AI2
29	AI3 loss	Loss of the current reference on input AI3
30	COM loss	Loss of communication on the P2 connector serial link
34	Fieldbus loss	Disconnection of the fieldbus during operation or timing error
39	Mains synchro	The rectifier cannot synchronise with the mains supply (**POWERDRIVE FX** only)
41	User 1	User trip 1 triggered by state 1 of **10.61**.
42	User 2	User trip 2 triggered by state 1 of **10.63**.
43	User 3	User trip 3 triggered by state 1 of **10.65**.
44	User 4	User trip 4 triggered by state 1 of **10.67**.
45	User 5	User trip 5 triggered by the serial link **10.38** = 45
46	User 6	User trip 6 triggered by the serial link **10.38** = 46
47	User 7	User trip 7 triggered by the serial link **10.38** = 47
48	User 8	User trip 8 triggered by the serial link **10.38** = 48
49	User 9	User trip 9 triggered by the serial link **10.38** = 49
50	User 10	User trip 10 triggered by the serial link **10.38** = 50
58	Th IGBT V	• Overheating of phase V IGBTs • Load too high
59	Th IGBT W	• Overheating of phase W IGBTs • Load too high
66	DO1 over Id	The DO1 output load current is > 200 mA
67	Internal ventilation	The internal ventilation is no longer working. Contact LEROY-SOMER Trip only valid for the **POWERDRIVE FX** 50T and 100T)
68	Motor overcurrent	The current has exceeded the limit programmed in **05.55**. The load is too high for the setting.
101	MAINS LOSS	Loss of AC supply
102	Rectifier	Loss of rectifier synchronisation with the mains (**POWERDRIVE FX** only)

20.20 to **20.29** **: Not used**

20.30 **: Backspin management**
Reserved

20.31 **: Backspin speed**
Reserved

20.32 **: Not used**

20.33 **: Backspin torque**
Reserved

20.34 **: Backspin threshold**
Reserved

5.22 - Menu 21: Second motor map

Refer to parameter **11.45** for the motor selection.

21.01 : Motor 2 maximum speed
Adjustment range : 0.00 to 60000.00 rpm
Factory setting : 1500.00 rpm
Format: 32 bits
This parameter defines the maximum speed in both directions of rotation.
This parameter is equivalent to 01.06 in motor 1.

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

21.02 : Motor 2 minimum speed
Adjustment range : 0.00 to **21.01** rpm
Factory setting : 0.00 rpm
Format: 32 bits
In unipolar mode, this parameter defines the minimum speed.
CAUTION:
This parameter is inactive during jog operation.
This parameter is equivalent to 01.07 in motor 1.

21.03 : Motor 2 reference selected
Adjustment range : Terminal inputs (0), Analog input 1 (1), Analog input 2 (2) Preset reference (3), Keypad (4)
Factory setting : Terminal inputs (0)
Format: 8 bits

Terminal inputs (0):
The speed reference is selected by combining the digital inputs assigned to parameters **01.41** and **01.42**.

Analog input 1 (1):
The speed reference comes from differential analog input 1 (AI1+, AI1-).

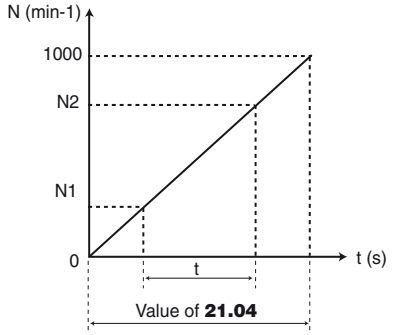
Analog input 2 (2):
The speed reference comes from differential analog input 2 (AI2+, AI2-).

Preset reference (3):
The speed reference comes from the preset references (RP1 to RP8).

Keypad (4):
The speed reference comes from the parameter-setting interface (see section 2.2.4).

21.04 : Motor 2 acceleration rate 1
Adjustment range : 0.0 to 3200.0 s *
Factory setting : 20.0 s
Format: 16 bits
Sets the time for acceleration from 0 to 1000 rpm *.

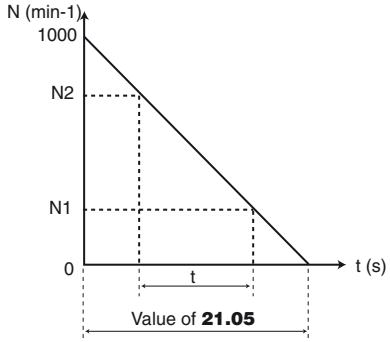
$$\mathbf{21.04} = \frac{t(s) \times 1000\ min^{-1}}{(N2 - N1)\ min^{-1}}$$



This parameter is equivalent to 02.11 in motor 1.

21.05 : Motor 2 deceleration rate 1
Adjustment range : 0.0 to 3200.0 s *
Factory setting : 20.0 s
Format: 16 bits
Sets the time for deceleration from 1000 rpm * to 0.

$$\mathbf{21.05} = \frac{t(s) \times 1000\ min^{-1}}{(N2 - N1)\ min^{-1}}$$



This parameter is equivalent to 02.21 in motor 1.

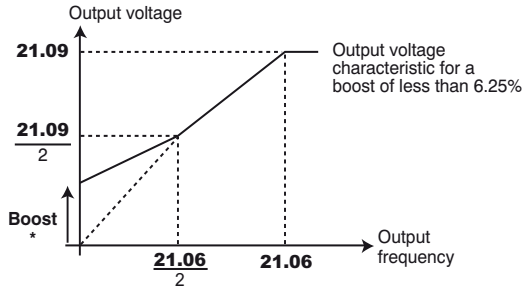
*** Note:** The reference speed can be changed from 1000 to 100 min^{-1} in parameter **02.56**. This makes it possible to multiply the acceleration and deceleration times by 10.

21.06 : Motor 2 nominal frequency
Adjustment range : 0.01 to 590.00 Hz
Factory setting : 50.00 Hz
Format: 32 bits
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.
This parameter is equivalent to 05.06 in motor 1.

21.07 : Motor 2 nominal current
Adjustment range : 0.00 to 2.2 x **11.32**
Factory setting : 0.00 A
Format: 32 bits
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 05.07 in motor 1.

21.08 : Motor 2 nominal speed
Adjustment range : 0.00 to 60000.00 rpm
Factory setting : 1500.00 rpm
Format: 32 bits
This is the on-load speed of the motor indicated on the nameplate.
This parameter is equivalent to 05.08 in motor 1.

21.09 : Motor 2 nominal voltage
Adjustment range : 0 to 999 V
Factory setting : 400 V
Format: 16 bits
Defines the voltage/frequency ratio as follows:



* If fixed boost has been selected **05.14** = LINEAR V TO F (2), the boost value is set via **05.15**.
This parameter is equivalent to 05.09 in motor 1.

21.10 : Motor 2 power factor
Adjustment range : 0.00 to 1.00
Factory setting : 0.85
Format: 8 bits
The power factor is measured automatically during an autotune phase in level 2 (see **05.12**) 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 05.10 in motor 1.

21.11 : Motor 2 number of poles
Adjustment range : Automatic calculation (0), 2 Poles (1), 4 Poles (2), 6 Poles (3), 8 Poles (4), 10 Poles (5), 12 Poles (6), 14 Poles (7), 16 Poles (8)
Factory setting : Automatic calculation (0):
Format: 8 bits
When this parameter is at 0 (Automatic calculation), 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.

Number of poles	21.11
2	2 Poles (1)
4	4 Poles (2)
6	6 Poles (3)
8	8 Poles (4)
10	10 Poles (5)
12	12 Poles (6)
14	14 Poles (7)
16	16 Poles (8)

This parameter is equivalent to 05.11 in motor 1.

21.12 : Motor 2 stator resistance
Adjustment range : 0.000 to 90000.00 mΩ
Factory setting : 0.000 mΩ
Format: 32 bits
This parameter stores the motor stator resistance for flux vector control mode (see parameter **05.14**).
If the stator resistance cannot be measured (motor not connected, value higher than the max. rating) a "Stator resistance" trip occurs.
During autotuning (**05.12** = Stationary (1) or Rotating (2)), the value of the stator resistance is stored automatically in **21.12**.
This parameter is equivalent to 05.17 in motor 1.

21.13 : Motor 2 voltage offset
Adjustment range : 0.0 to 25.5 V
Factory setting : 0.0 V
Format: 16 bits
This voltage offset is measured by the drive (see parameter **05.14**). It is used to correct imperfections in the drive, especially voltage drops in the IGBTs and idle times. This parameter has an important role in low-speed operation, i.e. when the drive output voltage is low.
During autotuning (**05.12** = Stationary (1) or Rotating (2)), the value of the voltage offset is stored automatically.
This parameter is equivalent to 05.23 in motor 1.

21.14 : Motor 2 Transient inductance / Ld
Adjustment range : 0.000 to 9000.000 mH
Factory setting : 0.000 mH
Format: 32 bits
During autotuning with rotation (**05.12** = Rotating (2)), the motor leakage inductance is stored in this parameter.
This parameter is equivalent to 05.24 in motor 1.

21.15 : Motor 2 map enable

Adjustment range : Disabled (0) or Enabled (1)
Format: 8 bits
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 Motor 2 (1) and the drive is disabled or in the trip state. During drive operation, **11.45** can be set to Motor 2 (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 : 0.000 to 9000.000 mH
Factory setting : 0.000 mH
Format: 32 bits
- Asynchronous motor: sum of the magnetising inductance and the leakage inductance at the motor rated flux.
During autotuning with rotation (**05.12**: Rotating (2)), the total motor inductance is stored in this parameter.
This parameter is not relevant with a synchronous motor.
This parameter is equivalent to 05.25 in motor 1.

21.25 to 21.29 : Not used

21.30 : Motor 2 volt per 1000 rpm (Ke) ( )
Adjustment range : 0 to 10000 V
Factory setting : 98 V
Format: 16 bits
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 05.33 in motor 1.

21.31 to 21.50 : Not used

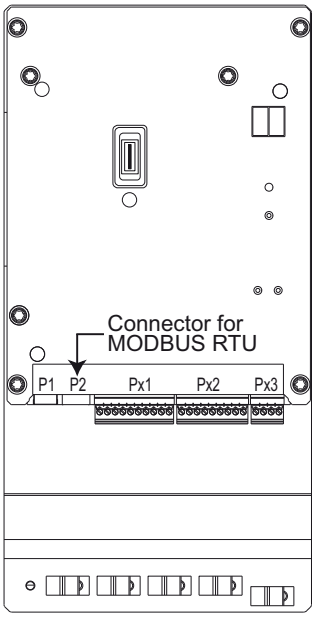
21.51 : Q axis inductance motor 2 ( )
Adjustment range : 40 to 999% of **21.14**
Factory setting : 100%
Format: 16 bits
Used to set an inductance value in quadrature with the pole axis for salient-pole synchronous machines.
This parameter is equivalent to 05.51 in motor 1.

6 - OPERATION WITH MODBUS RTU

6.1 - Serial link

The **POWERDRIVE** incorporates as standard a non-isolated serial link port accessible with a connector.
For users who wish to keep the parameter-setting interface permanently connected, it is then necessary to add the MDX-MODBUS option with an isolated 2 or 4-wire serial link port. For further details, please refer to the MDX-MODBUS manual ref. 4580.

6.1.1 - Location and connection



P2 is a standard RS485/RS422 terminal block.

Terminals	Description
1	0V
2	Rx\, Tx\
3	Rx, Tx
4	24V

6.1.2 - 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".

6.1.3 - Parameter setting

Depending on the application, the following parameters need to be modified.
11.23: Serial address
11.25: Baud rate
11.27: Parity type, number of stop bits
For more information on these parameters, refer to menu 11, section 5.12.2.

6.1.4 - Networking

The **POWERDRIVE** serial port allows the drive to communicate with a 2-wire RS485 network.
The network should therefore be connected in a "daisy-chain" (not a star).

6.2 - Parameter setting using the PC

With the MDX-SOFT parameter-setting software, setting up the **POWERDRIVE** from a PC is very user-friendly.
For further details, refer to section 3.

6.3 - Control word and status word

POWERDRIVE run commands can be managed using a single parameter **06.42**, called the "control word".
This is because the value of **06.42** 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 **06.43** = 1 (run commands via the terminals are no longer active), when the drive is disabled.

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

6.4 - MODBUS RTU

6.4.1 - 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 according to **11.27**
Baud rate	1200, 2400, 4800, 9600, 19200, 38400, 57600, 115200 bauds

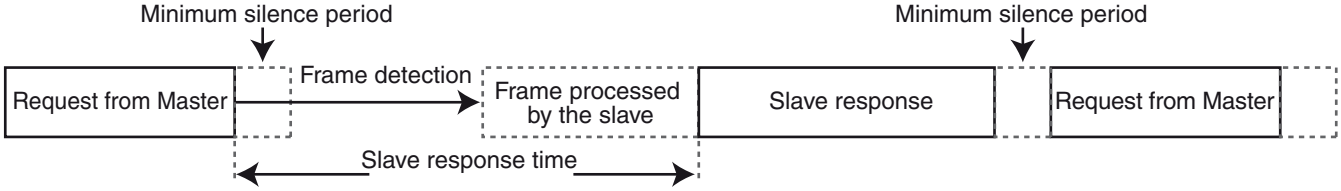
6.4.2 - Description of exchanges

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 in one byte)
- The function code which selects a command (read or write words, bits etc) for question and response frames (encoded in one byte)
- The data field containing the parameters relating to the command (encoded in "n" bytes)
- The frame CRC, calculated over 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	CRC 16 bits	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).
See diagram below.



6.4.3 - Parameter mapping

POWERDRIVE drives are configured using a **menu.parameter** notation.
The "menu" and "parameter" indices can take the values 0 to 99. Menu.parameter is assigned to 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:	
01.02	101
01.00	99
00.01	0
12.33	1232

6.4.4 - 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	– 0x1234	would be:	0x12	0x34	

6.4.5 - Function codes

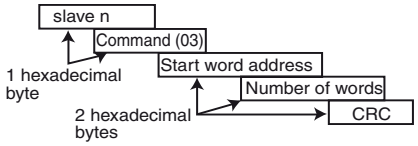
The function code determines the context and format of the message data.

Function code		Description
Decimal	Hexadecimal	
3	0x03	Read multiple 16-bit registers or words
6	0x06	Write single 16-bit register or word
16	0x10	Write multiple 16-bit registers or words
23	0x17	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:

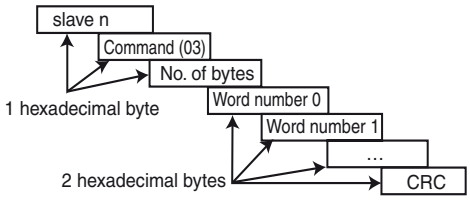
Bytes	Description
0	Slave address (1 to 247)
1	Function code 0x03
2	Start word address MS byte
3	Start word address LS byte
4	Number of words to be read MS byte
5	Number of words to be read LS byte
6	CRC LS byte
7	CRC MS byte



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.

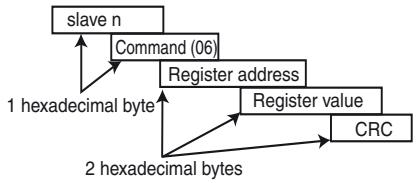


• Function code 6: Write single register

Writes 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 data MS byte
5	Register data LS byte
6	CRC LS byte
7	CRC MS byte

• Function code 16: Write multiple

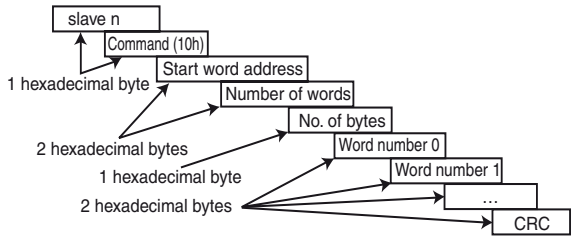
Writes a contiguous array of registers. The slave imposes an upper limit on the number of registers which can be written. If the limit is exceeded, the slave does not respond.

Note: 12 parameters maximum can be written.

Frame sent by the Master:

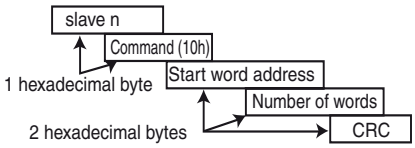
Bytes	Description
0	Slave address (1 to 247)
1	Function code 0x10
2	Start word address MS byte
3	Start word address LS byte
4	Number of words to be written MS byte
5	Number of words to be written LS byte
6	Number of bytes to be written
7	Word 0 to be written MS byte
8	Word 0 to be written LS byte
9	Word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



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.

6.4.6 - Example

Drive address = 1 (Default address).
Reading of 3 drive parameters from **1.05**.
1.05 becomes **1.04** which is equal to 68 in hexadecimal (Modbus address = drive parameter address - 1).

• Request

	Example (hex)	RTU (binary)
Slave address	1	0000 0001
Function	03	0000 0011
Start word or register address (MS byte)	00	0000 0000
Start word or register address (LS byte)	68	0110 1000
Number of words or registers (MSB)	00	0000 0000
Number of words or registers (LSB)	03	0000 0011
CRC check:LS byte	84	1000 0100
MS byte	17	0001 0111
Total bytes:		8

• Response

	Example (hex)	RTU (binary)
Slave address	1	0000 0001
Function	03	0000 0011
Number of bytes	06	0000 0110
Word or register 0 (MS byte)	00	0000 0000
Word or register 0 (LS byte)	2D	0010 1101
Word or register 1 (MS byte)	05	0000 0101
Word or register 1 (LS byte)	DC	1101 1100
Word or register 2 (MS byte)	00	0000 0000
Word or register 2 (LS byte)	00	0000 0000
CRC check:LS byte	4C	0100 1100
MS byte	45	0100 0101
Total bytes:		11

6.4.7 - 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.

6.4.8 - 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.

6.4.9 - CRC

This check word is used to detect transmission errors. It is calculated over 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.
```

7 - TRIPS - DIAGNOSTICS

7.1 - Warning

• The user must not attempt to repair the drive himself, nor perform diagnostics other than those listed in this section. If the drive malfunctions, it should be returned to LEROY-SOMER via your usual contact.

7.2 - Alarms

Alarms may appear during drive operation.
These alarms are for information only, in order to warn the user: the drive continues to operate but may switch to fault mode if no corrective action is taken.

On the drive control board, 2 LEDs display alternately "A.L." and a number that can be used to identify the alarm by means of the table below (this number corresponds to the value of parameter **10.97**).

Code	No.	Meaning
A.L.	1 to 4	User alarm 1 (**10.54**) to User alarm 4 (**10.54**)
	6	Motor overload (**10.17**)
	7	Drive overtemperature (**10.18**)
	8	Microcontroller overoccupancy
	9	Rectifier
	10	Emergency operation (see menu 20)

7.3 - Tripping on a fault

If the drive trips, the drive output bridge is inactive, and the drive no longer controls the motor.
When a trip is active, the LEDs present on the control board display alternately "t.r." and a number that can be used to identify the active trip (see left-hand column in the table below). For trips numbered higher than 100, only the last 2 digits are displayed with a point displayed on both LEDs to indicate the hundred.
Example:

 : indicates trip no. 1

 : indicates trip no. 101

After consulting the table, follow the procedure below:
- Make sure that the drive is disabled (STO-1 and STO-2 terminals open)
- Isolate the drive power supply
- Carry out the necessary checks in order to eliminate the reason for the trip
- Activate the STO-1 and STO-2 inputs to cancel the trip

The HMI displays an active trip page, where "TRIP" flashes at the top of the screen.
All the trips indicated on the keypad or parameter-setting interface are listed in the table below.

• Opening and then closing the STO-1/STO-2 drive enable terminals may cancel the trip. If the Run FWD or Run reverse terminal is closed at the time of resetting, the motor may or may not start immediately, depending on the setting of Ctr.06 (06.04).

No.	Parameter-setting interface name	Reason for trip	Solution
1	DC UnderVolt	DC bus undervoltage	• Check the input fuses • Check the quality of the power supply (voltage dips)
2	DC over volt	DC bus overvoltage	• Check that the mains voltage is within the permitted tolerance • Check the quality of the power supply (commutation notches or transient overvoltages) • Check the motor insulation **POWERDRIVE MD2 only:** • Check that the deceleration mode (**02.04**) is compatible with the application • If an MD TF option is used, check its size, its wiring and the state of the thermal relay
3	Over current	Overcurrent at drive output	• Check the motor insulation • Check the motor cables (connections and insulation) • Check the quality of the mains supply **POWERDRIVE MD2 only:** • Run power diagnostics
		This trip cannot be reset for a period of 10 seconds.	
4	Brak. IGBT	Braking IGBT transistor overcurrent (**POWERDRIVE MD2** only)	• Check the braking resistor wiring and insulation level. • Make sure that the resistor ohmic value is compatible with the MD TF option used.
		This trip cannot be reset for a period of 10 seconds.	

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No.	Parameter-setting interface name	Reason for trip	Solution
5	I IMBALANCED	Motor current imbalance: vectorial sum of the 3 motor currents is not zero	• Check the motor insulation • Check the cable insulation
6	Loss of a motor phase	Loss of a motor phase	Check the motor cable and resistance values between motor phases
7	Overspeed	The speed is higher than (1.3 x **01.06**) or (**01.06** + 1000 rpm)	• Check the drive settings • When the flying restart function is not being used, check that **06.09** is at "Disabled"
8	Drive overload Ixt	The drive overload level exceeds the conditions defined in section 1.4.2 of the installation manual	• Check the drive is suitable for the motor current cycle • Check the ambient temperature
9	IGBT U	Internal protection of phase U IGBTs	• Check the motor and cable insulation **POWERDRIVE MD2 only:** • Run power diagnostics
10	Th rectifier	Rectifier heatsink temperature too high	• Clean the cabinet dust filters • Check the drive external and internal fans are working correctly • Check that the product air inlet temperature is not outside the limits
11	Encoder rot	The measured position does not vary (only if the MDX-ENCODER option is present)	• Check the encoder wiring • Check that the motor shaft turns
13	UVW invert	The encoder U, V, W signals are reversed (only if encoder option is present)	Check the conformity of the encoder wiring
14	TUNE U Encod	During the autotune phase, one of the encoder U, V or W commutation channels is not present	• Check the encoder wiring • Check the encoder connections • Change the encoder
15	TUNE V Encod		
16	TUNE W Encod		
18	Autotune	A stop command has been given during the autotune phase.	Repeat the autotune procedure (see **05.12**)
19	Brak. resist.	Parameter **10.39** "Braking energy overload accumulator" has reached 100%	• Check the settings of **10.30** and **10.31** • Check the resistor is compatible with the application requirements
21	Th IGBT U	Overheating of phase U IGBTs	• Clean the cabinet dust filters • Check the drive ventilation units are working correctly • Check that the product air inlet temperature is not outside the limits • If the trip appears at frequencies lower than 10 Hz, check that the current levels depending on the frequency have been complied with. •Check that the switching frequency **05.18** is compatible with the motor current level
24	Motor PTC	Opening of the PTC input of the PX1 terminal block or T1 and T2 inputs of the MDX-ENCODER option	• Check the ambient temperature around the motor Check that the motor current is less than the stated current • Check the thermal sensor wiring
26	Overload + 24V	Overload on the +24 V power supply or digital outputs	Check the I/O wiring
28	AI2 loss	Loss of the current reference on analog input AI2	Check the input wiring and source
29	AI3 loss	Loss of the current reference on analog input AI3	

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No.	Parameter-setting interface name	Reason for trip	Solution
30	COM loss	Loss of communication on the P2 connector serial link	• Check the cable connections • Check that parameter **11.63** is compatible with the timing of requests from the master
31	EEPROM fail.	Number of write cycles to EEPROM exceeded (>1,000,000)	• Change the control board • Check the recurrence of write cycles from the drive controller
33	Stator resistance	Trip during measurement of the stator resistance	• Check the motor wiring
34	Fieldbus loss	Disconnection of the fieldbus during operation or timing error	• Check the fieldbus connections • Check that parameter **15.07** is compatible with the timing of requests from the master
35	STO inputs	Simultaneous opening of both STO (Safe Torque Off) inputs during operation	Check the remote control link
37	Encoder break	One of the encoder feedback data items is missing	• Check the encoder wiring • Check the encoder connections
38	Breakdown	Breakdown of synchronous motor in sensorless closed loop mode	Check the menu **5** parameters are compatible with the values on the motor nameplate
39	Mains synchro	The rectifier cannot synchronise with the mains supply (**POWERDRIVE FX** only)	Check the quality of the power supply (commutation notches present)
41	User 1	User trip 1 triggered by **10.61**.	• See **10.61**
42	User 2	User trip 2 triggered by **10.63**.	• See **10.63**
43	User 3	User trip 3 triggered by **10.65**.	• See **10.65**
44	User 4	User trip 4 triggered by **10.67**.	• See **10.67**
45	User 5	User trip 5 triggered by the serial link **10.38** = 45	• See **10.38** • See **10.37**
46	User 6	User trip 6 triggered by the serial link **10.38** = 46	• See **10.38** • See **10.37**
47	User 7	User trip 7 triggered by the serial link **10.38** = 47	• See **10.38** • See **10.37**
48	User 8	User trip 8 triggered by the serial link **10.38** = 48	• See **10.38** • See **10.37**
49	User 9	User trip 9 triggered by the serial link **10.38** = 49	• See **10.38** • See **10.37**
50	User 10	User trip 10 triggered by the serial link **10.38** = 50	• See **10.38** • See **10.37**
51	DO2 MDX-IO over ld	The DO2 output load current (MDX-IO option) is >200 mA	Check that DO2 is not short-circuited
52	DO3 MDX-IO over ld	The DO3 output load current (MDX-IO option) is >200 mA	Check that DO2 is not short-circuited
53	MDX-IO link	Communication problem between the drive and the MDX-IO option	Check the MDX-IO option mounting
54	Internal serial link	Communication problem between the drives	Check the setting of **11.66**
55	Unstable DC bus	The drive DC bus oscillates significantly	• Check the balancing of the mains phases • Check that all 3 mains phases are present.
56	IGBT V	Internal protection of phase V IGBTs	• Check the motor and cable insulation • If **POWERDRIVE MD2:** run power diagnostics
57	IGBT W	Internal protection of phase W IGBTs	

POWERDRIVE MD2/FX
Variable speed drive
TRIPS - DIAGNOSTICS

No.	Parameter-setting interface name	Reason for trip	Solution
58	Th IGBT V	Overheating of phase V IGBTs	• Clean the cabinet dust filters • Check the drive ventilation units are working correctly • Check that the product air inlet temperature is not outside the limits • If the trip appears at frequencies lower than 10 Hz, check that the current levels depending on the frequency have been complied with • Check that the switching frequency **05.18** is compatible with the motor current level
59	Th IGBT W	Overheating of phase W IGBTs	
60	DIAGNOSTIC	Problem detected during the control and interface boards test, the power test or during the self-test	• Check that the STO1 and STO2 inputs are closed • See diagnostic error table
63	Inconsistency between STO inputs	The STO1 and STO2 inputs have had a different state for more than 100 ms	Check the remote control link for the STO1 and STO2 inputs
65	10V over ld	Overload on the +10 V power supply	Check the I/O wiring
66	DO1 over ld	The DO1 output load current is >200 mA	Check that DO1 is not short-circuited
67	Internal ventilation	The internal ventilation has stopped working. (**POWERDRIVE FX** 50T and 100T only)	Get in touch with your usual LEROY-SOMER contact
68	Motor overcurrent	The current has exceeded the limit programmed in **05.55**. The load is too high for the setting.	Check that **05.55** is consistent with the application
69	24V MDX-IO over ld	The 24 V load current is too high	Check the MDX-I/O option I/O wiring
70	AI4 loss on MDX-IO	Loss of the current reference on analog input AI4 of the MDX-IO option	Check the input wiring and source of the MDX-IO option
71	AI5 loss on MDX-IO	Loss of the current reference on analog input AI5 of the MDX-IO option	
101	MAINS LOSS	Loss of AC supply	• Check the input fuses • Check the quality of the power supply (voltage dips)
102	Rectifier	Loss of rectifier synchronisation with the mains (**POWERDRIVE FX** only)	Check the quality of the power supply (commutation notches present)

8 - MAINTENANCE

For servicing instructions and a list of spare parts that may be needed, refer to the Maintenance section in the **POWERDRIVE** installation manual.

LEROY SOMER®

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MOTEURS LEROY-SOMER 16015 ANGOULÊME CEDEX - FRANCE

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